COMMENTARY ON ARISTOTLE'S PHYSICS

by
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BOOK I
THE PRINCIPLES OF NATURAL THINGS

LECTURE 1 (184 a 9-b 14)
THE MATTER AND THE SUBJECT OF NATURAL SCIENCE AND OF THIS BOOK. WE MUST PROCEED FROM THE MORE UNIVERSAL PRINCIPLES WHICH ARE BETTER KNOWN TO US

1. Because this book, *The Physics*, upon which we intend to comment here, is the first book of natural science, it is necessary in the beginning to decide what is the matter and the subject of natural science.

Since every science is in the intellect, it should be understood that something is rendered intelligible in act insofar as it is in some way abstracted from matter. And inasmuch as things are differently related to matter they pertain to different sciences.

Furthermore, since every science is established through demonstration, and since the definition is the middle term in a demonstration, it is necessary that sciences be distinguished according to the diverse modes of definition.

2. It must be understood, therefore, that there are some things whose existence depends upon matter, and which cannot be defined without matter. Further there are other things which, even though they cannot exist except in sensible matter, have no sensible matter in their definitions. And these differ from each other as the curved differs from the snub. For the snub exists in sensible matter, and it is necessary that sensible matter fall in its definition, for the snub is a curved nose. And the same is true of all natural things, such as man and stone. But sensible matter does not fall in the definition of the curved, even though the curved cannot exist except in sensible matter. And this is true of all the mathematicals, such as numbers, magnitudes and figures. Then, there are still other things which do not depend upon matter either according to their existence or according to their definitions. And this is either because they never exist in matter, such as God and the other separated substances, or because they do not universally exist in matter, such as substance, potency and act, and being itself.

3. Now metaphysics deals with things of this latter sort. Whereas mathematics deals with those things which depend upon sensible matter for their existence but not for their definitions. And natural science, which is called physics, deals with those things which depend upon matter not only for their existence, but also for

their definition.

And because everything which has matter is mobile, it follows that mobile being is the subject of natural philosophy. For natural philosophy is about natural things, and natural things are those whose principle is nature. But nature is a principle of motion and rest in that in which it is. Therefore natural science deals with those things which have in them a principle of motion.

4. Furthermore those things which are consequent upon something common must be treated first and separately. Otherwise it becomes necessary to repeat such things many times while discussing each instance of that which is common. Therefore it was necessary that one book in natural science be set forth in which those things which are consequent upon mobile being in common are treated; just as first philosophy, in which those things which are common to being insofar as it is being, is set forth for all the sciences.

This, then, is the book, *The Physics*, which is also called *On Physics*, or *Of the Natural to be Heard*, because it was handed down to hearers by way of instruction. And its subject is mobile being simply.

I do not, however, say mobile body, because the fact that every mobile being is a body is proven in this book, and no science proves its own subject. And thus in the very beginning of the *De Caelo*, which follows this book, we begin with the notion of body.

Moreover, after *The Physics* there are other books of natural science in which the species of motion are treated. Thus in the *De Caelo* we treat the mobile according to local motion, which is the first species of motion. In the *De Generatione*, we treat of motion to form and of the first mobile things, i.e., the elements, with respect to the common aspects of their changes. Their special changes are considered in the book *Meteororum*. In the book, *De Mineralibus*, we consider the mobile mixed bodies which are non-living. Living bodies are considered in the book, *De Anima* and the books which follow it.

5. To this book, then, the Philosopher writes a preface in which he shows the order of procedure in natural science.

In this preface he does two things. First he shows that it is necessary to begin with a consideration of principles. Secondly, where he says, 'The natural way of doing this...' (184 a 16), he shows that among principles, it is necessary to begin with the more universal principles.

First he gives the following argument. In all sciences of which there are principles or causes or elements, understanding and science proceed from a knowledge of the principles, causes and elements. But the science which is about nature has principles, elements and causes. Therefore it is necessary in it to begin with a determination of principles.

When he says 'to understand' he has reference to definitions, and when he says 'to have science' he has reference to demonstrations. For as demonstrations are from causes, so also are definitions, since a complete definition is a demonstration differing only by position, as is said in *Posterior Analytics*, I:8.

When, however, he speaks of principles or causes or elements, he does not intend to signify the same thing by each. For cause is wider in meaning than element. An element is a first component of a thing and is in it [i.e., in the composed], as is said in *Metaphysics*,V:3. Thus the letters, but not the syllables, are the elements of speech. But those things are called causes upon which things depend for their existence or their coming to be. Whence even that which is outside the thing, or that which is in it, though the thing is not first composed of it, can be called a cause. But it cannot be called an element. And thirdly principle implies a certain order in any progression. Whence something can be a principle which is not a cause, as that from which motion begins is a principle of motion, butis not a cause, and a point is a principle of a line but not a cause.

Therefore, by principle he seems to mean moving causes and agents in which, more than in others, there is found an order of some progression. By causes he seems to mean formal and final causes upon which things most of all depend for their existence and their coming to be. By elements he means properly the first material causes.

Moreover he uses these terms disjunctively and not copulatively in order to point out that not every science demonstrates through. all the causes. For mathematics demonstrates only through the formal cause. Metaphysics demonstrates through the formal and final causes principally but also through the agent. Natural science, however, demonstrates through all the causes.

He then proves from common opinion the first proposition of his argument. This is also proven in the *Posterior Analytics* I:2. For a man thinks that he knows something when he knows all its causes from the first to the last. The meaning here of causes, principles, and elements is exactly the same as we have explained above, even though the Commentator disagrees. Furthermore Aristotle says, '...as far as its simplest elements' (184 a 14), because that which is last in knowledge is matter. For matter is for the sake of form, and form is from the

agent for the sake of the end, unless it itself is the end. For example, we say that a saw has teeth in order to cut, and these teeth ought to be made of iron so they will be apt for cutting.

6. Next where he says, 'The natural way of doing this...'(184 a 16), he shows that among principles it is necessary to treat the more universal ones first, And he shows this first by means of an argument, and secondly, by an "ample, where he says, for it is a whole (184 a 25 #9).

First he gives the following argument. It is natural for us to proceed in knowing from those things which are better known to us to those which are better known by nature. But the things which are better known to us are confused, such as the universals. Therefore it is necessary for us to proceed from universals to singulars.

7. For purposes of clarifying the first proposition he makes the point that things which are better known to us and things which are better known according to nature are not the same. Rather those things which are better known according to nature are less known to us. And because the natural way or order of learning is that we should come to that which is unknown by us from that which is known by us, it is necessary for us to arrive at the better known in nature from the better known to us.

It must be noted, however, that that which is known by nature and that which is known simply mean the same. Those things are better known simply which are in themselves better known. But those things are better known in themselves which have more being, because each thing is knowable insofar as it is being. However, those beings are greater which are greater in act. Whence these are the most knowable by nature.

For us, however, the converse is true because we proceed in understanding from potency to act. Our knowledge begins from sensible things which are material and intelligible in potency. Whence these t ngs are known by us before the separated substances, which are better known according to nature, as is clear in *Metaphysics*, II:2.

He does not, therefore, say known by nature as if nature knew these things, but because they are better known in themselves and according to their proper natures. And he says better known and more certain, because in the sciences not just any kind of knowledge is sought, but a certain knowledge.

Next in order to understand the second proposition, it must be known that those things are here called 'confused' which contain in themselves something potential

and indistinct. And because to know something indistinctly is a mean between pure potency and perfect act, so it is that while our intellect proceeds from potency to act, it knows the confused before it knows the distinct. But it has complete science in act when it arrives, through resolution, at a distinct knowledge of the principles and elements. And this is the reason why the confused is known by us before the distinct.

That universals are confused is clear. For universals contain in themselves their species in potency. And whoever knows something in the universal knows it indistinctly. The knowledge, however, becomes distinct when each of the things which are contained in potency in the universal is known in act. For he who knows animal does not know the rational except in potency. Thus knowing something in potency is prior to knowing it in act. Therefore, according to this order of learning, in which we proceed from potency to act, we know animal before we know man.

8. It would seem, however, that this is contrary to what the Philosopher says in *Posterior Analytics*, I:2, namely, that singulars are better known to us, whereas the universals are better known by nature or simply.

But it must be understood that there he takes as singulars the individual sensible things themselves, which are better known to us because the knowledge of sense, which is of singulars, does precede in us the knowledge of the intellect, which is of universals. And because intellectual knowledge is more perfect, and because the universals are intelligible in act, whereas the singulars are not (since they are material), the universals are better known simply and according to nature.

Here, however, by singulars he means not the individuals themselves, but the species. And these are better known by nature, existing more perfectly, as it were, and being known with a distinct knowledge. But the genera are known by us first, being known, as it were, confusedly and in potency.

It should be known, however, that the Commentator explains this passage in another way. He says that in the passage beginning, 'The natural way of doing this...' (184 a 16), the Philosopher wishes to explain the method of demonstration of this science, namely, that this science demonstrates through the effect and what is posterior according to nature. Hence what is said here is to be understood of the progression in demonstration and not of the progression in determination. Then in the passage where Aristotle says, 'Now what is plain to us...'(184 a 22), he intends to make clear (according to the Commentator) what things are better known to us and what is better known by nature, i.e., things

which are composed of the simple, understanding 'confused' to mean 'composed'. Finally, then, he concludes, as if to a corollary, that we must proceed from the more universal to the less universal.

It is clear that his explanation is not suitable, because he does not join the whole passage to one intention. Moreover the Philosopher does not intend to set forth the mode of demonstration of this science here, because he will do this in Book II according to his order of treatment. Furthermore, the confused should not be taken to mean composed, but rather to mean indistinct. For nothing could be concluded from such universals because genera are not composed of species.

9. Next, where he says, '... for it is a whole ...' (184 a 25), he clarifies his position with three examples. The first of these is taken from the integral sensible whole. He says that since the sensible whole is better known to the sense, then, the intelligible whole is also better known to the intellect. But the universal is a sort of intelligible whole, because it comprehends many as parts, namely, its inferiors. Therefore the universal is better known to us intellectually.

But it would seem that this proof is not effective, because he uses whole and part and comprehension equivocally.

However it must be said that the integral whole and the universal agree in that each is confused and indistinct. For just as he who apprehends a genus does not apprehend the species distinctly, but in potency only, so also he who apprehends a house does not yet distinguish its parts. Whence it is that a whole is first known to us as confused. This applies to both of these wholes. However, to be composed is not common to each whole. Whence it is clear that Aristotle significantly said 'confused' above and not 'composed'.

10. Next where he says, 'Much the same thing ...' (184 b 9), he gives another example taken from the integral intelligible whole.

For that which is defined is related to the things defining it as a kind of integral whole, insofar as the things defining it are in act in that which is defined. But he who apprehends a name, for example, man or circle, does not at once distinguish the defining principles. Whence it is that the name is, as it were, a sort of whole and is indistinct, whereas the definition divides into singulars, i.e., distinctly sets forth the principles of that which is defined.

This, however, seems to be contrary to what he said above. For the things which define would seem to be more universal, and these, he said, were first known by us. Furthermore, if that which is defined were better known to us than the things

which define, we would not grasp that which is defined through the definition, for we grasp nothing except through that which is better known to us.

But it must be said that the things which define are in themselves known to us before that which is defined, but we know the thing which is defined before we know that these are the things which define it. Thus we know animal and rational before we know man. But man is known confusedly before we know that animal and rational are the things which define man.

11. Next where he says, 'Similarly a child ...' (184 b 11), he gives the third example taken from the more universal sensible. For as the more universal intelligible is first known to us intellectually, for example, animal is known before man, so the more common sensible is first known to us according to sense, for example, we know this animal before we know this man.

And I say first according to sense both with reference to place and with reference to time. This is true according to place because, when someone is seen at a distance, we perceive him to be a body before we perceive that he is an animal, and animal before we perceive him to be a man, and finally we perceive that he is Socrates. And in the same way with reference to time, a boy apprehends this individual as some man before he apprehends this man, Plato, who is his father. And this is what he says: children at first call all men fathers and all women mothers, but later they determine, that is, they know each determinately.

From this it is clearly shown that we know a thing confusedly before we know it distinctly.

LECTURE 2 (184 b 15-185 a 19)
THE OPINIONS OF THE ANCIENT PHILOSOPHERS ABOUT THE PRINCIPLES OF NATURE AND OF BEINGS. IT DOES NOT PERTAIN TO NATURAL SCIENCE TO DISPROVE SOME OF THESE OPINIONS

12. Having completed the preface in which it was shown that natural science ought to begin with the more universal principles, here, according to the order already stated, he begins to pursue those matters which pertain to natural science.

This discussion is divided into two parts. In the first part he treats the universal principles of natural science. In the second part he treats mobile being in common (which is what he intends to treat in this book).' This is taken up in Book III, where he says, 'Nature has been defined ...' (200 b 12; L1).

The first part is divided into two parts. First he treats the principles of the subject of this science, that is, the principles of mobile being as such. Secondly he treats the principles of the doctrine. This he does in Book II, where he says, 'Of things that exist...' (192 b 8; L1).

The first part is divided into two parts. First he considers the opinions others have had concerning the common principles of mobile being. Secondly he seeks the truth concerning them, where he says, 'All thinkers, then, agree ...' (188 a 18; L10).

Concerning the first part he makes three points. First he sets forth the different opinions of the ancient philosophers concerning the common principles of nature. Secondly, where he says, 'Now to investigate ...' (184 b 25 #15), he shows that it does not pertain to natural science to pursue some of these opinions. Thirdly, where he says, 'The most pertinent question...' (185 a 20; L3), he considers these opinions, showing their falsity.

Concerning the first part he makes two points. First he sets forth the different opinions of the philosophers concerning the principles of nature. Secondly, where he says, 'A similar inquiry is made ...' (184 b 23 #14), he shows that this same diversity exists with reference to the opinions of the philosophers concerning beings.

13. He says, therefore, first of all, that it is necessary that there be one principle of nature or many. And each position has claimed the opinions of the philosophers.

Some of them, indeed, held that there is one principle, others held that there are many. And of those who held that there is one principle, some hbld that it was immobile, as did Parmenides and Melissus, whose opinion he will examine below. Some, however, held that it was mobile, as did. the natural philosophers.

Of these, some held that air was the principle of all natural things, as Diogenes; others that it was water, as Thales; others that it was fire, as Heraclitus; and still others some mean between air and water, such as vapour.

But none of those who held that there was only one principle said that it was earth because of its density. For they held that principles of this sort were mobile, because they said that other things come to be through the rarefication and condensation of certain of these principles.

Of those who held the principles to be many, some held them to be finite, others

held that they were infinite.

Of those who held that they were finite (although more than one) some held that there were two, i.e., fire and earth, as Parmenides will say below [L 10]. Others held that there were three, i.e., fire, air and water (for 'they thought earth to be in some way composed because of its density). Others, however, held that there were four, as Empedocles did, or even some other number, because even Empedocles himself along with the four elements posited two other principles, namely, friendship and strife.

Those who held that there was an infinite plurality of principles had a diversity of opinions. For Democritus held that indivisible bodies which are called atoms are the principles of all things. And he held that bodies of this sort were all of one genus according to nature, but that they differed according to figure and form, and that they not only differed but even had contrariety among themselves. For he held three contrarieties: one according to figure, which is between the curved and the straight, another according to order, which is the prior and the posterior, and another according to position, namely, before and behind, above and below, to the right and to the left. And so he held that from these bodies existing of one nature different things come to be according to the diversity of the figure, position and order of the atoms. In this opinion, then, he gives us some basis for understanding the opposing opinion, namely that of Anaxagoras who held that the principles were infinite, but not of one genus according to nature. For he held that the principles of nature were the infinite, smallest parts of flesh and bone and other such things, as will be made clear below.

It must be noted, however, that he did not divide these many principles into mobile and immobile. For none of these who held that the first principles were many held that they were immobile. For since an place contrariety in the principles, and since it is natural for contraries to change, immobility could not stand with a plurality of principles.

14. Secondly, at the point where he says, 'A similar inquiry is made...' (184 b 23; L9), he shows that there is the same diversity of opinions concerning beings.

He says that in like manner the physicists, when inquiring about those things which are, i.e., about beings, wondered how many there are, i.e., whether there is one or many; and if many, whether finite or infinite.

And the reason for this is that the ancient physicists did not know any cause but the material cause (although they touched lightly upon the other causes). Rather they held that the natural forms were accidents, as the forms of artificial things

are. Since, therefore, the whole substance of artificial things is their matter, so it followed, according to them, that the whole substance of natural things would be their matter.

Hence those who held one principle only, for example, air, thought that other beings were air according to their substance. And the same is true of the other opinions. Hence Aristotle says that the physicists seek what is in thatfrom which things are, i.e., in inquiring about principles they sought the material causes from which beings are said to be. Whence it is clear that when they inquire about beings, whether they are one or many, their inquiry concerns the material principles which are called elements.

15. Next where he says, 'Now to investigate ...' (184 b 25), he shows that it does not pertain to natural science to disprove some of these opinions.

And concerning this he makes two points. First he shows that it does not pertain to natural science to disprove the opinion of Parmenides and Melissus. Secondly, where he says, 'At the same time the holders of the theory...' (185 a 18),2 he gives a reason why it is useful to the present work to disprove this opinion.

Concerning the first part he makes two points. First he shows that it does not pertain to natural science to disprove the aforesaid opinion. Secondly, where he says, '... or like refuting ...' (185 a 8 #17), he shows that it does not pertain to natural science to resolve the arguments which are brought forth to prove this opinion.

He establishes his first point with two arguments, the second , of which begins where he says, 'To inquire therefore ...' (185 a 5 #16).

He says, therefore, that it does not pertain to natural science to undertake a thorough consideration of the opinion whether being is one and immobile. For it has already been shown that there is no difference, according to the intention of the ancient philosophers, whether we hold one immobile principle or one immobile being.

And that it should not pertain to natural science to disprove this opinion he shows as follows. It does not pertain to geometry to bring forth reasons against an argument which destroys its principles. Rather, this either pertains to some other particular science (if, indeed, geometry is subalternated to some particular science, such as music is subalternated to arithmetic, to which it pertains to dispute against any position denying the principles of music), or it pertains to a

common science such as logic or metaphysics. But the aforesaid position destroys the principles of nature. For if there is only one being, and if this being is immobile, such that from it others cannot come to be, then the very nature of a principle is taken away. For every principle is either a principle of some thing or of some things. Therefore, if we posit a principle, a multiplicity follows, because one is the principle and the other is that of which it is the principle. Whoever, therefore, denies multiplicity removes principles. Therefore natural science ought not to argue against this position.

16. Next where he says, 'To inquire therefore...'(185 a 5), he shows the sar

gp point with another argument. It is not required of any science that it bring forth arguments against manifestly false and improbable opinions. For to worry about one who offers positions contrary to the opinions of the wise is stupid, as is said in Topics, I:11.

He says, therefore, that to undertake a thorough consideration of the question whether being is one, and hence immobile, is like arguing against any other improbable position. For example, it is like arguing against the position of Heraclitus, who said that all things are always moved and that nothing is true; or against the position of one who would say that the whole of being is one man, which position, indeed, would be altogether improbable. And indeed whoever holds being to be only one immobile thing is forced to hold that the whole of being is some one thing. It is clear, therefore, that it does not belong to natural science to argue against this position.

17. Next when he says, '... or like refuting ...' (185 a 8), he shows that it does not belong to natural science even to resolve the arguments of the aforementioned philosophers. And this for two reasons, the second of which begins where he says, 'We physicists ...' (185 a 13 #18).

First he proves his position by pointing out that it is not incumbent upon any science to resolve sophistic arguments which have an obvious defect of form or matter. He says that to deal with improbable arguments is like solving a contentious or sophistic argument. But each argument of both Melissus and Parmenides is sophistic, for they err in matter, whence he says that they have accepted what is false, i.e., they assume false propositions, and they err in form, whence he says that they are not syllogizing. But the position of Melissus is much worse, i.e., more vain and foolish and does not cause any difficulty. This will be shown below [L 5]. Moreover, it is not inconsistent that given one inconsistency another should follow. Therefore it can be concluded that it is not required of the philosopher of nature that he resolve the arguments of this man.

18. He sets forth the second argument for this where he says, 'We physicists...' (185 a 13). The argument is as follows. In natural science it is supposed that natural things are moved, either all or some of them. He says this because there is doubt whether some things are moved and how they are moved, for example, about the soul and the centre of the earth, and the pole of heaven, and about natural forms and other such things. But the fact that natural things are moved can be made clear from induction, for it is apparent to the sense that natural things are moved.

It is as necessary that motion be supposed in natural science as it is necessary that nature be supposed. For motion is placed in the definition of nature, for nature is a principle of motion, as will be said below [II, L1].

Having established this point, that motion is supposed in natural science, he proceeds further to prove his position as follows. Not A arguments must be resolved in any science, but only those which conclude to something false from the principles of that science. Any arguments which do not reach their conclusions from the principles of the science, but from the contraries of these principles, are not resolved in that science. He proves this by an example taken from geometry saying that it pertains to geometry to resolve the problem of squaring, i.e., the squaring of a circle by dissecting the circumference, because this method supposes nothing contrary to the principles of the science of geometry. For somebody wished to find a square equal to a circle by dividing the circumference of the circle into many parts and placing straight lines in each part. And so by finding some figure, which was rectilinear, equal to some of the figures which were contained by the dissections of the circumference and the cords (either many or all), he thought he had found a rectilinear figure equal to the whole circle, to which it was easy to find an equal square through the principles of geometry. And thus he thought that he was able to find a square equal to a circle. But he did not argue well enough, for although these dissections used up the whole circumference of the circle, the figures contained by the dissections of the circumference and the straight lines did not encompass the whole circular surface.

But to resolve the square of Antiphon does not pertain to geometry, because he used principles contrary to those of geometry. For he described in a circle a certain rectilinear figure, for example, a square. And he divided in half the arcs by which the sides of the square were subtended. And from the points of dissection he led straight lines to all the angles of the square. And then there resulted in the circle a figure of eight angles, which more closely approached equality with the circle than the square. Then he again divided in half the arcs by which the sides of the octagon were subtended, and thus by leading straight lines from the points

of dissection to the angles of this figure there resulted a figure of sixteen angles, which still further approached equality with the circle. Therefore, by always dividing the arcs and leading straight lines to the angles of the figure already existing there will arise a figure very near to equality with the circle. He said, then, that it was impossible to proceed to infinity in the dissection of arcs. Therefore, it was necessary to arrive at some rectilinear figure equal to the circle to which some square could be equal.

But, because he supposed that an arc is not always divisible in half, which is contrary to the principles of geometry, it does not pertain to geometry to resolve an argument of this sort.

Therefore, because the arguments of Parmenides and Melissus suppose being to be immobile (as will be shown below [L5]), and since this is contrary to the principles supposed in natural science, it follows that it does not pertain to the natural philosopher to resolve arguments of this sort.

19. Next where he says, 'At the same time ...' (185 a 18), he states why he will argue against the aforementioned position. He says that because the philosophers mentioned above did speak of natural things, even though they did not create a problem (that is, in the sphere of natural science), it is useful for his present purpose to argue against opinions of this sort. For even though it does not pertain to natural science to argue against such positions, it does pertain to first philosophy.

LECTURE 3 (185 a 20-b 27)
THE ASSERTION OF PARMENIDES AND MELISSUS THAT ALL THINGS ARE ONE BEING IS REFUTED

20. After he has set forth the opinions of the philosophers concerning principles, here Aristotle argues against them.

First he argues against those who spoke unnaturally about nature. Secondly, where he says, 'The physicists, on the other hand ...' (187 a 11; L8 #53), he argues against those who spoke of nature in a natural way.

Concerning the first part he makes two points. First he argues against the position of Melissus and Parmenides, and secondly against their arguments, where he says,'Further the arguments they use ...' (186 a 5; L5 #29). Concerning the first part he makes two points. First he argues against the position that 'being is one' by using an argument dealing with the 'being'which is the subject in this

proposition. Secondly, where he says, 'Again, "one" itself . . .'(185 b 5 #22), he uses an argument dealing with the 'one' which is the predicate.

21. He says first that that which should be taken primarily as a principle in arguing against the aforesaid position is the fact that that which is, i.e., being, is said in many ways. For we must ask of those who say that being is one how they are using 'being': whether they take it for substance, or for quality, or for one of the other genera. And because substance is divided into the universal and the particular, i.e., into first and second substance, and further into many species, we must ask the following questions. Do they say that being is one as one man or as one horse, or as one soul, or as one quality, such as white or hot or some other such thing? For it makes a great difference which of these is said.

Hence, if being is one, it must either be substance and accident together, or it must be accident alone, or substance alone.

If, however, it is substance and accident together, then being will not be one only, but two. Nor does it differ with reference to this whether substance and accident are together in one thing as one or as different.

For even though they are together in one thing, they are not one simply, but one in subject. And so by positing substance with accident it follows that they are not one simply, but many.

If, however, it is said that being is accident only and not substance, this is altogether impossible. For accident can in no way be without sub~tance. For every accident is said of substance as of its subject, and the very definition of accident involves this.

If, however, it is said that being is substance only without accident, then it follows that it would not be a quantity, for quantity is an accident. And this is contrary to the position of Melissus. For he held that being was infinite, whence it follows that it is quantity, because the infinite, properly speaking, does not exist except in quantity. And substance and quality and the like are not said to be infinite except accidentally insofar as they are, for instance, together with quantity. Since, then, Melissus held being to be infinite, he cannot hold that it is substance without quantity. If, therefore, being is substance and quantity together, it follows that being is not one only, but two. If, however, it is substance alone, it is not infinite, because it will not have magnitude or quantity. Hence what Melissus says, namely, that being is one, can in no way be true.

22. Then where he says, 'Again "one" itself...' (185 b 5) he sets forth his second

argument which deals with the 'one'.

Concerning this he makes two points. First he gives the argument. Secondly, where he says, 'Even the more recent ...' (185 b 25; L4 #25), he shows how some have erred in the solution of this question.

He says first that just as being is said in many ways, so also is one. And so we must consider in what way they say that all things are one.

For 'one'is used in three ways: either as the continuous is one, such as a line or a body, or as the indivisible is one, such as a point, or as those things are said to be one whose nature [ratio] or definition is one, as drink and wine are said to be one.

First, therefore, he shows that we cannot say that all are one by continuity, because a continuum is in a certain respect many. For every continuum is divisible to infinity, and so contains many in itself as parts. Hence whoever holds that being is a continuum must hold that it is in a certain respect many.

And this is true, not only because of the number of the parts, but also because of the difference which seems to exist between the whole and the parts.

For there is a question whether the whole and the parts are one or many. And although this question, perhaps, does not pertain to the matter at hand, it is, nevertheless, worthy of consideration for its own sake. And here we consider not only the continuous whole, but also the contiguous whole whose parts are not continuous, such as the parts of a house which are one by contact and composition. It is clear that that which is a whole accidentally is the same as its parts. But this is not true of that which is a whole simply. For if that which is a whole simply the same as one of the parts, then for the same reason it would be the same as another of the parts. But things which are identical with the same thing are identical with each other. And thus it would follow that both parts, if they are held simply to be the same as the whole, would be identical with each other. Hence it would follow that the whole would be indivisible having no diversity of parts.

23. Next where he says, 'But to proceed ...' (185 b 18), he shows that it is impossible for all to be one as the indivisible is one. For that which is indivisible cannot be a quantity, since every quantity is divisible. As a result of this it cannot be a quality, if it is understood that we are speaking of a quality which is founded upon quantity. And if it is not a quantity, it cannot be finite as Parmenides has said, nor can it be infinite as Melissus has said. For an indivisible terminus, such

as a point, is an end and is not finite. For the finite and the infinite are found in quantity.

24. Next where he says, 'But if all things...' (185 b 19), he shows how it cannot be said that all things are one in definition [ratio]. For if this were true, three absurdities would follow.

The first is that contraries would be one according to definition [ratio), so that the definitions of good and evil would be the same, just as Heraclitus held the definitions of contraries to be the same,. as is made clear in *Metaphysics*, IV:3.

The second absurdity is that the definitions [*ratio*] of the good and the non-good would be the same, because non-good follows upon evil. And thus it would follow that the definitions of being and non-being would be the same. And it would also follow that all beings would not only be one being, as they hold, but also they would be non-being or nothing. For things which are one in definition are so related that they may be used interchangeably as predicates. Whence if being and nothing are one according to definition, then it follows, that if all are one being, all are nothing.

The third absurdity is that the different genera, such as quantity and quality, would be the same according to definition [*ratio*]. He sets forth this absurdity where he says '... "to be of such-and-such a quality" is the same as "to be of such-and-such a size"' (185 b 24).

We must note however, that, as the Philosopher says in *Metaphysics*, IV:4, against those who deny principles there can be no unqualified demonstration which proceeds from what is more known simply. But we may use a demonstration to contradiction which proceeds from those things which are supposed by our adversary, which things are, for the time being, less known simply. And so the Philosopher, in this argument, uses many things which are less known than the fact that beings are many and not only one—the point about which he argues.

LECTURE 4 (185 b 27-186 a 4)
THE LATER PHILOSOPHERS ALSO WERE INVOLVED IN THIS SAME ERROR, NAMELY, THAT THE ONE AND THE MANY COULD NOT IN ANY WAY CONCUR

25. Having disproven the opinion of Parmenides and Melissus that being is one, the Philosopher here shows that certain later philosophers fell into difficulty on

this very same problem.

Parmenides and Melissus erred because they did not know how to distinguish the uses of the term 'one'. Thus, what is one in a certain respect, they said was one simply. But the later philosophers, also not knowing how to distinguish the uses of the term 'one', thought it absurd that one and the same thing should be in some way one and many. Yet, being convinced by the arguments, they were forced to believe it. And so Aristotle says that the later philosophers were 'disturbed' (that is, fell into a difficulty similar to that of the ancients, i.e., Parmenides and Melissus) lest they be forced to say that one and the same thing is one and many. Now this seemed absurd to both groups of philosophers. So the earlier philosophers, holding that all is one, rejected all multiplicity. The later philosophers, on the other hand, tried to remove multiplicity from anything they held to be one.

26. Thus some, such as Lycophron, removed the verb is from propositions. They said that we must not say 'man is white' but rather 'white man'. For they thought that man and. white were in some way one, otherwise white would not be predicated of man. And it seemed to them that the word 'is', since it is a verbal copula, must serve as a copula between two. And so, wishing to remove all multiplicity from that which is one, they said the verb 'is' must not be used.

But because such speech seemed to be imperfect, and because an imperfect understanding was produced in the soul of him who heard if names were spoken without the addition of any verb, some, wishing to correct this, changed the mode of speech. They did not say 'white man' because of the imperfection of this mode of speech. Nor did they say 'man is white' lest they give the impression that there is multiplicity. Rather they said 'man whitened',' because by this expression 'whitened' [*albari*] a thing is not understood (as it seemed to them), but rather a certain change in the subject. And in like manner they said that we must not say 'man is walking' but 'man walks', lest by the addition of the verbal copula 'is' they make that which they thought to be one (i.e., white man) to be many, as if one and being were used in only one way and not in many.

27. But this is false, For that which is one in one respect can be many in some other respect, as what is one in subject can be many in definition [*ratio*]. Thus the white and the musical are the same in subject but many in definition [*ratio*]. Hence it can be concluded that the one may be many.

This may happen also in another way. That which is actually one as a whole may be many according to a division of parts. Whence the whole is one in its totality, but it has multiplicity of parts.

And although those who wished to remove the verb 'is' or alter it, as was said above [#26], found some solution to the objection that things could be one in subject and many in definition [*ratio*], they failed altogether to answer the objection that a thing may be one as a whole but many in its parts. They still believed it to be something of an absurdity that the one should be many.

But it is not absurd if the one and the many are not taken as opposites. For the one in act and the many in act are opposed, but the one in act and the many in potency are not opposed. And because of this he adds that 'one' is said in many ways, i.e., one in potency and one in act. And so nothing prohibits the same thing from being one in act and many in potency, as is clear with regard to the whole and the parts.

28. Finally he draws the conclusion which he had uppermost in mind, namely, that it is clear from the foregoing arguments that it is impossible for all beings to be one.

LECTURE 5 (186 A 5-22)
THE ARGUMENT OF MELISSUS IS ANSWERED

29. Having disproved the position of Parmenides and Melissus, here the Philosopher begins to answer their arguments.

Concerning this he makes three points. First he shows how their arguments are to be answered. Secondly, where he says, 'The fallacy of Melissus ...' (186 a 10 #31), he answers the argument of Melissus. Thirdly, where he says,'The same kind of argument ...' (186 a 23; L6 #36), he answers the argument of Parmenides.

30. He says that it is not difficult to answer the arguments with which Parmenides and Melissus reasoned. For each syllogized sophistically both in that, they assumed false propositions and in that they did not observe the proper form of the syllogism. But the argument of Melissus is the more gross, that is, more vain and foolish, and does not cause any difficulty. For he assumed what is contrary to natural principles and what is manifestly false, namely, that being is not generated. And it is not a serious matter, granting one absurdity, if another should follow.

31. Next when he says, 'The fallacy of Melissus ...' (186 a 10), he answers the argument of Melissus, which argument is as follows.

What is made has a beginning. Therefore what is not made has no beginning. But being is not made. Therefore it has no beginning, and as a result has no end. But what has neither beginning nor end is infinite. Therefore being is infinite. But what is infinite is immobile, for it would not have outside itself that by which it would be moved. Furthermore what is infinite is one, because if there were many there must necessarily be something outside the infinite. Therefore being is one and infinite and immobile.

Furthermore, in order to show that being is not generated, Melissus used a certain argument which some natural philosophers also used. Aristotle gives this argument below, near the end of Book I [L14 #120].

32. Aristotle disproves this argument of Melissus on four counts.

He argues first against the statement of Melissus that if what is made has a beginning, then what is not made has no beginning. This does not follow. Rather it is a fallacy of consequent. For he argues from the destruction of the antecedent to the destruction of the consequent, whereas the correct form of argumentation would be the converse. Whence it does not follow that if a thing which is made has a beginning, then that which is not made does not have a beginning. The correct conclusion would be that if a thing does not have a beginning, then it is not made.

33. Secondly, where he says, 'Then this also is absurd ...' (186 a 13), he disproves the argument under discussion with reference to the inference that if something has no beginning, then it is infinite.

For 'beginning' may be taken in two ways. In one way we speak of a beginning,. of time and of generation. And this meaning of beginning is taken when it is said that what is made has a beginning or what is not made has no beginning. In another sense, beginning is the beginning of a thing or a magnitude. And in this sense it would follow that if a thing has no beginning, then it is infinite.

Whence it is clear that Melissus uses the term 'beginning' as if it had one meaning only. Hence Aristotle says that it is absurd to say that every case of beginning is the beginning of a thing, that is, of a magnitude, so that the beginning of time and of generation is not another meaning of the term.

However a simple and instantaneous generation (which is the induction of a form in matter) does not have a beginning. For of a simple generation there is no beginning. But there is a beginning for a whole alteration whose terminus is a generation, since this would not be an instantaneous change. And because of this

terminus this is sometimes called a generation.

34. Thirdly, where he says, 'Again does it follow...' (186 a 15), he disproves the above position with reference to its third inference, namely, that because being is infinite, it is immobile.

He shows in two ways that this does not follow. First it does not follow in regard to local motion. For a part of water could be moved with in water so that it is not moved to any extrinsic place. In this case it would be moved by a joining and separation of the parts. And likewise, if the whole infinite body were water, it would be possible for the parts of it to be moved within the whole and not proceed outside the place of the whole. Again he disproves this with reference to the motion of alteration. For nothing prevents the infinite from being altered either as a whole or in its parts, for it would not be necessary to posit something outside the infinite to account for this.

35. Fourthly, where he says,'But further...'(186 a 19), he disproves the given argument with reference to its fourth inference by which it is concluded that, if being is infinite, it is one. For it does not follow that it is one according to species, but rather that it is one according to matter, just as some of the philosophers of nature have held that all things are one according to matter, but not according to species. For it is obvious that man and horse differ in species, and in like manner contraries differ from each other in species.

` 6 (186 a 23-b 35)
THE ARGUMENT OF PARMENIDES IS ANSWERED IN A NUMBER OF WAYS

36. Having disproved the argument of Melissus, here the Philosopher disproves the argument of Parmenides.

First he disproves the argument. Secondly, where he says, 'Some thinkers did...'(187 a 1; L7 #47ff.), he rejects what has been said by some who have argued badly against Parmenides.

Concerning the first part he makes two points. First he sets forth the ways in which the argument of Parmenides is to be refuted. Secondly, where he says,'His assumption...'(186 a 24 #39), he resolves the argument in these ways.

37. Concerning the first part it must be known that the argument of Parmenides was as follows, as is clear from *Metaphysics*, I:5. Whatever is other than being is

non-being. But what is non-being is nothing. Therefore whatever is other than being is nothing. But being is one, therefore whatever is other than one is nothing. Therefore there is only one being. And from this he concluded that it would be immobile, because it would not have anything by which it would be moved, nor would there be anything outside of it by which it would be moved.

It is clear, moreover, from their very arguments that Parmenides considered being under the aspect [*secundum rationem*] of being, and so held it to be one and finite; whereas Melissus considered being from the point of view of matter. For Melissus considered being insofar as it is made or not made. And so he held being to be one and infinite.

38. Aristotle says, therefore, that the same approach must be used against the argument of Parmenides that was used against the argument of Melissus. For as the argument of Melissus was answerdd on the basis that he assumed false propositions and did not draw his conclusions according to the correct form of the syllogism, so also the argument of Parmenides is answered partly because he assumed false propositions and partly because he did not draw his conclusions correctly.

He says, however, that there are also other appropriate ways of arguing against Parmenides. For it is possible to argue against Parmenides from the propositions which he assumed and which are in a certain respect true and probable. But Melissus proceeded from what was false and improbable, for example, that being is not generated. Because of this, Aristotle did not argue against Melissus from the propositions which he assumed.

39. Next where he says, 'His assumption ...' (186 a 24), he follows the procedures just mentioned. First according to the first way, and secondly according to the second way, where he says, 'His conclusion does not follow ...' (186 a 25 #40).

He says, therefore, first that Parmenides assumed false propositions because he held that what is, i.e., being, is used simply, i.e., in one way. Whereas in fact it is used in many ways.

For being is used in one way for substance, in another way for accident; and the latter is used in many ways according to the different genera. Being also can be used commonly for substance and accident.

Hence it is clear that the propositions assumed by Parmenides are true in one sense and false in another. For when it is said that whatever is other than being

is non-being, this is true if being is taken, as it were, commonly for substance and accident. If, however, being is taken for accident alone or for substance alone, this is false, as will be shown below [#42-43].

Likewise when he says that being is one, this is true if being is taken for some one substance or for some one accident. But this will not be true in the sense that whatever is other than that being is non-being.

40. Next where he says, 'His conclusion does not follow ...' (186 a 25), he follows the second method of answering the argument, i.e., that the argument of Parmenides does not draw its conclusion according to proper form.

He shows this first in an example. And secondly, where he says, 'It is necessary for him ...' (186 a 33 #41), he adapts this example to the problem at hand.

He says, therefore, first that it can be seen that the argument of Parmenides does not draw its conclusion properly because of the fact that the form of argumentation used is not efficacious in every matter. And this could not be true if a proper form of argumentation were used. For if we take 'white' in the place of 'being', and if we say that 'white' signifies one thing only and is not used equivocally, and if we say that whatever is other than white is non-white, and whatever is non-white is nothing, then it will not follow that white would be one only. For it will not be necessary that all white things are one continuum. Or, to put it differently, white will not necessarily be one by continuity, i.e., from the fact that white is a continuum, it will not be one simply. For a continuum is in a certain respect many, as was said above [L3 #22].

And in like manner white will not be one in definition [*ratio*], for the white and that which is receptive of the white are different in definition [*ratio*]. Furthermore there will not be something other than white, as it were, separated from it. For the white is not other than that which is receptive of it because the white is separable from that which is receptive of it, but because the definitions [*ratio*] of the white and of that which is receptive of it are different. But. it was not yet known at the time of Parmenides that something could be one in subject and many in definition [*ratio*].

41. Next where he says, 'It is necessary for him ...' (186 a 33), he adapts this example to the matter at hand in order to show how what he has said of the white also applies to being.

Concerning this he makes two points. First he shows that it does not follow that being is one simply. For subject and accident are different according to definition

[*ratio*]. Secondly, where he says, 'In particular then...' (186 b 13 #44), he shows that this does not follow because of the multiplicity of parts.

Concerning the first part he makes two points. First he shows that when it is said that 'whatever is other than being is non-being', this 'being' cannot be taken to mean accident alone. Secondly, where he says, 'If, then, substance ...' (186 b 4 #43), he shows that this 'being' cannot be taken to mean substance alone.

42. He says, therefore, first that when it is said that 'whatever is other than being is non-being', if 'being' is said to signify one thing, then it will be necessary that it signify not some one being or what is predicated of some one thing. Rather it will signify what truly is, i.e., substance, and it will signify what is truly one, i.e., the indivisible. For if being were to signify accident, then, since accident would be predicated of a subject, the subject could not be that to which the accident, which is called being, occurs. For if whatever is other than being is non-being (i. e., other than accident), and if the subject is other than the accident, which is here said to be being, then it follows that the subject is nonbeing. And so when accident, which is being, is predicated of the subject which is non-being, it follows that being is predicated of non-being. Hence, Aristotle concludes, 'Something, therefore, which is not win be' (186 b 1), that is, it will follow that non-being is being. This, however, is impossible.. For what is first of all assumed in the sciences is that contradictories are not to be predicated of each other, as is said in *Metaphysics*, IV:7. Whence he concludes that if anything is truly being, as is supposed in the proposition 'whatever is other than being is nonbeing', it follows that it is not an accident inhering in something else. For in this case its subject would not be a being. That is, this subject would not have the nature [*ratio*] of being, unless being should signify many, so that each of the many would be a being. But it was assumed by Parmenides that being signifies one only.

43. Next where he says, 'If, then, substance.. .'(186 b 4), after he has concluded that 'being' cannot refer to accident when it is said that 'whatever is other than being is non-being', he shows further that 'being' cannot refer to substance either. Whence he says that if what truly is does not happen to something, but other things happen to it, then in the proposition 'whatever is other than being is non-being', it is necesstuy that 'what truly is', i.e., substance, be signified by being rather than by non-being.

But this cannot stand. For let it be held that that which truly is, i.e., substance, is white. But white is not that which truly is. For it has already been said that that which truly is cannot happen to something. And this is so because what is not truly, i.e., what is not substance, is not that which is, i.e., is not being. But what is other than being, i.e., other than substance, is non-being. Hence it follows that

white is non-being, not only in the sense that it is not this being, as a man is not this being which is an ass, but also in the sense that it is not in any way. For he says that whatever is other than being is non-being, and what is nonbeing is nothing. From this, therefore, it follows that non-being would be predicated of that which truly is, because white is predicated of substance, which truly is. And white does not signify being, as was said.

Whence it follows that being is non-being. And this indeed is impossible, because one contradictory is not predicated of another.

Whence, if in order to avoid this inconsistency, we say that true being signifies not only the subject, but also the white itself, it follows that being will signify many. And thus there will not be only one being, for subject and accident are many according to nature [*ratio*].

44. Next where he says, 'In particular then ...' (189 b 13), he shows, because of the multiplicity of parts, that it does not follow from the argument of Parmenides that there is only one being. He shows this first with reference to quantitative parts and secondly with reference to the parts of definition [*ratio*], where he says, 'Substance is plainly divisible ...' (186 b 14).1

He says, therefore, first that if being signifies only one thing, not only will it not be accident with subject, but neither will it be a, magnitude. For every magnitude is divisible into parts. But the natures [*ratio*] of each of the parts are not the same, but different. Whence it follows that this one being is not a corporeal substance.

45. Secondly, where he says, 'Substance is plainly divisible ...' (186 b 14), he shows that this being cannot be a definable substance.

For in a definition it is clear that that which truly is, i.e., the substance, is divided into many, each one of which is what truly is, i.e. substance, and each one of which has a different nature [*ratio*]. Let us suppose that man is one thing which truly is. Since man is a two-footed animal, it is necessary that animal be and that two-footed be. And each of these will be what truly is, i.e., substance. And if they are not substances, they are accidents, either of man or of some other thing. But it is impossible that they be accidents of man.

And to make this clear he assumes two things.

First he assumes that 'accident' is used in two ways. One type of accident is separable, and as such can be in something or not in it, for example, to sit.

Another type of accident is inseparable and *per se*. And this latter is the accident in whose definition is placed the subject in which it is. For example, the snub is a *per se* accident of nose, because nose is placed in the definition of the snub. For the snub is a curved nose.

The second thing which he assumes is that if certain things are placed in the definition of that which is defined, or in the definition of the things on which the definition depends, then it is impossible that the whole definition of that which is defined be placed in the definition of these certain things. Thus two-footed is placed in the definition of man, and certain other things are placed in the definition of two-footed or animal, from which [i.e., from two-footed and animal] man is defined. Hence it is impossible that man be placed in the definition of two-footed or in the definition of any of the things which fall in the definition of two-footed or of animal. Otherwise we would have a circular definition, and one and the same thing would be both prior and posterior, better known and less known. For every definition is from the prior and the better known, as is said in *Topics*, VI:4. And for the same reason, when white is placed in the definition of white man, it is impossible for white man to be placed in the definition of white.

These things having been assumed, the argument is as follows. If twofooted is an accident of man, it must be either a separable accident (and thus it could happen that man is not two-footed, which is impossible) or an inseparable accident (and thus it will be necessary that man be placed in the definition of two-footed). But this also is impossible, because twofooted is placed in the definition of man. It is impossible, therefore, that two-footed be an accident of man. For the same reason animal cannot be an accident. If, however, it is said that both are accidents of something else, it would follow that man also would be an accident of something else. But this is impossible, for it has already been said above that that which truly is is an accident of nothing. But man was assumed to be that which truly is, as is clear from what was said above.

That it would follow that man would be an accident of another if animal and two-footed were accidents of another, he shows as follows. What is said of both animal and two-footed taken separately may be said of them taken together, i.e., two-footed animal. And what is said of two-footed animal may be said of that which is from them, i.e., man, ecause man is nothing other than a two-footed animal.

Therefore it is clear that if being is held to be one only, we cannot hold that there are quantitative parts, or parts of a magnitude, or parts of a definition. Therefore it follows that every being is numerically indivisible. Otherwise, while holding being to be one, we would be forced to posit a multiplicity because of the parts.

46. the Commentator, however, says that in the passage beginning, 'But we must assume ...' (186 b 33), Aristotle sets forth the second argument of Parmenides to show that being is one. And this argument is as follows. A being which is one is substance and not accident (and by substance he means body). If, however, that body is divided into two halves, it will follow that being is predicated of each half and of the union of the two. And this either proceeds to infinity, which is impossible in itself, or else the being is divided into points. But this also is impossible. Hence it follows that being is an indivisible one.

But this exposition is fabricated and contrary to the intention of Aristotle, as is sufficiently clear from an examination of the letter of the text according to the first explanation.

LECTURE 7 (187 a 1-10)
HE DISPROVES THE POSITION OF THOSE WHO SAID THAT NON-BEING IS SOMETHING

47. After the Philosopher has disproved the argument of Parmenides by bringing forth certain inconsistencies found in it, he here disproves the position of those who have conceded these inconsistencies.

Concerning this he makes two points. First he sets forth their position. Secondly, he disproves it where he says, 'But obviously it is not...' (187 a 3 #50).

48. It must be noted first that the Philosopher used two arguments above [L6 #36ff.] against the argument of Parmenides. He used one to show that, because of the diversity of subject and accident, it does not follow from the argument of Parmenides that all is one. This argument led to the absurdity that non-being is being, as is clear from what was said above. The other argument proceeded to show that the conclusion that an is one does not follow because, if it were a magnitude, it would follow that this magnitude is indivisible. For if it were divisible, there would be some sort of multiplicity.

49. The Platonists, however, gave in to each argument, conceding the impossibilities to which they led.

They accepted the first argument which led to the conclusion that non-being would be being. Suppose that someone were to say that being signifies one thing, either substance alone or accident alone, and because of this he might also wish to say that all things are one-in regard to this argument, I say, they accepted [the conclusion] that non-being would be being.

For Plato said that accident is non-being. And because of this it is said in *Metaphysics*, VI:2 that Plato held that sophistry dealt with nonbeing, because it treated most of all those things which are predicated per accidens. Therefore Plato, understanding being to be substance, conceded the first proposition of Parmenides who said that whatever is other than being is non-being. For Plato held that accident, which is other than substance, was non-being.

He did not, however, concede the second proposition, namely, that whatever is non-being is nothing. For although he would say that accident is non-being, he did not say that accident is nothing, but rather that it is something. And because of this, according to Plato, it does not follow that being is one only.

But Plato, when he made magnitudes to be indivisible by dissection, that is, when he said that a magnitude is terminated in indivisibles by division, did assent to the other argument which led to the conclusion that a magnitude would be indivisible. For he held that bodies are resolved into surfaces, and surfaces into lines, and lines into indivisibles, as is clear in *De Caelo et Mundo*, III:1.

50. Next where he says, 'But obviously ...' (187 a 3), he disproves the above position in regard to the point that Plato conceded, namely, that non-being is something. In regard to the other point, namely, that Plato held that there are indivisible magnitudes, this is disproved in its proper place in the following books of natural science [VI L1].

He disproves the first point in two ways. First he shows that it does not follow from the argument of Plato that non-being is something. Secondly, he disproves Plato's remark that unless we hold this (i.e., that the non-being which is accident is something), it will follow that all is one. He does this where he says, 'To say that all things ...' (187 a 7 #52).

51. He says, therefore, first that the argument by which Plato concluded that being signifies one clearly does not follow. For he held that being is a genus and is predicated univocally of all things by a participation in the first being. And further he held that contradictories cannot be true at the same time. From these two points he thought that it followed that non-being is not nothing, but something. For if being signifies the one, which is substance, it will be necessary that whatever is not substance is non-being. For if it were being, then since being does not signify anything but substance, it would follow that it would be substance. And so it would at once be substance and non-substance, in which case contradictories would be true at the same time. If, therefore, it is impossible for contradictories to be true at the same time, and if being signifies the one, which is substance, it would follow that whatever is not substance is non-being.

But there is something which is not substance, namely, accident. Therefore something is non-being. And so it is not true that non-being is nothing.

But Aristotle shows that this does not follow. For if being signifies principally the one, which is substance, there is nothing to prevent one from saying that accident, which is not substance, is not being simply. But because of this it is not necessary to say that that which is not something, i.e., not substance, is absolute non-being. Hence, although accident is not being simply, it cannot, indeed, be called absolute nonbeing.

52. Next where he says, 'To say that all things ...' (187 a 7), he shows further that, if the non-being which is accident is not something, it does not follow that all is one. For if being can mean only substance, which truly is, then he says that it is absurd to hold that it would follow that all things are one unless there is something outside of being. For if there is substance, there is nothing to prevent there being a multiplicity of substances, as has already been said [L6 #45], even if magnitude and accident are removed. For the definition of substance is divided into the many things which are in the genus of substance, as man is divided into animal and two-footed. And further it follows that according to the diverse differentiae of a genus there are many substances in act. And finally he draws the conclusion which he had uppermost in mind, namely, that all things are not one, as Parmenides and Melissus said.

LECTURE 8 (187 a 11-26)
THE OPINIONS OF THE PHYSICISTS WHO SPOKE OF THE PRINCIPLES AS NATURAL PHILOSOPHERS

53. After the Philosopher has disproved the opinion concerning principles of those who did not speak of nature as natural philosophers, he here pursues the opinions of those who, not disregarding motion, spoke of the principles of nature as natural philosophers. And he calls these men physicists, i.e., natural philosophers.

Concerning this he makes two points. First he sets forth the diversity of their opinions. Secondly he examines one of these opinions, where he says, 'The theory of Anaxagoras ...' (187 a 28; L9 #58).

54. He says first that according to the opinion of the natural philosophers there are two ways in which things are generated from principles. One of the opinions was advanced by the natural philosophers who held that there is only one material principle. This principle would be either one of three elements, i.e., fire,

air, and water (for no one made earth alone the principle, as was said above [L2 #13]) or else some intermediate between them, for example, that which would be more dense than fire and more subtle than air. Theythen said that all other things were generated from this one principle by rarity and density. For example, those who made air to be the principle said that fire was generated from air by rarefaction, and water by condensation. However, the dense and the rare are contraries and are reduced to excess and defect as to something more universal. For the dense is what has much matter, whereas the rare has little.

55. And thus they agreed in a certain respect with Plato who held that the great and the small are principles which also pertain to excess and defect. But they differed from Plato as follows. Plato held that the great and the small are on the side of matter, because he posited one formal principle which is a certain idea participated in by different things according to a diversity of matter; the ancient natural philosophers, on the other hand, maintained a contrariety on the part of form, because they held that the first principle is one matter from which many things were constituted in being according to different forms.

56. Other natural philosophers, however, held that things come to be from principles in such a way that contraries themselves and different things are drawn forth from one thing in which they already existed, as it were, mixed and confused.

But they differed as follows. Anaximander held that the principle is one confused state in which there are not many things mixed together. Thus he held one principle only. But Empedocles and Anaxagoras held rather that the principles are the very things which are mixed together in that one confused state. And so they held many principles, although they also held that this one confused state is in some way a principle.

57. But Anaxagoras and Empedocles differed on two points. First, Empedocles held that there is a certain cycle of mixing and separating. For he held that the world has been made and corrupted many times; that is to say, when the world has been corrupted by friendship gathering all into one, the world is then generated again by strife separating and distinguishing. And thus the distinction of things follows upon their being confused, and vice versa. But Anaxagoras held that the world was made only once, such that from the beginning all things were mixed into one. But mind, which began to draw out and to distinguish, will never cease to do this, so that all things never will be mixed into one.

They also differed in another way. Anaxagoras held that the principles are infinite parts which are alike and contrary. Thus there are infinite parts of flesh which are

like each other and infinite parts of bone and other things which have similar parts, yet each has a contrariety to the others. Thus the contrariety of the parts of bone to the parts of blood is that of the dry to the moist. But Empedocles held as principles only those four things which are commonly called elements, i.e., fire, air, water, and earth.

LECTURE 9 (187 a 27-188 a 18)
THE OPINION OF ANAXAGORAS THAT THE PRINCIPLES ARE INFINITE IS REFUTED

58. Having set forth the opinions of the natural philosophers concerning the principles, he here pursues one of these opinions, namely, that of Anaxagoras. For this opinion seemed to assign a common cause for all the species of motion.

The discussion is divided into two parts. In the first part he sets forth Anaxagoras' argument; in the second part he raises objections against it, where he says, 'Now the infinite ...' (187 b 7 #64).

Concerning the first part he makes three points. First he sets forth those things which Anaxagoras supposed and from which he argues. Secondly, where he says, 'The one, they reasoned ...' (187 a 33 #62)2 he sets forth the order of his argument. Thirdly, where he says, 'But things, as they say ...' (187 b 2 #63), he sets forth Anaxagoras' response to a certain tacit objection.

59. Anaxagoras assumed two things from which he argued. The first of these is a point which is assumed by all of the natural philosophers, namely, that nothing comes to be from nothing. And Aristotle says that, because of this, Anaxagoras seemed to have held the opinion that the principles are infinite. For he accepted as true the common opinion of all philosophers of nature, namely, that what simply is not in no way comes to be. For they assumed this as a principle and then developed their different opinions.

60. Lest they would be forced to hold that something new comes to be which previously was in no way at all, some held that all things from the beginning existed together, either in some one confused state, as Anaxagoras and Empedocles held, or in some natural principle, such as water, fire, and air, or some intermediate between these.

And in accordance with this they posited two modes of production.

Those who held that all things pre-existed together as in one material principle

said that to come to be is nothing other than to be altered. For they said that all things come to be from that one material principle through its condensation and rarefaction.

Others, however, who held that all things pre-existed together in some one confused state and mixture of many, said that the coming to be of things is only a joining together and a separation.

All of these philosophers were deceived because they did not know how to distinguish between potency and act. For being in potency is, as it were, a mean between pure non-being and being in act. Therefore, those things which come to be naturally do not come to be from nonbeing simply, but from being in potency, and not, indeed, from being in act, as they thought. Hence things which come to be did not necessarily pre-exist in act, as they said, but only in potency.

61. Next where he says, 'Moreover the fact that ...' (187 a 32), he mentions the second thing which Anaxagoras assumed.

Anaxagorai said that contraries come to be from each other. For we see the cold come to be from the hot, and vice versa. And from this he concluded that, since nothing comes to be from nothing, one of the contraries pre-exists in the other.

And this is true, of course, in respect to potency. For the cold is in the hot in potency, but not in act, as Anaxagoras thought. For he was not aware of being in potency, which is a mean between pure non-being and being in act.

62. Next where he says, 'The one, they reasoned ...' (187 a 33), he sets forth the deductive order of the argument.

Anaxagoras proceeded as follows. If something comes to be, it is necessary that it should come to be either from being or from nonbeing. But he excluded one of these alternatives-namely, that something should come to be from non-being. He does this because of the common opinion of the philosophers mentioned above [#59]. Whence he concluded that the remaining member was correct, namely, that a thing comes to be from being. For example, if air comes to be from water, then air pre-existed. For it cannot be said that air comes to be from water unless air pre-existed in water. Hence he wished to say that everything which comes to be from something pre-existed in that from which it comes to be.

But because this seemed to be contrary to what appears to the senses (for it is not apparent to the senses that that which is generated from something pre-exists in it), he forestalled this objection by holding that that which comes to be

from something pre-exists in it as certain most minute parts which are not sensible to us because of their smallness. For example, if air comes to be from water, certain minute parts of air are in the water, but not in that quantity in which it is generated. And so he said that by the gathering together of these parts of air by themselves, and by their separation from the parts of water, air comes to be.

Having accepted, therefore, that everything which comes to be from something pre-exists in it, he further assumed that everything comes to be from everything. Whence he concluded that everything would be mixed in everything else as minute, non-sensible parts.

And because an infinite variety of things can come to be from another, he said that infinite minute parts were in each thing.

63. Next where he says, 'But things, as they say ...' (187 b 2), he excludes a certain tacit objection.

It is possible for someone to object as follows. If infinite parts of everything are in everything, it would follow that things neither differ from each other nor appear to differ from each other.

Therefore, as if he were answering this objection, Anaxagoras says that things appear to differ from each other and 'are diversely named because of that which is dominant in them, even though there,is an infinite number of minute parts contained in'any mixture. And so nothing is purely and totally white or black or bone. Rather, that which abounds in each thing seems to be the nature of that thing.

64. Next where he says, 'Now the infinite ...' (187 b 7), Aristotle refutes the above mentioned position.

Concerning this he makes two points. First he disproves the position absolutely. Secondly, where he says, '... and it is better...' (188 a 17), he compares it to the opinion of Empedocles.

Concerning the first part he makes two points. First he sets forth arguments to disprove the opinion of Anaxagoras. Secondly, where he says, 'The statement that...' (188 a 5 #72), he disagrees with Anaxagoras' way of understanding his own position.

Concerning the first part he gives five arguments.

The first of these is as follows. Every infinite thing, in that respect in which it is infinite, is unknown. He explains why he says 'in that respect in which it is infinite'. If it is infinite in respect to multitude or magnitude, it will be unknown in respect to quantity. If, however, it is infinite in respect to species (for example, if it is composed of an infinite variety of species), then it will be unknown according to quality. And the reason for this is that what is known by the intellect is grasped by the intellect with respect to all that belongs to that thing. But this cannot happen with regard to something infinite. If, therefore, the principles of a thing are infinite, they must be unknown either in respect to quantity or in respect to species.

But if the principles are unknown, those things which are from the principles must be unknown. He proves this as follows. We think that we know any composite when we know from what and from how many [principles] it is composed, i.e., when we know both the species and the quantity of the principles. It follows, therefore, from first to last that, if the principles of natural things are infinite, then natural things are unknown either in respect to quantity or in respect to species.

65. At the point where he says, 'Further if the parts ...' (187 b 14), he gives the second argument, which is as follows.

If the parts of a whole do not have a determinate quantity, either great or small, but can be any size, either great or small, it is not necessarythat the whole have a determinate greatness or smallness. Rather the whole could have any size. This is so because the quantity of the whole comes from the parts. (But this must be understood of the parts existing in act in the whole, as flesh and nerve and bone exist in an animal. Hence he says, '... by parts I mean components into which a whole can be divided and which are actually present in it' (187 b 15). And by this he excludes the parts of a continuous whole which are in the whole in potency.)

But it is impossible that an animal or a plant or some such thing be related indeterminately to any size, whether great or small. For there is some quantity so large that no animal exceeds it in size. So also there is some quantity so small that no animal is found to be smaller. And the same must be said of plants. Therefore by denying the consequent it follows that the parts are not of indeterminate quantity. For what is true of the whole is true of the parts. But flesh and bone and things of this sort are parts of an animal, and fruits are parts of plants. Therefore it is impossible that flesh and bone and such things should have an indeterminate quantity, either greater or smaller. Therefore it is not possible that there should be certain parts of flesh or bone which are non-sensible because of smallness.

66. It seems, however, that what is said here is contrary to the statement that a continuum is divisible to infinity. For if the continuous is divisible to infinity, and flesh is, indeed, a kind of continuum, it seems that flesh is divisible to infinity. Therefore, some part of flesh, according to a division to infinity, goes beyond every determinate smallness.

But it must be pointed out that although a body, considered mathematically, is divisible to infinity, the natural body is not divisible to infinity. For in a mathematical body nothing but quantity is considered. And in this there is nothing repugnant to division to infinity. But in a natural body the form also is considered, which form requires a determin.ate quantity and also other accidents. Whence it is not possible for quantity to be found in the species of flesh except as determined within some termini.

67. He gives the third argument where he says, 'Again according to the theory ...' (187 b 23).

Concerning this he makes two points. First he sets forth certain things which are the basis of the argument. Secondly, where he says, 'For let flesh ...' (187 b 28 #68), he sets forth the deductive order of the argument.

Concerning the first part he proposes three things.

The first is that according to the position of Anaxagoras, as was said above [#62], all things are together. And from this Aristotle wishes to reduce Anaxigoras' argument to absurdity. For Anaxagoras said, as was pointed out [#62ff], that all things which are of a certain kind, i.e., all things which are of like parts, such as flesh and bone and the like, are in each other, and do not come to be from nothing, but are separated from that in which they pre-exist. And each thing is named from that which abounds in it, i.e., from the largest number of parts existing in the thing.

The second point is that everything comes to be from everything, as water comes to be by separation from flesh, and in the same way flesh comes to be from water.

And the third point is that every finite body is reduced by a finite body. That is, if from some finite body, however large, a finite body, however small, is taken away, the smaller can be taken away from the larger until eventually the greater whole is consumed by the smaller through division.

And from these three points Aristotle concludes what he primiarily intended, namely, that each thing is not in each thing. And this is contrary to the first of these three points. For in arguments which lead to absurdity the denial of one of the premises is the final conclusion.

68. Next where he says, 'For let flesh...'(187 b 28), he develops his argument and assumes what was concluded in the preceding argument.

He says that if flesh is removed from water (since flesh is generated from water), and if again another separation of flesh is made from the remaining water, then although there will always remain a smaller quantity of flesh in the water, still the size of that flesh is not less than a certain smallness, i.e., there happens to be a certain small measure of flesh than which there will not be any smaller flesh, as is clear from the argument given above.

Therefore, having established that there is some small particle of flesh than which there is no smaller, he proceeds as follows.

If from water flesh is separated, and again other flesh, the process of separation will either stop or it will not. If it stops, then there is no flesh in the remaining water, and everything will not be in everything. If it does not stop, then some part of flesh will always remain in the water. Thus in the second separation the remaining flesh is smaller than in the first, and in the third it is smaller than in the second. And since we cannot proceed to infinity in smallness of parts, as was said, then the smallest parts of flesh are equal and infinite in number in some finite body of water. Otherwise separation could not proceed to infinity. It follows, therefore, that if the separation does not stop, but flesh is always removed from water to infinity, then in some finite magnitude, e.g., water, there are certain things which are finite in respect to quantity, and equal to each other, and infinite in respect to number, namely, the infinite smallest parts of flesh. But this is impossible and contrary to what was said above, namely, that every finite body is reduced by some finite body. Therefore the first point, namely, that everything is in everything, as Anaxagoras held, is also impossible.

69. We must note that it is not without reason that the Philosopher used the term 'equal' in stating the last absurdity to which this position leads. For if the nature of quantity is considered, it is not absurd that an infinity of unequal parts be in a finite body. For if a continuum is divided according to the same proportion, it will be possible to proceed to infinity, for example, if we take a third of a whole, and then a third of the third, and so on. In this case, however, the parts were not taken as equal in quantity. But if the division is made according to equal parts, we will not be able to proceed to infinity even if we consider only the nature

[*ratio*] of quantity which is found in a mathematical body.

70. He gives his fourth argument where he says, 'Another proof may be added ...' (187 b 35). The argument is as follows.

Every body becomes a smaller one when something is taken from it, because every whole is greater than its parts. Since then the quantity of flesh is determinately great or small, as is clear from what was said above, there must be some smallest bit of flesh. Therefore from this nothing can be separated, because the remainingfiesh would be smaller than this smallest piece of flesh. Therefore it is impossible that everything comes to be from everything by separation.

71. At the point where he says, 'Lastly in each ...' (188 a 3), he gives his fifth argument, which is as follows. If infinite parts of each thing are in each thing, and everything is in everything, it follows that infinite parts of flesh and infinite parts of blood and brain are in an infinite number of bodies. And regardless of how much is separated, the same amount would always remain. Therefore it would follow that the infinite is in the infinite infinitely. But this is unthinkable.

72. Next where he says, 'The statement that ...' (188 a 5), he disproves the position of Anaxagoras according to Anaxagoras' own understanding of it.

He does this in two ways. First he shows that Anaxagoras did not understand his own position. Secondly, where he says, 'Nor is Anaxagoras...'(188 a 13),1 he shows that Anaxagoras did not have sufficient evidence for holding this position.

He says, therefore, first that although Anaxagoras has in a certain respect spoken the truth, he himself did not understand what he said when he held that the process of separation would never end. For accidents can never be separated from substance; yet he held that there was a mixture not only of bodies but also of accidents. When something becomes white, he said that this happened by an abstraction of white froin the previously existing mixture. If then colours and other accidents of this sort are mixed together, as he said, and if someone on this supposition says all things that are mixed can be separated, it would follow that there would be white and healthy, and yet there would be no subject of which these are predicated and in which they are. But this is impossible. Therefore the truth is that if accidents are in the mixture it is impossible that all mixed things can be separated.

Another absurdity results from the following. Anaxagoras held that all things were mixed from the very beginning, but intellect began to separate them. Now any intellect which attempts to do what cannot be done is not worthy of the name

intellect. Hence that intellect will be inconsistent, intending the impossible, if it truly wishes this, i.e., wishes to separate things completely. For this is impossible both from the point of view of quantity, because there is no smallest magnitude, as Anaxagoras said, for from any small quantity something can be subtracted, and from the point of view of quality, because accidents are not separable from their subjects.

73. Next where he says, 'Nor is Anaxagoras ...' (188 a 13), he disproves this position by reason of the fact that Anaxagoras did not have sufficient evidence.

Since Anaxagoras saw that a thing is made large by the coming together of many small parts which are similar, as a stream is made from many brooks, he believed this to be the case for all things. And thus Aristotle says that Anaxagoras did not correctly understand the generation of things of the same species, i.e., he did not understand that a thing is not always generated by things which are similar in respect to species. For some things are both generated from and are resolved into things like unto themselves, as clay is divided into bricks; in other instances, however, this is not so. For some things are generated from that which is dissimilar. And in these instances there is not merely one mode of production. For some things are made by alteration from that which is unlike, as the sides of a house are made from clay and not from sides; whereas other things are made by composition, as the house is not made of houses, but of sides. It is in this way that air and water come to be from each other, i.e., as from the unlike.

Another reading here is 'as the sides are from the house'. And thus he sets forth a twofold way in which things come to be from the unlike, i.e., through composition, as the house is made of sides, and by resolution, as the sides come to be from the house.

74. Next where he says, '... and it is better ...' (188 a 17), he disproves the position of Anaxagoras by comparing it with the opinion of Empedocles. He says that it is better to make the principles smaller in number and finite, as Empedocles does, than to make them many and infinite, as does Anaxagoras.

LECTURE 10 (188 a 19-189 a 10)
THE OPINIONS OF THE ANCIENTS CONCERNING THE CONTRARIETY OF THE FIRST PRINCIPLES

75. Having set forth the opinions of the ancient philosophers concerning the principles of nature, Aristotle here begins to seek the truth.

He seeks it first by way of disputation, proceeding from probable opinions. Secondly, where he says, 'We will now give ...' (189 b 30; L12 #98), he determines the truth demonstratively. The Oxford English translation seems to be based upon this variant reading. Lecture 12, 98.

Concerning the first part he makes two points. First he investigates the contrariety of the principles, secondly, where he says, 'The next question is ...' (189 a 11; L11 #82), he inquires about their number.

Concerning the first part he makes three points. First he sets forth the opinion of the ancients about the contrariety of the principles. Secondly, where he says, 'And with good reason ...' (188 a 27 #77) he gives an argument in favour of this position. Thirdly he shows how the philosophers are related to each other in saying that the principles are contraries. He does this where he says, 'Up to this point...' (188 b 27 #79).

76. He says, therefore, first that all of the ancient philosophers posited contrariety in the principles. And he makes this clear by citing three opinions of the philosophers.

For some philosophers have said that the whole universe is one immobile being. Of these, Parmenides said that all things are one according to reason, but many according to sense. And to the extent that there are many, he posited in them contrary principles, e.g., the hot and the cold. He attributed the hot to fire and the cold to earth.

Secondly there was the opinion of the natural philosophers who posited one material and mobile principle. They said that other things come to be from this principle according to rarity and density. Thus they held that the rare and the dense are principles.

A third opinion was advanced by those who posited many principles. Among them, Democritus held that all things come to be from indivisible bodies which are joined together. And in this contact with each other they left a sort of void. Such voids he called pores, as is clear in *De Generatione*, I:8. Therefore he held that all bodies are composed of the fixed and the empty, that is, composed of the plenum and the void. Hence he said that the plenum and the void are principles of nature. But he assdeiated the plenum with being and the void with non-being. And although all of these indivisible bodies are one in nature, he said that different things are composed of them according to a diversity of figure, position, and order. Thus he held that the principles are contraries in the genus of position, i.e., above and below, before and behind, and also contraries in the

genus of figure, i.e., the straight, the angular, and the circular. The principles also are contraries in the genus of order, i.e., prior and posterior. (These last contraries are not mentioned in the text because they are obvious.) And thus Aristotle concludes, by a sort of induction, that all of the philosophers held that the principles are contraries in some way. He makes no mention of the opinion of Anaxagoras and Empedocles because he has already explained their position at length above [L8 #56-57]. However, they also placed a certain contrariety in the principles when they said that all things come to be through joining and separating, which agree in genus with the rare and the dense.

77. Next where he says, 'And with good reason' (188 a 27), he gives a probable argument to show that the first principles are contraries. The argument is as follows.

Three things seem to belong to the very nature of principles. First, they are not from other things. Secondly, they are not from each other. Thirdly, all other things are from them. But these three notes are found in the primary contraries. Therefore the primary contraries are principles.

Now in order to understand what he means when he speaks of primary contraries, we must realize that some contraries are caused by other contraries, e. g., the sweet and the bitter are caused by the wet and the dry and the hot and the cold. Since, however, it is impossible to proceed to infinity, but one must come to certain contraries, which are not caused by other contraries, he calls these last contraries the primary contraries.

Now the three conditions proper to principles mentioned above are found in these primary contraries. For things which are first are manifestly not from others. Moreover things which are contraries are manifestly not from each other. For even though the cold comes to be from the hot, insofar as that which was previously hot is later cold, nevertheless coldness itself never comes to be from heat, as will be pointed out later [L11 #90]. The third point—precisely how all things come to be from the contraries -we must investigate more carefully.

78. Now in order to clarify this latter point he states first that neither action nor passion can occur between things which are contingent in the sense of merely happening to be together, or between things which are contingent in the sense of being indeterminate. Nor does everything come to be from everything, as Anaxagoras said, except perhaps accidentally.

This is first of all seen clearly in simple things. For white does not come to be from musical except accidentally insofar as white or black happen to be in the

musical. But white comes to be *per se* from the non-white, and not from just any non-white, but from that non-white which is black or some mean colour. And in like manner, the musical comes to be from the non-musical, and again not from just any nonmusical, but from its opposite, which is called the unmusical, i.e., from that which is disposed to be musical but is not, or from some mean between these two. And for the same reason, a thing is not corrupted primarily and *per se* into just any contingent thing (e.g., the white into the musical) except accidentally. Rather white is corrupted*per se* into the non-white, and not into just any non-white, but into black or some mean colour. And he says the same of the corruption of the musical and of other similar things. The reason for this is as follows. Whatever comes to be or is corrupted does not exist before it comes to be and does not exist after it is corrupted. Whence it is necessary that that which a thing comes to be*per se* and that intowhich a thing is corrupted*per se* be such that it includes in its nature [*ratio*] the non-being of that which comes to be or is corrupted.

And he shows that the same is true of composite things. He says that the situation is the same with composite things as with simple things, but is more hidden in composite things because the opposites of composite things have no names, as do the opposites of simple things. For the opposite of house has no name, although we give a name to the opposite of white. Hence if the composite is reduced to something with a name, it will be clear. For every composite consists of a certain harmony. Now the harmonious comes to be from the inharmonious, and the inharmonious from the harmonious. And in like manner, the harmonious is corrupted into the inharmonious (not any inharmonious, but the opposite). However, we can speak of the harmonious according to order alone, or according to composition. For some wholes consist of a harmony of order, e.g., an army; and other wholes consist of a harmony of composition, e.g., a house. And the nature [*ratio*] of each of these is the same. It is also clear that all composites come to be from the noncomposed, for example, a house comes to be from non-composed things, and the figured from the non-figured. And in all such things nothing is involved except order and composition.

Thus it is clear by induction, as it were, that everything which comes to be or is corrupted comes to be from contraries or from some intermediate between them, or is corrupted into them. Moreover, intermediates between contraries come to be from the contraries, as the intermediate colours come to be from black and white. Hence he concludes that whatever comes to be according to nature is either a contrary, such as white and black, or comes to be from the contraries, such as the intermediates between the contraries.

This, then, is th e principal conclusion which he intended to draw, namely, thafall things come to be from contraries, w hich was the third characteristic of

principles.

79. Next where he says, 'Up to this point ...' (188 b 27), Aristotle shows how the philosophers are related in holding that the principles are contraries. First he shows how they are related with reference to being moved toward this position. Secondly, where he says, 'They differ, however...'(188 b 30 #80), he shows howthey are related itirespect to the position itself.

He says, therefore, as was pointed out above [#76] that many of the philosophers followed the truth to the point where they held that the principles are contraries. Although they indeed held this position, they did not hold it as though moved by reason, but rather as forced to it by the truth itself. For truth is the good of the intellect, toward which the intellect is naturally ordered. Hence as things which lack knowledge are moved to their ends without reason [*ratio*], so, at times, the intellect of man, by a sort of natural inclination, tends toward the truth, though it does not perceive the reason [*ratio*] for the truth.

80. Next where he says, 'They differ, however, ...' (188 b 30), he shows how the aforesaid philosophers are related in respect to the position itself.

Concerning this he makes two points. First he shows how they differ in holding that the principles are contraries. Secondly, where he says, 'Hence their principles...' (188 b 37 #81), he shows how they both differ and agree.

He says, therefore, first that the philosophers who held that the principles are contraries differed in two ways. First, those who argued reasonably held that the principles are the primary contraries. Others, however, considering the matter less well, held that the principles are posterior [derived] contraries.

And of those who appealed to the primary contraries, some considered those contraries which were better known to reason, others those contraries which were better known to sense.

Or it could be said that this second difference explains the first. For those things which are better known to reason are prior simply, whereas those things which are better known to sense are posterior simply, and

are prior relative to us. However, it is clear that the principles must be prior. Thus, those who judged 'prior' according to what is better known to reason held that the principles are those contraries which are prior simply. On the other hand, those who judged 'prior' according to what is better known to sense held that the principles are those contraries which are posterior simply. Hence some held that

the hot and the cold are first principles; others, the wet and the dry. And both of these are better known to sense. However the hot and the cold, which are active qualities, are prior to the wet and the dry, which are passive qualities, because the active is naturally prior to the passive.

Others, however, held principles which are better known to reason.

Among these, some held that the equal and the unequal are the principles. For example, the Pythagoreans, thinking that the substance of all things is numbers, held that all things are composed of the equal and the unequal as of form and matter. For they attributed infinity and

otherness to the equal because of its divisibility. Whereas to the unequal they attributed finiteness and identity because of its indivisibility.

Others, however, held that the cause of generation and corruption is strife and friendship, that is, the cycles of Empedocles, which are also better known to reason. Whence it is clear that the diversity mentioned above appears in these positions.

81. Next where he says, 'Hence their principles ...' (188 b 37), he shows how there is also a certain agreement within the differences of the aforementioned positions. He concludes from what he has said above that the ancient philosophers in a way called the same things principles and in a way called different things principles. For they differed insofar as different philosophers assumed different contraries (as was said above #80); yet they are the same insofar as their principles were alike according to analogy, i.e., proportion. For the principles taken by an of them have the same proportion.

And this is true in three respects. First, all the principles which they assumed are related as contraries. And thus Aristotle says that they all took their principles from the same columns, i.e., columns of contraries. For they all took contraries as their principles, even though the contraries differed. Nor is it remarkable that they took different principles from the columns of contraries. For among the contraries, some are containers, as the prior and more common; and others axe contained, as the posterior and less common. Hence one way in which they spoke alike is that all of them took their principles from the order of contraries.

Another way, in which they agree according to analogy is as follows. No matter what principles they accepted, one of these principles is better, and the other is worse. For example, friendship, or the plenum, or the hot, are better; but strife, or the void, or the cold, are worse. And the same thing is true of the other pairs

of contraries. This is so because one of the contraries always has privation joined to it. For the source of contrariety is the opposition of privation and habit, as is said in *Metaphysics*, X:4.

Thixdly they agree according to analogy by reason of the fact that they all took principles which are better known. But some took principles which are better known to reason, others those which are better known to sense. Since reason treats the universal and sense treats the particular, universals (such as the great and the small) are better known to reason, whereas singulars (such as the rare and the dense, which are less common) are better known to sense.

Then as a final summary, he concludes with that which he had uppermost in mind, namely, the principles are contraries.

LECTURE 11 (189 a 11-b 29)
THERE ARE THREE PRINCIPLES OF NATURAL THINGS, NO MORE, NO LESS

82. After the philosopher has investigated the contrariety of the principles, he here begins to inquire about their number.

Concerning this he makes three points. First, he raises the question. Secondly, where he says, 'One they cannot be ...' (189 a 12 #83), he excludes certain things which are not pertinent to this question. Thirdly, he takes up the question, where he says, 'Granted, then, that...' (189 a 21 #89).

He says, therefore, first that after an investigation into the contrariety of the principles, an inquiry about their number should follow, i.e., whether they are two, or three, or more.

83. Next where he says, 'One they cannot be ...' (189 a 12), he excludes those things which are not pertinent to this question. He shows first that there is not just one principle, and secondly, where he says, 'Nor can they be ...' (189 a 12 #84), he shows that the principles are not infinite.

He says first that it is impossible for there to be only one principle. For it has been shown [L 10] that the principles are contraries. But contraries are not just one, for nothing is the contrary of itself; therefore, there is not just one principle.

84. Next where he says, 'Nor can they be ...' (189 a 12), he gives four arguments to show that the principles are not infinite. The first of these is as follows.

The infinite as such is unknown. If, therefore, the principles are infinite, they must be unknown. But if the principles are unknown, then those things which are from the principles are unknown. It follows, therefore, that nothing in the world could be known.

85. He gives the second argument where he says, '... and in any one genus...' (189 a 13). The argument is as follows. The principles must be primary contraries, as was shown above [L10 #77]. But the primary contraries belong to the primary genus, which is substance. But substance, since it is one genus, has one primary contrariety. For the first contrariety of any genus is that of the primary differentiae by which the genus is divided. Therefore, the principles are not infinite.

86. He gives the third argument where he says, also a finite number ...' (189 a 15). The argument is as follows. It is better to say that what can come to be from finite principles comes from finite principles rather than from infinite principles. But all things which come to be according to nature are explained by Empedocles through finite principles,just as they are explained byAnaxagoras through infinite principles. Hence an infinite number of principles should not be posited.

87. He gives the fourth argument where he says, 'Lastly, some con traries ...' (189 a 17). The argument is as follows. Principles are contraries. If, therefore, the principles are infinite, it is necessary that all the contraries be principles. But all of the contraries are not principles. This is clear for two reasons. First, the principles must be primary contraries, but not all contraries are primary, since some are prior to others. Secondly, the principles ought not to be from each other, as was said above [L10 #77]. But some contraries are from each other, as the sweet and the bitter, and the white and the black. Therefore, the principles are not infinite.

Thus he finally concludes that the principles are neither one nor infinite.

88. However, we must note that the Philosopher proceeds here by way of disputation from probable arguments. Hence he assumes certain things which are seen in many instances, and which cannot be false taken as a whole, but are true in particular instances. Therefore, it is true that in a certain respect contraries do come to be from each other, as was said above [L10 #78], if the subject is taken along with the contraries. For that which is white later becomes black. However, whiteness itself is never changed into blackness. But some of the ancients, without including the subject, held that the primary contraries come to be from each other. Hence, Empedocles denied that the elements come to be from each other. And thus Aristotle significantly does not say in this place that the hot

comes to be from the cold, but the sweet from the bitter and the white from the black.

89. Next where he says,'Granted then...'(189 a 21), he takes up the question under discussion, namely, what is the number of the principles. 'Concerning this he makes two points. First he shows that there are not just two principles, but three. Secondly, where he says, 'On the other hand ...' (189 b 18 #95), he shows that there are no more than three principles.

Concerning the first part he makes two points. First, he shows through arguments that there are not just two principles, but that a third must be added. Secondly, where he says, 'If, then, we accept ...' (189 a 34 #93), he shows that even the ancient philosophers agreed on this point.

90. Concerning the first part he gives three arguments. He says first that since it was shown that the principles are contraries, and so could not be just one, but are at least two, and further since the principles are not infinite, then it remains for us to consider whether there are only two principles or more than two. Since it was shown abovei that the principles are contraries, it seems that there are only two principles, because contrariety exists between two extremes.

But one might question this. For it is necessary that other things come to befrom the principles, as was said above [L10 #77]. If, however, there are only two contrary principles, it is not apparent how all things can come to be from these two. For it cannot be said that one of them makes something from the other one. For density is not by nature such that it can convert rarity into something, nor can rarity convert density into something. And the same is true of any other contrariety. For friendship does not move strife and make something out of it, nor does the converse happen. Rather each of the contraries changes some third thing which is the subject of both of the contraries. For heat does not make coldness itself to be hot, but makes the subject of coldness to be hot. And conversely, coldness does not make heat itself to be cold, but makes the subject of heat to be cold. Therefore, in order that other things can come to be from the contraries, it seems that it is necessary to posit some third thing which will be the subject of the contraries.

It does not matter for the present whether that subject is one or many. For some have posited many material principles from which they prepare the nature of beings. For they said that the nature of things is matter, as will be said later in Book II [L2].

91. He gives the second argument where he says, 'Other objections ...'(189 a

28). He says that, unless there is something other than the contraries which are given as principles, then there arises an even greater difficulty. For a first principle cannot be an accident which is predicated of a subject. For since a subject is a principle of the accident which is predicated of it and is naturally prior to the accident, then if the first principle were an accident predicated of a subject, it would follow that what is 'of' a principle would be a principle, and there would be something prior to the first. But if we hold that only the contraries are principles, it is necessary that the principles be an accident predicated of a subject. For no substance is the contrary of something else. Rather contrariety is found only between accidents. It follows, therefore, that the contraries cannot be the only principles.

Moreover, it must be noted that in this argument he uses 'predicate' for 'accident', since a predicate designates a form of the subject. The ancients, however, believed that all forms are accidents. Hence he proceeds here by way of disputation from probable propositions which were well known among the ancients.

92. He gives the third argument where he says, 'Again we hold...' (189 a 33). The argument is as follows. Everything which is not a principle must be from principles. If, therefore, only the contraries are principles, then since substance is not the contrary of substance, it follows that substance would be from non-substance. And thus what is not substance is prior to substance, because what is from certain things is posterior to them. But this is impossible. For substance which is being *per se* is the first genus of being. Therefore, it cannot be that only the contraries are principles; rather it is necessary to posit some other third thing.

93. Next where he says, 'If, then, we accept ...' (189 a 34), he shows how the position of the philosophers also agrees with this.

Concerning this he makes two points. First, he shows how they posited one material principle. Secondly, where he says, 'All, however agree...' (189 b 9 #94), he shows how they posited two contrary principles besides this one material principle.

However, we must first note that the Philosopher in the preceding arguments seemed to be opposed, in the manner of those who dispute, to both sides of the question. For first he proved that the principles are contraries, and now he brings forth arguments to prove that the contraries are not sufficient for the generation of things. And since disputatious arguments do come to some kind of true conclusion, though it is not the whole [truth], he concludes one truth from each argument.

He says that if someone thinks that the first argument (which proves that the principles are contraries) is true, and that the argument just given (which proves that contrary principles are not sufficient) is also true, then to maintain both conclusions he must say that some third thing lies beneath the contraries, as was said by those who held that the whole universe is some one nature, understanding nature to mean matter, such as water, or fire or air, or some intermediate state between these, such as vapour, or some other thing of this sort.

This seems especially true in regard to an intermediate. For this third thing ietaken as the subject of the contraries, and as distinct from them in some way. Hence, that which has less of the nature of a contrary about it is more conveniently posited as the third principle beyond the contraries. For fire and earth and air and water have contrariety attached to them, e.g., the hot and the cold, the wet and the dry. Hence, it is not unreasonable that they make the subject something other than these and something in which the contraries are less prominent. After these philosophers, however, those who held that air was the principle spoke more wisely, for the contrary qualities found in air are less sensible. After these philosophers are those who held that water was the principle. But those who held that fire was the principle spoke most poorly, because fire has a contrary quality which is most sensible and which is very active. For in fire there is an excellence of heat. If, however, the elements are compared with reference to their subtlety, those who made fire the principle seem to have spoken better, as is said elsewhere,′ for what is more subtle seems to be more simple and prior. Hence no one held that earth was the principle because of its density.

94. Next where he says, ‘All, however, agree ...′ (189 b 9), he shows how they posited contrary principles with the one material principle.

He says that all who posited one material principle said that it is figured or formed by certain contraries, such as rarity and density, which are reducible to the great and the small and to excess and defect. And thus the position of Plato that the one and the great and the small are the principles of things was also the opinion of the ancient natural philosophers, but in a different way. For the ancient philosophers, thinking that one matter was differentiated by diverse forms, held two principles on the part of form, which is the principle of action, and one on the part of matter, which is the principle of passion. But the Platonists, thinking that many individuals in one species are distinguished by a division of matter, posited one principle on the part of the form, which is the active principle, and two on the part of the matter, which is the passive principle.

And thus he draws the conclusion which he had uppermost in mind, namely, that by considering the above and similar positions, it seems reasonable that there are three principles of nature. And he points out that he has proceeded from probable arguments.

95. Next where he says, 'On the other hand ...' (189 b 18), he shows that there are no more than three principles. He uses two arguments, the first of which is as follows.

It is superfluous for that which can come to be through fewer principles to come to be through many. But the whole generation of natural things can be achieved by positing one material principle and two formal principles. For one material principle is sufficient to account for passion.

But if there were four contrary principles, and two primary contrarieties, it would be necessary that each contrariety have a different subject. For it seems that there is one primary subject for any one contrariety. And so, if, by positing two contraries and one subject, things can come to be from each other, it seems superfluous to posit another contrariety. Therefore, we must not posit more than three principles.

96. He gives the second argument where he says, 'Moreover it is impossible ...' (189 b 23). If there are more than three principles, it is necessary that there be many primary contrarieties. But this is impossible because the first contrariety seems to belong to the first genus, which is one, namely, substance. Hence all contraries which are in the genus of substance do not differ in genus, but are related as prior and posterior. For in one genus there is only one contrariety, namely, the first, because all other contrarieties seem to be reduced to the first one. For there are certain first contrary differentiae by which a genus is divided. Therefore it seems that there are no more than three principles.

It must be noted, however, that each of the following statements is probable: namely, that there is no contrariety in substances, and that in substances there is only one primary contrariety. For if we take substance to mean 'that which is', it has no contrary. If, however, we take substance to mean formal differentiae in the genus of substance, then contrariety is found in them.

97. Finally by way of summary he concludes that there is not just one principle, nor are there more than two or three. But deciding which of these is true, that is, whether there are only two principles or three, involves much difficulty, as is clear from the foregoing.

LECTURE 12 (189 b 30-190 b 15)
IN EVERY COMING TO BE THREE PRINCIPLES ARE TO BE FOUND: THE SUBJECT, THE TERMINUS OF THE PRODUCTION, AND ITS OPPOSITE

98. After the Philosopher has investigated the number of principles by means of disputation, he here begins to determine the truth. This section is divided into two parts. First he determines the truth. Secondly, where he says, 'We will not proceed...' (191 a 23; L14 #120ff), he excludes from the truth already deterrained certain difficulties and errors of the ancients.

The first part is divided into two parts. First he shows that in any natural coming-to-be three things are found. Secondly, where he says, 'Plainly, then ...' (190 b 16; L13 #110), he shows from this that these three things are principles.

Concerning the first part he makes two points. First he states his intention, and secondly he pursues his intention, where he says, 'We say that ...' (189 b 33 #100).

99. Because he had said above [L11 #97] that the question of whether there are only two principles of nature or three involves much difficulty, he concludes that he must first speak of generation and production as common to all the species of mutation. For in any mutation there is found a certain coming-to-be. For example, when something is altered from white to black, the non-white comes to be from the white, and the black comes to be from the non-black. And the same is true of other mutations. He also points out the reason for this order of procedure. It is necessary to speak first of those things which are common, and afterwards to think of those things which are proper to each thing, as was said in the beginning of the Book [L1 #6].

100. Next where he says, 'We say that one thing ...' (189 b 33), he develops his position. Concerning this he makes two points. First he sets forth certain things which are necessary to prove his position. Secondly, where he says, 'These distinctions drawn ...' (190 a 13 #103),he proves his point.

Concerning the first part he makes two points. First he sets up a cerr tain division, secondly, where he says, 'As regards one ...' (190 a 5 #102), he points out the differences among the parts of the division.

101. He says, therefore, first that in any coming-to-be one thing is said to come to be from another thing with reference to coming to be in regard to substantial being [*esse*], or one comes to be from another with reference to coming to be in

regard to accidental being [*esse*]. Hence every change has two termini. The word 'termini', however, is used in two ways, for the termini of a production or mutation can be taken as either simple or composite.

He explains this as follows. Sometimes we say man becomes musical, and then the two termini of the production are simple. It is the same when we say that the non-musical becomes musical. But when we say that the non-musical man becomes a musical man, each of the termini is a composite. Yet when coming to be is attributed to man or to the nonmusical, each is simple. And thus, that which becomes, i.e., that to which coming to be is attributed, is said to come to be simply. Moreover, that in which the very coming to be is terminated, which is also said to come to be simply, is musical. Thus we say man becomes musical, or the non-musical becomes musical. But when each is signified as coming to be as composed (i.e., both what becomes, i.e., that to which the coming to be is attributed, and what is made, i.e., that in which the coming to be is terminated), then we say that the non-musical man becomes musical. For then there is composition on the part of the subject only and simplicity on the part of the predicate. But when I say that the nonmusical man becomes a musical man, then there is composition on the part of each.

102. Next where he says, 'As regards one ...' (190 a 5), he points out two differences in what was said above.

The first is that in some of the cases mentioned above we use a twofold mode of speech, i.e., we say 'this becomes this' and 'from this, this comes to be'. For we say 'the non-musical becomes musical', and 'from the non-musical, the musical comes to be'. But we do not speak this way in all cases. For we do not say'the musical comes to be from man', but 'man becomes musical'.

He points out the second difference where he says, 'When a "simple"...' (190 a 8). He says that when coming to be is attributed to two simple things, i.e., the subject and the opposite, one of these is permanent, but the other is not. For when someone has already been made musical, 'man' remains. But the opposite does not remain, whether it be the negative opposite, as the non-musical, or the privation or contrary, as the unmusical. Nor is the composite of subject and the opposite permanent, for the non-musical man does not remain after man has been made musical. And so coming to be is attributed to these three things: for it was said that man becomes musical, and the non-musical becomes musical, and the non-musical man becomes musical. Of these three, only the first remains complete in a production, the other two do not remain.

103. Next where he says, 'These distinctions drawn ...' (190 a 13), having

assumed the foregoing, he proves his position, namely that three t . ngs are found in any natural production.

Concerning this he makes three points. First he enumerates two things which are found in any natural production. Secondly, where he says, 'One part survives ...' (190 a 17 #105), he proves what he had supposed. Thirdly, where he says, 'Thus, clearly, ...' (190 b 10 #109), he draws his conclusion.

104. He says, therefore, first that, if anyone, taking for granted what was said above, wishes to consider [coming-to-be] in all the things which come to be naturally, he will agree that there must always be some subject to which the coming to be is attributed, and that that subject, although one in number and subject, is not the same in species or nature [*ratio*]. For when it is said of a man that he becomes musical, the man is indeed one in subject, but two in nature [*ratio*]. For man and the non-musical are not the same according to nature [*ratio*]. Aristotle does not, however, mention here the third point, namely, that in every generation there must be something generated, for this is obvious.

105. Next where he says, 'One part survives...' (190 a 17), he proves the two things which he had assumed. He shows first that the subject to which the coming to be is attributed is two in nature [*ratio*]. Secondly, where he says, 'But there are different ...' (190 a 32 #107), he shows that it is necessary to assume a subject in every coming to be.

He shows the first point in two ways. First he points out that in the subject to which the coming to be is attributed there is something which is permanent and something which is not permanent. For that which is not an opposite of the terminus of the production is permanent, for man remains when he becomes musical, but the non-musical does not remain. And from this it is clear that man and the non-musical are not the same in nature [*ratio*], since the one remains, whereas the other does not.

106. Secondly, where he says, 'We speak of ...'(190 a 2 1), he shows the same thing in another way. With reference to the non-permanent things, it is much better to say 'this comes to be from this' than to say 'this becomes this' (although this latter also may be said, but not as properly). For we say that the musical comes to be from the nonmusical. We also say that the non-musical becomes musical, but this is accidental, insofar as that which happens to be non-musical becomes musical. But in permanent things this is not said. For we do not say that the musical comes to be from man, rather we say that the man becomes musical.

Even in reference to permanent things we sometimes say 'this comes to be from

this′, as we say that a statue comes to be from bronze. But this happens because by the name ‘bronze′ we understand the ‘unshaped′, and so this is said by reason of the privation which is understood.

From this very fact, then, that we use different modes of speech with reference to the subject and the opposite, it is clear that the subject and the opposite, such as man and the non-musical, are two in nature [*ratio*].

107. Next where he says, ‘But there are different ...′ (190 a 32), he proves the other point which he had assumed, namely, that in every natural production there must be a subject.

The proof of this point by argumentation belongs to metaphysics. Hence this is proved in *Metaphysics*, VII:7. He proves it here only by induction. He does this first in regard to the things which come to be; secondly in regard to the modes of coming to be, where he says, ‘Generally things ...′ (190 b 5 #108).

He says, therefore, first that since ‘to come to be′ is used in many ways, ‘to come to be simply′ is said only of the coming to be of substances, whereas other things are said to come to be accidentally. This is so because ‘to come to be′ implies the beginning of existing. Therefore, in order for something to come to be simply, it is required that it previously will not have been simply, which happens in those things which comer to be substantially. For when a man comes to be, he not only previously was not a man, but it is true to say that he simply was not. When, however, a man becomes white, it is not true to say that he previously was not, but that he previously was not such.

Those things, however, which come to be accidentally clearly depend upon a subject. For quantity and quality and the other accidents, whose coming to be is accidental, cannot be without a subject. For only substance does not exist in a subject.

Further, it is clear, if one considers the point, that even substances come to be from a subject. For we see that plants and animals come to be from seed.

108. Next where he says, ‘Generally things ...′ (190 b 5), he shows the same thing by induction from the modes of coming to be.

He says that of things which come to be, some come to be by change of figure, as the statue comes to be from the bronze, others come to be by addition, as is clear in all instances of increase, as the river comes to be from many streams, others come to be by subtraction, as the image of Mercury comes to be from

stone by sculpture. Still other things come to be by composition, e.g., a house; and other things come to be by alteration, as those things whose matter is changed, either by nature or by art. And in all of these cases it is apparent that they come to be from some subject. Whence it is clear that everything which comes to be comes to be from a subject.

But it must be noted that artificial things are here enumerated along with those things which come to be simply (even though artificial forms are accidents) because artificial things are in some way in the genus of substance by reason of their matter. Or else perhaps he lists them because of the opinion of the ancients, who thought of natural things and artificial things in the same way, as will be said in Book II [L2 #149].

109. Next where he says, 'Thus clearly ...' (190 b 10), he draws his conclusion. He says that it has been shown from what was said above that that to which coming to be is attributed is always composed. And since in any production there is that at which the coming to be is terminated and that to which the coming to be is attributed, the latter of which is twofold, i.e., the subject and the opposite, it is then clear that there are three things in any coming to be, namely, the subject, the terminus of the production, and the opposite of this terminus. Thus when a man becomes musical, the opposite is the non-musical, the subject is the man, and musical is the terminus of the production. And in like manner, shapelessness and lack of figure and lack of order are opposites, while bronze and gold and stone are subjects in artificial productions.

LECTURE 13 (190 b 16-191 a 22)
THERE ARE TWO *per se* PRINCIPLES OF THE BEING AND OF THE BECOMING OF NATURAL THINGS, NAMELY, MATTER AND FORM, AND ONE *PER ACCIDENS* PRINCIPLE, NAMELY, PRIVATION

110. After the Philosopher has shown that three things are found in every natural coming to be, he intends here to show from the foregoing how many principles of nature there are.

Concerning this he makes two points. First he explains his position. Secondly, where he says, 'Briefly, we explained ...' (191 a 15 #119), in recapitulation he explains what has already been said and what remains to be said.

Concerning the first part he makes two points. First he shows that there are three principles of nature. Secondly he names them, where he says, 'The underlying nature ...' (191 a 8 #118).

Concerning the first part he makes three points. First he explains the truth about the first principles of nature. Secondly, where he says, 'There is a sense ...' (190 b 28 #114) from this disclosure of the truth he answers the problems about the principles which were raised above. Thirdly, since the ancients had said that the principles are contraries, he shows whether or not contraries are always required, where he says, 'We have now stated ...' (191 a 3 #115).

Concerning the first part he makes two points. First he shows that there are two *per se* principles of nature. Secondly, where he says, 'Now the subject ...' (190 b 23 #112), he shows that the third principle is a *per accidens* principle of nature.

111. With reference to the first point he uses the following argument. Those things from which natural things are and come to be *per se*, and not *per accidens*, are said to be the principles and causes of natural things. Whatever comes to be exists and comes to be both from subject and from form. Therefore the subject and the form are *per se* causes and principles of everything which comes to be according to nature.

That that which comes to be according to nature comes to be from subject and form he proves as follows. Those things into which the definition of a thing is resolved are the components of that thing, because each thing is resolved into the things of which it is composed. But the definition [*ratio*] of that which comes to be according to nature is resolved into subject and form. For the definition [*ratio*] of musical man is resolved into the definition [*ratio*] of man and the definition [*ratio*] of musical. For if anyone wishes to define musical man, he will have to give the definitions of man and musical. Therefore, that which comes to be according to nature both is and comes to be from subject and form.

And it must be noted that he intends here to inquire not only into the principles of the coming to be but also into the principles of the being. Hence he says significantly that things both are and come to be from these first principles. And by 'first principles' he means *per se* and not *per accidens* principles. Therefore, the *per se* principles of everything which comes to be according to nature are subject and form.

112. Next where he says, 'Now the subject ...' (190 b 23), he adds the third *per accidens* principle. He says that although the subject is one in number, it is nevertheless two in species and nature [*ratio*], as was said above [L12 #104]. For man and gold and any matter has some sort of number. This is a consideration of the subject itself, such as man or gold, which is something positive, and from which something comes to be *per se* and not *per accidens*. It is another thing, however, to consider that which happens to the subject, i.e.,

contrariety and privation, such as to be unmusical and unshaped. The third principle, then, is a species or form, as order is the form of a house, or musical is the form of a musical man, or as any of the other things which are predicated in this way.

Therefore the subject and the form are *per se* principles of that which comes to be according to nature, but privation or the contrary is a *per accidens* principle, insofar as it happens to the subject. Thus we say that the builder is the *per se* active cause of the house, but the musician is a *per accidens* active cause of the house insofar as the builder also happens to be musical. Hence the man is the *per se* cause as subject of musical man, but the non-musical is a *per accidens* cause and principle.

113. However someone may object that privation does not belong to a subject while it is under some form, and thus privation is not a *per accidens* principle of being.

Hence it must be said that matter is never without privation. For when nagter has one form, it is in privation of some other form. And so while it is coming to be that which it becomes (e.g., musical man), there is in the subject, which does not yet have the form, the privation of the musical itself. And so the *per accidens* principle of a musical man, while he is coming to be musical, is the non-musical. For he is a non-musical man while he is coming to be musical. But when this latter form has already come to him, then there is joined to him the privation of the other form. And thus the privation of the opposite form is a *per accidens* principle of being.

It is clear, therefore, according to the opinion of Aristotle that privation, which is posited as a *per accidens* principle of nature, is not a capacity for a form, nor an inchoate form, nor some imperfect active principle, as some say. Rather it is the very absence of form, or the contrary of form, which occurs in the subject.

114, Next where he says, 'There is a sense...' (190 b 28), he resolves, in the light of the truth already determined, all the preceding difficulties.

He concludes from the foregoing that in a certain respect it must be said that there are two principles, namely, the *per se* principles, and in another respect that there are three, if we accept along with the *per se* principles the *per accidens* principle. And in a certain respect the principles are contraries, if one takes the musical and the non-musical, the hot and the cold, the harmonious and the inharmonious. Yet in another respect the principles, if they are taken without the subject, are not contraries, for contraries cannot be acted upon by each

other, unless it be held that some subject is supposed for the contraries by reason of which they are acted upon by one another.

And thus he concludes that the principles are not more than the contraries, for there are only two *per se* principles. But there are not just two principles, for one of them according to its being [esse] is other, for the subject according to nature [*ratio*] is two, as was said [L12 #104ff]. And thus there are three principles, because man and the non-musical, and bronze and the unshaped, differ according to nature [*ratio*].

Therefore it is clear that the early opinions which argued for a part of the truth were in a certain respect true, but not altogether true.

115. Next where he says, 'We have now stated ...' (191 a 3), he shows in what way two contraries are necessary, and in what way they are not necessary.

He says that from what has been said it is clear how many principles of the generation of natural things there are, and how it happens that there are this number. For it was shown that it is necessary that two of the principles be contraries, of which one is a *per se* principle and the other a *per accidens* principle, and that something be the subject of the contraries, which is also a *per se* principle. But in a certain respect one of the contraries is not necessary for generation, for at times it is sufficient if one of the contraries bring about the change by its absence and its presence.

116. As evidence of this we must note that, as will be said in Book V [L2 #649ff], there are three species of mutation, namely, generation and corruption and motion. The difference among these is as follows. Motion is from one positive state to another positive state, as from white to black. Generation, however, is from the negative to the positive, as from the non-white to the white, or from non-man to man. Corruption, on the other hand, is from the positive to the negative, as from the white to the non-white, or from man to non-man. Therefore, it is clear that in motion two contraries and one subject are required. But in generation and corruption there is required the presence of one contrary and its absence, which is privation.

Generation and corruption, however, are found in motion. For when something is moved from white to black, white is corrupted and black comes to be. Therefore in every natural mutation subject and form and privation are required. However, the nature [*ratio*] of motion is not found in every generation and corruption, as is clear in the generation and corruption of substances. Hence subject and form and priv ` ation are found in every mutation, but not a subject and two contraries.

117. This opposition is also found in substances, which are the first genus. This, however, is not the opposition of contrariety. For substantial forms are not contraries, even though differentiae in the genus of substance are contrary insofar as one is received along with the privation of the other, as is clear in the animate and the inanimate.

118. Next where he says, 'The underlying nature ...' (191 a 8), he clarifies the above-mentioned principles.

He says that the nature which is first subject to mutation, i.e., primary matter, cannot be known of itself, since everything which is known is known through its form. Primary matter is, moreover, considered to be the subject of every form. But it is known by analogy, that is, according to proportion. For we know that wood is other than the form of a bench and a bed, for sometimes it underlies the one form, at other times the other. When, therefore, we see that air at times becomes water, it is necessary to say that there is something which sometimes exists under the form of air, and at other times under the form of water. And thus this something is other than the form of water and other than the form of air, as wood is something other than the form of a bench and other than the form of bed. This 'something', then, is related to these natural substances as bronze is related to the statue, and wood to the bed, and anything material and unformed to form. And this is called primary matter.

This, then, is one principle of nature. It is not one as a 'this something', that is, as some determinate individual, as though it had form and unity in act, but is rather called being and one insofar as it is in potency to form. The other principle, then, is the nature [ratio) or form, and the third is privation, which is contrary to the form. And how these principles are two and how they are three was explained above.'

119. Next where he says, 'Briefly, we explained ...' (191 a 15), he gives a r6sum6 of what has been said, and points out what remains to be said.

He says, therefore, that it was said first that the contraries are principles, and afterwards that something is subjected to them, and thus there are three principles. And from what was said just now it is clear what the difference is between the contraries: one of them is a *per se* principle, and the other a *per accidens* principle. And then it was pointed out how the principles are related to each other, since the subject and the contrary are one in number yet two in nature [*ratio*]. Then it was pointed out what the subject is insofar as this could be made clear. But it has n ' ot yet been decided which is the greater substance, form or matter, for this will be explained at the beginning of Book II [L2 #153].

But it has been explained that the principles are three in number, how they are principles, and in what way. And he finally draws the conclusion he had uppermost in mind, namely, that it is clear how many principles there are and what they are.

LECTURE 14 (191 a 23-b 34)
THE PROBLEMS AND THE ERRORS OF THE ANCIENTS WHICH SPRING FROM AN IGNORANCE OF MATTER ARE RESOLVED BY THE TRUTH ABOUT THE PRINCIPLES ALREADY DETERMINED

120. Having determined the truth about the principles of nature, the Philosopher here excludes certain difficulties of the ancients by means of what has been determined about the principles.

He considers first the problems or errors which stem from an ignorance of matter, and secondly, where he says, 'Others indeed ...' (191 b 35; L15 #129), the problems or errors which stem from an ignorance of privation. Thirdly, where he says, 'The accurate determination ...' (192 a 34; L15 #140), he reserves for another science the problems which arise with reference to form.

Concerning the first part he makes two points. First he states the problem and the error into which the ancients fell through their ignorance of matter. Secondly, where he says, 'Our explanation ...' (191 a 33 #122) he answers their difficulty by means of those things which have already been determined.

121. He says, therefore, first that, after determining the truth about the principles, it must be pointed out that only in this way is every difficulty of the ancients solved. And this is an indication that what has been said about the principles is true. For truth excludes every falsehood and difficulty. But given a position which is in some way false, some difficulty must remain.

Now the problem and error of the ancient philosophers was this. The first ones who philosophically sought the truth and the nature of things were diverted into a path other than the way of truth and the way of nature. This happened to them because of the weakness of their understanding. For they said that nothing is either generated or corrupted. This is contrary to truth and contrary to nature.

The weakness of their understanding forced them to hold this position because they did not know how to resolve the following argument, according to which it seemed to be proven that being is not generated. If being comes to be, it comes to be either from being or from non-being. And each of these seems to be

impossible, i.e., that being comes to be from being or that it comes to be from non-being. It is clearly impossible for something to come to be from being, because that which is does not come to be, for nothing is before it comes to be. And being already is, hence it does not come to be. It is also clearly impossible for something to come to be from non-being. For it is always necessary that there be a subject for that which comes to be, as was shown above [L12 #107]. From nothing, nothing comes to be. And from this it was concluded that there is neither generation nor corruption of being.

And those who argued in this fashion exaggerated their position to the point where they said that there are not many beings, but only one being. And they said this for the reason already given. Since they held that there is only one material principle, and since they said that nothing is caused from that one principle by way of generation and corruption, but only by way of alteration, then it follows that it would always be one according to substance.

122. Next where he says, 'Our explanation...' (191 a 33), he answers the objection just mentioned. Concerning this he makes two points. First, he answers the aforesaid objection in two ways. Secondly, where he says,'So as we said ...' (191 b 30 #128), he draws the conclusion which he has uppermost in mind.

The first point is divided into two parts according to the two solutions given, the second of which is found where he says, 'Another consists in ...' (191 b 28 #127).

123. He says, therefore, first that as far as the mode of speaking is concerned, it makes no difference whether we say that something comes to be from being or from non-being, or that being or non-being does something or is acted upon, or anything else, or whether we say this same sort of thing about a doctor; namely, that the doctor does something or is acted upon, or that something is or comes to be from the doctor.

But to say that the doctor does something or is acted upon, or that something comes to be from the doctor, has two meanings. Therefore, to say that something comes to be from being or from non-being, or that being or non-being makes something, or is acted upon, has two meanings. And the same is true regardless of the terms which are used; e.g., it might be said that something comes to be from white, or that the white does something or is acted upon.

That there is a twofold meaning when we use expressions such as the doctor does something or is acted upon, or that something comes to be from the doctor, he shows as follows.

We say that a doctor builds. But he does not do this insofar as he is a doctor, but insofar as he is a builder. And in like manner we say that the doctor becomes white, but not insofar as he is a doctor, but insofar as he is black. However in another sense we say that the doctor heals insofar as he is doctor, and in like manner that the doctor becomes a nondoctor insofar as he is a doctor. Thus we say properly and *per se* that the doctor does something or is acted upon, or that something comes to be from the doctor, when we attribute this to the doctor insofar as he is a doctor. But when something is attributed to him *per accidens*, it is not insofar as he is a doctor, but insofar as he is something else. Therefore, it is clear that when it is said that the doctor does something or is acted upon, or that something comes to be from doctor, this has two meanings, i.e., *per se* and *per accidens*.

Whence it is clear that when it is said that a thing comes to be from non-being, this is to be understood properly and *per se* if that thing should come to be from non-being insofar as it is non-being. And same argument applies to being.

But the ancients, failing to perceive this distinction, effed insofar as they thought that nothing comes to be. And they did not think that anything other than their first material principle had substantial existence. For example, those who said that air is the first material principle held that all other things signify a certain accidental existence. Thus they excluded every substantial generation, retaining only alteration. Because of the fact that nothing comes to be *per se* either from non-being or from being, they thought that it would not be possible for anything to come to be from being or non-being.

124. And we also say that nothing comes to be from non-being simply and *per se*, but only *per accidens*. For that which is,i.e., being, is not from privation*per se*. And this is so because privation does not enter into the essence of the thing made. Rather a thing comes to be *per se* from that which is in the thing after it has already been made. Thus the shaped comes to be from. the unshaped, not *per se*, but *per accidens*, because once it already has been shaped, the unshaped is not in it. But this is a remarkable way for a thing to come to be from non-being, and seemed impossible to the ancient philosophers. Therefore, it is clear that a thing comes to be from non-being not *per se* but *per accidens*.

125. In like manner, if it is asked whether a thing comes to be from being, we must say that a thing comes to be from being *per accidens*, but not *per se*. He shows this by the following example.

Let us suppose that a dog is generated from a horse. Granting this, it is clear that a certain animal comes to be from a certain animal, and thus animal would come

to be from animal. However, animal would not come to be from animal *per se*, but *per accidens*. For it does not come to be insofar as it is animal, but insofar as it is this animal. For animal already is before the dog comes to be. For the horse already is, but is not a dog. Hence the dog comes to be *per se* from that which is not a dog. And if animal were to come to be *per se*, and not *per accidens*, it would be necessary for it to come to be from non-animal.

And the same is true of being. For a being comes to be from that non-being which is not that which the being comes to be. Hence a thing does not come to be *per se* from being or *per se* from non-being. For this expression *per se* signifies that a thing comes to be from non-being in the sense that it comes to be from non-being insofar as it is non-b,eing, as was said [#123]. And thus when this animal comes to be from this animal, or when this body comes to be from this body, not all animal or nonanimal, nor all body or non-body, is removed from that from which the thing comes to be. And likewise not all being [esse] nor all non-being [non-esse] is removed from that from which this being comes to be. For ,that from which fire comes to be has some being, because it is air, and, also has some non-being, because it is not fire.

126. This, then, is one way of resolving the problem raised above. But this approach is not sufficient. For if being comes to be *per accidens* both from being and from non-being, it is necessary to posit something from which being comes to be *per se*. For every thing which is *per accidens* is reduced to that which is *per se*.

127. In order to designate that from which a thing comes to be *per se*, he adds a second approach where he says, 'Another consists...' (191 b 28).

He says that the same thing can be explained in terms of potency and act, as is clearly indicated in another place, i.e., in *Metaphysics*, IX:1. Thus a thing comes to be *per se* from being in potency; but a thing comes to be *per accidens* from being in act or from non-being.

He says this because matter, which is being in potency, is that from which a thing comes to be *per se*. For matter enters into the substance of the thing which is made. But from privation or from the preceding form, a thing comes to be *per accidens* insofar as the matter, from which the thing comes to be *per se*, happened to be under such a form or under such a privation. Thus a statue comes to be *per se* from bronze; but the statue comes to be *per accidens* both from that which does not have such a shape and from that which has another shape.

128. Finally, where he says, 'So as we said ...' (191 b 30), he draws the conclusion which he had uppermost in mind. He says that we can truly say that all the difficulties are answered by what has been said above. Driven on by certain difficulties, some of the ancients denied some of the things mentioned above, i.e., generation and corruption, and a plurality of substantially different things. But once matter is understood, all of their ignorance is removed.

LECTURE 15 (191 b 35-192 b 5)
MATTER IS DISTINGUISHED FROM PRIVATION. MATTER IS NEITHER GENERABLE NOR CORRUPTIBLE *PER SE*

129. Having excluded the problems and errors of the ancient philosophers which stem from their ignorance of matter, the Philosopher here excludes the errors which stem from their ignorance of privation.

Concerning this he makes three points. First, he sets forth the errors of those who wandered from the truth. Secondly, where he says, 'Now we distinguish ...' (192 a 2 #132), he shows how this position differs from the truth determined by him above. Thirdly, where he says, 'For the one which persists ...' (192 a 13 #134), he proves that his own opinion is true.

130. He says, therefore, first that some philosophers touched upon matter, but did not understand it sufficiently. For they did not distinguish between matter and privation. Hence, they attributed to matter what belongs to privation. And because privation, considered in itself, is non-being, they said that matter, considered in itself, is non-being. And so just as a thing comes to be simply and *per se* from matter, so they believed that a thing comes to be simply and *per se* from non-being.

And they were led to hold this position for two reasons. First they were influenced by the argument of Parmenides, who said that whatever is other than being is non-being. Since, then, matter is other than being, because it is not being in act, they said that it is non-being simply. Secondly, it seemed to them that that which is one in number or subject is also one in nature [*ratio*]. And Aristotle calls this a state of being one in potency, because things which are one in nature [*ratio*] are such that each has the same power. But things which are one in subject but not one in nature [*ratio*] do not have the same potency or power, as is clear in the white and the musical. But subject and privation are one in number, as for example, the bronze and the unshaped. Hence it seemed to them that they would be the same in nature [*ratio*] or in power. Hence this position accepts the unity of potency.

131. But lest anyone, because of these words, be in doubt about what the potency of matter is and whether it is one or many, it must be pointed out that act and potency divide every genus of beings, as is clear in *Metaphysics*, IX:1, and in Book III [L3] of this work. Hence, just as the potency for quality is not something outside the genus of quality, so the potency for substantial being is not outside the genus of substance. Therefore, the potency of matter is not some property added to its essence. Rather, matter in its very substance is potency for substantial being. Moreover, the potency of matter is one in subject with respect to many forms. But in its nature [*ratio*] there are many potencies according to its relation to different forms. Hence in Book IIIs it will be said that to be able to be healed and to be able to be ill differ according to nature [*ratio*].

132. Next where he says, 'Now we distinguish...' (192 a 2), he explains the difference between his own opinion and the opinion just given.

Concerning this he makes two points. First he widens our understanding of his own opinion. Secondly, where he says, 'They, on the other hand ...' (192 a 6 #133), he shows what the other opinion holds.

He says, therefore, first that there is a great difference between a thing's being one in number or subject and its being one in potency or nature [*ratio*]. For we say, as is clear from the above [L12 #104], that matter and privation although one in subject, are other in nature [*ratio*]. And this is clear for two reasons. First, matter is non-being accidentally, whereas privation is non-being *per se*. For 'unshaped' signifies non-being, but 'bronze'does not signify non-being except insofar as 'unshaped' happens to be in it. Secondly, matter is 'near to the thing' and exists in some respect, because it is in potency to the thing and is in some respect the substance of the thing, since it enters into the constitution of the substance. But this cannot be said of privation.

133. Next where he says, 'They, on the other hand ...'(192 a 6), he clarifies his understanding of the opinion of the Platonists.

He says that the Platonists also held a certain duality on the part of matter, namely, the great and the small. But this duality is different from that of Aristotle. For Aristotle held that the duality was matter and privation, which are one in subject but different in nature [*ratio*]. But the Platonists did not hold that one of these is privation and the other matter, but theyjoined privation to both, i.e., to the great and the small. They either took both of them together, not distinguishing in their speech between the great and the small, or else they took each separately. Whence it is clear that the Platonists, who posited form and the great and the small, held three completely different principles than Aristotle, who

posited matter and privation and form.

The Platonists realized more than the other ancient philosophers that it is necessary to suppose some one nature for an natural forms, which nature is primary matter. But they made it one both in subject and in nature [*ratio*], not distinguishing between it and privation. For although they held a duality on the part of matter, namely, the great and the small, they made no distinction at all between matter and privation. Rather they spoke only of matter under which they included the great and the small. And they ignored privation, making no mention of it.

134. Next where he says, 'For the one which persists ...' (192 a 13), he proves that his opinion is true. Concerning this he makes two points. First he states his position, i.e., that it is necessary to distinguish privation from matter. Secondly, where he says, 'The matter comes to be ...' (192 a 25),1 he shows how matter is corrupted or generated.

He treats the first point in two ways, first by explanation, and secondly by reducing [the opposite opinion] to the impossible, where he says, '...the other such ...' (192 a 18).

135. He says, therefore, first that this nature which is the subject, i.e., matter, together with form is a cause of the things which come to be according to nature after the manner of a mother. For just as a mother is a cause of generation by receiving, so also is matter.

But if one takes the other part of the contrariety, namely, the privation, we can imagine, by stretching our understanding, that it does not pertain to the constitution of the thing, but rather to some sort of evil for the thing. For privation is altogether non-being, since it is nothing other than the negation of a form in a subject, and is outside the whole being. Thus the argument of Parmenides that whatever is other than being is non-being, has a place in regard to privation, but not in regard to matter, as the Platonists said.

He shows that privation would pertain to evil as follows. Form is something divine and very good and desirable. It is divine because every form is a certain participation in the likeness of the divine being, which is pure act. For each thing, insofar as it is in act, has form. Form is very good because act is the perfection of potency and is its good; and it follows as a consequence of this that form is desirable, because every thing desires its own perfection.

Privation, on the other hand, is opposed to form, since it is nothing other than

the removal of form. Hence, since that which is opposed to the good and removes it is evil, it is clear that privation pertains to evil. Whence it follows that privation is not the same as matter, which is the cause of a thing as a mother.

136. Next where he says, the other such...' (192 a 18), he proves the same thing by an argument which reduces [the opposite position] to the impossible.

Since form is a sort of good and is desirable, matter, which is other than privation and other than form, naturally seeks and desires form according to its nature. But for those who do not distinguish matter from privation, this involves the absurdity that a contrary seeks its own corruption, which is absurd. That this is so he shows as follows.

If matter seeks form, it does not seek a form insofar as it is under this form. For in this latter case the matter does not stand in need of being through this form. (Every appetite exists because of a need, for an appetite is a desire for what is not possessed.) In like manner matter does not seek form insofar as it is under the contrary or privation, for one of the contraries is corruptive of the other, and thus something would seek its own corruption. It is clear, therefore, that matter, which seeks form, is other in nature [*ratio*] from both form and privation. For if matter seeks form according to its proper nature, as was said, and if it is held that matter and privation are the same in nature [*ratio*], it follows that privation seeks form, and thus seeks its own corruption, which is impossible. Hence it is also impossible that matter and privation be the same in nature [*ratio*].

Nevertheless, matter is 'a this', i.e., something having privation. Hence, if the feminine seeks the masculine, and if the base seeks the good, this is not because baseness itself seeks the good, which is its contrary; rather it seeks it accidentally, because that in which baseness happens to be seeks to be good. And likewise femininity does not seek masculinity; rather that in which the feminine happens to be seeks the masculine. And in like manner, privation does not seek to be form; rather that in which privation happens to be, namely, matter, seeks to be form.

137. But Avicenna opposes this position of the Philosopher in three ways.

First, matter has neither animal appetite (as is obvious in itself) nor natural appetite, whereby it would seek form. For matter does not have any form or power inclining it to anything, as for example, the heavy naturally seeks the lowest place insofar as it is inclined by its heaviness to such a place.

Secondly, he objects that, if matter seeks form, this is so because it lacks every

form, or because it seeks to possess many forms at once, both which are impossible, or because it dislikes the form which it has and seeks to have another form, and this also is meaningless. Hence it seems that we must say that matter in no way seeks form.

His third objection is as follows. To say that matter seeks form as the feminine seeks the masculine is to speak figuratively, i.e., as a poet, not as a philosopher.

138. But it is easy to resolve objections of this sort. For we must note that everything which seeks something either knows that which it seeks and orders itself to it, or else it tends toward it by the ordination and direction of someone who knows, as the arrow tends toward a determinate mark by the direction and ordination of the archer. Therefore, natural appetite is nothing but the ordination of things to their end in accordance with their proper natures. However a being in act is not only ordered to its end by an active power, but also by its matter insofar as it is potency. For form is the end of matter. Therefore for matter to seek form is nothing other than matter being ordered to form as potency to act.

And because matter still remains in potency to another form while it is under some form, there is always in it an appetite for form. This is not because of a dislike for the form which it has, nor because it seeks to be the contrary at the same time, but because it is in potency to other forms while it has some form in act.

Nor does he use a figure of speech here; rather, he uses an example. For it was said above [L13 #118] that primary matter is knowable by way of proportion, insofar as it is related to substantial forms as sensible matters are related to accidental forms. And thus in order to explain primary matter, it is necessary to use an example taken from sensible substances. Therefore, just as he used the example of unshaped bronze and the example of the non-musical man to explain matter, so now to explain matter he uses the example of the appetite of the woman for the man and the example of appetite of the base for the good. For this happens to these things insofar as they have something which is of the nature [*ratio*] of matter. However, it must be noted that Aristotle is here arguing against Plato, who used such metaphorical expressions, likening matter to a mother and the feminine, and form to the masculine. And so Aristotle uses Plato's own metaphors against him.

139. Next where he says, 'The matter comes to be ... (192 a 25), he shows how matter is corrupted. He says that in a certain respect matter is corrupted and in a certain respect it is not. For insofar as privation is in it, it is corrupted when the privation ceases to be in it, as if we should say that unshaped bronze is corrupted

when it ceases to be unshaped. But in itself, insofar as it is a certain being in potency, it is neither generated nor corruptible. This is clear from the following. If matter should come to be, there would have to be something which is the subject from which it comes to be, as is clear from what was said above [L12 #7,10ff]. But that which is the first subject in generation is matter. For we say that matter is the first subject from which a thing comes to be *per se*, and not *per accidens*, and is in the thing after it has come to be. (And privation differs from matter on both of these points. For privation is that from which a thing comes to be *per accidens*, and is that which is not in the thing after it has come to be.) It follows, therefore, that matter would be before it would come to be, which is impossible. And in like manner, everything which is corrupted is resolved into primary matter.. Therefore, at the very time when primary matter already is, it would be corrupted; and thus if primary matter is corrupted, it will have been corrupted before it is corrupted, which is impossible. Therefore, it is impossible for primary matter to be generated and corrupted. But by this we do not deny that it comes into existence through creation.

140. Next where he says, 'The accurate determination...' (192 a 34), he indicates that since the errors about matter and privation have been eliminated, then the errors and problems about form should also be eliminated. For some have posited separated forms, i.e., ideas, which they reduced to one first idea.

And so he says that first philosophy treats such questions as whether the formal principle is one or many, and how many there are, and what kind there are. Hence these questions will be reserved for first philosophy. For form is a principle of existing, and being as such is the subject of first philosophy. But matter and privation are. principles of mutable being, which is considered by the natural philosopher. Nevertheless we shall treat of natural and corruptible forms in the following books on this discipline.

Finally he summarizes what has been said. It has been determined that there are principles, what the principles are, and how many there are. But it is necessary to make a new start in our study of natural science, inquiring, that is, into the principles of the science.

BOOK II
THE PRINCIPLES OF NATURAL SCIENCE

LECTURE 1 (192 b 8-193 a 8)
WHAT IS NATURE? WHAT THINGS HAVE A NATURE? WHAT THINGS ARE 'ACCORDING TO NATURE'?

141. After the Philosopher has treated the principles of natural things in Book I, he here treats the principles of natural science.

Now the things which we ought to know first in any science are its subject and the method by which it demonstrates.

Hence Book II is divided into two parts. First he determines what things belong to the consideration of natural science, and secondly, where he says, 'Now that we have established...'(194 b 16; L5 #176ff), he points out the causes from which it demonstrates.

The first part is divided into two parts. First he shows what nature is. Secondly, where he says, 'We have distinguished ...' (193 b 23; L3 #157ff), he determines what things natural science considers.

The first part is divided into two parts. First he shows what nature is. Secondly the number of ways [in which the name nature is used] is pointed out, where he says, 'Some identify...' (193 a 9; L2 #149ff).

The first part is divided into two parts. First he shows what nature is. Secondly, where he says, 'That nature exists ...' (193 a 2 #148), he refutes the position of those who attempt to demonstrate that nature exists.

Concerning the first part he makes two points. First he states what nature is. Secondly, where he says, 'Things "have a nature" (192 b 33 #146), he designates those things which are called 'nature'.

Concerning the first part he makes three points. First he inquires into the definition of nature. Secondly he arrives at the definition, where he says, '... nature is ...'(192 b 22 #145). Thirdly, he explains this definition, where he says, 'I say ...' (192 b 23 #145).

142. He says, therefore, first that we say that of all beings some are from nature,

whereas others are from other causes, for example, from art or from chance.

Now we say that the following things are from nature: every sort of animal, and their parts, such as flesh and blood, and also plants and simple bodies, i.e., the elements, such as earth, fire, air and water, which are nbt resolved into any prior bodies. For these and all things like them are said to be from nature.

All of these things differ from the things which are not from nature because all things of this sort seem to have in themselves a principle of motion and rest; some according to place, such as the heavy and the light, and also the celestial bodies, some according to increase and decrease, such as the animals and plants, and some according to alteration, such as the simple bodies and everything which is composed of them.

But things which are not from nature, such as a bed and clothing and like things, which are spoken of in this way because they are from art, have in themselves no principle of mutation, except *per accidents*, insofar as the matter and substance of artificial bodies are natural things. Thus insofar as artificial things happen to be iron or stone, they have a principle of motion in them, but not insofar as they are artifacts. For a knife has in itself a principle of downward motion, not insofar as it is a knife, but insofar as it is iron.

143. But it does not seem to be true that in every change of natural things a principle of motion is- in that which is moved. For in the alteration and the generation of simple bodies, the whole principle of motion seems to be from an external agent. For example, when water is heated, or air is converted into fire, the principle of the change is from an external agent.

Therefore, some say that even in changes of this sort an active principle of motion is in that which is moved, not perfectly, but imperfectly, which principle helps the action of the external agent. For they say that in matter there is a certain inchoateness of form, which they say is privation, the third principle of nature. And the generations and alterations of simple bodies are said to be from this intrinsic principle.

But this cannot be. Since a thing acts only insofar as it is in act, the aforesaid inchoate state of form, since it is not act, but a certain disposition for act, cannot be an active principle. And furthermore, even if it were a complete form, it would not act on its own subject by ‘changing it. For the form does not act, rather the composite acts. And the composite cannot alter itself unless there are two parts in it, one of which alters, the other of which is altered.

144. And so it must be said that a principle of motion is in natural things in the way in which motion belongs to them. Therefore in those things to which it belongs to move, there is an active priatiple of motion. Whereas in those things to which it belongs to be moved, there is a passive principle, which is matter. And this principle, insofar as it has a natural potency for such a form and motion, makes the motion to be natural. And for this reason the production of artificial things is not natural. For even though the material principle is in that which comes to be, it does not have a natural potency for such a form.

So also the local motion of the celestial bodies is natural, even though it is from a separated mover, inasmuch as there is in the celestial body itself a natural potency for such a motion.

However in heavy and light bodies there is a formal principle of motion. (But a formal principle of this sort cannot be called the active potency to which this motion pertains. Rather it is understood as a passive potency. For heaviness in earth is not a principle for moving, but rather for being moved.) For just as the other accidents are consequent upon substantial form, so also is place, and thus also 'to be moved to place'. However the natural form is not the mover. Rather the mover is that which generates and gives such and such a form upon which such a motion follows.

145. Next where he says, '... nature is...' (192 b 22), he concludes from the above the definition of nature in the following manner.

Natural things differ from the non-natural insofar as they have a nature. But they differ from the non-natural only insofar as they have in themselves a principle of motion. Therefore, nature is nothing other than a principle of motion and rest in that in which it is primarily and *per se* and not *per accidens*.

Now 'principle' is placed in the definition of nature as its genus, and not as something absolute, for the name 'nature' involves a relation to a principle. For those things are said to be born which are generated after having been joined to a generator, as is clear in plants and animals, thus the principle of generation or motion is called nature. Hence they are to be laughed at who, wishing to correct the definition of Aristotle, tried to define nature by something absolute, saying that nature is a power seated in things or something of this sort.

Moreover, nature is called a principle and cause in order to point out that in that which is moved nature is not a principle of all motions in the same way, but in different ways, as was said above [#144].

Moreover, he says that nature is a principle 'of motion and rest'. For those things which are naturally moved to a place, also or even more naturally rest in that place. Because of this, fire is naturally moved upward, since it is natural for it to be there. And for the same reason everything can be said to be moved naturally and to rest naturally in its place. This, however, must not be understood to mean that in everything which is moved naturally nature is also a principle of coming to rest. For a heavenly body is indeed moved naturally, but it does not naturally come to rest. But on the whole it can be said that nature is not only a principle of motion but also of rest.

Further he says 'in which it is' in order to differentiate nature from artificial things in which there is motion only *per accidens*.

Then he adds 'Primarily' because even though nature is a principle of the motion of composite things, nevertheless it is not such primarily. Hence that an animal is moved downwards is not because of the nature of animal insofar as it is animal, but because of the nature of the dominant element.

He explains why he says '*per se* and not *per accidens*' where he says, 'I say "not in virtue of..."' (192 b 24).

It sometimes happens that a doctor is the cause of his own health, and so the principle of his own coming to health is in him, but *per accidens*. Hence nature is not the principle of his coming to health. For it is not insofar as he is cured that he has the art of medicine, but insofar as he is a doctor. Hence the same being happens to be a doctor and to be cured, and he is cured insofar as he is sick. And so because these things are joined *per accidens*, they are also at times separated *per accidens*. For it is one thing to be a doctor who cures, and another thing to be a sick person who is cured. But the principle of a natural motion is in the natural body which is moved insofar as it is moved. For insofar as fire has lightness, it is carried upward. And these two things are not divided from each other so that the lightness is different than the body which is moved upward. Rather they are always one and the same. And all artificial things are like the doctor who cures. For none of them has in itself the principle of its own making. Rather some of them come to be from something outside, as a house and other things which are carved by hand, while others come to be through an intrinsic principle, but *per accidens*, as was said [#142]. And so it has been stated what nature is.

146. Next where he says, 'Things "have a nature"...' (192 b 33), he defines those things which are given the name 'nature'.

He says that those things which have in themselves a principle of their motion have a nature. And such are all subjects of nature. For nature is a subject insofar as it is called matter, and nature is in a subject insofar as it is called form.

147. Next where he says, 'The term "according to nature" (192 b 35), he explains what is 'according to nature'.

He says that 'to be according to nature' is said both of subjects whose existence is from nature and also of the accidents which are in them and caused by such a principle. Thus to be carried upward is not a nature itself, nor does it have nature, but it is caused by nature.

And thus it has been stated what nature is, and what it is that has nature, and what is 'according to nature'.

148. Next where he says, 'That nature exists...' (193 a 2), he denies the presumptuous position of those who wish to demonstrate that nature exists.

He says that it is ridiculous for anyone to attempt to demonstrate that nature exists. For it is manifest to the senses that many things are from nature, which have in themselves the principle of their own motion. To wish, moreover, to demonstrate the obvious by what is not obvious is the mark of a man who cannot judge what is known in itself and what is not known in itself. For when he wishes to demonstrate that which is known in itself, he uses that which is known in itself as if it were not known in itself. And it is clear that some people do this. A man who is born blind may sometimes reason about colours. But that which he uses as a principle is not known to him *per se*, because he has no understanding of the thing. Rather he only uses names. For our knowledge has its origin from the senses, and he who lacks one sense, lacks one science. Hence those who are born blind, and who never sense colour, cannot understand any thing about colour. And so they use the unknown as if it were known. And the converse applies to those who wish to demonstrate that nature exists. For they use the known as if it were not known. The existence of nature is known *per se*, insofar as natural things are manifest to the senses. But what the nature of each thing is, or what the principle of its motion is, is not manifest.

Hence it is clear from this that Avicenna, who wished that it were possible to prove the existence of nature, unreasonably attempted to disprove what Aristotle has said. However Avicenna did not wish to prove this from natural things, for no science proves its own principles. But ignorance of moving principles does not mean that the existence of nature is not known *per se*, as was said.

LECTURE 2 (193.a 9-b 21)
NATURE IS BOTH MATTER AND FORM, BUT PRIMARILY FORM

149. Having shown what nature is, the Philosopher here points out the number of ways in which the name 'nature' is used. He shows first that nature is predicated of matter, secondly that it is predicated of form, where he says, 'Another account ...' (193 a 30 #151).

Concerning the first point we must note that the ancient natural philosophers, being unable to arrive at primary matter, as was said above [I, L12 #108], held that some sensible body, such as fire or air or water, is the first matter of all things. And so it followed that all forms come to matter as to something existing in act, as happens in artificial things. For the form of knife comes to iron already existing in act. And so they adopted an opinion about natural forms similar to that which is true of artificial forms.

He says, therefore, first that it seems to some that that which is primarily in each thing and which considered in itself is unformed is the substance and nature of natural things, as if we would say that the nature of a bed is wood, and the nature of a statue is bronze. For wood is in the bed and is, when considered in itself, not formed. And Antiphon said that the following is a sign of this: if one should bury a bed in the earth and if the wood by rotting should acquire the potency to germinate something, that which is generated will not be a bed, but wood. Now since the substance is that which remains permanent, and since it belongs to nature to generate what is like itself, he concluded that every disposition in respect to any law of reason [ratio] or art is an accident. And that which remains permanent is substance, which continually undergoes change of dispositions of this sort.

Having supposed, therefore, that the forms of artificial things are accidents, and that matter is substance, Antiphon assumed the other proposition, namely, that just as the bed and statue are related to bronze and wood, so also each natural thing is related to some other thing which is its matter. Thus bronze and gold are related to water (because the matter of all liquifiable things seems to be water), and bone and wood are related to earth, and it is the same with all other natural things. Hence he concluded that the material things which subsist under natural forms are their nature and substance. And because of this some have said that earth is the nature and substance of all things, for example, the first theological poets; whereas the later philosophers chose fire or air or water, or some of these or all of them, as is clear from what was said above [I, L2 #13; L8 #54]. For they said that there are as many u stances of things as there are material principles. And they said that all other things are accidents of these material principles,

either as passions, or as habits, or as dispositions, or as anything else which is reducedto the genus of accident.

Thus one difference which they posited between material and formal principles is that they said that they differed as substance and accident.

There is, however, another difference, for they also said that these principles differ as the permanent and the corruptible. Since they held that each of the aforementioned simple bodies is a material principle, they said it was permanent, for they did not say that they were changed into each other. But they said that all other things come to be and are corrupted infinitely. For example, if water is the material principle, they said that water is never corrupted, but remains water in all things as their substance. But they said that bronze and gold and other things of this sort are corrupted and generated infinitely.

150. This position is in part true and in part false. With reference to the point that matter is the substance and the nature of natural things, it is true. For matter enters into the constitution of the substance of each natural thing. But insofar as they said that all forms are accidents, this position is false.

Whence from this opinion and from his argument, Aristotle concludes to that which is true, namely, that nature in one way is called matter, which underlies each natural thing which has in itself a principle of motion or of some sort of mutation. For motion is a species of mutation, as will be said in Book V [L2 #649ff].

151. Next where he says, 'Another account...' (193 a 30), he shows that the form is also called nature.

Concerning this he makes two points. First he states his position, i.e., that form is nature. Secondly, where he says, 'Shape and nature...' (193 b 19 #156), he explains the diversity of forms.

He explains the first point with three arguments. He says, therefore, first that nature is used in another way to refer to the form and species, from which the nature [*ratio*] of the thing is constituted. He proves this by the following argument.

Just as art belongs to a thing insofar as it is according to art and the artistic, so also nature belongs to a thing insofar as it is according to nature and the natural. But we do not say that that which is only in potency to that which is artistic has anything of art, because it does not yet have the species [e.g.] of a bed.

Therefore in natural things that which is potentially flesh and bone does not have the nature of flesh and bone before it takes on the form in respect to which the definitive nature [*ratio*] of the thing is established (i.e. that through which we know what flesh and bone are). The nature is not yet in it before it has the form. Therefore the nature of natural things which have in themselves a principle of motion is in another way the form. And this form, although it is not separated from the matter in the thing, still differs from the matter by reason [*ratio*]. For as bronze and the shapeless, although one in subject, are different in reason [*ratio*], so also are matter and form.

He says this because unless form were other than matter according to reason [*ratio*], the ways in which matter is called nature and form is called nature would not be different.

152. Moreover one might believe that since both matter and form are called nature then the composite could also be called nature. For substance is predicated of form and of matter and of the composite.

But he denies this, saying,that the composite of matter and form, such as a man, is not the nature itself, but is some thing from nature. For nature [natura] has the nature [*ratio*] of a principle, but the composite has the nature [*ratio*] of 'being from a principle'.

153. From the foregoing argument he proceeds further to show that form is nature more than matter. For a thing is said to be greater insofar as it is in act rather than insofar as it is in potency. Whence form, according to which a thing is natural in act, is nature more than matter, according to which a thing is something natural in potency.

154. He gives the second argument where he says, 'Again man is...' (193 b 8). He says that although a bed does not come to be from a bed, as Antiphon said, man does come to be from man. Whence what they say is true, namely, that the form of bed is not the nature, but the wood is. For if wood should germinate, a bed would not come to be, but wood. Therefore, as this form, which does not arise through germination, is not nature but art, so the form which arises from generation is nature. But the form of a natural thing does arise through generation, for man comes to be from man. Therefore the form of a natural thing is nature.

155. He gives his third argument where he says, 'We also speak...' (193 b 13). Nature can be signified as a generation, for instance, if we should call it birth. Thus nature in the sense of generation, i.e., birth, is the way to nature. For the

difference between actions and passions is that actions are named from their principles while passions are named from their terminations. For each thing is named from act, which is the principle of action and the termination of passion. But naming is not the same in passions and actions. For medication is not called the way to medicine, but the way to health. It is necessary for medication to proceed from medicine, not to medicine. But nature in the sense of generation, i. e., birth, is not related to nature as medication is related to medicine. Rather it is related to nature as to a termination, since it is a passion. For that which is born, insofar as it is born, comes from something to something. Hence that which is born is named from that to which it proceeds, and not from that from which it proceeds. That, however, to which birth tends is form. Therefore form is nature.

156. Next where he says, 'Shape and nature ...' (193 b 19), he shows that the nature which is form is used in two ways, i.e., of the incomplete form and the complete form. This is clear in accidental generation, for example, when something becomes white. For whiteness is a complete form, and the privation of whiteness is in some way a species, insofar as it is joined to blackness, which is an imperfect form. But whether or not in simple generation, which is the generation of substances, there is something which is a privation and also a contrary, so that substantial forms are contraries, must be considered later in Book VI and in *De Generatione et Corruptione* I:3.

LECTURE 3 (193 b 22-194 a 11)
HOW PHYSICS AND MATHEMATICS DIFFER IN THEIR CONSIDERATION OF THE SAME THING

157. After the Philosopher has explained what nature is and how many ways the name is used, he here intends to show what it is that natural science considers.

This section is divided into two parts. First he shows how natural science differs from mathematics. Secondly, where he says, 'Since nature has...' (194 a 12; L4 #166), he designates that to which the consideration of natural science extends.

Concerning the first part he makes three points. First he states the question. Secondly, where he says, 'Obviously physical bodies ...' (193 b 23 #158), he gives his reasons for [raising] the question. Thirdly, he answers the question where he says, 'Now the mathematician...' (193 b 31 #159).

He says, therefore, first that after the uses of the name 'nature' have been determined, it is necessary to consider how mathematics differs from natural philosophy.

158. Next where he says, 'Obviously physical bodies ...' (193 b 23), he gives his reasons for [raising] the question. The first of these is as follows.

Whenever sciences consider the same subjects, they are either the same science, or one is a part of the other. But the mathematical philosopher considers points and lines and surfaces and bodies, and so does the natural philosopher. (For he proves from the fact that natural bodies have planes, i.e., surfaces, and volumes, i.e., solidity, and lengths and points. Moreover the natural philosopher must consider all things that are in natural bodies.) Therefore it seems that natural science and mathematics are either the same or that one is a part of the other.

He gives the second reason where he says, 'Further, is astronomy...' (193 b 25). In connection with this reason he raises the question whether astronomy is altogether other than natural philosophy or a part of it. For it is clear that astronomy is a part of mathematics. Whence, if it is also a part of natural philosophy, it follows that mathematics and physics agree at least in this part.

That astronomy is a part of physics he proves in two ways. First by the followiiig argument. To whomever it belongs to know the substances and natures of certain things, also belongs the consideration of their accidents. But it belongs to the natural philosopher to consider the nature and substance of the sun and the moon, since they are certain natural bodies. Therefore it belongs to the natural philosopher to consider their *per se* accidents.

He proves this also from the custom of the philosophers. For natural philosophers are found to have treated the shape of the sun and of the moon and of the earth and of the whole world. And these are topics which claim the attention of the astronomers. Therefore astronomy and natural science agree not only in [having] the same subjects but also in the consideration of the same accidents, and in demonstrating the same conclusions. Whence it seems that astronomy is a part of physics, and as a result physics does not differ totally from mathematics.

159. Next where he says, 'Now the mathematician ...' (193 b 3 1), he answers the question raised above. Concerning this he makes two points. First he gives his solution, and secondly he confirms it, where he says, 'This becomes plain...' (194 a 1 #163).

Concerning the first part he makes three points. First he answers the question. Secondly, where he says, 'That is why he separates ...' (193 b 33 #161), he concludes to a sort of corollary from the above. Thirdly, where he says, 'The holders of ...' (193 b 35 #162), he excludes an error.

160. He says, therefore, first that the mathematician and the natural philosopher treat the same things, i.e., points, and lines, and surfaces, and things of this sort, but not in the same way. For the mathematician does not treat these things insofar as each of them is a boundary of a natural body, nor does he consider those things which belong to them insofar as they are the boundaries of a natural body. But this is the way in which natural science treats them. And, it is not inconsistent that the same thing should fall under the consideration of different sciences according to different points of view.

161. Next where he says, 'That is why he separates ...'(193 b 33), he concludes to a sort of corollary from what he has just said. Because the matherhatician does not consider lines, and points, and surfaces, and things of this sort, and their accidents, insofar as they are the boundaries of a natural body, he is said to abstract from sensible and natural matter. And the reason why he is able to abstract is this: according to the intellect these things are abstracted from motion.

As evidence for this reason we must note that many things are joined in the thing, but the understanding of one of them is not derived from the understanding of another. Thus white and musical are joined in the same subject, nevertheless the understanding of one of these is not derived from an understanding of the other. And so one can be separately understood without the other. And this one is understood as abstracted from the other. It is clear, however, that the posterior is not derived from the understanding of the prior, but conversely. Hence the prior can be understood without the posterior, but not conversely. Thus it is clear that animal is prior to man, and man is prior to this man (for man is had by addition to animal, and this man by addition to man). And because of this our understanding of man is not derived from our understanding of animal, nor our understanding of Socrates from our understanding of man. Hence animal can be understood without man, and man without Socrates and other individuals. And this is to abstract the universal from the particular.

In like manner, among all the accidents which come to substance, quantity comes first, and then the sensible qualities, and actions and passions, and the motions consequent upon sensible qualities. Therefore quantity does not embrace in its intelligibility the sensible qualities or the passions or the motions. Yet it does include substance in its intelligibility. Therefore quantity can be understood without matter, which is subject to motion, and without sensible qualities, but not without substance. And thus quantities and those things which belong to them are understood as abstracted from motion and sensible matter, but not from intelligible matter, as is said in *Metaphysics*, VII:10.

Since, therefore, the objects of mathematics are abstracted from motion

according to the intellect, and since they do not include in their intelligibility sensible matter, which is a subject of motion, the mathematician can abstract them from sensible matter. And it makes no difference as far as the truth is concerned whether they are considered one way or the other. For although the objects of mathematics are not separated according to existence, the mathematicians, in abstracting them according to their understanding, do not lie, because they do not assert that these things exist apart from sensible matter (for this would be a lie). But they consider them without any consideration of sensible matter, which can be done without lying. Thus one can truly consider the white without the musical, even though they exist together in the same subject. But it would not be a true consideration if one were to assert that the white is not musical.

162. Next where he says, "The holders of the theory...' (193 b 35), he excludes from what he has said an error of Plato.

Since Plato was puzzled as to how the intellect could truly separate those things which were not separated in their existence, he held that all things which are separated in the understanding are separated in the thing. Hence he not only held that mathematical entities are separated, because of the fact that the mathematician abstracts from sensible matter, but he even held that natural things themselves are separated, because of the fact that natural science is of universals and not of singulars. Hence he held that man is separated, and horse, and stone, and other such things. And he said these separated things are ideas, although natural things are less abstract than mathematical entities. For mathematical entities are altogether separated from sensible matter in the understanding, because sensible matter is not included in the understanding of the mathernaticals, neither in the universal nor in the particular. But sensible matter is included in the understanding of natural things, whereas individual matter is not. For in the understanding of man flesh and bone is included, but not this flesh and this bone.

163. Next where he says, 'This becomes plain ...' (194 a 1), he clarifies the solution he has given in two ways, first by means of the difference in the definitions which the mathematician and the natural philosopher assign, and secondly by means of the intermediate sciences, where he says, 'Similar evidence ...' (194 a 7 #164).

He says, therefore, first that what has been said of the different modes of consideration of the mathematician and the natural philosopher will become evident if one attempts to give definitions of the mathematicals, and of natural things and of their accidents. For the mathernaticals, such as equal and unequal, straight and curved, and number, and line, and figure, are defined without

motion and matter, but this is not so with flesh and bone and man. Rather the definition of these latter is like the definition of the snub in which definition a sensible subject is placed, i.e., nose. But this is not the case with the definition of the curved in which definition a sensible subject is not placed.

And thus from the very definitions of natural things and of the mathernaticals, what was said above [#160ff] about the difference between the mathematician and the natural philosopher is apparent.

164. Next where he says, 'Similar evidence...' (194 a 7), he proves the same thing by means of those sciences which are intermediates betweenAmathernatics and natural philosophy.

Those sciences are called intermediate sciences which take principles abstracted by the purely mathematical sciences and apply them to sensible matter. For example, perspective applies to the visual line those things which are demonstrated by geometry about the abstracted line; and harmony, that is music, applies to sound those things which arithmetic considers about the proportions of numbers; and astronomy applies the consideration of geometry and arithmetic to the heavens and its parts.

However, although sciences of this sort are intermediates between natural science and mathematics, they are here said by the Philosopher to be more natural than mathematical, because each thing is named and takes its species from its terminus. Hence, since the consideration of these sciences is terminated in natural matter, then even though they proceed by mathematical principles, they are more natural than mathematical sciences.

He says, therefore, that sciences of this sort are established in a way contrary to the sciences which are purely mathematical, such as geometry or arithmetic. For geometry considers the line which has existence in sensible matter, which is the natural line. But it does not consider it insofar as it is in sensible matter, insofar as it is natural, but abstractly, as was said [#160ff]. But perspective conversely takes the abstract line which is in the consideration of mathematics, and applies it to sensible matter, and thus treats it not insofar as it is a mathematical, but insofar as it is a physical thing.

Therefore from this difference between intermediate sciences and the purely mathematical sciences, what was said above is clear. For if intermediate sciences of this sort apply the abstract to sensible matter, it is clear that mathematics conversely separates those things which are in sensible matter.

165. And from this it is clear what his answer is to the objection raised above [#158] concerning astronomy. For astronomy is a natural science more than a mathematical science. Hence it is no wonder that astronomy agrees in its conclusions with natural science.

However, since it is not a purely natural science, it demonstrates the same conclusion through another method. Thus, the fact that the earth is spherical is demonstrated by natural science by a natural method, e.g., because its parts everywhere and equally come together at the middle. But this is demonstrated by astronomy from the figure of the lunar eclipse, or from the fact that the same stars are not seen from every part of the earth.

LECTURE 4 (194 a 12-b 15)
PHYSICS CONSIDERS NOT ONLY MATTER BUT ALSO EVERY FORM EXISTING IN MATTER

166. Having shown the difference between natural science and mathematics, the Philosopher here designates that to which the consideration of natural science extends.

Concerning this he makes two points. First he shows that it pertains to natural science to consider both form and matter. Secondly, where he says, 'How far then . (194 b 10 #175), he points out the limits of natural science in its consideration of form.

Concerning the first part he makes two points. First he draws his conclusion from what has gone before. Secondly, where he says, 'Here too indeed...' (194 a 15 #168), he raises difficulties against his own position.

167. He says, therefore, first that since 'nature' is used in two ways, i.e., of the matter and of the form, as was said above [L2 #145ff], so must it be considered in natural science. Thus when we consider what the snub is, we consider not only its form, i.e., its curvature, but we also consider its matter, i.e., the nose. Hence in natural science nothing is considered, in respect to matter and also in respect to form, without sensible matter.

And it must be noted that this argument of Aristotle includes two approaches.

In one way we can argue as follows. The natural philosopher ought to consider nature. But nature is both form and matter. Therefore he ought to consider both matter and form.

The other way is as follows. The natural philosopher differs from the mathematician, as was said above [L3 #163], because the consideration of the natural philosopher is like the consideration of the snub, whereas that of the mathematician is like the consideration of the curved. But the consideration of the snub is a consideration of the form and the matter. Therefore the consideration of the natural philosopher is a consideration of both.

168. Next where he says, 'Here too indeed...' (194 a 15), he raises a two-fold problem relative to what he has just said.

The first is as follows. Since 'nature' is used for matter and form, is natural science about the matter alone, or the form alone, or about that which is a composite of both?

The second problem is as follows. Supposing that natural science does consider both, is it the same natural science which considers form and matter, or are there different sciences which consider each?

169. Next where he says, 'If we look at the ancients ...' (194 a 19), he answets the above mentioned problems, and especially the second, showing that it pertains to the consideration of the same natural science to consider both form and matter. For the first question seems to have been adequately answered by what he has said, namely, that the consideration of natural science is the same as the consideration of what the snub is.

Concerning this, therefore, he makes two points. First he states what the ancients seem to have thought. He says that if one wishes to look at the sayings of the ancient natural philosophers, it seems that [for them] natural science is concerned only with matter. For they said either nothing about form, or some small bit, as when Democritus and Empedocles touched upon it insofar as they held that a thing comes to be from many according to a determinate mode of mixing or joining.

170. Secondly, where he says, 'But if on the other hand...'(194 a 21), he proves his position with three arguments, the first of which is as follows.

Art imitates nature. Therefore natural science must be related to natural things as the science of the artificial is related to artificial things. But it belongs to the same science of the artificial to know the matter and the form up to a certain point, as the doctor knows health as a form, and bile and phlegm and such things as the matter in which health is. For health consists in a harmony of humours. And in like manner the builder considers the form of the house and also the bricks and

the wood which are the matter of the house. And so it is in all the other arts. Therefore it belongs to the same natural science to know both the matter and the form.

171. The reason for saying that art imitates nature is as follows. Knowledge is the principle of operation in art. But an of our knowledge is through the senses and taken from sensible, natural things. Hence in artificial things we work to a likeness of natural things. And so imitable natural things are [i.e., are produced] through art, because all nature is ordered to its end by some intellective principle, so that the work of nature thus seems to be the work of intelligence as it proceeds to certain ends through determinate means. And this order is imitated by art in its operation.

172. He gives the second argument where he says, 'Again "that for the sake of which"...' (194 a 27).

It belongs to the same science to consider the end and those things which are for the end. This is so because the reason [*ratio*] for those things which are for the end is taken from the end. But nature, which is form, is the end of matter. Therefore it belongs to the same natural science to consider matter and form.

173. That form is the end of matter he proves as follows. In order for something to be the end of a continuous motion two things are required. First it must be the final stage of the motion, and secondly it must be that for the sake of which the thing comes to be. For something can be last, but not be that for the sake of which something comes to be, and hence not have the nature [*ratio*] of an end. And because it is of the nature [*ratio*] of an end that it be that for the sake of which something comes to be, the poet maintained that it would be a jest to say that the end is that for the sake of which something comes to be. This seemed to him to be a trifle, for just as if we were to say 'man animal' because animal is in the nature [*ratio*] of man, so also, that for the sake of which something comes to be is in the nature [*ratio*] of end. For the poet wished to say that not every last thing is an end, but rather only that which is last and best. This is that for the sake of which something comes to be.

And indeed that the form is last in generation is *per se* evident. But that it is that for the sake of which something comes to be with respect to matter is made clear by a simile taken from the arts. Certain arts make matter. And of these some make it simply, as the art of the moulder makes tiles which are the matter of a house, while others make it operative, i.e., they dispose matter pre-existing in nature for the reception of a form, as the art of the carpenter prepares wood for the form of a ship.

It must further be noted that we use all things which are made by art as though they exist for us. For we are in a sense the end of all artificial things. And he says 'in a sense' because, as is said in first philosophy [*Metaph*. XII:7], that for the sake of which something comes to be is used in two ways, i. e., 'of which' and 'for which'. Thus the end of a house as 'of which' is the dweller, as 'for which' it is a dwelling.

From this, therefore, we can conclude that matter is ordered by two arts, that is, those that direct the arts which make matter, and those that pass judgment on the former. Thus there is one art which uses, and another art which is productive of the artifact, as it were, inducing the form. And this latter art is architectonic with reference to that which disposes matter. Thus the art of the ship builder is architectonic with respect to the art of the carpenter who cuts wood. Hence it is necessary that the art which uses be in a sense architectonic, i.e., the principal art, with respect to the productive art.

Therefore, although each is architectonic, i.e., the art which uses and the productive art, they nevertheless differ. For the art which uses is architectonic insofar as it knows and passes judgment on the form, whereas the other, which is architectonic as productive of the form, knows the matter, i.e., passes judgment on the matter. He makes this clear by an example. The use of a ship pertains to the navigator, and thus the art of the navigator is an art which uses, and hence it is architectoni6 with respect to the art of the ship builder, and knows and passes judgment on the form. He says that the navigator knows and judges what the shape of the rudder should be. The other art, however, i.e., the art of the ship builder, knows and judges from what wood and from what kind of wood the ship should be made.

It is clear, therefore, that the art which produces the form directs the art which makes or disposes the matter. However the art which uses the completed artifact directs the art which produces the form.

From this, then, we can conclude that matter is related to form as form is related to use. But use is that for the sake of which the artifact comes to be. Therefore, form also is that for the sake of which matter is in artificial things. And so as in those things which are according to art we make matter for the sake of the work of art, which is the artifact itself, likewise matter is in natural things from nature, and not made by us; nevertheless it has the same ordination to form, i.e., it is for the sake of form.

Hence it follows that it belongs to the same natural science to consider the matter and the form.

174. He gives the third argument where he says, 'Again matter is...' (194 b 9). The argument is as follows.

Things which are related belong to one science. But matter is one of the things which are related, because it is spoken of in relation to form. However it is not spoken of as if matter itself were in the genus of relation, but rather because a proper matter is determined for each form. And he adds that there must be a different matter under a different form. Hence it follows that the same natural science considers form and matter.

175. Next where he says, 'How far then ...' (194 b 10), he shows to what extent natural science considers form.

Concerning this he makes two points. First he raises the question, i.e., to what extent should natural science consider the form and quiddity of a thing. (For to consider the forms and quiddities of things absolutely seems to belong to first philosophy.)

Secondly, he answers the question by saying that as the doctor considers nerves, and the smith considers bronze, up to a certain point, so also the natural philosopher considers forms. For the doctor does not consider nerve insofar as it is nerve, for this belongs to the natural philosopher. Rather he considers it as a subject of health. So also the smith does not consider bronze insofar as it is bronze, but insofar as it is the subject of a statue or something of the sort. So also the natural philosopher does not consider form insofar as it is form, but insofar as it is in matter. And thus, as the doctor considers nerve only insofar as it pertains to health, for the sake of which he considers nerve, so also the natural philosopher considers form only insofar as it has existence in matter.

And so the last things considered by natural science are forms which are, indeed, in some way separated, but which have existence in matter. And rational souls are forms of this sort. For such souls are, indeed, separated insofar as the intellective power is not the act of a corporeal organ, as the power of seeing is the act of an eye. But they are in matter insofar as they give natural existence to such a body.

That such souls are in matter he proves as follows. The form of anything generated from matter is a form which is in matter. For the generation is-terminated when the form is in matter. But man is generated from matter and by man, as by a proper agent, and by the sun, as by auniversal agent with respect to the generable. Whence it follows that the soul, which is the human form, is a form in matter. Hence the consideration of natural science about forms extends

to the rational soul.

But how forms are totally separated from matter, and what they are, .or even how this form, i.e., the rational soul, exists insofar as it is separable and capable of existence without a body, and what it is according to its separable essence, are questions which pertain to first philosophy.

LECTURE 5 (194 b 16-195 a 27)
PHYSICS DETERMINES WHAT THE CAUSES ARE AND HOW MANY SPECIES OF CAUSES THERE ARE

176. Having shown what natural science considers, the Philosopher here begins to designate the causes from which it should demonstrate.

This section is divided into two parts. First he treats the causes. Secondly, where he says, 'Now the causes...' (198 a 23; L11 #241), he points out the causes from which natural science should demonstrate.

Concerning the first part he makes two points. First he shows the need for treating the causes. Secondly, where he says, 'In one sense...' (194 b 23 #177), he begins to treat the causes.

He says, therefore, first that after it has been determined what falls under the consideration of natural science, there remains to be considered the causes—what they are and how many there are.

This is so because the business of studying nature is not ordered to operation, but to science. For we are not able to make natural things, but only to have science of them.

Now we do not think that we know anything unless we grasp the 'why', which is to grasp the cause. Hence it is clear that we must observe generation and corruption and every natural change in such a way that we know the causes and that we reduce to its proximate cause each thing concerning which we seek the 'why'.

He says this because the consideration of causes insofar as they are causes is proper to first philosophy. For a cause insofar as it is a cause does not depend upon matter for its existence, because the nature [*ratio*] of cause is found also in those things which are separated from matter. But the consideration of causes because of a certain necessity is taken up by the natural philosopher. However he

considers causes only insofar as they are the causes of natural mutations.

177. Next where he says, 'In one sense ...' (194 b 23), he treats the causes.

Concerning this he makes three points. First he names the clearly diverse species of causes. Secondly, where he says, 'But chance also (195 b 31; L7 #198), he treats certain less obvious causes. Thirdly, where he says, 'They differ ...' (197 a 36; L10 #226) he shows that the causes are neither more nor less.

The first part is divided into two parts. First he treats the species of causes. Secondly, where hip says, 'Now the modes ...' (195 a 27; L6 #187), he treats the modes of diverse causes in each species.

Concerning the first part he makes two points. First he sets forth the different species of causes. Secondly, where he says, 'All the causes... (195 a 15 #184) he reduces them to four.

Concerning the first part he makes two points. First he sets forth the different causes. Secondly, where he says, 'As the word ...' (195 a 3 #182), he points out certain consequences which follow from the above mentioned diversity.

178. He says, therefore, first that in one way a cause is said to be that from which something comes to be when it is in it, as bronze is said to be the cause of a statue and* silver the cause of a vase. The genera of these things, i.e., the metallic, or the liquifiable, and such things, are also called causes of these same things.

He adds 'when it is in it' in order to differentiate this cause from the privation and the contrary. For the statue, indeed, comes to be from bronze, which is in the statue when it is made. It also comes to be from the unshaped, which, however, is not in the statue when it is made. Hence bronze is a cause of statue, but the unshaped is not, since it is only a *per accidens* principle, as was said in Book I [L13 #112].

179. Secondly a cause is said to be the species and exemplar. This is called a cause insofar as it is the quidditative nature [*ratio*] of the thing, for this is that through which we know of each thing 'what it is'.

And as was said above that even the genera of matter are called causes, so also the genera of a species are called causes. And he gives as an example that harmony of music which is called the octave. The form of an octave is a proportion of the double, which is a relation of two to one. For musical harmonies

are constituted by the application of numerical proportions to sounds as to matter. And since two or the double is the form of that harmony which is the octave, the genus of two, which is number, is also a cause. Thus just as we say that the form of the octave is that proportion of two to one which is the proportion of the double, so also we can say that the form of the octave is that proportion of two to one which is multiplicity. And so all of the parts which are placed in the definition are reduced to this mode of cause. For the parts of the species are placed in the definition, but not the parts of the matter, as is said in *Metaphysics*, VII:10. Nor is this contrary to what was said above [L3 #163] about matter being placed in the definitions of natural things. For individual matter is not placed in the definition of the species, but common matter is. Thus flesh and bones are placed in′ the definition of man, but not this flesh and these bones.

The nature of the species, therefore, which is constituted of form and common matter, is related as a formal cause to the individual which participates in such a nature, and to this extent it is said that the parts which are placed in the definition pertain to the formal cause.

It must be noted, however, that he posits two things which pertain to the quiddity of the thing, i.e., the species and the exemplar. For there is a diversity of opinions concerning the essences of things.

Plato held that the natures of species are certain abstracted forms, which he called exemplars and ideas, and because of this he posited the exemplar or paradigm.

However those natural philosophers who said something about form placed the forms in matter, and because of this he named them species.

180. Next he says that that from which there is a beginning of motion or rest is in some way called a cause. Thus one who gives advice is a cause, and the father is a cause of the son, and everything which brings about a change is a cause of that which is changed.

It must be noted with reference to causes of this sort that there are four kinds of efficient cause, namely, the perfecting, the preparing, the assisting, and the advising causes.

The perfecting cause is that which gives fulfilment to motion or mutation, as that which introduces the substantial form in generation.

The preparing or disposing cause is that which renders matter or the subject

suitable for its ultimate completion.

The assisting cause is that which does not operate for its own proper end, but for the end of another.

The advising cause, which operates in those things which act because of something proposed to them, is that which gives to the agent the form through which it acts. For the agent acts because of something proposed to him through his knowledge, which the advisor has given to him, just as in natural things the generator is said to move the heavy or the light insofar as he gives the form through which they are moved.

181. Further, he posits a fourth mode of cause. A thing is called a cause as an end. This is that for the sake of which something comes to be, as health is said to be a cause of walking. And this is evident because it answers the proposed question 'why'. For when we ask, 'Why does he walk?', we say, 'That he may become healthy'; and we say this thinking that we assign a cause. And thus he gives more proof that the end is a cause than that the other things are causes, because the end is less evident, inasmuch as it is last in generation.

And he adds further that all things which are intermediates between the first mover and the ultimate end are in some way ends. Thus the doctor reduces the body in order to produce health, and so health is the end of thinness. But thinness is produced by purgation~ and purgation is produced by a drug, and the drug is prepared by instruments. Hence all of these things are in some way ends, for the thinness is the end of the purging, the purging is the end of the drug, and the drug is the end of the instruments, and the instruments are the ends in the operation or in the seeking for the instruments.

And thus it is clear that these intermediate things -differ from each other insofar as some of them are instruments and some of them are operations performed by instruments. And he brings this out lest anyone think that only that which is last is a cause in the sense of 'that for the sake of which'. For the name 'end' seems to refer to something which is last. Thus every end is last, not simply, but in respect to something.

He finally concludes that this is perhaps all the ways in which the name 'cause' is used. He adds 'perhaps' because of the causes which are *per accidens*, such as chance and fortune.

182. Next where he says, 'As the word has ...' (195 a 3), he makes clear three things which follow from what he has said about the different causes.

The first point is that since there are many causes, then one and the same thing has many causes*per se*, and not*per accidens*. Thus the art of the sculptor is a cause of a statue as an efficient cause, and bronze is a cause as matter. And so it is that many definitions of one thing are sometimes given in accordance with the different causes. But the perfect definition embraces all of the causes.

The second point is that some things are causes of each other in respect to different species of cause. Thus work is an efficient cause of a good habit, yet a good habit is a final cause of work. For nothing prevents a thing from being prior and posterior to another according to different aspects [*ratio*]. The end is prior according to reason [*ratio*], but posterior in existence; the converse is true of the agent. And in like manner, the form is prior to matter in respect to the nature [*ratio*] of being a complement, but the matter is prior to form in respect to generation and time in everything which is moved from potency to act.

The third point is that the same thing is, at times, the cause of contraries. Thus through his presence the navigator is the cause of the safety of the ship, through his absence, however, he is a cause of its sinking.

183. Next where he says, 'All the causes.. .'(195 a 15), he reduces all the causes mentioned above to four species. He says that all the causes enumerated above are reduced to four modes, which are evident. For the elements, i.e., the letters, are causes of syllables, and in like manner earth is a cause of vases, and silver of a vial, and fire and such things, i.e., the simple bodies, are causes of bodies. And in the same way every part is a cause of the whole, and the propositions in a syllogism are a cause of the conclusion. And all of these things are understood as causes in the same way, namely, as that from which something comes to be is called a cause, for this is common to all the instances mentioned above.

However, of all the things just enumerated some are causes as matter, and some as form, which causes the quiddity of the thing. Thus all parts, such as the elements of syllables, and the four elements of mixed bodies, are causes as matter. But those things which imply a whole or a composition or some species are understood as form. Thus species is referred to the forms of simple things, and the whole and composition are referred to the forms of composites.

184. But there seems to be two difficulties here.

The first is the fact that he says that the parts are material causes of the whole, whereas above [#179] he reduced the parts of the definition to the formal cause.

It can be said that he spoke above of the parts of the species which fall in the

definition of the whole. But here he speaks of the parts of the matter in whose definition falls the whole. Thus circle falls in the definition of semicircle.

But it would be better to say that, although the parts of the species which are placed in the definition are related to the supposit of nature as a formal cause, they are, nevertheless, related to the very nature of which they are parts as matter. For all parts are related to the whole as the imperfect to the perfect, which is, indeed, the relation of matter to form.

Further a difficulty can be raised with reference to what he says about propositions being the matter of conclusions. For matter is in that of which it is the matter. Hence speaking of the material cause above [#178] he said that it is that from which something comes to be when it is in it. But propositions are apart from the conclusion.

But it must be pointed out that the conclusion is formed from the terms of the propositions. Hence in view of this the propositions are said to be the matter of the conclusion insofar as the terms which are the matter of the propositions are also the matter of the conclusion, although they are not in the same order as they are in the propositions. In this same way flour is called the matter of bread, but not insofar as it stands under the form of flour. And so propositions are better called the matter of the conclusion than conversely. For the terms which are joined in the conclusion are posited separately in the premises. Thus we have two modes of cause.

185. Some things are called causes for another reason, i.e., because they are a principle of motion and rest. And in this way the seed which is active in generation is called a cause. Likewise the doctor is called a cause of health according to this mode; so also the adviser is a cause according to this mode, and everyone who makes something.

Another text has 'and propositions'. For although propositions, insofar as their terms are concerned, are the matter of the conclusion, as was said above [#184], nevertheless insofar as their inferential power is concerned, they are reduced to this genus of cause. For the principle of the discourse of reason to its conclusion is from propositions.

186. Another meaning of cause is found in other causes, i.e., insofar as the end or the good has the nature [*ratio*] of a cause. And this species of cause is the most powerful of all the causes, for the final cause is the cause of the other causes. It is clear that the agent acts for the sake of the end. And likewise it was shown above [L4 #173] in regard to artificial things that the form is ordered to

use as to an end, and matter is ordered to form as to an end. And to this extent the end is called the cause of causes.

Now since he has said that this species of cause has the nature of a good, while sometimes in those things which act by choice it happens that the end is evil, he forestalls this difficulty by saying that it makes no difference whether the final cause is a true or an apparent good. For what appears good does not move except under the aspect [*ratio*] of good.

And thus he finally concludes that the species of cause are as many as were mentioned.

LECTURE 6 (195 a 28-b 30)
CONCERNING THE DIFFERENT MODES OF CAUSING AND THOSE THINGS WHICH ARE CONSEQUENT UPON THESE DIFFERENT MODES OF CAUSING

187. After the Philosopher has distinguished the species of causes, he here distinguishes the various modes of causes in respect to the same species of cause.

Concerning this he makes two points. First he distinguishes the different modes of causes. Secondly, where he says, 'The difference is ...' (195 b 17 #195), he treats certain consequences of this distinction.

Concerning the first part he makes two points. First he distinguishes the different modes of causes, and secondly, where he says, 'An these various ...' (195 b 13 #194), he reduces them to a certain number.

Concerning the first part he distinguishes the modes of causes according to four divisions.

He says, therefore, first that the modes of causes are numerous, but if they are reduced to headings, either under some highest, or under some common aspect, they are found to be fewer. Or 'headings' may be taken as a combination, for it is obvious that combinations of the modes are fewer than the modes.

188. Therefore the first division or combination of modes is that in the same species of cause one cause is said to be prior to another, as when we understand that the more universal cause is prior. Thus the doctor is the proper and posterior cause of health, whereas the artisan is the more common and prior cause. This is in the species of efficient cause. And the same thing is true in the species of

formal cause. For the proper and posterior formal cause of the octave is the proportion of the double, whereas the more common and prior is the numerical proportion which is called multiplicity. And in like manner a cause which contains any cause in the community of its extension is a prior cause.

189. It must be noted, however, that the universal cause and the proper cause, and the prior cause and the posterior cause, can be taken either according to a commonness in predication, as in the example given about the doctor and the artisan, or according to a commonness in causality, as if we say the sun is a universal cause of heating, whereas fire is a proper cause. And these two divisions correspond to each other.

For it is clear that any power extends to certain things insofar as they share in one nature [*ratio*], and the farther that that power extends, the more common that nature [*ratio*] must be. And since a power is proportioned to its object according to its nature [*ratio*], it follows that a higher cause acts according to a form which is more universal and less contracted. And this can be seen in the order of things. For to the extent that among beings some things are superior, to that extent they have forms which are less contracted and more dominant over matter, which contracts the power of form. And so that which is prior in causing is found to be prior in some way under the aspect [*ratio*] of a more universal predication. For example, if fire is the first in heating, then the heavens are not only the first in heating but also the first in producing alteration.

190. He gives the second division where he says, 'Another mode of causation ...' (195 a 33).

He says that just as *per se* causes are divided into prior and posterior or common and proper, so also are *per accidens* causes.

For besides *per se* causes there are *per accidens* causes and their genera. Thus Polycletus is. a *per accidens* cause of the statue, while the sculptor is a*per se* cause. For Polycletus is a cause of statue insofar as he happens to be a sculptor. And in like manner those things which contain Polycletus in their commonness, e. g., man and animal, are *per accidens* causes of statue.

Moreover it must be noted that among *per accidens* causes some are closer to the *per se* causes and some are more removed. For everything which is joined to the *per se* cause but is not of its nature [*ratio*] is called a *per accidens* cause. Now a thing can be closer to the nature [*ratio*] of the [*per se*] cause or more removed from it, and to this extent the *per accidens* causes are closer or more removed. Thus, if a sculptor happens to be white and musical, the musical is

closer, because it is in the same subject in respect to the same thing, i.e., in respect to the soul in which are both [the art of the] musician and the art of statue making. But the subject itself is still more closely related than the other accidents. Thus Polycletus is closer than white or musical, for these latter are not joined to this sculptor except through the subject.

191. He gives the third division where he says, 'All causes...' (195 b 4).

He says that besides the causes properly so called, i.e., the causes*per se* and the causes *per accidens*, some things are said to be causes in potency, as being able to operate, while other things are actually operating causes. Thus either the builder in habit or the builder in act can be called the cause of the building of a house.

192. And just as causes are distinguished according to the above mentioned modes, so also the things of which they are the causes are distinguished. For one thing is caused posteriorly and more properly, and another priorly and more commonly. Thus something might be called the cause of this statue, or of statue in general, or still more commonly it might be called the cause of an image. And likewise something might be called the moving cause of this bronze, or of bronze in the universal, or of matter.

So also, in *per accidens* effects, it can be said that one thing is more common and another less common. An effect is said to be *per accidens* when it is joined to a *per se* effect and is outside its nature [*ratio*]. Thus the*per se* effect of cooking is delectable food, but the*per accidens* effect is healthful food. However the converse is true of medicine.

193. He gives the fourth division where he says, 'Again we may use...' (195 b 10).

He says that sometimes *per se* causes are taken as a complex with *per accidens* causes, as when we say that neither Polycletus, who is a *per accidens* cause, nor the sculptor, who is the cause *per se*, is the cause of the statue, but rather that the sculptor Polycletus is the cause.

194. Next where he says, 'All these various uses ...' (195 b 13), he reduces the above mentioned modes to a certain number.

He says that the above mentioned modes are six in number, but each of them is used in two ways. These are the six modes: the singular and the genus, which above [#188] he called the prior and the posterior, the accident and the genus of the accident, the simple and the complex. And each of these is divided by

potency and act; and so all the modes become twelve. He distinguishes all the modes by potency and act because what is in potency is not simply.

195. Next where he says, 'The difference is ...' (195 b 17), he treats three things which follow from the distinction of modes just made.

The first point is that causes in act and causes in potency differ as follows. Causes operating in act exist and do not exist simultaneously with those things of which they are the causes in act. For example, if we take singular causes, i.e., proper causes, then this healer exists and does not exist simultaneously with him who becomes healed, and this builder exists simultaneously with that which is built. But this is not true if we take causes in act which are not proper causes. For it is not true that builder exists and does not exist simultaneously with that which is built. For it can happen that the builder is in act but this building is not being built, but some other. But if we take the one who is building this building, and if we take this building insofar as it is being built, then it is necessary that when one is posited, the other must be posited also, and when one is removed the other is removed. But this does not always happen in regard to causes which are in potency. For a home and the man who built it are not corrupted simultaneously.

And thus it follows that just as inferior agents, which are causes of the coining to be of things, must exist simultaneously with the things which come to be as long as they are coming to be, so also the divine agent, which is the cause of existing in act, is simultaneous with the existence of the thing in act. Hence if the divine action were removed from things, things would fall into nothingness, just as when the presence of the sun is removed, light ceases to be in the air.

196. He sets forth the second point where he says, 'In investigating the cause...' (195 b 21). He says that it is necessary to seek in natural things the first cause of each thing, just as we do in artificial things. So if we should ask why it is that a man builds, we answer 'because he is a builder'. Likewise, if we ask why he is a builder, we answer,'because he possesses the builder's art'. And here the inquiry stops, because this is the first cause in this order. Hence in natural things we should proceed to the first cause. This is so because the effect is not known unless the cause is known. Hence if the cause of an effect is also the effect of some other cause, then it cannot be known unless its cause is known, and so on until we arrive at a first cause.

197. He sets forth the third point where he says, 'Further generic effects ...' (195 b 25). Effects should correspond proportionally to causes so that general effects be referred to general causes and singular effects to singular causes. For example, if it is said that the cause of statue is sculptor, then the cause of this

statue is this sculptor. In like manner effects in potency should correspond to causes in potency and effects in act to causes in act.

And finally in summary he concludes that this is a sufficient treatment of the species and modes of causes.

LECTURE 7 (195 b 31-196 b 9)
DIFFERENT OPINIONS ABOUT FORTUNE AND CHANCE, THE HIDDEN CAUSES

198. Having treated the obvious species and modes of cause, the Philosopher here takes up certain hidden modes, namely, fortune and chance.

Concerning this he makes two points. First he states his intention. Secondly, he pursues his intention, where he says, 'Some people even question ...'(195 b 36 #198)

He says, therefore, first that fortune and chance are also reckoned among the causes, since many things are said to come to be or to exist because of fortune and chance.

And so with respect to fortune and chance three things must be considered; namely, how they are reduced to the causes mentioned above, then whether fortune and chance are the same or different, and finally what chance and fortune are.

Next where1e says, 'Some people even question ...' (195 b 36), he begins his treatment of fortune and chance.

First he sets forth the opinions of others. Secondly, where he says, 'First then we observe ...' (196 b 10; L8 #207), he establishes the truth.

Concerning the first part he sets forth three opinions. The second begins where he says, 'There are some ...'(196 a 25 #203), and the third, where he says, 'Others there are ...' (196 b 5 #206).

Concerning the first part he makes two points. First he sets forth the opinions and arguments of those who deny fortune and chance. Secondly, where he says, 'But there is a further circumstance.. .'(196 a 11 #201), he argues about some of these reasons.

199. He says, therefore, first that some have questioned whether fortune and chance exist. They deny that they exist for two reasons.

The first argument is that all of those things which are said to come to be by chance or fortune are found to have some determinate cause other than fortune. He gives an example of this sort of thing. If someone coming to the market place should find some man whom he wished to find, but who he did not previously believe would be found, we say that his finding of this man was due to fortune. But the cause of this findingishis willto buy, forthe sake of whichhewent to the marketwhere the man whom he sought was. And the same is true of all other things which are said to be by fortune, for they have some cause other than fortune. And so fortune does not seem to be a cause of anything, and consequently is nothing. For we do not posit fortune except insofar as we hold that some things exist by fortune.

200. He gives the second argument where he says, for if chance were real ...′ (196 a 6).

He says that if fortune were something, it seems to be inconsistent (and that it is truly inconsistent is shown below #201) and puzzling why none of the ancient wise men who treated the causes of generation and corruption treated fortune. But, as it seems, those ancients thought that nothing exists by fortune. This second argument is taken from the opinion of the ancient natural philosophers.

201. Next where he says, ‘But there is a further circumstance...′ (196 a 11), he argues about this second proof, showing what he had assumed above, namely, that it is inconsistent that the ancient natural philosophers did not treat chance and fortune. He proves this with two arguments.

His first argument is as follows. It seems remarkable, and indeed it is, that′the ancient natural philosophers did not treat chance and fortune. For they assumed that they treated the causes of those things which come to be, yet there are many things which come to be by fortune and chance. Hence they should have treated fortune and chance. Nor are they to be excused by the argument given above [200] which denies fortune and chance. For although men know that every effect is reduced to some cause, as the above opinion which denies fortune and chance stated, nevertheless, regardless of this argument, these philosophers held that some things come to be by fortune, and other things do not. Hence these natural philosophers must make mention of fortune and chance at least in order to show that it is false that some things come to be by fortune and chance, and in order to point out the reason why some things are said to be by fortune and some not. Nor can they be excused by reason of the fact that chance and fortune

would be reduced to one of the causes which they posited. For they did not think that fortune is one of the things which they thought to be causes, such as friendship or strife or some other such thing.

202. He gives his second argument where he says, 'This is strange...' (196 a 19).

He says that whether they thought that fortune existed or not, it is inconsistent that the ancient natural philosophers neglected to treat fortune. For if they thought that there was fortune, it is inconsistent that they did not treat it; if, however, they thought that there was no fortune, it is inconsistent that they sometimes used it. For example, Empedocles said that air is not always united on high above the earth, as if this were natural to it, but rather this happens by chance. For he says that when the earth was made by strife distinguishing the elements, it happened that air gathered together in this place, and as it came together then, it will hold this course so long as the world remains. But in other worlds, which he held come to be and are corrupted to infinity, as was said above [I, L10 #76], air would be differently related in many ways to the parts of the universe. And likewise he said that the many parts of animals come to be by fortune, so that in the first production of the world, heads came to be without necks.

203. Next where he says, 'These are some ...' (196 a 25), he gives the second opinion.

Concerning this he makes two points. First he sets forth the opinion. Secondly, he disproves it where he says, 'This statement might...' (196 a 28 #204).

He says, therefore first, that some have said that chance is the cause of the heavens and all the parts of the world. And they said that the revolution of the world, and the movement of the stars distinguishing and constituting the whole universe below according to this order, is by chance. This seems to be the opinion of Democritus, who says that the heavens and the whole world are constituted by chance through the movement of atoms which are *per se* mobile.

204. Next where he says, 'This statement might ...' (196 a 28), he disproves this position with two arguments.

The first argument is that it would seem to be worthy of great wonder that animals and plants are not from fortune but from intellect or nature or some other determinate cause. For it is clear that a thing is not generated from any seed whatsoever, but man from a determinate seed, and the olive from a determinate seed. And since these inferior things do not come to be by fortune, it

is worthy of wonder that the heavens and those things which are more divine among the sensible things obvious to us, e.g. the sempiternal parts of the world, are by chance, and should not have any determinate cause, as do animals and plants. And if this is true, it would have been worthwhile to insist and to give a reason why this is so. But the ancients failed to do this.

205. He gives the second argument where he says, 'For besides the other...' (196 b 1). How can it be true that the celestial bodies are by chance, while inferior bodies are not? This seems to be inconsistent first from the fact that they are the nobler, and secondly it is even more inconsistent in the light of what is seen. For we see that in the heavens nothing comes to be by chance, whereas in inferior bodies, which are not said to be by chance, many things seem to happen by fortune. According to their position it would be more reasonable if the converse were true, so that in those things whose cause is chance or fortune, some things would be found to come to be by chance or by fortune, whereas in those things whose cause is not chance or fortune, these latter would not be found.

206. Next where he says, 'Others there are...' (196 b 5), he sets forth the third opinion about fortune.

He says that it seems to some that fortune is a cause, but it is hidden to the human intellect, as if it were something divine and above men. For they wanted to hold the position that all fortuitous events are reduced to some divine ordaining cause, as we hold that all things are ordered by divine providence.

But although this opinion has a radical truth, they did not use the name 'fortune' well. For that divine thing which orders cannot be called or named fortune, because to the extent that a thing participates in reason or order, it recedes from the nature [*ratio*] of fortune. Hence, the inferior cause, which of itself does not have an ordination to the fortuitous event, should much more be called fortune than the superior cause, if such a cause is the one which orders.

He omits an inquiry about this opinion, both because it exceeds the bounds of natural science, and because he shows below [L8 #214] that fortune is not a *per se* cause, but a *per accidens* cause. Hence how he evaluates these opinions will be made more clear in what follows. And so he concludes that for the clarification of these opinions, we must consider what fortune and chance are, and whether they are the same or different, and how they are reduced to the causes mentioned above.

LECTURE 8 (196 b 10-197 a 7)

AFTER MAKING CERTAIN DIVISIONS AMONG EFFECTS AND CAUSES, HE CONCLUDES TO A DEFINITION OF FORTUNE

207. Having set forth the opinions of others about fortune and chance, the Philosopher here determines the truth.

This section is divided into three parts. First he shows what fortune is. Secondly, where he says, 'They differ ...' (197 a 36; L10 #226), he shows how fortune and chance differ. Thirdly, where he says, 'Both belong to ...' (198 a 2; L10 #236), he points out the genus of cause to which chance and fortune are reduced.

The first part is divided into two parts. First he shows what fortune is. Secondly, where he says, 'It is necessary ...' (197 a 8; L9 #217), from the definition of fortune he explains the meaning [*ratio*] of those things which are said about fortune.

Concerning the first part he makes three points. First he sets forth certain divisions needed for the investigation of the definition of fortune. Secondly, where he says, 'To resume then ...' (196 b 29 #215), he shows under which members of these divisions fortune is contained. Thirdly, where he says, 'It is clear ...' (197 a 5 #216), he concludes to the definition of fortune.

Now since fortune is posited as a kind of cause, and since it is necessary, in order to understand a cause, to know that of which it is the cause, he first sets forth a division on the part of that of which fortune is the cause. Secondly, where he says, 'Things of this kind ...' (196 b 23 #214), he sets forth a division on the part of the cause itself.

208. With reference to the first point he sets forth three divisions.

The first of these is that certain things always come to be, e.g., the rising of the sun; and certain things come to be frequently, e.g., man is born having eyes. But neither of these is said to be by fortune.

But certain other things occur in fewer instances, as when a man is born with six fingers or without eyes. And everyone says that things of this sort come to be by fortune. Hence, it is clear that fortune is something, since to be by fortune and to be in fewer instances are convertible. And he brings this up in opposition to the first opinion which denied fortune.

209. However, it seems that this division of the Philosopher is insufficient, for there are some happenings which are indeterminate. Therefore Avicenna said

that in those things which are indeterminate a thing happens to be by fortune, as for example those things which are occasional. And it is no objection that it is not said that it is by fortune that Socrates sits, since this is indeterminate. For although this is indeterminate with respect to the moving potency, it is not indeterminate with respect to the appetitive potency which tends determinately to one thing. And if something should happen outside of this, it would be said to be fortuitous.

Now just as the moving potency, which is indeterminate, does not move to act unless it is determined to one thing by the appetitive potency, so also nothing which is indeterminate moves to act unless it is determined to one thing by something. For that which is indeterminate is, as it were, being in potency. However, potency is not a principle of action, but only act is such. Hence from that which is indeterminate nothing follows unless it is determined to one thing by something, either always or frequently. And because of this, he omitted things which are indeterminate from his discussion of things which come to be.

210. It must also be noted that some define the necessary as that which is never impeded and the contingent as that which occurs frequently but may be impeded in a few instances.

But this is unreasonable. For that is called necessary which has in its nature that which cannot not be, whereas the contingent, as happening frequently, has in its nature that which can not be. But to have or not have some impediment is itself contingent. For nature does not prepare an impediment for that which cannot not be, since this would be superfluous.

211. He gives the second division where he says, 'But secondly...' (196 b 17). He says that some things come to be for the sake of an end, and other things do not.

This division, however, raises a difficulty, because every agent acts for an end; it acts either by nature or by intellect.

But we must note that he is saying that those things which come to be for themselves do not come to be for the sake of something, insofar as they have in themselves a pleasure or perfection because of which they are pleasing in themselves.

Or else he is speaking of those things which do not occur for the sake of a deliberate end, for example, stroking the beard or some other such thing which takes place at times without deliberation solely from the movement of the imagination. Hence they have an imagined end, but not a deliberated end.

212. He gives the third division where he says, 'Again, some of the former...' (196 b 18). He says that of the things which come to be for the sake of an end, some happen in accordance with will and others do not. Both of these are found among those things which come to be for the sake of something. For not only those things which come to be by will, but also those things which come to be by nature, come to be for the sake of something.

213. Now since those things which come to be either necessarily or frequently come to be from nature or from that which is proposed [by the intellect], it is clear that both in those things which always happen and in those things which happen frequently there are some things which come to be for an end. For both nature and that which is proposed [by the intellect] act for the sake of an end.

And thus it is clear that these three divisions include each other. For those things which come to be from what is proposed [by the intellect] or from nature come to be for the sake of an end, and those things which come to be for the sake of an end come to be always or frequently.

214. Next where he says, 'Things of this kind ...' (196 b 23), he gives the division which is taken on the part of the cause.

He says that when things of this sort (i.e., things which are from what is proposed [by the intellect] for the sake of something, and which are in few instances) come to be through a *per accidens* cause, we say that they are by fortune. For as certain aspects of beings are *per se* and others *per accidens*, the same is true of causes. Thus the *per se* cause of a house is the builder's art, while the *per accidens* cause is the white or the musical.

But it must be noted that *per accidens* cause is taken in two ways: in one way on the part of the cause, and in another way on the part of the effect.

On the part of the cause, that which is called a *per accidens* cause is joined to the *per se* cause. Thus if the white and the musical are called causes of a house, it is because they are accidentally joined to the builder.

On the part of the effect, we sometimes refer to something which is accidentally joined to the effect, as when we say that a builder is the cause of strife because strife arises from the building of a house.

In this sense fortune is said to be a *per accidens* cause when something is accidentally, joined to the effect, for example, if the discovery of a treasure is

accidentally joined to the digging of a grave. Thus the *per se* effect of a natural cause is what follows according to the exigencies of its form, so that the effect of the agent who acts through something proposed [by the intellect] is that which happens because of the intention of the agent. Hence whatever takes place in the effect outside this intention is *per accidens*.

And I say that this is true if what is outside the intention follows in few cases. For what is always or frequently joined to the effect falls under the intention itself. For it is stupid to say that someone intends something but does not will that which is always or frequently joined to it.

Moreover, he points out a difference between the *per se* cause the *per accidens* cause. The *per se* cause is limited and determinate, whereas the *per accidens* cause is unlimited and indeterminate, because an infinity of things can happen to be united.

215. Next where he says, 'To resume then...'(196 b 29), he points out those members of the above divisions under which fortune is contained, and what fortune is.

He says first that fortune and chance, as was said above [#214], pertain to those things which happen for the sake of something. However, the difference between fortune and chance will be determined later [L10 #226ff].

But now it should be clear that each of them is contained among those things which act for the sake of an end. Thus if one knows that he will receive money in the forum, and if he goes there to take it away, [this does not happen by fortune], but if he did not go there for this purpose, it is *per accidens* that his arrival should have this effect. And thus it is clear that fortune is a *per accidens* cause of things which are for the sake of something.

Further it is clear that fortune is a cause of things which occur in few instances. For carrying money away is said to be by fortune when he who takes money away comes to the house neither necessarily nor frequently.

Moreover, fortune pertains to those things which come to be because of what is proposed [by the intellect]. For taking money away, which is said to be by fortune, is the end of some causes, but not in itself, as in those things which happen by nature. Rather it is the end of those things which come to be as proposed by the intellect. But if someone acting under such a proposal should go in order to take money away, or if he always or frequently takes money away when he comes, this would not be said to be by fortune, just as if anyone

frequently or always soaks his feet when he goes to a muddy place, it would not be said that this is due to fortune, even though he did not intend it.

216. Next where he says, 'It is clear ...' (197 a 5), lie concludes to a definition of fortune which is drawn from what was said above.

He says that it is clear from the foregoing that fortune is a *per accidens* cause in those things which come to be in a few instances according to what is proposed for the sake of an end. And from this it is clear that fortune and intellect pertain to the same thing. For only those who have an intellect act by fortune, for there is no proposal or will without intellect. And although only those who have an intellect act by fortune, still the more something is subject to the intellect, the less is it subject to fortune.

LECTURE 9 (197 a 8-35)
THE MEANING OF THE THINGS WHICH THE ANCIENT PHILOSOPHERS AND THE COMMON MAN SAY ABOUT FORTUNE

217. Having given the definition of fortune, he establishes from this definition the meaning [*ratio*] of those things which are said about fortune.

First he considers those things which the ancient philosophers said about fortune. Secondly, where he says, 'Thus to say...' (197 a 18 #219), he considers those things which the common man says about fortune. He has given above [L7 #199ff] three opinions concerning fortune and chance. And he disproved the second of these opinions as being altogether false, for this position held that fortune is the cause of the heavens and of all worldly things.

Thus, having rejected the second opinion, he here shows that the third opinion, which holds that fortune is hidden to man, is true. Secondly, where he says, '... and why...' (197 a 10 #218), he shows how the first opinion, which holds that nothing comes to be by fortune or chance, might be true.

Since it was said above [L8 #214] that *per accidens* causes are infinite, and since it was also said [L8 #214] that fortune is a *per accidens* cause, he concludes from this that the causes of that which is by fortune are infinite. And since the infinite, insofar as it is infinite, is unknown, it follows that fortune is hidden to man.

218. Next where he says,'... and why...'(197 a 10), he shows how the first opinion might be true. He says that in a way it is true to say that nothing comes

to be by fortune. For all of those things which others say about fortune are in a certain respect true, because they have some meaning [*ratio*]. Since fortune is a *per accidens* cause, it follows that what is by fortune is something *per accidens*. But what is *per accidens* is not simply. Hence it follows that fortune is not the cause of anything simply.

And he clarifies what he has said about each of these opinions through an example. He says that as the builder is the *per se* cause of a house and is the cause simply, whereas flute player is a *per accidens* cause of the house; in like manner the fact that someone should come to a place with no intention of taking money away is a *per accidens* cause of carrying it away. But this *per accidens* cause is infinite, because it is possible for a man to′go to that place because of an infinity of other reasons, e.g.,if he cametovisit someone,or to pursue an enemy, or to escape from a pursuer, or to see a show of some sort. Now all these things and anything similar are causes of the taking of money which happens by chance.

219. Next where he says, 'Thus to say ...′ (197 a 18), he explains the meaning [*ratio*] of those things which are commonly said about fortune.

First he explains why it is said that that which is by fortune is without reason [*ratio*]. Secondly, where he says, 'Chance, or fortune ...′ (197 a 25 #222), he explains why it is said that fortune is good or bad.

Concerning the first part he makes two points. First he proves his position. Secondly he raises a certain difficulty where he says, 'Yet in some cases...′ (197 a 21 #221).

220. He says, therefore, first that fortune is rightly said to be without reason [*ratio*]. For we can reason only about those things which happen always or in most instances. But fortune lies outside of both of these. And so since such causes, which occur in exceptional cases, are *per accidens* and infinite and without reason [*ratio*], it follows that causes by fortune are infinite and without reason [*ratio*]. For every *per se* cause produces its effect either always or in most cases.

221. Next where he says, 'Yet in some cases...′ (197 a 21), he raises a certain difficulty. He says that although it may be said that fortune is a*per accidens* cause, some will question this.

The problem is whether everything which happens to be a*per accidens* cause ought to be called a cause of that which comes to be by fortune. Thus it is clear that the *per se* cause of health can be either nature or the art of the doctor.

However, can all those things with which the coming to be of health happens to be connected, such as the wind, and the heat, and shaving of the head, be called causes *per accidens* ? The question, therefore, is whether each of these is a cause *per accidens*.

Now since we said above [L8 #214] that fortune is most properly called a *per accidens* cause on the part of the effect, since a thing is said to be a cause of that which happens to the effect, it is clear that a fortuitous cause produces something in the fortuitous effect although it does not intend that, but rather something else connected with the effect. According to this wind or heat can be called fortuitous causes of health insofar as they produce some change in the body, upon which change health follows. But removing the hair or some other such thing does not produce anything clearly related to health.

But among the *per accidens* causes, some are nearer [to the *per se* cause] and others are more remote. Those which are more remote seem less to be causes.

222. Next where he says, 'Chance or fortune ...' (197 a 25), he explains why fortune is said to be good or bad.

First he explains why fortune is said to be good or bad simply. He says that fortune is said to be good when something good happens and bad when something bad happens.

223. Secondly, where he says, 'The terms "good fortune"...' (197 a 26), he explains the meaning [*ratio*] of good fortune and misfortune.

He says that we refer to good fortune and misfortune when [the fortuitous event] has some great good or great evil. For an event is called good fortune when some great good follows; it is called misfortune when some great evil follows.

And since being deprived of a good is included in the notion [*ratio*] of evil, and being deprived of evil is included in the notion [*ratio*] of the good, then when one is a little removed from a great good, he is said to be unfortunate if he misses it. On the other hand, if one is close to a great evil and is freed from it, he is said to be fortunate. This is so because the intellect takes that which is only a little removed as if it were not removed at all, but already possessed.

224. Thirdly where he says, 'Further, it is with reason ...' (197 a 30), he explains why good fortune is uncertain. He says that this is so because good fortune is a kind of fortune. But fortune is uncertain because it pertains to things which are neither always nor frequent, as was said.' Hence it follows that good fortune is

uncertain.

225. Finally where he says, 'Both are then ...' (197 a 33), he concludes as a sort of r6sum6 that each, i.e., chance and fortune, is a cause *per accidens*, and that each pertains to things which do not happen simply, i.e., neither always nor frequently, and that each pertains to things which come to be for the sake of something, as is clear from what was said above [L7 #198ff].

LECTURE 10 (197 a 36-198 a 21)
THE DIFFERENCE BETWEEN CHANCE AND FORTUNE. THE CAUSES ARE NEITHER MORE NOR LESS THAN FOUR

226. Having treated fortune and chance with reference to those aspects in which they are alike, the Philosopher here explains the difference between them.

This section is divided into two parts. First he explains the difference between fortune and chance. Secondly, where he says, 'The difference between ...' (197 b 32 #235), he explains that in which this difference primarily consists.

The first part is divided into two parts. First he explains the difference between chance and fortune. Secondly, where he says, 'Hence it is clear ...' (197 b 18 #235), he summarizes what he has said about each of them.

227. Concerning the first part he makes two points. First he explains the difference between chance and fortune. He says that they differ by reason of the fact that chance pertains to more things than fortune, because everything which is by fortune is by chance, but not conversely.

228. Secondly, where he says, 'Chance and what results...' (197 b 1), he clarifies the difference mentioned above.

First he designates the things in which fortune is found. Secondly, where he says, 'The spontaneous ...' (197 b 14 #231), he shows thatchance is found in more things.

Concerning the first part he makes two points. First he designates the things in which fortune is found. Secondly, where he says, 'Thus an inanimate thing ...' (197 b 6 #230), he draws a conclusion about those things in which fortune is not found.

229. He says, therefore, first that fortune and that which is by fortune are found

in those things in which something is said to happen well. For fortune is found in those things in which there can be good fortune and misfortune.

Now a thing is said to happen well for him to whom action belongs. However, action belongs properly to him who has dominion over his action. For what does not have dominion over its action is that which is acted upon rather than that which acts. And thus action is not in the power of that which is acted upon, but rather in the power of that which acts.

Now since the active or practical life pertains to those who have dominion over their acts (for here is where operation according to virtue or vice is found), it is necessary that fortune pertains to the practicgd.

A sign of this is the fact that fortune seems to be the same as happiness, or very nearly so. Hence the happy are commonly called the fortunate. For according to those who think that happiness consists in external goods, happiness is the same as fortune; according to those, however, who say that external goods, in which fortune plays a great part, help as instruments in the attainment of happiness, good fortune is close to happiness because it helps one attain it.

Hence, since happiness is a certain operation (for it is good operation, i.e., that of perfected virtue, as is said in *Ethics*, I:7, it follows that fortune pertains to the actions in which one happens to act well or is impeded from acting well. And this means that things turn out either well or badly. Hence, since one has dominion over his actions insofar as he acts voluntarily, it follows that in those actions alone where one acts voluntarily should something happen by fortune, but not in others.

230. Next where he says, 'Thus an inanimate thing...'(197 b 6), he draws from the above a conclusion about the things in which fortune is not found.

He says that since fortune is found only in those who act voluntarily, it follows that neither an inanimate thing, nor a child, nor a beast act by fortune, since they do not act voluntarily as having free choice (which is here called 'that which is proposed'). Hence, neither good fortune nor misfortune can happen to them except metaphorically. Thus, someone said that the stones from which altars are built are fortunate because honour and reverence are shown them, but the stones next to the altar stones are walked upon. This is said because of a certain likeness to men among whom the honoured seemed to be fortunate, whereas those stones which are walked upon are called unfortunate.

But although it follows from the foregoing that such things do not act by fortune,

there is nothing to prevent them from being acted upon by fortune. For some voluntary agent may act upon them. Thus, we say that it is good fortune when a man finds a treasure, or it is a misfortune when he is struck by a falling stone.

231. Next where he says, 'The spontaneous ...' (197 b 14), he points out that chance is found also in other things.

Concerning this he makes three points. First, he shows that chance is found in other things. Secondly, where he says, 'Hence it is clear ...' (197 b 18 #233), he draws a certain conclusion from what was said above. Thirdly, where he says, 'This is indicated ...' (197 b 23 #234), he uses an example to clarify the point.

232. He says, therefore, first that chance is found not only in men, who act voluntarily, but also in other animals and even in inanimate things. He gives an example dealing with other animals. It is said that a horse comes by chance when his coming is conducive to his safety, although he did not come for the sake of safety. He gives another example taken from inanimate things. We say that a tripod falls by chance because, as it stands, it is suitable for sitting, although it did not fall for the sake of this, i.e., so that someone might sit on it.

233. Next where he says, 'Hence it is clear...' (197 b 18), he draws the following conclusion from the above. When things which come to be simply for the sake of something do not come to be for the sake of that which happens, but for the sake of something extrinsic, then we say that these things come to be by chance. But we say that among the things which come to be by chance, only those things which happen in those who have free choice come to be by fortune.

234. Next where he says, 'This is indicated.. .'(197 b 23), he clarifies what he has stated in this conclusion, i.e., that chance occurs in those things which happen for the sake of something.

A sign of this is the fact that the word 'vain' is used, which in the Greek is close to chance. For we use the term 'vain' when that which is for the sake of something does not come to be because of that something, i.e., when that for the sake of which something is done does not occur. Thus if one should walk in order to evacuate the bowels, and if this should not occur to the walker, then he is said to have walked in vain, and his walking would be vain. Thus that which is suitable for the coming to be of something is vain and frustrated when it does not accomplish that for whose coming to be it is suitable.

He explains why he says 'that for whose coming to be it is suitable'. If someone were to say that he bathed in vain because the sun was not eclipsed while he

bathed, he would speak ridiculously, because bathing oneself is not apt for producing an eclipse of the sun.

Hence chance, which in the Greek is called 'automatum', i.e., *per se* vain, occurs in those things which are for the sake of something. This is also true of that which is frustrated or vain. For the name *per se* vain signifies the very thing which is frustrated, just as *per se* man signifies man himself and *per se* good signifies good itself.

He gives an example of things which happen by chance. Thus fit is chance] when it is said that a stone, which strikes someone when falling, did not fall for the purpose of striking him. Therefore it fen because of that which is *per se* vain or *per se* frustrated, for the stone does not naturally fall for this purpose. However at times a stone does fall as thrown by someone for the purpose of hitting another.

However, although chance and the vain are alike insofar as each is among the things which are for the sake of something, nevertheless they also differ. For a thing is called vain because of the fact that that which was intended does not follow, whereas a thing is called chance because of the fact that something else which was not intended does follow.

Hence sometimes a thing is vain and chance at the same time, for example, when that which was intended does not occur but something else does occur. However, sometimes there is chance but not the vain, as when both that which was intended and something else occur. And there is the vain and no chance when neither that which was intended nor anything else occurs.

235. Next where he says, 'The difference ...' (197 b 32), he explains that in which chance most of all differs from fortune.

He says that they differ most of all in the things which happen by nature, because chance has a place here but fortune does not. For when in the operations of nature something happens outside of nature, for example, when a six fingered person is born, we do not say that this happens by fortune, but rather because of that which is *per se* vain, i.e., by chance.

And so we can take as another difference between chance and fortune the fact that the cause of those things which are by chance is intrinsic, just as the cause of those things which are by nature is intrinsic.

But the cause of those things which are by fortune is extrinsic, just as the cause

of those things which are from free choice is extrinsic.

And he finally concludes that he has now explained what the *per se* vain or chance is, what fortune is, and how they differ from each other.

236. Next where he says, 'Both belong ...' (198 a 2), he points out the genus of cause to which chance and fortune are reduced.

First he states his position. Secondly, where he says, 'Spontaneity and chance...'(198 a 5 #237), he disproves from this a certain opinion mentioned above [L7 #203].

He says, therefore, first that both chance and fortune are reduced to the genus of the moving cause. For chance and fortune are causes either of those things which proceed from nature or of those things which proceed from intelligence, as is clear from what has been said. Hence, since nature and intelligence are causes as things from which motion begins, so fortune and chance also are reduced to the same genus. But since chance and fortune are *per accidens* causes, their number is indeterminate, as was said above [L9 #217,220].

237. Next where he says, 'Spontaneity and chance...' (198 a 5), he refutes the opinion of those who maintain that fortune and chance are the causes of the heavens and of all worldly things.

He says that since chance and fortune are *per accidens* causes of those things of which intellect and nature are the*per se* causes, and since a *per accidens* cause is not prior to a *per se* cause, as nothing *per accidens* is prior to that which is*per se*, it follows that chance and fortune are causes which are posterior to intellect and nature. Hence if it should be held that chance is the cause of the heavens, as some maintained, as was said above [L7 #203] it would follow that intellect and nature are first of all causes of some other things and afterwards causes of the whole universe.

Moreover, the cause of the whole universe seems to be prior to the cause of some part of the universe, since any part of the universe is ordered to the perfection of the universe. But it seems to be inconsistent that some other cause is prior to that which is the cause of the heavens. Hence it is inconsistent that chance is the cause of the heavens.

238. Furthermore we must consider that if those things which happen fortuitously or by chance, i.e., outside the intention of inferior causes, are reduced to some superior cause which orders them, then in relation to this latter cause they

cannot be said to be fortuitous or by chance. Hence that superior cause cannot be called fortune.

239. Next where he says, 'It is clear then ...' (198 a 14), he shows that the causes are not more than those mentioned.

This is clarified as follows. The question 'why' asks for the cause. But only the above mentioned causes answer the question 'why'. Therefore, the causes are not more than those which were mentioned. He says that the answers to the question 'why' are the same in number as the above mentioned causes.

For sometimes the 'why' is reduced finally to what the thing is, i.e., to the definition, as is clear in all immobile things. The mathematicals are of this sort, in which the 'why' is reduced to the definition of the straight or of the commensurate, or of some other thing which is demonstrated in mathematics. Since a right angle is defined as that angle which is formed by the falling of one line upon another which makes of both parts two equal angles, then if it should be asked why an angle is a right angle, the reply would be because it is formed by a line making two equal angles from each part. And it is the same in the other instances.

Sometimes the 'why' is reduced to the first moving cause. Thus, why does someone fight? Because he has stolen. For this is what brought on the fight.

Sometimes it is reduced to the final cause, as if we should ask for the sake of what does someone fight, and the answer is that he might rule.

Sometimes it is reduced to the material cause, as when it is asked why this body is corruptible, and the answer is because it is composed of contraries.

Thus it is clear that these are the causes and they are just so many.

240. Furthermore there must be four causes.

A cause is that upon which the existence of another follows. Now the existence of that which has a cause can be considered in two ways. First it is considered absolutely, and thus the cause of the existing is the form by,which something is in act. Secondly it is considered insofar as a being comes to be in act from being in potency. And since everything which is in potency is reduced to act by that which is a being in act, it is necessary that there be two other causes, namely the matter and the agent which reduces the matter from potency to act. However, the action of the agent tends toward something determinate, and thus it

proceeds from some determinate principle. For every agent does that which is suitable to it. But that toward which the action of the agent tends is called the final cause. Therefore, there must be four causes.

But since the form is the cause of existing absolutely, the other three are causes of existence insofar as something receives existence. Hence in immobile things the other three causes are not considered, but only the formal cause is considered.

LECTURE 11 (198 a 22-b 9)
NATURAL PHILOSOPHY DEMONSTRATES FROM ALL OF THE FOUR GENERA OF CAUSES

241. Having treated the causes, the Philosopher here shows that the natural philosopher demonstrates from all the causes.

Concerning this he makes two points. First he states his intention. Secondly, where he says, 'The last three ...'(198 a 25 #241), he explains his position.

He says, therefore, first that inasmuch as there are four causes, as was said above [L10 #239ff], it pertains to natural science both to know all of them and to demonstrate naturally through all of them by reducing the question 'why' to each of the aforementioned causes, i.e., the form, the moving cause, the end and the matter.

Nextwhere he says,'The last three...'(198 a 25), he explains his position. Concerning this he makes two points.

First he sets forth certain things which are necessary to clarify his position. Secondly, where he says, 'The question ...' (198 a 32 #244), he proves his position.

Concerning the first point he sets forth two things which are necessary for the proof of what follows. The first of these deals with the relationship of the causes among themselves. The second deals with the consideration of natural philosophy, and is given where he says'... and so too in general ...' (198 a 27 #243).

242. He says, therefore, first that it often happens that three of the causes combine into one, such that the formal cause and the final cause are one in number.

This must be understood to apply to the final cause of generation, not, however, to the final cause of the thing generated. For the end of the generation of man is the human form, but this form is not the end of man. Rather through this form man acts for his end.

But the moving cause is the same as both of these according to species. And this is especially true in univocal agents in which the agent produces something like unto itself according to species, as man generates man. For in these cases the form of the generator, which is the principle of generation, is the same in species as the form of the generated, which is the end of the generation. However in non-univocal agents the species [*ratio*] is different. For in these cases the things which come to be cannot reach the point where they follow upon the form of the generator according to the same kind [*ratio*] of species. Rather they participate in some likeness to it, insofar as they are able, as is clear in those things which are generated by the sun. Therefore, the agent is not always the same in species with the form which is the end of generation, and furthermore, not every end is a form. And because of this it is significant that he said 'often'.

The matter, however, is neither the same in species nor the same in number as the other causes. For matter as such is being in potency, whereas the agent as such is being in act, and the form or the end is act or perfection.

243. Next where he says, and so too ...' (198 a 27), he makes his second point which deals with the things which natural philosophy should treat.

He says that it pertains to natural philosophy to consider any movers which move in such a way that they are moved. Things, however, which move, but are not themselves moved, do not belong within the consideration of natural philosophy which properly considers natural things which have in themselves a principle of motion. For movers which are not themselves moved do not have in themselves a principle of motion, since they are not moved but are immobile. Thus, they are not natural things, and as a result do not come under the consideration of natural philosophy.

Hence, it is clear that there are three branches of study, i.e., the study and intention of philosophy is threefold according to the three genera of things which are found.

For some things are immobile, and one philosophical study deals with them. Another philosophical study deals with things which are mobile but incorruptible, such as the celestial bodies. And there is a third philosophical study which deals with things which are mobile and corruptible, such as the inferior bodies.

The first of these studies pertains to metaphysics, while the other two pertain tp natural science which treats all mobile things, both corruptible and incorruptible.

Hence some have misunderstood this passage, desiring to reduce these three studies to the three parts of philosophy, namely, mathematics, metaphysics and physics. For astronomy, which seems to consider the incorruptible mobile things, belongs more to natural philosophy than to mathematics, as was said above [L3 #164-5]. For insofar as it applies mathematical principles to natural matter, it considers mobile things. Therefore, this division is taken according to the diversity of things existing outside the mind and not according to the division of the sciences.

244. Next where he says, 'The question "why" ...' (198 a 32), he sets forth his position.

Concerning this he makes two points. First he shows that it pertains to natural philosophy to consider all the causes and to demonstrate through them. These are the two points he has proposed above [#241]. Secondly, where he says, 'We must explain ...' (198 b 10; L12 #250), he proves certain things which are assumed in this argument.

Concerning the first part he makes two points. First he shows that natural philosophy considers all the causes. Secondly, where he says, 'We must explain ...' (198 b 4 #246) he shows that it demonstrates through all of them.

Concerning the first part he makes two points. First he shows that natural philosophy considers the matter and the form and the moving cause. Secondly, where he says, '... the essence of that ...'(198 b 3 #246), he shows that it considers the end.

Concerning the first part he makes two points. First he states his intention, and secondly, he proves it, where he says, 'For in respect of... (198 a 33 #245).

First he concludes from what was said above that the 'why'is assigned to natural things by reference to the matter, and to what the thing is, i.e., the form, and to the first mover.

245. Next where he says, 'For in respect of ...'(198 a 33), he proves his position as follows.

It has been said [#243] that natural philosophy considers those things which are

moved, both the generable and the corruptible. Therefore, whatever should be considered about generation should be considered by natural philosophy. But with reference to generation one ought to consider the form, the matter, and the moving cause.

Those who wish to consider the causes of generation consider them as follows. First we consider what it is that comes to be after something, as fire come to be after air, since fire is generated from air. And in this way the form, through which the generated is what it is, is considered.

Next we consider what it is that first makes [this), that is, we consider that which first moves to generation. And this is the moving cause.

Next we consider what it is that undergoes this change. And this is the subject and the matter.

With reference to generation we consider not only the first mover and the first subject, but also those things which are consequent upon them. And thus it is clear that it pertains to natural philosophy to consider the form, the mover, and the matter.

However, natural philosophy does not consider every mover. For there are two kinds of moving principles, namely, the moved and the non-moved. Now a mover that is not moved is not natural, because it does not have in itself a principle of motion. And such is the moving principle which is altogether immobile and the first of all movers, as will be shown in Book VIII [L9 & 13].

246. Next where be says, the essence of that which ...′ (198 b 3), he shows that natural philosophy also considers the end.

He says that the form and what the thing is also fall under the consideration of natural philosophy, insofar as the end is that for the sake of which the generation occurs. For it was said above [#242] that the form and the end coincide in the same thing. And since nature acts for the sake of something, as will be proven below [L12 #250], it must belong to natural philosophy to consider the form not only insofar as it is form but also insofar as it is the end. If, however, nature were not to act for the sake of something, then natural philosophy would consider form insofar as it is form, but not insofar as it is an end.

247. Next where he says, 'We must explain ...′ (198 b 4), he shows how natural philosophy demonstrates through all the causes.

First he shows how it demonstrates through matter and the moving cause, which are the prior causes in generation. Secondly, where he says, '... that this must be so ...' (198 b 7 #248), he shows how it demonstrates through the form. Thirdly, where he says, '... because it is better...' (198 b 8 #249), he shows how it demonstrates through the end.

He says, therefore, first that in natural things the 'why' must be elaborated fully, i. e., in every genus of cause. Thus if something has gone before, whether it be the matter or the mover, then something necessarily follows. For example, if something is generated from contraries, it is necessary that the latter be corrupted, and if the sun approaches the north pole, the days must become longer, and cold must diminish and heat increase for those who dwell in the northern part.

However, we must realize that it is not always necessary that something follows from a preceding matter or mover. Rather sometimes a thing follows simply or in every case, as in the things mentioned. But sometimes a thing follows in most instances, e.g., from human seed and a mover in generation, it follows in most instances that what is generated has two eyes, but at times this fails to happen. Similarly, because of the fact that matter is so disposed in the human body, it happens that a fever is frequently produced because of festering, but at times this is impeded.

248. Next where he says, that this must be so ...' (198 b 7), he shows how in natural things demonstration must be made through the formal cause.

In order to understand this, we must know that when something follows from the preceding causes in generation (i.e., from the matter and the mover) by necessity, then a demonstration can be established, as was said above [#247]. However, a demonstration cannot be established when something follows in most instances. But then a demonstration should be founded upon that which is posterior in generation in order that something might follow of necessity from another, just as the conclusion follows from the propositions of a demonstration. Thus let us proceed in demonstration as follows: if this should come to be, then this and that are required, for example, if man should be generated, it is necessary that human seed be an agent in the generation.

If, however, we proceed conversely by saying that 'human seed is an agent in generation', then the proposition 'therefore man will be generated', does not follow as a conclusion follows from propositions. But that which ought to come to be, i.e., that in which the generation is terminated, was (as was said above #242,246) 'what the thing was to be', i.e., the form.

Hence, it is clear that when we demonstrate according to this mode, i.e., 'that "this must be so if that is to be so"' (198 b 7), we demonstrate through the formal cause.

249. Next where he says, '...because it is better ...' (198 b 8), he shows how natural philosophy demonstrates through the final cause.

He says that natural philosophy sometimes also demonstrates that something is true because it is better that it be so. For example, we might demonstrate that the front teeth are sharp because as such they are better for cutting food, and nature does what is better. Nature does not, however, do what is better simply, but what is better with reference to what belongs to each substance; otherwise nature would give a rational soul, which is better than an irrational soul, to each animal.

LECTURE 12 (198 b 10-33)
THE ARGUMENT OF THOSE WHO DENY THAT NATURE ACTS FOR AN END

250. Having shown that natural philosophy demonstrates from all the causes, the Philosopher here clarifies certain things which he had assumed,s namely, that nature acts for an end and that in some things necessity is not from the causes which are prior in being (which are the matter and the moving cause), but from the posterior causes, which are the form and the end.

Concerning this he makes two points. First he states his intention, and secondly, where he says, 'A difficulty presents itself ...' (198 b 17 #251), he develops his position.

He says, therefore, first that it must be pointed. out that nature is among the number of causes which act for the sake of something. And this is important with reference to the problem of providence. For things which do not know the end do not tend toward the end unless they are directed by one who does know, as the arrow is directed by the archer. Hence if nature acts for an end, it is necessary that it be ordered by someone who is intelligent. This is the work of providence.

After this it must be pointed out how necessity is present in natural things. Is the necessity of natural things always from the matter, or is it sometimes from the matter and the mover, or sometimes from the form and the end.

It is necessary to make this inquiry for the following reason. All of the ancient natural philosophers, when giving the reason [*ratio*] for natural effects, reduced

such effects to this cause, i.e., that it is necessary for these things to happen because of matter. For example, since heat is by nature what it is and naturally produces a certain effect (and in like manner cold and other similar things), then those things which are caused by them must come to be or exist. And if some of the ancient natural philosophers touched upon some cause other than the necessity of matter, they have no reason for taking any glory from the fact. For after such causes were posited by them, e.g., intellect which Anaxagoras posited, and friendship and strife which Empedocles posited, they did not use them except in certain general instances, such as in the constitution of the world. But they omitted such causes when discussing particular effects.

251. Next where he says, 'A difficulty presents itself ...' (198 b 17), he develops his position.

First he asks whether nature acts for the sake of something, and secondly, where he says, 'As regards what is "of necessity" ...' (199 b 34; L15 #269ff), how necessity is found in natural things.

Concerning the first part he makes two points. First he gives the opinion and argument of those who hold that nature does not act for the sake of something. Secondly, he disproved this position, where he says, 'Yet it is impossible...' (198 b 34; L13 #255ff).

252. Concerning the first point it must be noted that those who held that nature does not act for the sake of something tried to confirm their position by denying that in which nature is most clearly seen to act for the sake, of something. That which most strongly demonstrates that nature acts for the sake of something is the fact that in the operation of nature a thing is always found to come to be as good and as suitable as it can be. Thus, the foot is made in a certain way by nature so that it may be suitable for walking. Hence if it falls short of this natural disposition, it is not fit for this use. And the same is true of other instances.

And since they tried especially to oppose this point, Aristotle says that it can be objected that there is nothing to prevent nature from not acting for the sake of something nor from doing what is always better. For at times we find that from some operation of nature some utility results which nevertheless is not the end of that natural operation, but merely happens to occur. Thus, we might say that Jupiter rains, i.e., God or universal nature, but not for the purpose that grain should grow. Rather rain results from the necessity of matter. For it must be that in the lower regions, because of the closeness of the heat of the sun, vapours are drawn out from the water. Having been carried above because of the heat, when they arrive at the point where heat is lacking because of the distance from the

place where the rays of the sun are reflected, it is necessary that the vaporized water which is going up freeze at that very point. When the freezing is completed, the vapours are changed into water. And when water has been generated, it must fall down because of its weight. And when this takes place, it happens that the grain grows. Now it does not rain so that grain might grow. For in the same way grain might be destroyed in some place because of rain, as when grain is gathered on a thrashing floor. Thus, rain does not fall in order to destroy grain, rather this happens by chance when rain falls.

And in the same way it seems to happen by chance that grain accidentally grows when rain falls.

Hence it seems that there is nothing to prevent this from being true also in regard to animals, which seem to be disposed for the sake of some end. For example, one might say that because of the necessity of matter some teeth, i.e., the front teeth, happen to be sharp and suitable for cutting food, and the molars happen to be broad and useful for grinding food. Nevertheless, nature did not make the teeth such and so for the sake of these utilities. Rather after teeth have been made by nature in such a way as they develop from the necessity of matter, it is accidental that they acquired such a form. And once this form exists, this utility follows. And the same thing can be said of all other parts which seem to have some determinate form for the sake of some end.

253. But one might say that such utilities follow always or in many cases, and what is always or in most cases suitable exists by nature. In order to forestall this objection they say that from the beginning of the formation of the world the four elements were joined in the constitution of natural things, and thus the many and varied dispositions of natural things were produced. And in all these things only that which happened to be suitable for some utility, as if it were made for that utility, was preserved. For such things had a disposition which made them suitable for being preserved, not because of some agent intending an end, but because of that which is *per se* vain, i.e., by chance. On the other hand, whatever did not have such a disposition was destroyed, and is destroyed daily. Thus Empedocles said that in the beginning things which were part ox and part man were generated.

254. Therefore, because of this argument, or because of some other similar argument, some will have a difficulty on this point.

But in regard to this argument it must be noted that they use an unsuitable example. For although rain does have a necessary cause in regard to matter, it is nevertheless ordered to some end, namely, the conservation of things generable

and corruptible. For in inferior things mutual generation and corruption are for this purpose: that perpetual existence be preserved in them. Hence the growth of grain is poorly taken as an example. For a universal cause is referred to a particular effect.

And it must also be noted that the growth and conservation of growing things on earth occur in most cases because of the rain, whereas their corruption occurs in few instances. Hence although rain is not for their destruction, it does not follow that it is not for their preservation and growth.

LECTURE 13 (198 b 34-199 a 33)
IT IS DEMONSTRATED THAT NATURE ACTS FOR AN END

255. Having stated the opinion and argument of those who say that nature does not act for an end, he here disproves this position.

He does this first through appropriate arguments, and secondly, where he says, 'Now mistakes come to pass...' (199 a 33; L14), through argumonts taken from those things from which the opponents tried to prove the contrary position.

256. Concerning the first point he sets forth five arguments. The first is as follows. Everything which happens naturally either happens in every instance or in most instances. But nothing which happens by fortune or by that which is *per se* vain, i.e., by chance, happens in every instance or in most instances. For we do not say that in the winter it rains frequently by fortune or by chance. But if it rains frequently during the dog days, we would say that this happens by chance. And in like manner, we do not say that it happens by chance that there is heat during the dog days, but only if this should happen during the winter.

From these two points he argues as follows. Everything which happens either happens by chance or for the sake of an end. Now those things which happen outside the intention of an end are said to happen by chance. But it is impossible for those things which happen in every instance or in most instances to happen by chance. Therefore, those things which happen in every instance or in most instances happen for the sake of an end.

Now whatever happens according to nature happens either in every instance or in most instances, as even they admitted. Therefore, whatever happens by nature happens for the sake of something.

257. He gives the second argument where he says, 'Further, where a

series...'(199 a 9). He says that there is an end for all things. That which is prior and all of its consequences are done for the sake of the end.

Having assumed this he argues as follows. As something is done naturally, so is it disposed to be done. For 'so disposed' [aptum natum] means 'naturally'. And this proposition is convertible, because as something is disposed to be done, so it is done. However, it is necessary to add this condition: unless it is impeded.

Therefore, let us agree that there is no impediment. Hence as something is done naturally, so is it disposed to be done. But things which happen naturally are done so that they lead to an end. Therefore, they are disposed to be done in such a way that they are for the sake of an end. And thus nature seeks an end, i. e., nature has a natural disposition for an end. Hence, it is clear that nature acts for the sake of an end.

He clarifies what he has said by an example.

One proceeds from the prior to the posterior in the same way in both art and nature. Thus if artificial things, e.g., houses, were made by nature, they would be made according to the order in which they now are made by art. Thus the foundation would be constructed first, and afterwards the walls would be erected, and finally the roof would be placed on top. For nature proceeds this way in the things which are rooted in the earth, i.e., in plants. Their roots, like a foundation, are fixed in the earth, the trunk, after the manner of a wall, is raised on high, and the branches are on top like a roof.

And in like manner if the things which are produced by nature were made by art, they would be made according to the way they are disposed to be produced by nature. This is clear in regard to health, which happens to be produced by art and by nature. For as nature heals by heating and cooling, so also does art.

Hence it is clear that in nature one thing is for the sake of another, i.e., the prior is for the sake of the posterior. And the same is true of art.

258. He gives the third argument where he says, '... and generally art ...' (199 a 16). He says that art makes certain things which nature cannot make' such as a house and things of this sort. However, in regard to those things which happen to be produced by art and by nature, art imitates nature, as is clear in regard to health, as was said above [#257]. Hence, if things which are made according to art are for the sake of an end, it is clear that things which are made according to nature also are made for an end, since in each case the prior and the posterior are similarly related.

However, it can be said that this is not a different argument from the one already given, but is complementary to it and a clarification of it.

259. He gives the fourth argument where he says, 'This is most obvious ...' (199 a 20). This argument is drawn from those things in nature which more obviously seem to act for the sake of something.

He says that it is most clear that nature acts for the sake of something when we consider animals which act neither through art, nor through inquiry, nor through deliberation. It is manifest in their operations that they act for the sake of something. Because of this some have wondered whether spiders and ants and animals of this sort act through intellect or through some other principle.

But because they always act in the same way, it is clear that they do not act by intellect, but by nature. For every swallow makes a nest in the same way, and every spider a web in the same way, which would not be the case if they acted by intellect and from art. For not every builder makes a house in the same way, because the artisan judges the form of the thing built and can vary it.

If we proceed beyond animals to plants, it is apparent among them that some things have been made and are useful for an end, as the leaves are useful as a covering for the fruit.

Hence, if these things are due to nature and not to art, i.e., that the swallow makes a nest, and the spider a web, and the plants produce leaves for the sake of the fruit, and the roots of plants are not above, but below, so that they might take nourishment from the earth, it is clear that a final cause is found in things which come to be and are by nature, i.e., by-nature acting for the sake of something.

260. He gives the fifth argument where he says, 'And since nature means ...' (199 a 30):

He says that nature is used in two ways, i.e., for the matter and for the form. The form is the end of generation, as was said above [L11 #242]. And the nature [*ratio*] of an end is that other things come to be for the sake of it. Hence it follows that to be and to come to be for the sake of something should be found in natural things.

LECTURE 14 (199 a 34-b 33)
HE DEMONSTRATES THAT NATURE ACTS FOR AN END FROM THE

EVIDENCE FROM WHICH SOME CONCLUDE TO THE OPPOSITE POSITION

261. After the Philosopher has shown by appropriate arguments that nature acts for the sake of something, he here intends to make this clear by destroying those things through which some embraced the contrary position.

This section is divided into three parts according to the three things by which some seem to be moved to deny that nature acts for an end. The second part begins where he says, 'But the person...' (199 b 14 #267). The third part begins where he says, 'It is absurd ...' (199 b 26 #268).

262. The first thing by which some seem to be moved to deny that nature acts for an end is the following. Sometimes we see things happen otherwise [than is customary], as happens in the case of monsters which are the errors of nature. Whence Empedocles held that at the beginning of the constitution of things certain things were produced which did not have this form and this order which is now commonly found in nature.

263. He brings forth four arguments to overcome this difficulty.

First he shows that although art acts for the sake of something, still in things which are made by art error occurs. For sometimes the grammarian does not write correctly, and the doctor prescribes a drink as a medicinal potion incorrectly.

Hence it is clear that error occurs also in things which are by nature, even though nature acts for the sake of something. Of the things which are made by art for the sake of something, some are made according to art and are made correctly. There are other things, however, in which the artisan fails, not acting according to his art, and in these cases error occurs, even though the art is acting for the sake of something. For if art does not act for a′determinate end, then there would be no error no matter how the art was performed. For the operation of the art would be equally related to all things. The very fact, then, that there happens to be error in art is a sign that art acts for the sake of something. The same thing also happens in natural things in which monsters are, as it were, the errors of nature acting for the sake of something insofar as the correct operation of nature is deficient. And this very fact that error occurs in natural things is a sign that nature acts for the sake of some thing.

The same thing is true of those substances which Empedocles said were produced at the beginning of the world, such as the 'ox-progeny′, i.e., half ox and half man. For if such things were not able to arrive at some end and final state of nature so that they would be preserved in existence, this was not because nature

did not intend this [a final state], but because they were not capable of being preserved. For they were not generated according to nature, but by the corruption of some natural principle, as it now also happens that some monstrous offspring are generated because of the corruption of seed.

264. He gives the second argument where he says, 'Further, seed must have ...' (199 b 8). The argument is as follows.

Wherever there are determinate principles and a determinate order of proceeding, there must be a determinate end for the sake of which other things come to be. But in the generation of animals there is a determinate order of proceeding. For it is necessary that seed come to be first, and there is no animal which exists immediately from the beginning. And the seed itself is not immediately hardened, but in the beginning it is soft and tends toward perfection in a certain order. Therefore, there is a determinate end in the generation of animals. Therefore, monsters and errors do not occur in animals because nature does not act for the sake of something.

265. He gives the third argument where he says, 'Again in plants...' (199 b 9). The argument is as follows.

Although nature acts for the sake of something in regard to plants as well as animals, this is less clear. Fewer things can be inferred from the operations of plants.

If, therefore, monsters and errors occur in animals because nature does not act for the sake of something, this should be even more true of plants. As the 'man headed ox-progeny' occurs in animals, does there also occur in plants an 'olive-headed vine progeny', i.e., half olive and half vine? It seems absurd to say that these things occur. Nevertheless this must be so if in regard to animals it is true that nature does not act for the sake of something. Therefore, in regard to animals it is not true that nature does not act for the sake of something.

266. Hegives the fourth argument where he says, 'Moreover, among the seeds ...' (199 b 13). The argument is as follows.

As animals are generated by nature, so also are the seeds of animals. If, therefore, what occurs in the generation of animals happens in any way whatsoever, and not by nature, as it were, acting for a determinate end, then the same would be true of seeds, i.e., that any sort of seed would be produced by any sort of thing. This is obviously false. Hence, the first [supposition) is also false.

267. Next where he says, 'But the person...' (199 b 14), he destroys the second point by which some were moved to hold that nature does not act for the sake of something.

This seemed true to some because things which happen naturally seem to proceed from the prior principles, which are the agent and the matter, and not from the intention for an end.

But Axistotle shows the contrary. He says that one who speaks in this manner, i. e., one who says that nature does not act for the sake of something, destroys nature and the things which are according to nature. For those things are said to be according to nature which are moved continuously by some intrinsic principle until they arrive at some end—not to some contingent end, and not from any principle to any end, but from a determinate principle to a determinate end. For progress is always made from the same principle to the same end, unless something impedes it. However, that for the sake of which something is done sometimes happens to occur by fortune, when [that which is done] is not done for the sake of this. For example, if some stranger should come and leave after he has bathed, we say this was by fortune. For he did not bathe himself as if he had come for this purpose, since he did not come for this. Hence his bathing is accidental (for fortune is a *per accidens* cause, as was said above; L8 #214). But if this should happen always or in most instances to him who comes, it would not be said to be by fortune. But in natural things events occur not *per accidens* but always, unless something should impede. Hence, it is clear that the determinate end which follows in nature does not follow by chance, but from the intention of nature. And from this it is clear that it is contrary to the meaning [*ratio*] of nature to say that nature does not act for the sake of something.

268. Next where he says, 'It is absurd...'(199 b 26), he destroys the third point by which some hold the opinion that nature does not act for the sake of something. For it seems to some that nature does not act for the sake of something because nature does not deliberate.

But the Philosopher says that it is absurd to hold this opinion. For it is obvious, that art acts for the sake of something, yet it is also obvious that art does not deliberate. Nor does the artisan deliberate insofar as he has the art, but insofar as he falls short of the certitude of the art. Hence the most certain arts do not deliberate, as the writer does not deliberate how he should form letters. Moreover, those artisans who do deliberate, after they have discovered the certain principles of the art, do not deliberate in the execution. Thus one who plays the harp would seem most inexperienced if he should deliberate in playing any chord. And from this it is clear that an agent does not deliberate, not

because he does not act for an end, but because he has the determinate means by which he acts. Hence since nature has the determinate means by which it acts, it does, not deliberate. For nature seems to differ from art only because nature is an intrinsic principle and art is an extrinsic principle. For if the art of ship building were intrinsic to wood, a ship would have been made by nature in the same way as it is made by art. And this is most obvious in the art which is in that which is moved, although *per accidens*, such as in the doctor who cures himself. For nature is very similar to this art.

Hence, it is clear that nature is nothing but a certain kind of art, i.e., the divine art, impressed upon things, by which these things are moved to a determinate end. It is as if the shipbuilder were able to give to timbers that by which they would move themselves to take the form of a ship.

Finally, he concludes by saying that it is clear that nature is a cause and that it acts for the sake of some thing.

LECTURE 15 (199 b 34-200 b 9)
HOW NECESSITY IS FOUND IN NATURAL THINGS

269. Having shown that nature acts for an end, the Philosopher here proceeds to inquire into the second question, i.e., how necessity is found in natural things.

Concerning this he makes three points. First he raises the question. Secondly, where he says, 'The current view...' (199 b 35 #271), he sets forth the opinion of others. Thirdly, where he says, 'Whereas, though the wall ...' (200 a 5 #272), he determines the truth.

270. He asks, therefore, whether in natural things there is a simple necessity, i. e., an absolute necessity, or a necessary by condition or by supposition.

In order to understand this, it must be noted that the necessity which depends upon prior causes is an absolute necessity, as is clear from the the neeessity which depends upon matter. That an animal is corruptible is absolutely necessary. For to be composed of contraries is a consequence of being an animal.

In like manner, that which has necessity from the formal cause is also absolutely necessary. For example, man is rational, or a triangle has three angles equal to two right angles, which is reduced to the definition of triangle.

Similarly, that which has necessity from the efficient cause is absolutely

necessary. Thus because of the motion of the sun it is necessary that day and night alternate.

But that which has necessity from that which is posterior in existence is necessary upon condition, or by supposition. For example, it might be said that it is necessary that this be if this should come to be. Necessity of this kind is from the end and from the form insofar as it is the end of generation.

Therefore to ask whether in natural things there is a simple necessity or a necessity by supposition is nothing else than to ask whether necessity is found in natural things from the end or from the matter.

271. Next where he says, 'The current view...' (199 b 35), he gives the opinion of others.

He says that some are of the opinion that the generation of natural things arises from an absolute necessity of matter. For example, one might say that a wall or a house is such as it is by the necessity of matter because heavy things are disposed to move downward and light things to rise above. And because of this the heavy and hard stones remain in the foundation, while earth being lighter rises above the stones, as is clear in walls constructed of tiles which are made of earth. But the timbers which are the lightest are placed at the highest point, i.e., at the roof. Thus they thought that the dispositions of natural things have come to be such as they are from the necessity of matter. For example, it might be said that a man has feet below and hands above because of the heaviness or lightness of humours.

272. Next where he says, 'Whereas, though the wall ...' (200 a 5), he determines the truth.

Concerning this he makes two points. First he shows what sort of necessity there is in natural things. Secondly, where he says, 'Necessity in mathematics ...' (200 a 15 #273), he compares the necessity of natural things to the necessity which is in the demonstrative sciences.

He says, therefore, first that granting that it seems absurd to say that there is such a disposition in natural things because of the matter, it also appears absurd to say that this is true of artificial things, an example of which has already been given [#271]. However, such a disposition is not produced in natural things and in artificial things unless the material principles have an aptitude for such a disposition. For a house would not stand well unless the heavier materials were placed in the foundation and the lighter materials above.

However, it must not be said because of this that the house is so disposed that one part of it is below and another above. [I say] 'because of this', i.e., because of the heaviness or lightness of certain parts, (except insofar as the term 'because of 'refers to the material cause, which is for the sake of the form). Rather the parts of a house are so disposed for the sake of an end, which is to shelter and protect men from the heat and the rain.

And just as it is with a house, so it is with all other things in which something happens to act for the sake of something. For in all things of this sort the dispositions of what is generated or made do not follow without material principles, which have a necessary matter by which they are apt to be so disposed.

However, the things made or generated are not so disposed because the material principles are such, unless the term 'because of 'refers to the material cause. Rather they are so disposed because of the end. And the material principles seek to be apt for this disposition which the end requires, as is clear in a saw. For a saw has a certain disposition or form. And for this reason it must have such a matter. And it has a certain disposition or form because of some end. However, this end, which is cutting, could not be achieved unless the saw were of iron. Therefore, it is necessary that a saw be iron, if there must be a saw and if it must be for this end, which is its operation.

Thus it is clear that there is a necessity by supposition in natural things, just as there is such a necessity in artificial things, but not such that that which is necessary is the end. For that which is necessary is posited on the part of the matter, whereas on the part of the end the reason [*ratio*] for the necessity is posited. For we do not say that there must be such an end because the matter is such. Rather we say conversely that since the end and the future form are such, the matter must be such. And so the necessity is placed in the matter, but the reason [*ratio*] for the necessity is placed in the end.

273. Next where he says, 'Necessity in mathematics ...' (200 a 15), he compares the necessity which is in the generation of natural things to the necessity which is in the demonstrative sciences.

He does this first with reference to the order of necessity, and secondly with reference to that which is the principle of the necessity, where he says, '... and the end ...' (200 a 34 #274).

He says, therefore, first that in a certain respect necessity is found in the demonstrative sciences in the same way that it is found in things which are

generated according to nature.

For an 'a priori' necessity is found in the demonstrative sciences, as when we say that since the definition of a right angle is such, it is necessary that a triangle be such and so, i.e., that it have three angles equal to two right angles. Therefore, from that which is first assumed as a principle the conclusion arises by necessity.

But the converse does not follow, i.e., if the conclusion is, then the principle is. For sometimes a true conclusion can be drawn from false propositions. But it does follow that if the conclusion is not true, then, neither is the given premise true. For a false conclusion is drawn only from a false premise.

But in things which are made for the sake of something, either according to art or according to nature, this converse does obtain. For if the end either will be or is, then it is necessary that what is prior to the end either will have been or is. If, however, that which is prior to the end is not, then the end will not be, just as in demonstrative sciences, if the conclusion is not true, the premise will not be true.

It is clear, therefore, that in things which come to be for the sake of an end the end holds the same order which the premise holds in demonstrative sciences. This is so because the end also is a principle, not indeed of action, but of reasoning. For from the end we begin to reason about those things which are the means to the end. In demonstrative sciences, however, a principle of action is not considered, but only a principle of reasoning, because there are no actions in demonstrative sciences, but only reasonings. Hence in things which are done for the sake of an end, the end properly holds the place which the premise holds in demonstrative sciences. Hence, there is a similarity on both sides, even though they seem to be related conversely because of the fact that the end is last in action, which does not pertain to demonstration.

Therefore, he concludes that if a house which is the end of a generation, is to come to be, it is necessary that the matter which is for the sake of this end come to be and pre-exist. Thus, tiles and stones must exist first if a house is to come to be. This does not mean that the end is for the sake of the matter, but rather that the end will not be if the matter does not exist. Thus, there will be no house if there are no stones, and there will be no saw if there were no iron. For just as in demonstrative sciences the premises are not true if the conclusion, which is similar to things which are for an end, is not true, so also is the beginning related to the end, as was said.

Thus it is clear that in natural things that is said to be necessary which is material or is a material motion. And the reason [*ratio*] for this necessity is taken from the

end, for it is necessary for the sake of the end that the matter be such.

And one ought to determine both causes of a natural thing, i.e., both the material and the final cause, but especially the final cause, because the end is the cause of the matter, but not conversely. For the end is not such as it is because the matter is such, but rather the matter is such as it is because the end is such, as was said above [#272].

274. Next where he says, '... and the end ...' (200 a 34), he compares the necessity of natural generation to the necessity of the demonstrative sciences with respect to that which is the principle of the necessity.

It is clear that in demonstrative sciences the definition is the principle of the demonstration. And in like manner the end, which is the principle and reason [*ratio*] for necessity in things which come to be according to nature, is a sort of principle taken by reason and by definition. For the end of generation is the form of the species which the definition signifies.

This also is clear in artificial things. For as the demonstrator in demonstrating takes the definition as a principle, so also does the builder in building, and the physician in curing. Thus, because the definition of a house is such, this [what is in the definition] must come to be and exist in order that a house might come to be, and because this is the definition of health, this must come to be in order for someone to be cured. And if this and that are to be, then we must accomplish those things which must come to be.

However, in demonstrative sciences definition is threefold.

One of these is a principle of demonstration, for example, thunder is the extinguishing of fire in a cloud. The second is the conclusion of a demonstration, for example, thunder is a continuous sound in the clouds. The third is a combination of these two, for example, thunder is a continuous sound in the clouds caused by the extinguishing of fire in a cloud. This definition embraces within itself the whole demonstration without the order of demonstration. Hence it is said in *Posterior Analytics*, I:8, that definition is a demonstration differing by position.

Since, therefore, in things which come to be for the sake of an end the end is like a principle in demonstrative science, and since those things which are for the sake of the end are like the conclusion, there is also found in the definition of natural things that which is necessary because of the end. For if one wishes to define the operation of a saw (which is a division of a certain sort which will not

occur unless the saw has teeth, and these teeth are not suitable for cutting unless they are of iron), it′ will be necessary to place iron in the definition of saw. For nothing prevents us from placing certain parts of matter in the definition, not individual parts, such as this flesh and these bones, but common parts, such as flesh and bones. And this is necessary in the definition of all natural things [cf. L5 #179].

Therefore, the definition which comprises in itself the principle of the demonstration and the conclusion is the whole demonstration. Thus the definition which draws together the end, the form, and the matter comprises the whole process of natural generation.

BOOK III
MOBILE BEING IN GENERAL

Lecture I

Need for defining motion and things related to it.

275. Having settled the question of the principles of natural things (Book I), and that of the principles of this science (Book II), the Philosopher here begins to pursue his original plan, which is to arrive at conclusions concerning the subject of this science, mobile being taken absolutely.

The treatment, then, is divided into two parts:

In the first he concludes with respect to motion in itself (Books III-VI);
In the second he concludes with respect to motion in relation to movers [things moving others] and things movable [things which others move] (Book VII).

The first part is divided into two:

He concludes in regard to motion itself (Books III-IV);
He concludes in regard to its parts (Book V).

As to the first, he does two things:

He states what is under investigation;
He follows it out, at 279.

With reference to the first of these, he does two things:

He states that concerning which he intends to treat principally;
He sets down certain things which adjoin thereto, with which he will be subsequently concerned, at 277.

276. As to the first [189] he uses the following argument: Nature is the principle of motion and change, as is evident from the definition set down in Book II. (But how motion and change differ, will be shown in Book V.) And thus it is evident that if one does not know motion, one does not know nature, since the former [motion] is placed in the definition of the latter [nature]. Since, therefore, we intend to present the science of nature, we must make motion understood.

277. Then [196] he adds certain things which accompany motion. And he employs two sets of reasons [for including them], the first of which is as follows [the second at no. 2778, below]:

Whoever determines something, must determine those things which follow upon it —for the subject and its accidents [Properties] are considered in a single science.

But the infinite follows upon motion intrinsically, as the following makes plain:

Motion is of the number of continuous things, as will be evident below in Book VI (l.6). But "infinite" enters into the definition of "**continuum.**"

And he [Aristotle] adds "first of all," because the infinite which is found in the addition of number, is caused from the infinite which is in the division of the continuum. And that the infinite enters [first of all] into the definition of the continuum, he shows from the fact that those defining the continuum often use "infinite"—as, for example, when they say that the "continuum" is that which is"divisible to infinity."

And he [Aristotle] says "often," since there is also found another definition of the continuum, which is given in the *Predicaments* [or *Categories*]: the "continuum" is that "whose parts are joined at a common boundary."

Now these two definitions differ. For the continuum, since it is a certain whole, is properly defined through its parts. But parts are compared to the whole in a twofold way, namely, as its components, i.e., according to composition, insofar as the whole is composed out of the parts; and as its resolutes, i.e., according to resolution, insofar as the whole is divided into the parts.

The present definition, therefore, of the contintium , is given according to the mode of resolution [division into parts]; while that which is set down in the *Predicaments* is according to the mode of composition [composition out of parts].

Hence it is clear that the infinite follows upon motion intrinsically.

But there are some things which follow upon motion extrinsically, as certain external measures: such as place, and the void, and time.

For time is the measure of motion itself; while the measure of the mobile thing is indeed place according to truth, but the void according to the opinion of some. And therefore he adds that motion cannot be without place, the void, and time.

Nor does the fact that not all motion is local affect this; since nothing is moved which is not in place. For every sensible body is in place, and to it [sensible body] alone does it belong to be moved.

Likewise, local motion is the first of motions, which, when it is removed, the other motions are removed, as will be evident below in Book VIII (l.14).

It is thus clear that the four above-mentioned properties are consequent upon motion; whence they pertain to the consideration of the natural philosopher for the aforesaid reason.

278. This is also true for yet another reason which he [Aristotle] adds

subsequently: namely, because the aforesaid are common to all natural things.

Accordingly, since it is the task of natural science to reach conclusions concerning all natural things, one must therefore first determine concerning each of these [four]. For the speculation which is directed toward proper things, comes after that which is of common things, as was stated in the beginning [Book I, l.1, no. 6]. But among all these common things, one must first reach conclusions concerning motion itself, because the other things follow upon it as was stated [in the preceding no].

279. Then [191] he puts his plan into execution:

> He reaches conclusions concerning motion, and the infinite, which follows motion intrinsically;
> He does the same for the other three, which follow moti§n extrinsically, and this he does in Book IV.

The first treatment is divided into two parts:

> He concludes with respect to motion;
> He does the same for the infinite, at 326.

With respect to the first of these, he does two things:

> He prefaces his treatment with certain considerations requisite for investigating the definition of motion;
> He defines motion, at 283.

As to the first of these, he does two things:

> He sets down in advance certain divisions, since the most suitable path towards finding definitions is through division, as is clear from the Philosopher in *Posterior Analytics* II (l.14 ff.), and in *Metaphysics* VII (l.12);
> He shows that motion falls within the aforesaid divisions, at 281.

280. With respect to the first of these, he sets down three divisions:

The first of these is that being is divided by potency and act. Now this division does not distinguish beings into genera—for potency and act are found in every genus.

The second division is of being as divided according to the ten genera: the first of these is "this something," i.e., substance; others are: how much [i.e., quantity], or how [quality], or some other of the Predicaments.

The third division is of one genus of beings, namely, of the one which is "to something" [relation]. For motion seems in a certain way to pertain to this genus, insofar as the mover is referred to the movable thing.

In order to understand this third division, one must consider that, since relation has the weakest existence—consisting alone, as it does, in the fact of being something referred to something else—it is necessary that it be grounded on some other accident. For the more perfect accidents are closer to the substance, and it is through them as intermediates that the other accidents inhere in the substance.

Now relation is founded chiefly upon two accidents which have an order to something else, namely, upon quantity and action. [or quantity may be a measure even of something external to it; while the agent transfuses its action into something other than itself.

Accordingly, certain relations are founded upon quantity; and especially upon that species of quantity which is number, to which the basic notion of measure pertains, as—is evident in "double and half," "multiple and submultiple [fraction]" and other such. Similarly, "same," "like," and "equal" are founded upon unity, which is the principle of number.

Still other relations are founded upon action and passion: either according to existing act [in the present], as something is said to be "heating" in relation to that which is heated; or according to "having acted" [in the past], as a father is referred to a son because he because he engendered him; or else according to the possibility of acting [in the future], as master is related to a servant because he is able to make him do something.

Now the Philosopher clearly explains this division in *Metaphysics* V (l.17); but he here touches on it briefly, saying that one sort of "to something" [relation] is that according to "excess and defect," which sort, indeed, is founded on quantity, as in the case of "double and half"; while the other is according to "active and passive," and "mover and movable," which are referred to each other, as is self-evident.

281. Then [192] he shows how motion is reduced to the aforesaid [three] divisions.

And as to this he does two things:

He shows that motion is not outside the genera of things in which motion occurs;
He shows that motion is divided as the genera of things are divided, at 282.

As to the first of these, it should be observed that since motion, as will be evident below (lesson following, nos. 285, 287; l.3, no. 296), is an imperfect act, and since everything which is imperfect falls under the same genus with that which is perfect in respect to it—not, indeed, as a species, but by reduction (as prime matter is by reduction in the genus of "substance") necessarily motion is not outside the genera of things in which motion occurs. And this is what he

[Aristotle] states, namely, that motion is not "outside of things," i.e., outside the genera of things in which motion is found, in such a way as to be something extraneous to, or something common to, these genera.

And he makes this plain by the fact that whatever is changed, is changed either according to substance, or quantity, or quality, or place, as will be shown in Book V.

Now there is not to be found in these genera some common univocal element which would not be found under some predicament but would be their genus; but being is common to them according to analogy, as will be shown in *Metaphysics* IV (l.1). Whence it is also plain that neither motion nor change is outside the aforesaid genera, since nothing is outside the latter and they sufficiently divide being. But, as to the question of how motion is related to the predicament of action or passion, this will be explained below (l.5).

282. Then [193] he shows that motion is divided as the genera of things are divided,

For it is plain that in all the genera a thing may be present in two ways, either as something perfect, or as something imperfect. The reason for this is that privation and possession is the prime contrariety, which is found in all the contraries, as is stated in *Metaphysics* X (l.6). Whence, since all the genera are divided through contrary differences, it is necessary that in all there be the perfect and the imperfect: as in "substance" something is as form and something is as privation; and in "quality" there is something such as white, which is perfect, and something such as black, which is, as it were, imperfect; and in "quantity" one thing is perfect quantity, another imperfect; and in "place" something is above, which is, as it were, perfect, and something is below, which is, so to speak, imperfect; or else there is light and heavy, which are placed in "where" [place] by virtue of the inclination [to a certain place] which is in them. Hence it is plain that according to the divisions of being, there are corresponding divisions of motion.

For the species of motion differ according to the different genera of being—as "increase," which is motion in quantity, differs from "generation," which is motion in substance.

The species of motion likewise differ according to perfect and imperfect in the same genus: for "generation" is motion in substance toward form, while "corruption" is motion toward privation; and in quantity, "increase" is toward perfect quantity, "diminution" toward imperfect. But as to the question of why there are not assigned two kinds in quality and where [place], this will be explained in Book V (l.4).

Lecture 2

Definition of Motion

283. After first setting down certain things necessary for investigating the definition of motion, the Philosopher now defines motion:

In general;
More specifically, at 325.

With regard to the first, he does two things:

He shows what motion is;
He inquires whether motion belongs to the mover or to the mobile thing, at 299.

As to the first of these, he does three things:

He gives the definition of motion;
He explains the parts of the definition, at 287.
He shows that it is a good definition, at 291.

As to the first, he does two things:

He gives the definition of motion;
He gives examples, at 286.

284. As to the first, one must understand that some have defined motion by saying that motion is "a going-out from potency to act which is not sudden." But they are found to be in error, because they have placed in the definition certain elements that are posterior to motion: for a "going-out" is a species of motion; "sudden," likewise, involves time in its definition—the "sudden" is that which occurs in the indivisible of time [i.e., the instant]; time, however, is defined in terms of motion.

285. Consequently it is entirely impossible to define motion in terms of what is prior and better known otherwise than the Philosopher here does. For it has been pointed out already that every genus is divided by potency and act. Now potency and act, since they are among the first differences of being, are naturally prior to motion, and it is these that the Philosopher uses to define motion.

Consider, therefore, that something is in act only, something is in potency only, something else is midway between potency and act. What is in potency only is not yet being moved; what is already in perfect act is not being moved but has already been moved. Consequently, that is being moved which is midway between pure potency and act, which is partly in potency and partly in act—as is evident in alteration. [or when water is only potentially hot, it is not being moved; when it has now been heated, the motion of heating is finished; but when it

possesses " some heat, through imperfectly, then it is being moved—for whatever is being heated gradually acquires heat step by step. Therefore this imperfect act of heat existing in a heatable object is motion—not, indeed, by reason of what the heatable object has already become, but inasmuch as, being already in act, it has an order to a further act. For should this order to a further act be taken away, the act already present, however, imperfect, would be the term of motion and not motion itself—as happens when something becomes half-heated. This order to a further act belongs to the thing that is in potency to it.

Similarly, if the imperfect act were considered solely as ordered to a further act, under its aspect of potency, it would not have the nature of motion but of a principle of motion—for heating can begin from either a cold or a lukewarm object.

The imperfect act, therefore, has the character of motion both insofar as is compared, as potency, to a further act, and insofar as it is compared, as act, to something more imperfect.

Hence, motion is neither the potency of a thing existing in potency, nor the act of a thing in act, but it is the act of a thing in potency; where the word "act" designates its relation to a prior potency, and the words "of a thing in potency" designates its relation to a further act.

Whence the Philosopher most aptly defines motion as the *entelechy*, i.e., the act, of a thing existing in potency insofar as it is in potency.

286. Then [195] he gives examples from all the species of motion—as, for example, alteration is the act of the alterable insofar as it is alterable.

And because motion in quantity and in substance does not have a single name in the same way as motion in quality is called "alteration," he gives two different names for the motions in quantity, and says that the act of the increasable, and of its opposite, i.e., the decreasable, for which two there is no common name, is "increase" and "decrease." Similarly, the acts of the generable and of the corruptible are "generation" and "corruption"; and the act of what is mutable in regard to place is called "change of place."

In this section the Philosopher uses the word "motion" for any kind of change and avoids the strict usage in which "motion" is distinct from "generation" and "corruption," as will be said in Book V.

287. Then [196] he explains the several words of the definition:

He explains the use of the word "act";
He explains "of a thing existing in potency," at 288.
He explains "insofar as it is such," at 289.

As to the first he uses this reasoning. That by which something previously

existing in potency becomes actual is an act. But something becomes actual when it is being moved, although previously it was in potency. Therefore motion is an act.

He says therefore that it is plain that motion is an act from the fact that the "buildable" implies a potency to something, but when the "buildable" according to this potency which it implies, is being reduced to act, we then say it is "being built"—and this act is "building" taken passively. And the same thing is true in all other motions such as indoctrination, healing, rolling, jumping, youth (i.e., increase),old age (i.e., decrease).

For it must be remembered that before something is being moved it is in potency to two acts: to a perfect act which is the term of the motion, and to an imperfect act which is motion itself. Thus water, before it begins to be heated, is in potency to being heated and to having been heated: when it is being heated it is being reduced to the imperfect act which is motion but not yet to perfect act which is the term of the motion—rather, in respect to this it still remains in potency.

288. Then [1977 he shows that motion is the act "of a thing existing in potency."

For every act is strictly the act of that in which it is always found—as light is never found but in the transparent, for which reason it is the act of the transparent. But motion is found always in a thing existing in potency. Therefore, motion is the act of a thing existing in potency.

To explain the second proposition he says that, since certain same things are both in potency and in act, although not at the same time, nor in the same respect—as, for example, something is hot actually and cold potentially it follows that many things mutually act and are acted upon insofar, namely, as both are in potency and in act with respect to the other under different aspects. And because all lower natural bodies share the same matter, there is therefore in each of them a potency to what is actual in another. Hence, in all such bodies something simultaneously acts and is acted upon, both moves and is moved.

This fact had led some to say absolutely that every mover is likewise being moved. This point will be cleared up in a later place. For it will be shown in *Physics* VIII (l.9 ff.) and in *Metaphysics* XII (l.7) that there exists an immobile mover, since it is not in potency but in act only.

But when that which is in potency, yet existing in a certain way in act, either acts itself or is acted upon by another so far as it is movable, i.e., is reduced to the act of motion, whether moved by itself or by another, at such time motion is its act. That is why things in potency, whether they act or are acted upon, are moved, since when acting they are acted upon and when moving they are being moved—just as fire, when it acts on logs, it acted upon, insofar as it becomes more dense through smoke, flame being nothing more than smoke afire.

289. Then [198] he explains this part of the definition, "insofar as it is such":

By an example;
By giving a reason, at 290.

He says therefore first that the phrase, "insofar as it is such," had to be added, because what is in potency is at the same time something in act. And although the subject which is both in potency and in act may be the same, nevertheless to be in potency and to be in act is not contained under the same notion. Thus, although brass is a statue in potency but is brass actually, nevertheless the notion of the brass as brass is not the same as the notion of the brass as it is in potency to a statue. Now motion is not an act of the brass insofar as it is brass but insofar as it is in potency to a statue; otherwise. during the whole time that it was brass it would be undergoing motion, which is clearly false. That is why it is necessary to add "insofar as it is such.

290. Then [199] he explains the same thing by using an argument based on the nature of contraries. For it is clear that a given subject is in potency to contraries —as a humor or the blood is in potency to health and to sickness. But to be in potency to health is one thing and to be in potency to sickness is another, if one considers their objects. Otherwise, if to be able to be sick and to be able to be well were the same thing, it then would follow that being sick and being well would be the same. Hence to be able to be sick and to be able to be healthy are different notions, although their actual subject is one and the same thing.

It is plain, therefore, that there is not one and the same notion of the subject as it is a certain being, and as it is in potency to something else. Otherwise, potency to contrary things would fall under one and the same notion. In like manner, the notion of that which is "color" and that which is "visible" are not one and the same.

Thus it was necessary to say that motion is the act of the possible "insofar as it is possible"—to prevent supposing that it is the act of what is in potency insofar as it is merely some subject.

Lecture 3

Justification of the definition of motion

291. Having given the definition of motion and an explanation of each of the words in the definition, the Philosopher now shows it to be a good definition:

Directly;
Indirectly, at 293.

292. In regard to the first [200] he uses the following argument: Everything

which is in potency may at some time be in act; butt he "buildable" is in potency. Therefore, there may . at some time be an act of the "buildable" insofar as it is buildable.

But this act is either the house itself or the building of it. But "house" is not the act of the "buildable" insofar as it is "buildable." Since the "buildable" as such is being reduced into act when the building is taking place, but when the house now exists, it is no longer being built. Hence, building is an act of the buildable as such. Building, however, is a certain motion. Motion, therefore, is the act of a thing existing in potency as such. The same is true of other motions.

It is clear, therefore, that motion is the type of act above-described, and that something is being moved only when it is in such an act, and neither before nor after—not before, since if it is only in potency the motion has not begun; nor after, since it has now completely ceased to be in potency, by virtue of being in perfect act.

293. Then [201] he shows indirectly that it is a good definition by showing that motion cannot be defined in any other way. In regard to this he does three things:

He proposes what he intends;
He presents definitions given by others and rejects them, at 294.
He explains why others defined motion as they did, at 295.

He says therefore that two things show why the definition given of motion is a good one:

First, because the definitions that others have given are unsuitable;

Secondly, because it is impossible to define motion otherwise than as Aristotle has defined it, the reason being that motion cannot be placed in any other genus but that of "act of a thing existing in potency."

294. Then [202] he excludes the definitions of motion given by others. These followed a three-fold course in their definitions. For they said that motion is "otherness," because the thing being moved constantly changes from one state to another. Similarly, they said motion is "unequalness," because the thing being moved approaches its term always more and more. They also said that motion is "non-being," because the thing being moved does not yet have that to which it is being moved as long as it is being moved—as that which is being moved toward whiteness is not yet white.

These definitions the Philosopher destroys in three ways.

He does so first by looking at the subject of motion. For if motion were "otherness" or "unequalness" or"non-being," then whatever would possess any one of these three characteristics would of necessity be undergoing motion—in whatever this motion is, that thing is being moved. But things that are other are

not necessarily being moved by the fact that they are "other," nor by the fact that they are "unequal," nor by the fact that they "do not exist." It follows, therefore, that otherness and unequalness and non-being are not motion.

Secondly, he shows the same thing by looking at the term to which the motion is tending for motion and change do not tend more to "otherness" than to "likeness," or to "unequalness" more than to "equality," or to "non-being" more than to "being." For generation is a change to "being", and corruption to "non-being." Hence motion is not "otherness" any more than "a likeness," "unequalness" any more than "equalness," "non-being"any more than "being."

Thirdly, he shows the same thing by looking at the term from which the motion begins since just as some motions start from otherness and from unequalness and from non-being, so others start from their opposites. Hence there is no reason to place motion in the afore-mentioned genera any more than in their opposites.

295. Then [203] he points out why some defined motion in the aforesaid ways. In regard to this he does two things:

First he assigns the reason of what has already been stated.
Secondly, he explains a supposition he had made, at 296.

He says therefore that the reason why the older philosophers placed motion in the above-mentioned genera (namely, "otherness," "unequalness" and "non-being") is that motion seems to be something indeterminate, i.e., something incomplete and imperfect as though possessing no determinate nature. And because it is indeterminate, its proper place seemed to be in the genus of privation. For when Pythagoras laid down two ordinations of reality, in each of which he placed ten principles, the principles in the second group were said by him to be indeterminate because they were privative. They were not, indeed, determined by a form in the genus of substance, nor by the form of quality, or by any special form in either of these genera or by the form of any of the other predicaments.

In one of these groups the Pythagoreans placed ten things: finite, unequal, one, right, male, rest, straight, light, good, equilateral triangle; in the other they placed: infinite, equal, many, left, female, motion, oblique, dark, evil and scalene triangle.

296. Then [204] he gives the reason why motion is placed among the indeterminates. And he says that the reason for this is that motion cannot be placed either in potency or in act. For if it were placed under potency, whatever would be in potency, for example, to quantity, would be being moved according to quantity. If, on the other hand, it were included under act, then whatever things were actually quantified would be being moved according to quantity.

Now it is indeed true that motion is act, yet it is imperfect act, a medium between potency and act. And that it is imperfect act is clear from the fact that that of which it is an act is a being in potency as stated above (I.2, no.285). And that is why it is difficult to grasp what motion is. For at first sight It seems to be either entirely act or entirely potency or else to be contained under privation as it seemed to the ancients who called it "non-being" or "unequalness." But none of these is possible, as we have shown above (no.294). Hence it follows that there is just one way to define motion; namely, that it is the kind of act we have said, i. e., that of a thing existing in potency.

It is difficult to dwell on such an act on account of the commingling of act and potency; yet that there should be such an act is not impossible,.but contingent.

Lecture 4

Action and passion are the same motion

297. After defining motion, the Philosopher now shows whose act motion is, i.e., whether it is the act of the mobile or of the mover. Also it may be said that he gives another definition of notion which is related to the previous one as material to formal and as a conclusion to its principle. And this is the definition: motion is "the act of the mobile inasmuch as it is mobile." This definition is a conclusion from the previous one. For since motion is "the act of a thing existing in potency inasmuch as it is in potence," and since that which exists in potency as such is the mobile and not the mover (for the mover as such is in act), it follows that motion is an act of the mobile as such.

298. In regard to the main question he does three things:

First he shows that motion is an act of the mobile;
Secondly, he shows how motion is related to the mover, at 303;
Thirdly, he raises a difficulty, at 308.

About the first he does two things:

He posits a definition of motion, namely, that motion is an act of the mobile;
He clears up a doubt, at 303.

In regard to (1) he does three things:

He investigates the definition of motion:
He concludes to the definition, at 302;
He explains it, at 302 bis.

In investigating the definition he shows that "to be moved" even occurs to the mover. In regard to this he does two things:

He shows that every mover is being moved;
He shows why that happens, at 301.

299. He shows in two ways that the mover is moved. This is so first of all because anything that is previously in potency and then in act is somehow being moved. But movers are found that are previously movers in potency and afterwards movers in act; therefore they are moved. He states, therefore, that every mover, since it is such that it is in potency to being a mover, is likewise moved. This is clear from what has been already said, for it was said that motion is an act of a thing existing in potency and this occurs in every natural mover; that is why it was said above that every physical mover is moved.

300. Secondly [206] he brings out the same point in another way: Whatsoever's immobility is its rest is capable of motion; for rest and motion, since they are opposites, happen to the same. But the immobility of a mover, i.e., its ceasing from moving, is called rest; for there are things which said to rest when they cease to act. Therefore every such mover, i.e., one whose immobility is rest, is moved.

301. Then [207] he shows why it happens that a mover is moved. For it does not happen precisely because it is a mover but because it is such by touching; because to move is to act in order to cause something to be moved and what is so acted upon by the mover is moved. But whatever acts does so by touching, for bodies act by touching; hence it follows that what acts is at the same time acted upon, because that which touches is acted upon. However, this must be understood of those cases where there is mutual touching; namely, when the thing touching is also touched, as happens in things which are material, where both of the things are acted upon when they touch one another. But heavenly bodies, because they do not have material like the lower bodies, so act on them that they are not acted upon in return and they touch without being touched as is stated in *De Generatione* I (l.18).

302. Then [208] he posits a definition of motion concluding from the aforesaid that although the mover is moved, motion nevertheless is not an act of the mover but of the mobile inasmuch as it is mobile. He shows this subsequently by the fact that "to be moved" is accidental to the mover and does not belong essentially to it. Whence, if something is moved precisely inasmuch as its act is motion it follows that motion is an act not of the mover but of the mobile, not, indeed, insofar as it is a mover but insofar as it is a mobile.

That "to be moved" is accidental to the mover is clear from what was pointed out in the earlier part of this lecture; for the act of the mobile which is motion happens from its contact with the mover; from which it follows that at the same time that it is acting it is acted upon and thus "to be moved" is accidental to the mover.

That "to be moved" does not belong essentially to the mover is clear from the fact that some form is always seen to be the mover—as the form which is in the genus of substance is the mover in substantial change, and a form in the genus of quality is the mover in alteration, and a form in the genus of quantity in growth and decrease. Forms of this type are the causes and principles of motions, since every agent moves according to its form. For every agent acts inasmuch it is actual—as an actual man makes an actual man of man in potency. Hence, since it is through its form that a thing is actual it follows that form is the moving principle. Thus "to move" belongs to a thing inasmuch as it has a form through which it is actual. Wherefore, since motion. is the act of a thing existing in potency, as said above (I.2, no.285), it follows that motion belongs to a thing not insofar as it is a mover but insofar as it is mobile. For that reason the definition says that motion is an act of the mobile inasmuch as it is mobile.

303. Then [209] he shows a difficulty that arises from the aforesaid. For some wonder whether motion is in the mover or in the mobile. But this doubt is solved from what went before. For it is clear that an act of anything is in that thing of which it is the act. Thus, it is plain that the act of motion is in the mobile, since it is an act of the mobile, although caused in it by the mover.

304. Then [2167 he shows how motion and mover are related. And first of all he proposes his intention, saying that the act of the mover is not distinct from the act of the mobile. Hence since motion is an act of the mobile it is somehow also an act of the mover.

305. Secondly [211] he explains this. And in regard to this he does three things. First he shows that there is an act of the mover as well as of the mobile. For whatever is described according to potency and act has some act competent to it. Now just as that which is moved is called "mobile" in potency since it is capable of being moved, and is called "moved" according to act inasmuch it is actually being moved, so on the part of the mover, a mover is described "potential mover" inasmuch as it is able to move, and "moves" in the act inasmuch as it actually acts. Therefore some act is competent to both, i.e., to mover and to mobile.

306. Secondly [212] he shows that the act of the mover and of the mobile is the same act. For something is called "mover" inasmuch as it acts and "moved" inasmuch as it is being acted upon. But what the mover causes by acting and what the moved receives is being acted upon are one and the same. thing. And this is what he means when he says that the mover actualizes the mobile, i.e., causes the act of the mobile. Wherefore, they must both, namely, mover and moved, have the same act; for what is from the mover as agent cause is the same as what is in the moved as patient and receiver.

307. Thirdly [213] he illustrates this by an example. For the distance from one to

two is the same as that from two to one, but they differ according to conception; for in relating two to one we have "double," but in relating one to two we have "one-half." The same thing is true of the distance covered by one ascending and by one descending, but by reason of the diversity of starting point and term, one is called "ascent" and one "descent." A parallel case is true of the mover and of the thing moved. For motion, inasmuch as it proceeds from the mover into the mobile, is an act of the mover, but inasmuch as it is in the mobile from the mover, it is an act of the mobile.

Lecture 5

Motion as from the agent and in the patient

308. After showing that motion is the act both of the mobile and of the mover, the Philosopher now raises a difficulty on this point.

First, he raises the difficulty:
Secondly, he solves it, at 314.

Regarding the first, he does two things:

First, he prefaces certain things to the difficulty;
Secondly, he builds up the difficulty, at 310.

309. He says therefore [214] that what has been said above now causes a "rational", i.e., logical, "defect," i.e., doubt—by virtue of there being probable reasons for both sides. In introducing the difficulty he says that there is an act in that which is active and there is an act in that which is passive, just as above (no. 305) there was stated to be an act of the mover and of the moved. As a matter of fact, the act of the active is called "action" and the act of the passive is called "passion". This he proves by saying that the work and end of anything is its act and perfection; hence, since the work and end of the agent is action and that of the patient is passion (or undergoing), it follows that action is the act of the agent and passion that of the patient.

310. Then [215] he develops this doubt. For it is clear that both action and passion are motion; for each is the same as motion. Therefore, action and passion are either the same motion or diverse motions. If they are diverse, then each of them must be in some subject. Either both will be in the patient, i.e., the thing moved, or one of them (action) is in the agent and the other (passion) is in the patient. To say the opposite, i.e., that what is in the agent is passion and what is in the patient is action is to speak equivocally, or it would be calling passion action and vice vers.& The fourth possibility, namely, that both are in the agent is left out, but this is because it has already been shown (nos. 302-303) that motion is in the mobile, which excludes the fourth possibility that neither be

in the patient but both in the agent.

311. Of the two possibilities listed, he develops the second one first [216]. For if anyone says that action is in the agent and passion in the patient, then since action is a certain motion, as was stated (no. 310), it follows that motion is in the mover. For the same thing should be true both of the mover and of the moved, namely, that if motion is in either one it is being moved. Or else, that is true of the mover and of the moved which is true of the patient and of the agent. Now, if motion is in something, that thing is being moved; wherefore, it follows that either every mover is being moved or that something has motion but is not being moved; each of these seems unreasonable.

312. Then [217] he develops the second possibility given in 310. He says that if anyone should say that both of them, namely, action and passion, since they are two motions, are in the patient, which is equivalent to saying that teaching which is on the part of the teacher and learning which is on the part of the learner are both in the learner, then two conflicts arise. The first is that if what we said previously is true, namely, that action is an act of the agent, then if action is not in the agent but in the patient, it will follow that the proper act of each thing is not in the thing of which it is the act.

Then another conflict follows, namely, that one and the same thing is being moved according to two motions. For action and passion are now supposed to be two motions. Now in whatever thing there is a motion that thing is being moved according to that motion; if then action and passion are in the mobile, it follows that the mobile is being moved according to two motions. This would be tantamount to having two alterations in one subject both of them specifically the same; for example, one subject being moved to two whitenings, which is impossible. This does not mean that one subject could not be moved by two alterations tending toward two specifically different terms, for example, whitening and heating. Nevertheless, it is clear that action and passion terminate at the same specific term; for what the agent does and what the patient receives are one and the same.

313. Then [218] he develops the other possibility. For it could be said that action and passion are not two motions but one. But this leads to four difficulties. The first is that the act of things of different species would be the same. For it has been already pointed out (no. 309) that action is an act of the agent and passion ant act of the patient and that these are specifically diverse; but if action and passion are the same motion then the act of specifically different things will be the same. The second difficulty is that if action and passion are one motion, then action is the same as passion, so that teaching which is laid to the teacher is the same as learning which is in the learner. The third difficulty is that acting would be the same as being acted upon and teaching would be the same as learning. The fourth difficulty that follows from this is that every teacher would be learning

and every agent would be being acted upon.

314. Then [2197] he solves the difficulty. From what was settled previously, (nos. 304,306) it is clear that action and passion are not two motions but one and the same motion; for insofar as motion is from the agent it is called "action," and insofar as it is in the patient it is called "passion."

315. Hence not all the conflicts which follow from the first case, in which it was supposed that action and passion are two motions, have to be solved. But one remains to be solved even on the supposition that action and passion are one motion: because since action is an act of the agent, then if action and passion are one motion, it follows that the act of the agent is somehow in the patient and thus the act of one thing will be in something else. This remaining difficulty together with the four listed in 313 leave five to be solved.

316. He says in the first place that there is nothing wrong with an act of one thing being in something else, for teaching is an act of the teacher, an act continuously tending from him into someone else without interruption; hence, this act which is the agent's as being "from which" is the very one which is in the patient as received in him. But it would be wrong if the act of the one were the act of the other in precisely the same way.

317. Then [220] he solves another difficulty; namely, that there would be one and the same act for two diverse things. And he says that there is nothing to prevent one act belonging to two things so long as it is not one and the same in aspect but only in reality, as was already explained above (no. 307) when it was pointed out that the distance from one to two and from two to one are the same; and of that which is in potency looking toward the agent and conversely. For in these cases the same one reality is assigned to two things according to different aspects: it is assigned to the agent inasmuch as it is from it and to the patient inasmuch as it is in it.

318. The three remaining difficulties of which one followed logically from the other he takes care of in reverse order. He disposes first of the last difficulty deduced, because it is so evidently improper. Thus he is now, thirdly, settling the fifth difficulty. He says that it is not necessary to say that one who is teaching is learning or that an agent is being acted upon just because to act and to be acted upon are the same, as long as we understand that they are not the same in the way that dress and clothing are the same (for these are the same in motion) but in the way, as said above (nos. 307,318), that the road from Thebes to Athens and from Athens to Thebes are the same, i.e., as being the same as to subject but differing as to notion. For it is not necessary that things which are somehow the same should be the same in all ways; that is true only of things that are the same in subject or reality and also in motion. And therefore even granting that to act and to be acted upon are the same, yet since they are not the same in

notion, it will not follow that it is the same for an object to act and to be acted upon.

319. Then [221] he answers the fourth difficulty. And he says that even though teaching and the doctrine of the learner were the same, it does not follow that to teach and to learn are the same; because teaching and doctrine are abstract terms, whereas to teach and to learn are concrete. Hence they are being applied to ends or to terms which serve as the basis for the difference in notion between action and passion. For just as the distance between two points is one and the same space in the abstract, yet if we apply it to two concrete places it is not one and the same, as when we say that there is a distance between here and there and between there and here.

320. Then [222] he answers the third difficulty by destroying the inference that if action and passion are one motion, they are the same. And he says it necessary to say finally that it does not follow that action and passion are the same or that teaching and learning are, but rather that the motion in which both are is the same. This motion as a matter of fact is action from one viewpoint and passion from another. For it is one thing as to notion to be an act of a thing as being in it and another to be the act of a thing as being from it. Now motion is called "action" inasmuch as it is an act of the agent as from the agent; it is called "passion" inasmuch as it is an act of the patient as in the patient. Thus it is clear that although the motion of the mover and of the moved is the same thing due to the fact that motion as such abstracts from these aspects, yet action and passion differ due to the fact that these aspects are included in their signification. From this it is also apparent that since motion abstracts from the notion of action and passion, it belongs neither in the predicament "action" nor in the predicament "passion," as some supposed.

321. But two difficulties still remain with respect to this. The first is this: if action and passion are one motion, and they differ merely in thought, as said above (no. 317), it seems that they should not be listed as two distinct predicaments, since the predicaments are genera of things. Secondly, if motion is either action or passion, motion will not be found in substance, quality, quantity, and place, as said above (no. 286), but only in action and passion.

322. To settle this matter it must be remembered that being is divided into the ten predicaments not univocally, as a genus into its species, but according to the diverse manner of existing. Now the modes of existing are parallel to the modes of predicating. For in predicating something of something, we say that this is that; that is why the ten genera of being are called "predicaments."

Now every predication takes place in one of three ways. One way is to predicate of a subject that which pertains to its essence, as when I say "Socrates is man" or "Man is animal." According to this the predicament of "substance" is taken.

Another way is to predicate of a subject something that is not of its essence but yet inheres in the subject, This inherent thing may be traceable to the matter in the subject, in which case one has the predicament of "quantity" (for quantity is properly a result of matter; for which reason Plato traced the "large" to matter); or it is traceable to the form and in this case, there is the predicament of "quality" (for which reason qualities are founded on quality, as color in a surface, and figure in lines or in a plane); or the predication may be due to a relation existing between subject and something else and thus we have the predicament of "relation", (for when I say, "The man is a father," it is not something absolute that is predicated of the man but a relation in him to something without).

The third mode of predicating is when something outside the subject is predicated after the manner of denomination; this allows even extrinsic accidents to be predicated of substance; but yet we do not say that man is whiteness but that man is white. To be denominated by something extrinsic can occur, generally speaking, to all things in one way or another, and in a special way in those matters that refer only to man.

Speaking generally, a thing can be denominated by something extrinsic either according to the notion of cause or according to that of measure. For something is denominated "caused" or "measured" on account of its relationship to something extrinsic. Now there are four genera of causes, two of which are parts of the essence, namely, matter and form; hence any predication based on these two pertains to the predicament of "substance," as when I say that man is rational and man is corporeal. In regard to the other two causes, the final cause does not cause separately from the agent; for the end is a cause only insofar as it influences the agent. Therefore, the only cause according to which a thing can be denominated something as based on something extrinsic is the agent cause. Consequently, when something is denominated from the agent cause, it is the predicament of "passion," for to undergo (*pati*) is nothing but the undergoing of something from an agent; on the other hand, if the agent cause is denominated something on account of its effect, one has the predicament of "action," for action is an act from the agent into something else, as stated above (no, 316).

In regard to measures, it will be either intrinsic or extrinsic. An intrinsic measure would be a thing's own length and width and depth: in these cases a subject is being denominated something by reason of what inheres intrinsically; hence this Pertains to the predicament quantity. The extrinsic measures are time and place. It is the predicament "when", whenever something is denominated by time; when it is denominated by place, it is the predicament "where" or the predicament "situs", which adds to "where" the order of the parts in place. Such an order of parts is not considered in regard to the measure which is time, for the order of parts in time in time is already implied in the notion of time; for time is the number of motion according to the order of the "before" and the "after" [its parts]. Thus it is through denomination from time or place that something is said

to be "when" or "where".

There is a special predicament for men. For in other animals nature provided the requirements for preserving life, such as horns for defense, a tough and wooly hide as a covering, claws or the like for proceeding without harm. Hence, when by reason of this equipment animals are said to be "armed" or "covered" or "shod," they are somehow so called not by reason of something; extrinsic but of something intrinsic, which is part of them. Hence, such are referred to the predicament of "substance," as the same would be if man were said to be "endowed with hands" or "feet." But the other things could not be endowed upon man by nature, both because they would be out of keeping with the subtlety of his complexion and because reason makes man capable of an enormous number of works for the performance of which nature could not have endowed him with specific instruments. In the place of all these instruments man has reason, which he can use to make for himself the things that are intrinsic to other animals. So when a man is said to be armed or clothed or shod, he is denominated thus by reason of something extrinsic to him that is neither a cause nor a measure; hence it is located in a special predicament called "habitus." But we should not fail to note that this predicament is in certain matters used also for other animals not inasmuch as they are considered in their nature but insofar as they are put at the service of man: thus we that a horse is caparisoned or saddled or armed.

323. This makes it clear that although motion is one, yet there are two predicaments which are based on motion depending on the different external things according to which the predicamental denominations are made. For an agent is one thing from which as from something external the predicament of "passion" is taken; and the patient is some other thing from which something in denominated an agent. This solves the first difficulty (mentioned in 321).

324. The second doubt is easy to solve. For the idea of motion depends not only on that which pertains to motion in reality but also on that which reason apprehends. In reality, motion is nothing more than an imperfect act which is a sort of beginning of a perfect act in that which is being moved; thus, in that which is becoming white, some whiteness has begun to be. But in order that what is imperfect have the aspect of motion it is further required that we understand it as a medium between two: the preceding one of them is compared to motion as potency to act (whence motion is called act); the consequent one is compared to motion as the perfect to the imperfect or as act to potency, wherefore motion is called "the act of a being that exists in potency," as we said above (no. 285). But anything imperfect, if it is not considered to be tending on to something other as perfect, is called the terminus of motion and one will not have a motion according to which something is being moved; as, for example, if something should start to become white and then the alteration was immediately stopped.

Therefore, in regard to what there is of motion in external reality, motion is placed reductively in that genus which terminates the motion, as the imperfect is reduced to the perfect, as stated above (no. 281). But in regard to what reason apprehends about motion, namely, that it is midway between two-terms, here the notion of cause and effect are brought in; because for something to be reduced from potency to act an agent cause is required. From this aspect, motion pertains to the predicaments of "action" and "passion"; for these two predicaments are based on the notions of acting cause and of effect, as was said above (no. 322).

325. Then [223] he defines motion more particularly. He says that we have pointed out what motion is both in general and in particular—because from what was said about the definition of motion in general is clear how it can be defined in particular. For if motion is the act of the mobile as such, it follows that alteration is the act of the, alterable as alterable, and so on for other particular kinds of motion.

And because there was a doubt whether motion is an act of the mover or of the mobile and we showed(no. 320) that it is an act of the active as from it and of the passive as in it, then to remove any further doubts we can say somewhat more explicitly that motion is an act of the potency of that which is active and of that which is passive.

In this way we could have said that building is an act of the "builder" and. of the "buildable as buildable"; the same is true of healing and of other motions.

LECTURE 6

Early opinions on the infinite

326. After settling motion, the Philosopher now begins to settle the infinite.

First he shows that natural science should settle the infinite;
Secondly, he begins to determine the infinite, at 336.

As to the first he does two things:

First he shows that it pertains to natural science to settle the infinite.
Secondly, he gives the opinions of the earlier philosophers concerning the infinite, at 329.

327. He proves the first point with an argument and a sign.

The argument is as follows: Natural science studies magnitudes and time and motion. But in such things the finite and infinite are necessarily found for every magnitude or motion or time is contained under one or the other, i.e., either the finite or the infinite. Therefore, it pertains ta natural science to consider the

infinite, namely, as to whether it exists and as to what it is.

But because it could be objected that consideration of the infinite pertains to first philosophy, on account of its general character, he counters this by saying that not every being has to be either finite or infinite; for a point and a passion, i.e., passible [sensible] quality, are not contained under either, whereas the objects of consideration in first philosophy are things that follow upon being inasmuch as it is being and not upon some definite genus of being.

328. Then [225] he establishes the same point through a sign taken from tho. practice of the natural philosophers. For all who have treated this, namely, natural philosophy, according to reason, have mentioned the infinite. This fact is a probable argument, based on the authority of wise men, that it belongs to natural philosophy to settle the infinite.

329. Then [226] he gives the opinion of the earlier philosophers about the infinite.

First he shows in what they differ;
Secondly, he shows in what they all agreed, at 335.

As to the first he does two things:

First he gives the opinions on the infinite of those philosophers who were non-natural [i.e., disregarded sense], i.e., the Pythagoreans, and the Platonists;
Secondly, he gives the opinions of the natural philosophers, at 333.

As to the first he does two things:

First he dhows the points of agreement between the Pythagoreans and the Platonists;
Secondly, their points of disagreement, at 331.

330. He says therefore that while all the philosophers posited the infinite as a certain principle of things, only the Pythagoreans and Platonists asserted that the infinite is not something accidental to some nature but something existing of itself. This is not surprising, because it is in keeping with their claim that numbers and quantities are the substances of things. Now the infinite is found in quantity; hence they posited that the infinite exists of itself.

331. Then [227] he shows the difference between Plato and the Pythagorean, first, as to the laying down of the infinite; secondly, as to the basis thereof (no. 332).

Regarding the laying down of the infinite, Plato differed in two respects from the Pythagoreans. For the Pythagoreans did not lay down an infinite except in sensible things. Since the infinite belongs to quantity, and the first quantity is number, the Pythagoreans, not laying down number to be separated from

sensible things, but stating number to be, rather, the substance of sensible things, consequently did not lay down any infinite except in sensible things.

Likewise Pythagoras considered that the sensible beings which are within the confines of the heavens are circumscribed by the heavens—whence the infinite cannot be in them—hence he laid down that the infinite was in the sensible things outside the heavens,

But Plato by contrast laid down that nothing is outside the heavens. For neither did he say that there was outside the heavens any sensible body, since he maintained that the heavens contained all sensible things; nor did he say that the ideas and species of things, which he laid down as being separated, were outside the heavens, since "inside of" and "outside of" signify place, while the ideas, according to him, are not in any place, place being of corporeal things.

Plato likewise said that the infinite is not only in sensible things, but also in "them", i.e., the separated ideas, there being, even in the separated numbers something formal, such as unity, and something material, such as duality, out of which all numbers are composed.

332. Then [228] he shows the difference between them as to the basis of the infinite.

And he says that the Pythagoreans attributed the infinite to a basis which was "even number." And they demonstrated this in two ways. The first was an argument. That which is enclosed by another, and is terminated by another has the nature of the infinite; whereas that which encloses and terminated has the nature of a term. Now even number is comprehended and included under odd number. For if some even number is proposed, it is seen as in every way divisible. But when by the addition of unity it is reduced to an odd number, it now takes on a certain indivisibility, as though even was compressed under odd. Hence it seems as though "even" is infinite in itself, and causes infinity in others.

Secondly, the same is shown by an example. To follow it one must know that in geometry a "gnomon" is the name for a square on the diameter with two supplements [i.e., three squares put together to form the shape of an "L"]. If a square is added to this gnomon, a square is constituted. From this likeness those numbers may be called "gnomons" which are added to certain numbers.

Here one should notice that if one takes the odd numbers according to the order of natural progression, and to unity, which is a square as to power (since one times one is one), one adds the first odd number, namely, three, there will be constituted four, which is a squared number since twice two is four. If now to this second square there is added the second odd number, namely, five, one obtains nine, which is the square of three, since three times three is nine. Then if to this third square there is added the third odd number, namely, seven, one obtains

sixteen, which is the square of four. And thus, following the ordered addition of odd numbers, there always arises the same form in those numbers, namely, a square.

By the addition of even numbers, however, there is always produced a different shape. For if the first even number, namely, two, be added to unity, there arises three, which has a triangular figure; if then to this there be added the second even number, namely, four, one has seven, which is in the shape of a heptagon. And thus, in this wise the figure of the resulting numbers constantly varies with the addition of even numbers.

And this appears to be a sign that uniformity belongs to odd number, while difformity and variation and the infinite belong to even number.

Hence he says, namely, that a sign of this, i.e., that infinity follows even number, is what occurs in numbers. For by the addition of gnomons, i.e., numbers, to one, i.e., to unity, and outside, i.e., to other numbers, sometimes there occurs another species, i.e., another natural form, namely, when one adds an even number; sometimes there occurs a single species, namely, when one adds an odd number. [rom this it is evident why Pythagoras attributed infinity to even number.

But Plato attributed it to two roots, namely, to the "large" and the "small." Tor these two, according to him, belong to matter, to which in turn the infinite belongs.

333. Then [229] he gives the opinions of the natural philosophers about the infinite. He says that all the natural philosophers, those, namely, who gave natural [i.e., sensible principles for things, taught that the infinite does not subsist by itself, as said above (no. 330), but is an accident of some nature. Hence those who posited just one material principle (some member of the list of things called elements, i.e., air or water or something intermediate) said it was infinite. But of those who posited a finite number of principles, none supposed them to be infinite in quantity: for the very distinction of the elements seemed to conflict with the notion that they could be infinite. But those who posited. an infinitude of principles said that from all those infinites was formed one infinite through contact.

334. Those who taught this were Anaxagoraa and Democritus, who differed in two respects.

They differed first as to the nature of the infinite principles: for Anaxagoras taught that the infinite principles were infinite similar parts of flesh and of bone and so on; but Democritus taught that-they were indivisible bodies differing in figure. He said these bodies were the seeds of all of nature.

Another difference was as in the relation of these principles one to the other. For Anaxagoras said that each of these parts was a mixture of all the others, so that

in each part of flesh there was bone and vice versa and the same for the other parts. He came to this opinion because he saw that anything came from anything; and, hence, since he believed that whatever comes to be from something is in it, he concluded that everything is in everything. And from this he seems to assert that at some time all things were commingled and nothing was distinct from anything else. Just as this flesh and this bone are commingled (which is proved by the generation of one from the other) so is everything else commingled. Therefore at one time all things were together. For it is necessary to posit a principle of separation not only in one single thing but in all things simultaneously. He proved this thus: Whatever comes to be from something other was previously commingled with it and is produced by being separated from it; but all things are produced, though not all at the same time; therefore, there must be some one principle generating not only each thing but all things. This one principle he called "intellect," which alone has the capacity to separate and bring together because it is itself uncommingled.

Now whatever comes to be through intellect seems to have a principle; because intellect acts by starting from a definite principle. Therefore, if separation is brought about by intellect, separation must have a principle; hence, he concluded, at some time all things were together and the motion by which things were separated one from the other began in time, and did not previously exist. Thus Anaxagoras laid down one principle as producing another.

But Democritus said that one principle is not derived from another, but that the nature of body which is common to all indivisible bodies, though different in parts and figure, is the principle of all things according to magnitude, for he posited that all divisible magnitudes are composed of indivisibles.

And thus does Aristotle conclude that to consider the infinite pertains to the natural philosopher.

335. Then [230] he outlines four points of agreement among the early philosophers in regard to the infinite. The first of which is that all posited the infinite as a principle, and this "reasonably" i.e., for the following reason: If the infinite exists, it is impossible for It to be in vain, i.e., that it lack some definite standing among the beings of reality. But it can have no power other than that of a principle. For all things in the world are either principles, or derived from principles. But it is not fitting for the infinite to have a principle, because what has a principle has an end. Hence it follows that the infinite is a principle. Note, however, that in ths reasoning, "principle" and "end" are both used equivocally; for that which is derived from a principle has a principle of origin whereas it is to have a principle and end of its quantity or size which is incompatible with infinite.

The second point of agreement is that they denied coming into existence and ceasing to exist to the infinite. This follows from the fact that it is a principle. For

whatever is produced must have an ending just as it has a principle; and likewise any process of corruption has an end. But "end" and "infinite" are incompatible; hence the infinite can neither be generated nror corrupted. Hence it is clear that the infinite has no principle, but that the infinite is the principle of everything else.

This argument, too, uses "principle" and "end" equivocally, as above.

The third point of agreement is that they attributed to the infinite the prerogative of containing and governing all things, for this seems to belong to a first principle. And this was the opinion of those who did not grant in addition to matter, which they said was infinite, other causes, namely, agent causes, as Anaxagoras posited an intellect and Empedocles concord. For to contain and to govern pertain more to an active principle than to matter.

The fourth point of agreement was to attribute divinity to the infinite; for whatever is immortal or incorruptible they called divine. This was the doctrine of Anaximander and a number of the ancient natural philosophers.

LECTURE 7

Arguments for and against the infinite

336. Having listed the opinions of the earlier philosophers on the infinite, Aristotle now begins to inquire into the truth of the matter.

First he objects to both sides of the question;
Secondly, he solves the objections, in Lecture 10.

About the first he does two things:

First he gives reasons to show that the infinite exists;
Secondly, to show that it does not exist, at 342.

337. In regard to the first he gives five reasons to show that the infinite exists. The first of these is based on time, which according to the common opinion of the earlier philosophers was infinite [i.e., always was and always will be]. For Plato alone supposed that time was generated, as will be shown in Book VIII (l.2).

The first of these is taken from time, which, according to the common opinion of the ancients, was infinite. Indeed, Plato alone generated time, as will be said in Book VIII (l.2).

He says therefore first that tha infinite is shown to exist by five arguments. Abe first of these is taken from time, which is infinite according to those who held that time always was and always will be.

338. The second reason is taken from the infinite divisibility of magnitude. For

even mathematicians use the infinite in their demonstrations. This, however, would not happen, if there were no infinite at all; hence the infinite exists.

339. The third reason is based on the perpetual processes of generation and. corruption according to the opinion of many; for if the infinite were denied, generation and corruption could not endure indefinitely; hence, it would have to te admitted that generation would sometime cease, which is against the opinion of many. Therefore, it is necessary to posit the infinite.

340. The fourth reason is based on the apparent nature of the infinite, to many seems to consist in this that it is something always included by something else, because we observe that every finite reaches into something else. Let a body be pointed out; if it be infinite, then the infinite exists; if it be finite, it must be terminated at something else, and this latter, if it in turn be finite, at something else. We must either proceed thus to infinity or come to a body that is infinite. In either case, the infinite exists. Hence there can be no end to bodies, if every finite body is always included by some other.

341. The fifth reason is taken from the apprehension of the intellect or of the imagination. Hence, he says that that which chiefly constitutes the common difficulty which induces men to posit the infinite is that the intellect never is exhausted but can always add something to any given finite amount. Now the earlier philosophers supposed that things corresponded to the intellect's or senses' apprehension of them; hence because they said that whatever appeared to be is true, as stated in *Metaphysics* IV (l.11), they believed that even in reality there exists an infinite. Hence number seems to be infinite, because the intellect can always create a new number, simply by adding unity to a given number. For the same reason mathematical magnitudes, which exist in the imagination, seem to be infinite, because, given any definite magnitude, we can imagine a greater. And for the same reason there seems to be an infinite space beyond the heavens, because we can imagine certain dimensions existing beyond the heavens to infinity.

Now if there be infinite space beyond the heavens, it seems that there is an infinite body and even infinite worlds. This for two reasons. The first is that if the totality of space be considered infinite, that totality will be uniform; hence, there is no reason why that space should be devoid of body in one part rather than in another, Therefore, if there is found in one part of that space the bodily magnitude of this world, then there should be found in each part of that space some bodily magnitude comparable to that of this world. Thus body must be infinite in the same way as space or there must even exist infinite worlds, as Democritus supposed. Another reason proving the same point is that if there be infinite space, it is either empty or full. If it is full, we have our point that there is infinite body; but if it is empty, then since the empty is a place not filled with a body but capable of being so filled, it follows that if space is infinite, there is

infinite place capable of being filled with body. Thus there must be infinite body, because in perpetual matters, there is no difference between what can be and what is. Hence, if infinite place can be filled with body, it must be admitted that it is fillee with infinite body. Therefore, it seems necessary to say that there is infinite body.

342. Then [232] he takes the opposite position. And in regard to this he does three things:

First, he shows that the matter is debatable, lest anyone suppose that the afore -mentioned reasons are unassailable;

Secondly, he gives the various meanings of the word "infinite," at 344;

Thirdly, he gives reasons showing that the infinite.,does not exist, at 345.

343. He says therefore [232] that there is a question about whether the infinite exists or not. For, on the one hand, many impossibilities follow upon holding that it does not; those, for example, listed in 337 ff. On the other hand, there are also difficulties attendant upon holding that the infinite does exist, as will be clear subsequently (no. 345 ff). There is doubt also as to its manner of existence. Does it exist as a substance does, or as an accident belonging essentially to some nature? Of if neither as a substance nor as an essential accident, but as an accident nevertheless, is there some infinite continuum and are there things infinite in number? Now it very much pertains to the philosopher of nature to discuss whether there exists such a thing as an infinite sensible magnitude, for a sensible magnitude is a natural magnitude.

344. Then [233] he shows in how many ways "infinite" is said, and lists two divisions of the infinite. The first division is con on to the infinite and to all things said privatively.

For "invisible" is said in three ways: either as denoting 1) what of its very nature 13 not apt to be seen, for example, a sound which is not in the genus of visible things; or 2) what is difficult to see, as what is seen in the dark or from a distance; 3) what is apt to be seen but is not, as something in total darkness. Correspondingly, what of its very nature is not apt to be passed over is called "infinite" (for the infinite is the same as that which cannot be passed over)—and this is because it belongs to the genus of intraversable things, as are indivisibles, such as a point and a form; this is the way that a sound was called invisible. In a second way, infinity is ascribed to what could be passed over but its passage is impossible for us; thus, we say that the depth of the sea is infinite; or if it could be passed through, it would be with difficulty, as if we should say that a trip to India is infinite. Both of these belong to that which is "difficultly traversable." In a third way, infinity is ascribed to what is passable but there is no passage to its terminus; for example, a line without an end or any other such quantity without limits; this is the proper cense of the word "infinite."

He then gives the other division of infinite, [233 bis], saying that infinity is spoken either by addition, as in numbers, or according to division, ai in magnitudes, or both ways, as in time.

345. Then [234] he lays down the arguments leading to an exclusion of the infinite:

> First those excluding a separated infinite, such as laid down by the Platonists;
> Secondly, those excluding the infinite from sensible things, at no. 349.

With respect to the first he lays down three reasons. As to the first of these he says that it is impossible for the infinite to be separated from sensible things, in such a way that the infinite should be something existing of itself, as the Platonists laid down. For if the infinite is laid down as something separated, either it has a certain quantity (namely, continuous, which is size, or discrete, which is number), or not. If it is a substance without either the accident of size or that of number, then the infinite must be indivisible—since whatever is divisible is either number or size. But if something is indivisible, it will not be infinite except in the first way, namely, as something is called "infinite" which is not by nature susceptible to being passed through, in the same way that a sound is said to be "invisible" [as not being by nature susceptible to being seen], but this is not what is intended in the present inquiry concerning the infinite, nor by those who laid down the infinite. For they did not intend to lay down the infinite as something indivisible, but as something that could not be passed through, i.e., as being susceptible to such, but with the passage having no completion.

If, however, the infinite should not only be a substance, but also should have an accident which is size or number to which the infinite belongs, in such a way that the infinite would be inherent in the substance in the manner of that accident, then the principle of existing things will not be infinite as such the ancients laid down, just as we do not say that the principle of speech is invisible, although such a thing is an accident of sound, which is the principle of speech.

346. The second reason [235] is as follows. A passion is less separable and able to exist of itself than a subject. But the infinite is a passion of size and number—which cannot be separated and exist of themselves, as is proved in the *Metaphysics* [XI, l.10]. Therefore neither can this be so of the infinite.

347. The third argument [236] is as follows. He [Aristotle] states that it is clear that the infinite cannot be laid down as being in act, and as being a certain substance, and as being the principle of things. For the infinite is either divisible, or indivisible.

If indeed it is divisible, every one of its parts will have to be infinite, on the supposition that the infinite is a substance. For if it is a substance, and is not predicated of any subject as an accident, then that which is infinite and the

nature of the infinite, i.e., the essence and notion of the infinite, will have to be the same. For that which is white and the nature of white are not the same, but that which is man, and the nature of man, are. Whence it will be necessary that the infinite, if it be a substance, be either indivisible, or divided into parts which are infinite—which is impossible, since it is impossible to compose some same thing out of many infinities, as this would involve one infinite's being terminated by another infinite.

It likewise appears not only from argument but also from an analogy that if the infinite is a substance and is divided, it is necessary that each and every part of it be infinite.

For just as every part of air is air, so too every part of the infinite will be infinite, if the infinite is a substance and a principle. For if it is a principle, the infinite has to be a simple substance, not composed out of differing parts, as in the case of man whose every part is not man. Since, therefore, it is impossible for every part of some infinite to be infinite, the infinite must then be unable to be reduced to parts, and indivisible. But what is indivisible cannot be infinite in act—since whatever is infinite in act is quantitified, and everything quantified is divisible. It follows, therefore, that if there be any infinite in act, it is not after the manner of substance, but has the reason of the accident which is quantity. And if this be infinite, it will not be a principle, but that to which the infinite occurs, whether it be some sensible substance, such as air; or some intelligible substance, such as "even," as the Pythagoreans laid down.

Whence it is plain that the Pythagoreans did not speak sensibly, positing the infinite as a substance, and the same time holding it as divisible—since it follows that every part of it would be infinite, which is impossible, as said above.

348. Finally, he says that this question "whether there be an infinite in mathematical quantities and in intelligible things not having magnitude" is a more general one than the present question. For our question concerns sensible things about which natural science treats: "Whether among natural things there be a body infinite in size, such as the early philosophers posited.

LECTURE 8

No Sensible Infinite

349. After rejecting the opinion of the earlier philosophers who spoke non-naturally of the infinite, separating it from sensible things, the Philosopher now shows there is no infinite even in the sense in which the natural philosophers laid it down.

First he shows this by logical reasons;

Secondly by natural reasons in 353.

The first set of reasons are called "logical,"not because they proceed logically from logical terms, but because they proceed in a logical manner, i.e., from common and probable propositions, which is the characteristic of the dialectical syllogism.

350. He gives therefore [237] two logical reasons. In the first of theseit is shown that there is no infinite body. For the definition of body is that it is determined by a surface, just as the definition of a line is that its terms are points. But no body determined by a surface is infinite. Therefore, no body is infinite, whether it be sensible, i.e., a natural body, or intelligible, i.e., a mathematical body. (The word "rational" [or dialectical] should be here expounded as "logical" indeed, logic is called "rational philosophy.")

351. The second reason shows that there is no infinite multitude. For everything countable can be numbered and consequently passed through by counting. But every number and whatever has a number is countable. Therefore, every such thing can be passed over. If, therefore any number, whether separated or existing in sensible things, be infinite, it follows that the infinite can be passed through, which is impossible.

352. Notice that these reasons are probable and proceed from common premisses. For they do not conclude of necessity: in effect, whoever posits an infinite body would not concede that it would of its very nature be terminated by a surface, except perhaps potentially; although this is probable and well-known. Similarly, whoever would posit an infinite multitude would not admit it to be a number or that it has a number. For number adds to multitude the notion of measure, because a number is "multitude measured by unity," as is said in *Metaphysics* X. For this reason number is considered to be a species of discrete quantity, but multitude is not; it is, rather, a transcendental.

353. Then [238] he produces natural reasons to show that there is no infinite body in act.

In connection with these reasons ane must consider that since Aristotle had not yet proved that the heavenly body was of another essence from that of the four elements, and the connon opinion of his time was that it was of the same nature as the four elements, he therefore proceeds in these reasonings as though there were no other sensible body outside of the four elements. This is in keeping with his custom, since he always, before proving that which is his own belief, proceeds from what is supposed by the common opinion of others. Hence, after he proved in *De Caelo* I (l.4) that the heavens are of another nature from the elements, he repeats, for the sake of the certitude of the truth, the consideration of the infinite, showing unqualifiedly that no sensible body is infinite.

Here, however, he first shows that there is no sensible infinite body on the supposition that the elements are finite in number; secondly he shows the same thing in a universal way, at no. 358.

He says therefore first that when one proceeds "naturally," i.e., according to the principles of natural science, one is better able, and with more certitude, to consider that there is no sensible infinite body from what will be said. For every sensible body is either simple or composite.

354. First therefore he shows that there is no composite sensible body that is infinite, supposing that the elements are finite according to multitude. For it cannot be that one of the elements is infinite and the others finite—because the composition of any compound body requires that there be a number of elements and that the contraries therein be somehow in equilibrium. If this were not so, the composition could not endure—for the strongest would destroy all the others, since the elements are contrary. But if one of the elements were infinite, no equilibrium would ensue as long as the other elements were finite, because there is no proportion between infinite and finite. Therefore it cannot be that only one of the elements in the composite be infinite.

But someone could claim that the infinite element might have such weak energy in acting, that it would not destroy the finite elements which are stronger; for example, if the infinite one were air and the finite one fire. And therefore, to remove this objection he says that no matter how much less the energy of that one infinite body is than that of the finite body (for example, if fire be infinite and air finite) nevertheless an infinite accumulation of air would be equal in energy to the fire. For if the energy of the fire is one hundred times greater than an equal quantity of air, then if the air be multiplied a hundredfold, it will equal the fire in energy; and yet air multiplied a hundred times is multiplied according to a finite number and is exceeded by the power of the whole infinite amount of air. Hence, it is clear that even the energy of the fire will be overcome by the energy of infinite air: thus the infinite will excel and corrupt the finite, no matter how powerful its nature.

355. Similarly, it cannot be that any of the elements out of which a compound body is composed be infinite; because it is a property of a body that it have dimensions in every direction, and not in length only, as in a line, or in length and width only, as on a surface. But the nature of the infinite is to have infinite "distances" or dimensions. Therefore, the infinite body should have infinite dimensions in every direction. Thus, it cannot be that one body result from a number of infinite bodies, because each occupies the whole world, unless you posit that two bodies interpenetrate, which is impossible.

356. Therefore, having shown that a composite body cannot be infinite, he now proves that neither can a simple body, nor one of the elements, nor any medium

among the elements(taking vapor as a medium between air and water) be infinite. For some posited this last as a principle stating other things to be generated from it. And they said that this was something infinite, but not air or water or any of the other elements; because the other elements would be corrupted by whichever one was supposed as infinite. For the elements have contrariety one to the other since air is humid, water cold, fire hot and earth dry. Hence if one of them were infinite, it would destroy the others, since one contrary is disposed to be corrupted by another. And that is why they said that something other than the elements was infinite, from which, as from a principle, the elements arose.

Now he states this position to be impossible not only as to its maintaining such a mediate body to be infinite, since there will be applied a same common argument [in no. 35] to fire and air and water and likewise to the mediate body, but also as to its laying down some elemental principle in addition to the elements.

For there is found no sensible body outside of those things called the "elements," namely, air, water, and the like. But this would have to be the case if anything besides the elements should enter into the composition of such bodies. If, therefore, anything else should enter into the composition of those bodies in addition to the four elements, it would follow that we should find here some simple body besides the elements, by the resolution of the above bodies into their elements. It follows therefore that the aforesaid position is false as to its positing of some simple body besides the known elements.

357. He further shows by a general argument that none of the elements can be infinite. For if any of the elements were infinite, it would be impossible for the whole universe to be anything but that element. It would likewise be necessary that all the other elements be changed into it, or to have already been changed into it, due to the excess of power of the infinite over other things, as Heraclitus says that at some future time all things will be converted into fire because of the excelling power of fire. And the same reason holds good for one of the elements and for come other body that some natural philosophers create besides the elements. For it is necessary that this other body have contrariety toward the elements, since other things are laid down as being generated from it, and change does not take place except from ;)ne contrary to another, as in the case of going from hot to cold, as shown above (I, l.10). This middle body would therefore in this way destroy, by reason of its contrariety, the other elements.

LECTURE 9

No infinite body shown absolutely

358. After showing that there is no infinite sensible body on the assumption that

the elements are finite, the Philosopher here shows the same absolutely, without assumptions of any kind.

First he declares his intention;
Secondly he carries out his proposal, at 359.

He says therefore first [239] that in what follows it is necessary to consider every body universally, without any suppositions, and ask whether any natural body can be infinite. And from the follwwing reasons it will be clear that none can. Then, he proves his proposition with four reasons, beginning at 359. The second reason begins at 367; the third at 368; the fourth at 369.

In regard to the first reason he does three things:

First he lays down certain facts presupposed to his reasoning;
Secondly he gives the reasoning itself, at 360.
Thirdly, he excludes a false opinion, at 364.

359. Therefore [240] he lays down three presuppositions. The first of these is that every sensible body has a natural aptitude to be in some definite place. Secondly, that every natural body has, among available places, some place that befits it. Thirdly, that the natural place of the whole and of the part is the same, i. e., of all earth and each clod, of all fire and each spark. A sign of this is that in whatever part of the place of the whole there is placed a part of some body, it is at rest there.

360. Then [24171 he gives the [first] reason, which is this. If an infinite body be supposed, it must have parts either of the same species, as water or air, of parts of varying species, as a man or a plant has.

If all its parts are of the same species, it follows according to our pre-suppositions (no. 359) that it is either entirely immobile and is never moved, or is always being moved. But both of these are impossible: for in the second case, rest is excluded; and in the other, motion is excluded from natural things. Thus, in both cases there is denied the notion of nature, for nature is a principle of motion and of rest.

He proves that this body would be either entirely mobile or entirely at rest by the fact that no reason can be given for its being moved either up or down or in any direction whatsoever. He manifesto this by an example: for let us suppose that the entire infinite body which is similar throughout is earth. Then it will be impossible to say where any clod of earth should move or be at rest, because each part of infinite place would be occupied by some body related to it, i.e., of the same species. Can it be said that one clod of earth would be moved so as to occupy successively all the infinite places, as the sun is moved so as to be in each part of the zodiacal circle? And how could one clod of earth pass through all the parts of infinite place? Now nothing is moved toward the impossible: if therefore

it is impossible for a clod of earth to be moved so as to occupy all the infinite places, in which place will it rest and in which will it be in motion? it will either always be at rest and thus never in motion or it will always be in motion and thus never at rest.

361. If we suppose the other possibility, namely, that the infinite body has parts that are unlike in species, it will then follow that there would be unlike places for the unlike parts, for the natural place of water is one thing and that of earth is another, But on this supposition it follows at once that the body of this infinite whole would not be one body simply but one through contact; and thus there will not be one infinite body as our supposition granted.

362. Because someone might not consider this impossible [i.e., an infinite body of dissimilar parts], he adds another reason against this, saying that if the infinite whole is composed of unlike parts, these parts will be either of a finite number of species or of an infinite number. It will not be the first, because it then follows that if the whole is infinite, then some of the parts will be finite and some infinite; otherwise we would be able to get an infinite composed all of finites. On this assumption it follows that those which are infinite will corrupt the others, on account of contrariety, as was said in previous reasoning (nos. 354, 356). For this reason, no one of the early philosophers who posited one infinite principle, posited it to be fire or earth, which are extremes; rather they posited water or air or some medium between them, because the places of the former were evident, i. e., above and below, but it is not the same with the others, for earth is below in respect of them and fire above.

363. But if someone admits the other alternative, namely, that the parts of the body are infinite in species, it follows that their places also are infinite in species, and that the elements are infinite. But if it is impossible that the elements be infinite, as was already proved in Book I (l.11), and that places be infinite, since it is not possible to find infinite species of place, it is necessary to admit that the whole body is finite.

And because he had concluded to an infinity of places from the infinite of bodies, he adds that it is impossible not to equate body with place; for no place is greater than the body it contains, nor can a body be infinite if its place is not infinite, nor can in any way a body be greater than its place. This is so because if the place is greater than the body, there will be some empty place; if the body is greater than its place, then some part of the body is in no place.

364. Then [242] he excludes an error. First, he cites the error and says that Anaxagoras claimed that the infinite is at rest but gave an invalid reason for its rest. For he said that the infinite bears up, i.e., sustains itself since it exists in itself and not in something else, for nothing contains it. And thus it could not be moved outside itself.

365. Secondly [24R] he disproves this statement with two reasons. The first of which is that Anaxagoras so assigned his reason for the rest of the infinite as to suppose that wherever a thing is, that is its natural place, for the only reason he gave for saying that the infinite is at rest, is that it exists in itself. But it is not true that where a thing is, there it is always naturally disposed to be, because some things are somewhere by force and not by nature.

Now although it is true that an infinite whole is not moved, because it is sustained and remains in itself and for that reason is immobile, yet a reason should be given why it is not naturally disposed to be moved. one cannot evade this simply by saying that the infinite is not moved, since by the same reasoning there is nothing to prevent any other body from not being moved while it might be naturally disposed to be moved. Because oven if earth were infinite, just as now it will not be carried further when it is in the center, so even then no part in the center would move further: but this would not be because it had no other natural place except the center where it could be sustained but because it does not have a natural aptitude to be moved from the center. If, therefore, this is the case with earth, that the reason why it rests at the center is not that it is infinite but that it has gravity which accounts for its remaining in the center; similarly, in the case of any other infinite, the reason why it rests should be given, and this is not simply because it is infinite or that it supports itself.

366. He lays down another argument [244]. Thus he states that if the whole infinite is in repose because it remains within itself, it follows that any part thereof necessarily is necessarily at rest since it remains within itself. For the place of the whole and the part is the same, as was said (no. 359), e.g., that of fire and a spark upwards, that of earth and a clod of earth downward. If, therefore, the place of the whole infinite is itself, it follows that any part of the infinite will remain at rest within itself as in its proper place.

367. He gives a second reason against Anaxagoras [245] saying that it is clearly impossible to say that there is an actually infinite body and that there is some place for each body, if every sensible body is either heavy or light, as the ancients said who posited the infinite. Because if the body is heavy, it will be naturally carried to the center; if it is light, it will be carried upward. If, therefore, there be an infinite sensible body, there must be in it an "up" and a center. But it is impossible that the infinite body should sustain in itself either of these, i.e., either an "up" or a center, or even that it sustain both according to different centers. For how could the infinite be divided so that one part would be "up" and another "down" or how can there be in the infinite a boundary or a center? Therefore there is no infinite sensible body.

368. He gives the third reason [246] saying that every sensible body is in place. But the differences of place are six: above, and below, before and behind, to the right and to the left—and these are determined not only in relation to us but even

in the whole universe itself.

For such positions are determined in themselves in those things in which there are determinate principles and terms of motion. Whence in living things "up" and "down" are determined according to the movement of food; "front" and "rear" according to the movement of sense; "right" and "left" according to forward motion, which begins from the right. But in inanimate things, in which there are no determinate principles of such motions, "right" and "left" are said with respect to us—for a column is said to be "at the right" which is to the right of a man, and "at the left" which is at his left.

But in the whole universe "up" and "down" are determined according to the movement of heavy and light things; while according to the motion of the heavens the rising sun determines "right," the setting sun, "left"; "front" is determined by the upper hemisphere, "rear" by the lower hemisphere; "above" by the south, "below" by the north. Now such things cannot be determined in an infinite body. It is therefore impossible for the whole universe to be infinite.

369. Then [247] he gives the fourth reason, saying that if it is impossible that there be an infinite place because every body is in a place, it follows that there can be no infinite body. That an infinite place is impossible be proves thus: To be in place and to be in some place are convertible, just as to be man and to be some man or to be quantity and to be some quantity. Therefore, just as it is impossible that there be infinite quantity, because then it would follow that some quantity is infinite, e.g., two cubits or three cubits, which is impossible, so infinite place is impossible , because it would follow that some place is infinite (either up or down or some other place), which is impossible—since each of these implies a definite term as was said (in 368). Therefore no sensible body is infinite.

LECTURE 10

The infinite as existing in potency

370. After discussing the infinite dialectically, the Philosopher now begins to determine the truth.

First he determines whether there is an infinite;
Secondly, what it is, at 382.

The first is divided into two parts:

In the first, he shows how the infinite exists;
In the second, he compares various infinites one to the other, at 374.

About the first he does three things:

First, he shows that the infinite in a way exists and in a way it does not;

Secondly, he shows that it is in potence and is not as a being in act, at 372;
Thirdly, he manifests how it is in potency, at 373.

371. Accordingly, he says first [246] that from the foregoing (ll.8.9) it is manifest that there is no infinite body in act. It is also clear from what has been said (l.7) that if the infinite absolutely does not exist, many impossibilities arise. One is that time will have a beginning and an end, considered impossible by those holding for the eternity of the world. Another is that it would follow that a magnitude would not be always divisible into further magnitudes, but eventually one would arrive through division of magnitudes at certain things which are not magnitudes. But every magnitude is divisible. Likewise, it would follow that number could not increase to infinity. Since therefore, according to what has been said (ll.7-9) neither seems to occur, i.e.,) either an infinite in act or no infinite at all, it must be said that the infinite somehow is and somehow is not.

372. Then [244] he shows that the infinite is as a being in potency. And he says that something is said to be in act and something is said to be in potency. Now the infinite is said to come about either by addition, as in numbers, or by subtraction, as in magnitudes. Now it has been shown that magnitude is not infinite in act; hence in magnitudes an infinite through addition is not found, but there is found in them an infinite through division. For it is easy to destroy the opinion that posits lines as indivisibles, or according to another letter, it is easy "to divide indivisible lines," i.e, to show that lines held indivisible by some, are divisible. Now the infinite, whether in addition or division, is spoken of to the extent of the ability [or potency] to add or divide. It therefore follows that the infinite is as a being in potency.

373. Then [256] he shows how the infinite exists in potency. For something is found to be in potency in two ways. In one way, in the sense that the whole can be reduced to act, as it is possible for this bronze to be a statue, because at some time it will be a statue. But the infinite in potency is not so meant as that which later will be entirely in act. In another way, something is said to be in potency in such a way that later it will be in act, not, indeed, all at once, but part after part. For there are many ways in which a thing is said to be: 1) because the whole exists at the same time, as in the case of a man or a house; or 2) because one part of it always comes to be after another part, in the way that a day is said to exist and a competition exists.

It is in this latter way that the infinite is said to be at once in potency and in act. For all successive things are at once in potency as to one part and in act as to another part. For the Olympic games, i.e., the festive contests held on Mt. Olympus, are said to be and to continue as long as the contests are scheduled and as long as the schedule is being carried out. For as long as those games lasted, one part of the schedule was taking place at the time and another was to take place later.

374. Then [251] he compares various infinites one to another:

First he compares the infinite of time and of generation to the infinite which is in magnitudes;

Secondly, he compares the infinite according to addition to the infinite according to division in the case of magnitudes, at 377.

In regard to the first he does three things:

First, he proposes his intention and says that the infinite in the generation of man, and in time, must be explained in a manner different from that of the infinite in the division of magnitudes.

375. Secondly [252] he shows what is common to all infinites, saying in all of them it is universally found that the infinite consists in always taking one thing followed by another according to some certain succession, in such away that the whole of whatever is taken, be finite. Hence one must not suppose the infinite to be some whole existing all at once, as a substance that can be pointed out, e.g.,a man or a house. Rather the infinite must be taken as in the case of successive things, such as a day or a tournament, whose existence is not that of a perfect substance actually existing as a complete whole all at once. Now, in generation and corruption, even though the process continue to infinity, whatever is taken in act is finite. For in the whole course of generation, even should it proceed to infinity, both all the men existing at a given time are finite in number, and this finite amount must be taken as other and other, accordingly as men succeed one another in time.

376. Thirdly, [253] he shows how they differ, saying that the finite actually present in magnitudes as a result of adding or of dividing is permanent and is not corrupted, but the finites considered in the infinite course of time and of human generation are corrupted, although in such a way that time and generation themselves do not fail.

377. Then [254] he compares the two types of infinite which are found in magnitudes; namely, the infinite according to addition and the infinite according to division. About this he does three things:

First he shows their points of agreement;

Secondly, he shows wherein they differ, at 379;

Thirdly, he draws a conclusion from what has been said, at 380.

In regard to the first, [254] he says that in some sense the infinite resulting from addition is the same as the one resulting from division, because the former comes to be as a converse of the latter. For it is accordingly as something is divided to infinity, that additions to infinity seem to be able to be made to some determinate quantity.

378. He demonstrates, therefore, how the infinite in division exists in magnitude.

Thus he states that if someone, in some infinite magnitude, having taken some determinate part by division, should then continue to take other parts by division, always maintaining the same ratio, I.e., proportion, he will not go through that finite magnitude by means of division.

For example, from a line of one cubit we may take one half, and from the remainder one-half again. We can proceed in this process to infinity. For the same proportion will be maintained in subtracting, but not the same amount of what is subtracted. The half of the half is less, according to quantity, than the half of the whole. But if we were to take away always the same amount, the proportion taken away would be continually growing. For example, if from a quantity of ten cubits, we take away one cubit, the ratio of the part removed to the original is one-tenth. If we take from the remainder another inch, the ratio between the part removed and that which remains will be in a greater proportion [i.e., one-ninth]. For one cubit is less exceeded by 9 than by 10. Just as, by preserving the same proportion throughout, the quantity subtracted is continually smaller, so, by taking away the same amount each time, the proportion gets continually larger. If, therefore, by so subtracting from some finite magnitude, we continually increase the proportion by taking away the sawe amount, the original magnitude will be exhausted. For example, if from a line of 10 cubits we always subtract one cubit. This will happen because every finite thing will be exhausted by continually removing the same finite amount.

The infinite that depends on division does not exist, therefore, except in potency, but with this potency there exists always something in act, as was said of a day or of a tournament. And since the infinite is always in potency, it is assimilated to matter, which likewise is always in potency; and it never exists in act in its entirety, the way that the finite is in act. And just as the infinite according to division is at once in potency and act, so too is the infinite according to addition, which has been shown to be in some sense the same as the infinite according to division, as was said (no. 377). And the reason why the infinite according to addition is in potency is that it can always grow through addition.

379. Then [2557he shows the difference between the infinite according to addition and the infinite according to division. And he says that the former does not exceed any given finite magnitude, whereas the latter diminishes beyond any pre-determined smallness. For If we take any predetermined smallness, for example, the width of a finger, we can, by repeated halving of a line of 10 cubits, arrive at a remainder which is less than the width of a finger. But in adding to infinity, in distinction to division, there will exist some given finite quantity which will never be gone through. Take two magnitudes each of 10 cubits, and a third one of 20 cubits. If what I subtract to infinity from one magnitude of 10 cubits, always taking a half, is added to the other, which is also of 10 cubits, I shall

never reach, by adding to infinity, the measure of the quantity of 20 cubits, since as much as remains in the quantity being divided will be lacking from the given measure in the quantity being added to.

380. Then [256] he draws a conclusion from the foregoing. First he draws it; secondly he explains it by a saying of Plato, at 381.

He says therefore first [256] that since addition to infinity never actually transcends every determined quantity, it is not possible, even in potency, to transcend every determined quantity by addition. For if there were in nature potency for addition transcending every quantity, it would follow that something actually infinite exists; such an infinite would be an accident of some nature, in the same way that the natural philosophers posit, outside the world we see, some sort of infinite, whose substance is air or something similar. But if, as was shown (II.8,9), no infinite sensible body exists in act, it follows that there is in nature no potency to transcend every magnitude by addition, but only a potency to the infinite addition which is in contrast to [and derived from] division, as was said above (no. 379).

Why the existence of a potency to infinite addition transcending every magnitude would imply a body infinite in act, whereas in numbers infinite addition transcending every number does not imply an actually infinite umber will be explained below(in Lecture 12).

381. Then [257] he confirms what he has said by a dictum of Plato, saying that because the infinite resulting from the addition of magnitudes is the reverse of division, Plato therefore posited two infinites: "the large," which pertains to addition, and "the small," which pertains to division—for the finite seems to excel both by addition unto increase, and by division unto decrease or towards nothing. Yet although Plato makes two infinites, he does not use them. For in number, which he posited to be the substance of all things, there is no infinite by division since there is among them something smallest, which is unity; nor is there according to him an infinite according by addition, since he said that the species of number vary only up to ten and then a return is made to unity when we count eleven, twelve, and so on.

LECTURE 11

Definition of the infinite

382. After showing how the infinite exists, the Philosopher now explains what it is. About this he does three things:

First he shows what the infinite is;
Secondly, from this he assigns the reason for the things said of the infinite, at

390 (l.12).
Thirdly, he solves the difficulties mentioned earlier, at 400 (l.13).

In regard to the first he does two things:

First he shows what the infinite is and rejects the false definition of some;
Secondly, he rejects a certain false opinion that follows from the above false definition, at 387.

About the first he does three things:

First, he proposes what he intends;
Secondly, he explains the proposition, at 384;
Thirdly, he draws a conclusion, at 386.

383. He says therefore [258] that the infinite must be defined in a manner contrary to the way some have defined it. For some have said that infinite is 'that outside of which there is nothing," whereas, to the contrary, it should be defined as "that beyond which there is always something."

384. Then [259] he explains his proposition.

First he shows that his description is good;
Secondly, that the description of the earlier philosophers is incompetent, at 385.

He shows therefore first by an example that the infinite is "that beyond which there is always something." For some people say that a ring is infinite since, because it has a circular direction, one can always take part after part. But this is to speak analogously and not properly, because to be infinite requires this, namely, that beyond whatever part is taken there be some other part, in such a way, nevertheless, that one never take again a part taken previously. But in a circle this does not happen, because the part which is counted after another happens to be different from that immediately before it, but not from all the parts previously counted, because one part can be counted any number of times, as is evident in a circular motion. Therefore, if rings are called infinite according to this analogy, it follows that that which is truly infinite is something which always has something beyond, if one were to measure its quantity. For it is impossible to measure the quantity of the infinite; but if someone should desire to reckon it, he would take part after part to infinity, as said above.

385. Then [260] he proves that the definition of the earlier philosophers is since "that outside of which there is nothing" is a definition of the perfect and a whole thing. Here is his proof. Every whole is defined as "that to which nothing to lacking"—as we speak of a whole man, or of a whole box, if they lack nothing which they ought to have. And just as we speak thus in regard to some individual whole, as in the case of this or that particular, so too this notion holds in regard

to what is truly and perfectly whole, namely, that outside of which there is absolutely nothing. But when something is lacking through the absence of something intrinsic, then such a thing is not a whole.

So it is evident that this is the definition of a whole: "a whole is that nothing of which is outside of it." But a whole thing and a perfect thing are either entirely the same or of a proximate nature. He says this, because "whole" is not found in simple things which have no parts; in which things, nevertheless, we use the word "perfect." This shows that the perfect is "that which has nothing of itself outside of it." But nothing that lacks an end is perfect, because the end is the perfection of each thing. For the end is the term of that of which it is the end. Nothing infinite, therefore, and unterminated, is perfect. Hence the definition of the perfect as that, namely, which has nothing of itself outside itself, does not apply to the infinite.

386. Then [261] he draws a conclusion from the foregoing. Since the definition of a "whole" does not apply to the infinite, it is clear that the position of Parmenides is better than that of Melissus. For Melissus said that the whole universe was infinite. Parmenides said the whole is terminated by what is "striving equally from the middle,"by which he designated the body of the universe as spherical. For in a spherical figure, lines from the center to the term, i.e., the circumference, are drawn according to equality, as though "striving equally" with each other. And it is rightly stated that the whole universe is finite, for to be a whole and to be infinite are not reciprocally connected, i.e., not continuous as thread follows thread in spinning. For there was a proverb that things which follow one upon the other should be said to be continuous as thread following thread.

387. Then [262] he rejects a false opinion that arose from the aforesaid definition, and first in a general way, covering all variations; secondly the opinion of Plato, at 389.

He says therefore first that because some thought that whole and infinite were mutually connected, they consequently took it as a "dignity" [axium], i.e., something self-evident, that the infinite contains all things and that it has all things in itself. This was due to the fact that the infinite has a likeness to a whole, as what is in potency has a likeness to act. For the infinite, inasmuch as it is in potency, is as matter in respect to the perfection of magnitude, and it is as a whole in potency, not as a whole in act. This is proved by the fact that the infinite is based on the possibility of dividing things into what is smaller and of making, by a contrasting division, continual additions, as was said above (I.10). Consequently, the infinite in itself, according to its proper nature, is a whole in potency only; and it is something imperfect, comparable to matter not having perfection.

For it is not whole and infinite [or finished] according to itself, i.e., according to

proper notion by which it is infinite, but according to something other, i.e., according to end and whole, to which it is in potency. For division, which is possible *ad infinitum*, is called "perfect" insofar as it is, whereas the division that goes on *ad infinitum* is imperfect. And it is clear, since it is the whole that contains but matter that is contained, that the infinite an such does not contain but is contained. This is true, insofar, namely, as whatever is in act of the infinite is always contained by something greater, accordingly as it is possible to take something beyond.

388. Now from the fact that the infinite is as a being in potency, not only does it follow that the infinite is contained and does not contain, but two other conclusions also follow. One is that the infinite, as such, is unknown, because it is as matter without species, i.e., form, and matter is not known except through form. The other conclusion, which has the same source, is that the infinite has more the notion of a part than that of a whole, since matter is compared to the whole as a part. And it is not a surprise that the infinite conducts itself as a part, inasmuch as only a part of it is ever actual.

389. Then [263] he rejects an opinion of Plato who posited an infinite both in sensible and in intelligible things. And he states that from this it is plain also that if "the large" and "the small." to which Plato attributed infinity, are in sensible and intelligible things as containing (by virtue of containment being attributed to the infinite), it follows that the infinite contains the intelligible things. But this seems unfitting and impossible, namely, that the infinite, since it is unknown and undetermined, should contain and determine intelligible things. For the known is not determined by the unknown, but rather the converse is true.

LECTURE 12

Explanations in the light of the definition of the infinite

390. After giving a definition of the infinite, the Philosopher now assigns reasons for the things that are said about the infinite.

First, the reason for what is said about addition and division of the infinite;
Secondly, the reason for saying that the infinite is found in different things according to a certain order, at 397;
Thirdly, the reason for saying that mathematicians use the infinite, at 398;
Fourthly, the reason why the infinite is called a principle, at 399.

About the first he does two things:

First he presents the reason for what is said about the infinite in relation to division and addition in magnitudes;
Secondly, the reason for what is said of it in numbers by comparison to

magnitudes, at 392.

391. It was said above (no. 379) that addition to infinity in magnitudes takes place in such a way that the resulting magnitude does not become greater than any given magnitude. But division to infinity in magnitudes results in reaching a quantity that is smaller than any pre-assigned quantity, as was expounded above (no. 379). However, he states [264] that this occurs reasonably, for since the infinite is like matter it is contained within just as matter is, while that which contains is the species and form. Now it is clear from what was said in Book II (l.5) that the whole is like form and the parts are like matter. Since, therefore, the division of a magnitude proceeds from the whole to the parts, it is reasonable that no limit be found there which is not transcended through infinite division. But the process of addition goes from the parts to the whole, which is like a form that contains and terminates; hence it is reasonable that there be some definite quantity which infinite addition does not exceed.

392. Then [267] he explains infinity in numbers by comparison to magnitudes. For it was said that in number there is a smallest terminus below which division does not go; but there is no maximum limit which it cannot exceed, because it is possible through addition to exceed any given number. The opposite hcwever takes place in magnitudes, as was said (no. 391). The reason why is because every unity, inasmuch as it is a unity, is indivisible, as indivisible man is one man and not many men. Now every number can be resolved into unity, as is evident from the nature of number. For number signifies that there are more things than one, and any plurality exceeding one to a greater or lesser degree constitutes a definite species of number. Hence, since unity pertains to the notion of number and indivisibility pertains to the notion of unity, It follows that the division of number should halt at an indivisible terminus.

This statement that it is of the nature of number to be more than unity he explains by appealing to the species of number, because 2 and 3 and every other number is denominated by unity. Wherefore it is said in *Metaphysics* that the substance of 6 consists in its being six times one and not two times three, or three times two. Otherwise, it would follow that of the same thing there would be more than one definition and more than one nature, since, starting from different parts, a same number would come about in different ways.

393. Then [266] he gives the reason why in numbers addition exceeds any predetermined multitude. And he says that we can always think of a number greater than any given number, for the reason that magnitude is divided to infinity. For it is plain that division causes multidude; hence the more magnitude is divided the greater is the multitude that results, and upon the infinite division of magnitudes there follows the infinite addition of numbers. Therefore just as infinite division of magnitude is not in act but in potency, and exceeds every determinate quantity in smallness, as was said (nos.391,392), so the infinite

addition of numbers is not in act but in potency, and exceeds every determinate multitude. But this number which is thus multiplied to infinity is not a number independent of the division of magnitudes.

394. On this point it must be remembered that division, as was stated (no.393), causes multitude. But division is of two kinds: one is formal, which is through opposites; the other is according to quantity. Now the first division causes that multitude which is a transcendental, accordingly as being is divided into "one" and "many"; but the division of continuous quantity causes number, which is a species of quantity, insofar as it has the notion of measure. And this number can grow to infinity, just as magnitude is divisible to infinity. But the multitude which arises from formal division cannot grow to infinity. For the species of things are determined, just as there is a determined quantity of the universe. That is why he says that the number which grows to infinity is not separated from the division of the continuum. Nor is this number infinite in the sense of something permanent. Rather it is as something always in a state of becoming, inasmuch as, to any given number, additions may be successively made, as is evident in the case of time and the number of time. For the number of time increases successively by the addition of day to day but not all days existed at once.

395. Then [267] he shows that the opposite occurs in magnitudes. For although a continuum be divided to infinity, as was said (nos. 393,394), the size cannot grow indefinitely even potentially. For as great as a thing is in potency, so great can it be in act. If, therefore, it were in the potency of nature that a magnitude grow to infinity, it would follow that there would actually be some infinite sensible magnitude—which is false, as stated (ll.8.9). The consequence is, therefore, that addition of magnitudes cannot go on to infinity so as to exceed every pre-determined quantity; for otherwise there would be something greater than the heavens.

396. [rom the foregoing it is plain that the claim of some that in primi matter there is a potency to every quantity is false; for in prime matter there is a potency only to determined quantity. It Is plain also from the foregoing why number does not have to be as great in act as it is potentially, as is said here of magnitude: for addition occurs in number as a consequence of the division of the continuum, by which one passes from a whole to what is in potency to number. Hence one need not arrive at some act terminating the potency. But the addition of magnitudes arrives at act, as was said (no. 391).

The Commentator [Averroes], however, assigns another reason: namely, that potency to addition in magnitude is in one and the same magnitude but the potency to addition in numbers is in various numbers inasmuch as to any number something can be added. But this reason has little value because just as addition produces varying species of number, so also varying species of measure, as, for example, "two cubits long" and "three cubits long" are called species of quantity.

Moreover, whatever is added to a higher number is added to the lower. Accordingly, there is in one and the same number, e.g., two or three, a potency to infinite addition.

397. Then [260] he shows how the infinite is found in diverse ways in diverse things. And he says that the infinite is not found according to the same aspect in motion and magnitude and time, as if it were one nature being predicated univocally in all three cases. Rather it is said of the subsequent member in terms of its antecedent, for example, of motion by reference to the magnitude in which notion takes place (whether it be local motion, alteration or augmentation;) and of time by reference to notion. This happens because the infinite pertains to quantity, and notion is quantified by reference to magnitude, while time is quantified by reference to motion, as will be evident below (Bk. IV, l.17). And therefore he says that we are now mentioning these, but later what each of them is will be explained, as well as that every magnitude is divisible into magnitudes (Bk. VI, l.1).

398. Then [269] he explains how mathematicians make use of the infinite, and says that the argument that there is no actually infinite magnitude,(ll.8,9) does not destroy the consideration of the mathematicians, who use the infinite, as, for examplao when the geometer says, "Let this line be infinite." For they do not need for their demonstrations the infinite in act,nor do they use it, but they need only some finite line of sufficient quantity for their needs, so as to be able to subtract from it so much as they wish. For their purpose it is enough that there exist some maximum magnitude which can be divided according to any proportion in respect to another given magnitude. Hence, for purposes of demonstration, it makes no difference whether this maximum magnitude be one way or the other, i.e., finite or infinite;but as to the being of things, it makes a great difference whether it is one or the other.

399. Then [270] he shows how the infinite is a principle. And he says that since there are four genera of causes, as was said above (Bk. II), the infinite is a cause in the manner of matter. For the infinite has being in potency, which is proper to matter. Now matter is sometimes under a form and sometimes under privation. The infinite, however, has the notion of matter, not insofar as matter lies under a form but inasmuch as matter has privation—for the infinite implies the lack of perfection and term. That is why the Philosopher adds that the being of the infinite is privation, i.e., the notion of the infinite consists in privation.

And lest anyone suppose that the infinite is matter like prime matter, he adds that the *per se* subject of the privation which constitutes the nature of the infinite is the sensible continuum. That this is so is clear from the fact that the infinite found in numbers is caused from the infinite division of magnitude; and similarly, the infinite in time and notion are caused by magnitude. Hence, the first subject of the infinite in the continuum. And since really existing magnitude is not

separated from sensible things, it follows that the subject of the infinite is sensible.

And on this point all the earlier philosophers agree who use the infinite as a material principle. Wherefore they improperly attributed to the infinite the capacity to contain, for matter does not contain but rather is contained.

LECTURE 13

Solution of arguments in favor of existence of the infinite

400. After the Philosopher has used the definition of the infinite to explain the things attributed to it he now solves the argument presented above (l.7) to show the infinite existed.

First, he proposes his intention;
Then he follows it out, at 401.

He says therefore first [271] that after speaking of the nature of the it remains to settle the arguments which appeared to show that the infinite is not only something in potency, as we determined above (l. 10), but that was in act, as things are that are finite and determined. For some of the arguments do not conclude necessarily but are entirely false, while others are partially true.

401. Then [272] he solves the five reasons cited above (l.7) as proving that the infinite exists. And first he solves the one based on the fact of generation. For it concluded that if generation does not cease, then the infinite must be. Now this argument concludes truly insofar as the infinite is in a potency that is successively reduced to act. But it is not necessary that there be some sensible body which is infinite in act, in order to account for generation not ceasing, as the earlier philosophers supposed when they said that generation continues to infinity, supposing it to take place by extracting from some body, with the consequence that the process could not be infinite unless that body were infinite. But this is not necessary: for even supposing the whole of sensible body as finite, generation can endure ad infinitum by the fact that the corruption of one thing is the generation of another.

402. Then [273] he solves the argument based on the principle of contact, as though it were necessary for every finite body to touch some other body and so on to infinity. But he solves this by saying that it is one thing to be "touched" and another to be "terminated", because to be "touched" and "enclosed" are said in respect to something else, for whatever touches, touches something else. To be "terminated," however, is said absolutely and does not imply a relationship to something else, because a thing is made finite in itself by its own terminations. For it is incidental to the finite that it be touching something. Nevertheless,

neither is it necessary that everything touched by something should touch something else and that this go on to infinity. Hence it is evident that this argument does not conclude anything of necessity.

403. Then [274] he solves the argument based on the intellect and the imagination, which latter the ancients did not distinguish from the intellect. This argument above (l.7) concluded that there was outside the universe an infinite space, and consequently a place and a body. But it is incorrect to "trust to thought," i.e., believe that whatever is apprehended by the imagination or intellect is true, as some of the ancients thought, whose opinion is refuted in *Metaphysics* IV. For if I apprehend a thing as smaller or larger than it is, it does not thereby follow that there is such an abundance or defect in the object itself but only in the apprehension of the intellect or imagination. For one might understand some man to be a multiple of himself, i.e., two or three times larger than he really if, or any other amount to infinity, yet there will not be because of this a corresponding multiplication of him outside the intellect or outside a definite quantity or magnitude.

404. But while a thing remains what it is, one can conceive of it in such a manner. Then [275] he solves the difficulty based on time and motion. And he says that time and motion are not infinite in act, because nothing of time is actual but the "now," and nothing of motion is actual except a kind of indivisible. But the intellect apprehends a continuity in time and in motion by apprehending an order of "prior" and "posterior," in such a way, however, that what was first taken in time or in motion does not remain in the same state. Hence it is not necessary to say that the whole of motion is infinite, or that the whole of time is infinite.

405. Then [276] he solves the argument based on magnitude, and he says that magnitude is not infinite in act either as a result of division or of an intelligible increase, as is evident from what was said above (ll.8-10).

Finally he summarizes by saying that we have completed our study of the infinite.

BOOK IV

Lecture 1

Place, its existence

406. After treating in Book III of motion, and the infinite, which belongs intrinsically to motion insofar as it is in the genus of continuous things, the Philosopher now intends, in Book IV, to deal with the things that are extrinsically connected with motion.

First, of things that are connected with motion extrinsically as measures of mobile things:
Secondly, of time which is the measure of motion itself, at no.558 (L.15,1.

As to the first he does two things:

First, he studies place;
Secondly, the void, at no. 494 (L.9).

About the first he does two things:

First, he shows that it is the business of the natural philosopher to study place;
Secondly, he carries out his proposition, at no. 411.

As to the first he does two things:

First, [277] he proposes what he intends and says that just as it is the business of the natural philosopher to determine about the infinite; namely, whether it exists or not, and how it exists, and what it is, so also about place;
Secondly, at no. 407, he proves what he had said:

First from the viewpoint of place itself;
Secondly, from our viewpoint [i.e., that of the ones studying place] at no. 409.

407. About the first he gives two reasons, of which the following is the first [278]. Whatever things are common to all natural things pertain especially to the considerations of the natural philosopher; but place is such, for all generally maintain that whatever exists is in some place. They prove it by a sophistic argument consisting of positing the consequent. They argue thus: What does not exist is nowhere, i.e., in no place, for there is no place where the goat-stag or the sphinx exist, which are certain fictions after the manner of chimeras. They argue therefore that if what is found in no place does not exist, then whatever exists is in a place.

But if to be in place belongs to all beings, it seems that place pertains rather to the consideration of metaphysics then that of physics.

And it must be said that Aristotle here argues from the opinion of those who posit that all beings are sensible, on account of their inability to go beyond their imaginations. According to them, natural science is first philosophy, common to all beings, as is mentioned in *Metaphysics* IV (L.5).

408. Then [279] he gives the second reason: The consideration of motion belongs to the natural philosopher; but the motion which is according to place and is called "change of place" is the most general of all motions. For some things namely, the heavenly bodies, are moved solely according to this motion and nothing is moved with other motions without being moved by this one. Moreover, this motion is more properly so because it alone is truly continuous and perfect, as will be proved in Book VIII. But notion according to place cannot be known without knowing place. The natural philosopher therefore should consider place.

409. Then [280] he arrives at the same conclusion from our viewpoint: Wise men should settle matters about which there is doubt; but there are many doubts about what place is. The cause of these doubts is twofold. One is based on place itself: because not all the properties of place lead to the same opinion about place, but from certain properties of place it seems that place is one thing and from other properties that it is something else. The other cause is based on men, for the ancients neither proposed their doubts about place well nor pursued the truth of the matter well.

410. Then [281] he begins to determine about place.

> First in a dialectical manner;
> Secondly, by determining the truth, at no. 434.

As to the first he does two things:

> First he discusses dialectically whether place exists;
> Secondly what it is at no. 422.

About the first he does two things:

> First he gives reasons showing that place exists;
> Secondly, showing that it does not exist, at no. 415.

As to the first he does two things:

> First he shows that place exists, by using reasons based on the truth of things;
> Secondly, by reasons based on the opinions of others, at no. 413.

411. In regard to the first, he gives two reasons. In the first of these he proceeds thus: That place is something, is clear from the very transmutation of bodies that are moved according to place. For just as the transmutation which is according to form led men to the knowledge of matter, because there had to be a subject in which the forms could succeed one another, so transmutation according to place led men to a knowledge of place, for there had to be something where bodies could succeed one another. And this is what he adds, namely, that when water goes out from where it now is, i.e., from some vessel, air re-enters. Since, therefore, another body sometimes occupies the same place, it is clear that place is something different from the things that are in place and which are moved according to place. For where air now is there was previously water, and this would not be if place were not something different from both the air and the water. Consequently, place is something: it is a sort of receptacle distinct from any of the things located in it, and it is the term "from which" and "unto which" of local motion.

412. He gives the second reason [282], saying that since the motion of any body whatsoever shows that place exists, as has been said, then the local motion of natural simple bodies, such as fire and earth, and such like heavy and light bodies, not only shows that place is something, but also that place has a certain power and force.

For we observe that each of these bodies is carried to its proper place when it is not prevented, i.e., the heavy are carried down and the light upward. This shows that place has a certain power of pre-serving the thing that is in place. For this reason, an object tends to its own place by a desire of self-preservation. This, however, does not prove that place has the power to attract, except in the sense in which the end is said to attract.

"Up" and "down" and the other directions, namely, "before" and "behind," "right" and "left," are the parts and species of place. These directions are determined in the universe according to nature and not merely in relation to ourselves. This is clear from the fact that when we speak of them in relation to ourselves, the same thing is not always "up" or "down," "right" or "left," but varies according to our various relations to it. Hence it frequently happens that an immobile object which was "on the right" comes to be "on the left." The same is true of the other directions, depending on our different relations to them.

But in nature there is a definite "up" and "down" according to the motion of heavy and light bodies, and the other [four] directions are determined by the movements of the heavens, as was said in Book III. It is not just any part of the universe that is "up" and just any part that is "down," but "up" is always whether light bodies are carried and "down" is whether heavy bodies tend. Now whatever things have according to themselves definite positions must have powers by which they are determined, for in an animal the power of the right is distinct from

the power of the left. Accordingly, place exists and has definite powers.

Now, that in certain things the position is assigned only in relation to us is shown in mathematical objects, which, although they are not in place, yet have a position attributed to them solely in relation to ourselves. Hence they have no position according to nature but only according to the intellect, inasmuch as they are understood in some relation to ourselves, either as above or below, or to the right or left.

413. Then [283] he appeals to the opinions of others to show that place exists. First, to the opinion of those who posit a void. For whoever asserts that the void exists must admit that place exists, since the void is nothing more than a place devoid of body. And so from this and from the reasons given above, it is possible to conceive that place is something other than bodies and that all sensible bodies exist in place.

414. Secondly, [284] to confirm the same point he uses the opinion of Hesiod, who was one of the ancient theological poets. It was he who taught that the first thing made was chaos. For he said that the first of all things made was chaos, it being a sort of confusion and a receptacle for bodies; later the extended earth was made to receive various bodies—as if first a receptacle of things had to exist before the things themselves could exist. And he and others posited this because, with many others, they believed that all things that exist are in place. And if this is true, it follows that place not only exists but that it has a remarkable power in that it is the first of all beings. For that can exist without other things but they not without it, seems to be first. But according to them place can exist without bodies—a conjecture they made by observing that place remains even when the things occupying it are destroyed. But things cannot exist without place. It follows, therefore, according to them, that place is the first among all beings.

Lecture 2

Six dialectical reasons showing place does not exist

415. After giving reasons to show that place exists, the Philosopher now gives six reasons showing that place does not exist. Now the way to begin investigating the question "whether a thing exists" is to settle on "what it is," at least as to what its name means. Therefore he says [285] that although it has been shown that place exists, there is a difficulty, i.e., a question, about what it is, even if it does exist: Is it a bodily mass or a nature of some other kind?

416. Hence, he argues thus: If place is anything it must be a body; for place has three dimensions, namely, length, width and depth; and such things determine a body because whatever has three dimensions is body. But place cannot be a body, because, since place and the body in it are together, there would be two

bodies together, which is unacceptable. Therefore, it is impossible for place to be anything.

417. He gives a second reason [286]: If the place of a body is a receptacle distinct from the body, then the place of its surface must be a receptacle distinct from this surface, and similarly for the other limits of quantity, such as the line and the point. He proves this conditional proposition in the following manner: Place was proved to be distinct from bodies on the ground that where the body of air now is, there was the body of water previously; but similarly where the surface of the water was, there is now the surface of the air; therefore the place of the surface is distinct from the surface and the same holds for the line and the point.

He argues therefore by the destruction of the consequent, starting from the fact that there can be no difference between the place of ths point itself. For, since a place is not greater than the thing in place, the place of a point can be only an indivisible. Now two quantitative indivisibles, e.g., two points joined together, are just one point. For the same reason, therefore, neither the place of the surface will be different from the surface itself, nor the place of the body different from the body itself.

418. He gives a third reason [287]: whatever is, either in an element or composed of elements; but place is neither of these; therefore place does not exist. The middle [minor] premise he proves thus: Whatever is an element or composed of elements is either corporeal or incorporeal; but place is not incorporeal, for it has magnitude, nor is it corporeal, because it is not a body, as we have already shown. Therefore it is neither an element nor composed of elements.

Now since someone might say that even though it is not a body, it is nevertheless a bodily element, he excludes this by adding that all sensible bodies have corporeal elements, because the elements are not outside the genus of their compounds. For no magnitude results from intelligible principles which are incorporeal. Hence if place is not a body, it cannot be a corporeal element.

419. He gives the fourth reason [288]: Everything that exists is somehow a cause in relation to something else; but place cannot be a cause in any of the four ways. It is not a cause as matter, because things that exist are not composed out of place and that is implied in the very notion of matter, nor is it a formal cause, for then all things that have the same place would be of the same species, since the principle of the species is the form. It is not like the final cause in things, since places seem to be for the sake of the things in place rather than they for the sake of the places. Finally, it is not an efficient or moving cause, since place is the terminus of a motion. Therefore it seems place is nothing.

420. He gives the fifth reason [289], which is Zeno′s reason: Whatever exists is in

place; hence if place is anything it follows that it is itself in place and that place in another place and so on ad infinitum. But this is impossible; consequently, place is not anything.

421. He gives the sixth reason [290]: Every body is in a place and in every place is a body (according to the opinion of many). From this it is taken that place is neither smaller nor larger than the thing in place. When therefore a thing in place grows, its place also should grow. However, this seems impossible, for place is an immobile something. Therefore place is not anything.

In summary he says that for reasons of this sort doubts are raised not only as to the nature of place, but also as to its very existence. However, these reasons will be answered by what follows.

Lecture 3

Is place matter or form?

422. Having inquired dialectically into the question of place's existence, the Philosopher now attacks the question: what is place?

> First he gives dialectical reasons showing that place is form or matter;
> Secondly, he gives reasons to the contrary, at no. 429.

As to the first he does three things:

> First he gives a reason showing that place is form;
> Secondly, that place is matter, at no. 425.
> Thirdly, from these he draws a corollary, at no. 428.

423. He says therefore first 52917 that just as in beings some are *per se* beings and others *per accidens*, so in regard to place, one place is common, in which all bodies exist, and another is proper and is called "place", primarily and *per se*. Now common place is so called only *per accidens* and in relation to a previous place. He explains this thus: "I can say that you are in the heavens, because you are in the air which is in the heavens, and that you are in the air and in the heavens, because you are on earth and you are said to be on earth, because you are in a place containing nothing but you."

424. Consequently, what contains a thing primarily and *per se* is its *per se* place. Now such a place is the boundary at which a thing is terminated. Therefore, place is properly and *per se* a boundary of a thing. But the boundary of each thing is its form, because it is through the form that the matter of anything is limited to its own existence and magnitude to a determinate measure. For the quantities of things follow upon their forms. According to this, therefore, it seems that place is the form.

However, it should be noted that in this argument there is the fallacy of consequent; for it is a syllogism in the second figure with two affirmative premises.

425. Then [292] he gives a reason of Plato through which it seemed to him that place is matter. To see this, one must note that the ancients thought that place was the space enveloped by the boundaries of the container, which has the dimensions of length, breadth, and depth. But this space did not seem to be the same as any sensible body, because the space remained the same even when various bodies successively entered it and left. Thus it follows that place is a set of separate dimensions.

426. From this Plato wished to demonstrate that place is matter. This is what he [Aristotle] says: Because some consider that place is the distance of the magnitude of space distinct from every sensible body, place would seem to be matter. For the distance or dimension of a magnitude is distinct from the magnitude. For magnitude signifies something terminated by some species [or form], as a line is terminated by points, and a surface by line, and a body by surface, and these are species of magnitude. But the dimension of space is contained under a determined form as a body is determined by a plane, i.e., by a surface, as, by a definite boundary. Now whatever is contained under boundaries seems to be in itself not determined. What is not determined in itself but by a form and boundary is matter which has the nature of the infinite. For were we to remove from some spherical body its sensible qualities and the boundaries by which the dimension of its magnitude acquires its definite figure, nothing would remain but the matter. Consequently the dimensions themselves, which are not determined by themselves but by something else, are matter.

This followed mainly from the underlying principles of Plato, who posited numbers and quantities as the substance of things.

427. Therefore, because place is dimensions and dimensions are matter, Plato said in the *Timaeus* that place and matter are the same. For he said that whatever is a receptacle of anything is a place (failing to distinguish between the receptiveness of place and of matter). Hence, since matter receives form, it follows that matter is place.

Yet it should be noted that Plato spoke in various ways about receptacles: for in the *Timaeus* he said that the receptacle is matter but in his "unwritten teaching," i.e., his oral teaching in the schools, he said that the receptacle was "the large and the small," which however he allied with matter, as we have said above. Yet no matter to what he attributed receptivity, he always said that the receptacle and place are the same. Therefore, while many did say that place is something, Plato alone endeavored to say what place is.

428. Then [293] he concludes from the foregoing that if place is either matter or

form, it seems reasonable to say that it is difficult to know what place is: because both matter and form involve very lofty and difficult speculation; moreover, it is not easy to know either of them without the other.

429. Then [294] he gives five reasons to the contrary. In the first of these he says that it is not difficult to see that place is neither matter nor form. For form and matter are not separate from the thing of which they are components, whereas place can be separated—in the place where air was, water now is. In like manner, other bodies also mutually change place. Hence it is clear that place is not part of a thing, as matter or form. Nor is place an accident of a thing, because parts and accidents are nor separable from a thing, whereas place is separable. He shows this by an example: place seems to be related to the thing in place as a vessel, the only difference being that place is immobile and the vessel mobile, as will be explained below (L.6). Consequently, since place is separable, it is not form. But that place is not matter is shown not only by the fact that it is separable, but also by the fact that it contains, whereas matter does not contain but is contained.

430. He now gives a second reason [295]. Since he had shown that place is neither matter nor form on the ground that place is separated from the thing in place, he now wishes to show that even if place were never separated from the thing in place, yet the very fact that we say something is in place shows that place is neither form nor matter. For whatever is said to be anywhere seems both to be something and to be distinct from that in which it is. Hence, when something is said to be in place, it follows that place is outside the thing, whereas matter and form are not outside the thing. Therefore, neither matter nor form is place.

431. In the third reason [296] he makes a digression to argue specifically against the position of Plato. For it was said in Book III that Plato posited ideas and numbers as not in place. But logically, according to his opinion about place, they should be in place, because whatever is participated is in the participant—and he said that species and numbers are participated either by matter or by "the large and the small." Accordingly, species and number exist in matter or in "the large and small," Therefore, if matter or "the large and the small" are place, it follows that numbers and species are in place.

432. He gives the fourth reason [297]. In this regard he says that no good explanation could be given of how something could be moved according to place, if matter and form are place. For it is impossible to assign a place in things that are not moved up or down or in any direction of place; hence place must be sought in things that are moved according to place. But if place is something intrinsic to what is moved (which would be the case if matter or form were place), it follows that place will be in a place, for whatever is changed in respect to place is itself in place. Now whatever is in a thing, such as its species and the

infinite, i.e., its matter, is moved with the thing, since they are not always in the same place, but are wherever the thing is. Therefore, matter and form must be in a place. Therefore, if either of them is place, it follows that place is in a place, which is unacceptable.

433. The fifth reason is then given [298]. Whenever anything is corrupted, the parts of its species are somehow corrupted. Now matter and form are the parts of the species. Therefore, when the thing corrupts, then, at least *per accidens*, the matter and form are corrupted. Consequently, if matter and form are place, it follows that place is corrupted, if place pertains to the species. Now the body which is generated would not be in the same place, if the place of air pertained to the species of the air, as when water is generated from air. But no explanation can be given of how place is corrupted; hence it cannot be said that matter or form are place.

Finally, he summarizes by asserting that we have stated why it seems place must exist and what causes doubt about its existence.

Lecture 4

Prerequisites to determining the truth about place.

434. After inquiring dialectically into the existence and nature of place, the Philosopher now proceeds to the task of determining the truth.

> First he lays down certain things necessary to the consideration of the truth:
> Secondly, he determines the truth, at no. 445.

As to the first he does three things:

> First he points out the ways in which one thing is said to be in another;
> Secondly, he asks whether anything can be in itself, at no. 437;
> Thirdly, he settles some difficulties previously raised, at no. 443.

435. He lists [299] eight ways in which something is said to be in something.

The first of these is the way in which a finger is said to be in the hand and in general how any part is in its whole.

The second way is as the whole is said to be in the parts. And because this way is not so customary as the first, he explains it by adding that the whole is not something outside the parts, and thus must be understood as existing in the parts.

The third way is as "man" is said to be in "animal," and any species in its genus.

The fourth way is as the genus is said to be in the species. And lest this way

seem out of place, he gives a reason for mentioning it: the genus is part of the definition of the species as is the difference; hence in some way both the genus and the difference are said to be in the species as parts in the whole.

The fifth way is as health is said to be in hot and cold things, the balance between which constitutes health; and in general as any other form is in matter or a subject, whether it be an accidental or a substantial form.

The sixth way is as the affairs of the Greeks are said to exist in the king of Greece, and generally as everything that is moved is in the first mover. According to this way, I can say that something is in me, because it is in my power to do it.

In the seventh way something is said to be in something as in something supremely loveable and desirable, and generally as in an end. in this way someone's heart is said to be in what he desires and loves.

Finally in an eighth way something is said to be in something as in a vessel, and in general as a thing in place is in its place.

He seems to have skipped the way in which something is in something as in time. But this is reduced to the eighth way. For just as place is the measure of the mobile thing, so time is the measure of motion.

436. Then he says that it is according to the eighth way that something is in a very proper sense said to be in something. Hence, according to the rule given in *Metaphysics* IV and V, all the other modes must somehow be reduced to this eighth way, according to which, something is in something as in a place. This is done in the following way.

The thing in place is contained or included by its place and has rest and it has rest and immobility therein. Therefore the way closest to this one is that in which a part is said to be in the integral whole in which it is actually included. Accordingly, it will be said below that a thing in place is as a "separated" part, and a part as a "conjoined" thing in place.

The whole which is according to reason is like this whole; hence it is said that what is in the notion of something is in it, as "animal" in "man."

Now just as it happens that the part of an integral whole is enclosed in a whole according to act, so the part of a universal whole is enclosed in a whole according to potency for the genus extends to more things potentially than the species does, although the species may have more elements in act. Consequently, species is also said to be in the genus.

And because, just as the species is contained in the potency of the genus, so form is contained in the potency of matter, it is further said that form is in the matter.

And because the whole has the notion of form in relation to the parts, as was said in Book II, consequently the whole is also said to be in the parts. But just as form is enclosed under the passive potency of matter, so the effect is enclosed under the active potency of the agent. Whence it is that something is said to be in a first mover.

Finally, it is clear that the appetite rests in the good it desires and loves and is, indeed, fixed in it, just as the thing in place is fixed in place. Hence the affection of the lover is said to be in the thing loved.

And thus it is evident that all the other ways are derived from the last, which is the most proper.

437. Then [302] he asks whether anything can be in itself, for Anaxagoras said above that the infinite exists in itself.

Therefore, he first raises the question: whether one and the same thing can be in itself; or whether nothing can, but all things either never are or are in something else.

438. Secondly [302] he answers this;

> First he shows how something can be in itself;
> Secondly, how it cannot, at no. 439.

He says first, therefore [301] that something may be understood to be in itself in two ways: in one way, primarily and per se; in another way, in relation to something else, i.e., in relation to a part. And it is in this second way that something may be said to be in itself. For when two parts of some whole are so related that one part is that in which the other exists and the other is that which is in the first, it follows that the whole is both that "in which" something exists (by reason of one part) and that which is "in this" (by reason of the other), and thus is the whole said to be in itself.

For we observe that something is said of something according to a part, for example, someone is called "white" because his surface is white, and a man is called "knowing" because science is in his rational part. If therefore we take a jug full of wine as a certain "whole" whose parts are jug and wine, neither of the parts will exist in itself, i.e., neither the jug nor the wine, but this whole, which is a jug of wine, will be in itself inasmuch as each is a part of it, i.e., both the wine which is in the jug and the jug in which the wine is. It is in this way, therefore, that one and the same thing can be in itself.

439. Then [302] he shows that nothing can be primarily in itself.

> First he proposes what he intends, distinguishing both the way in which something is in itself and the way in which it is not;

Secondly, he proves his proposition, at no. 440.

He says, therefore, that there is no case of anything being primarily in itself. And he makes clear what it is for something to be primarily in itself by citing an example of the opposite. For something white is said to be in a body, because the surface is in the body: hence the white is nor primarily in the body but in the surface. In like manner, science is said to be primarily in the soul, and not in the man, in whom science exists by reason of the soul. And it is according to this, i. e., according to the soul and the surface, that the appellations whereby a man is called "white" or "knowing" are verified, since the soul and the surface are as parts of man—not that the surface is a part, but it is like a part, inasmuch as it is something of the man, as The boundary of his body.

Now, if wine and jug are taken as separated one from the other, they are not parts; hence it belongs to neither of them to exist in itself. But when they are together, as when a jug is full of wine, then because both jug and wine are parts, the same thing will be existing in itself (as was explained above), not primarily but through its parts, just as white is not primarily in the man but is there through the body, and in the body through the surface. But it is not in the surface through anything else; hence it is said to be in the surface primarily. Nor is that in which something exists primarily, and that which is in it, the same, as in the case of white and surface. For surface and white are specifically different, and the nature and potency of each is different.

440. Then [303] having pointed out the difference between being primarily in something and not being primarily in something, he now shows that nothing is primarily in itself.

First he shows that nothing is primarily in itself per se;
Secondly, *per accidens*, at no. 442.

And he explains the first point in two ways: namely, inductively and with an argument. He says therefore first, that by considering inductively all the ways determined above in which something is said to be in itself, it is found that nothing exists in itself primarily and *per se*: for nothing is the totality of itself, [i. e., in itself as whole in part?], nor as part [in whole?] as genus [in species?], and so on. He lays this down by concluding from what has gone before, because just as it is clear in the case of the white and of the surface (which are related as form and matter) that they differ both in species and in power, the same thing can be considered in all the other modes.

441. Then [304] he proves the same thing with an argument and says that it is clear by reasoning that it is impossible for anything to be primarily and *per se* in itself. For if there be anything such, necessarily the same thing, in the same way, will have the notion both of that in which something is, and that which is in it. Hence, each would have to be both the container and the content; for example,

the jug would be the vessel and the wine, and the wine both the wine and jug, if something could be primarily and *per se* in itself. Now on this assumption (namely, that the wine is both the jug and wine, and the jug both wine and jug), if anyone were to say that either is in the other, for example, that the wine is in the jug, it would follow that the wine is received into the jug not inasmuch it is wine, but inasmuch as wine is the jug. Wherefore, if to be in the jug primarily and *per se* is a property of the jug (on the assumption that something is primarily and ptr se in itself), it follows that nothing can be said to be in the jug except inasmuch as that something is the jug. And so, if the wine is said to be in the jug, it follows that to be in the jug belongs to the wine, not inasmuch as it is wine, but inasmuch as the wine is the jug.

For the same reason, if the jug receives the wine, it will receive it not inasmuch as the jug is jug but inasmuch as the jug is wine. Now this is unacceptable. Hence, it is clear that it is under different aspects that something is "that in which" and "that which is in." For it is one thing to be that which is in something, and another to be that in which something is. Consequently, nothing can be primarily and *per se* in itself.

442. Then [305] he shows that nothing exists primarily in itself even according to accident. For something is said to be in something according to accident, when it is in it on account of something else existing in it; as, for example, when we say that a man is in the sea because he is in a boat which is in the sea: he is nevertheless said to be in the boat primarily, i.e., not according to a part. If therefore something could be in itself primarily, though not *per se* but *per accidens*, it would be in itself on account of something else being in it. And so it follows that two bodies are in the same thing; namely, the body which is in something and that same thing as existing in itself. In this way a jug will be in itself *per accidens*, if the jug itself, whose nature it is to receive something, is in itself, and again that which it receives, i.e., the wine. Therefore, in the jug will exist both jug and wine, if, because the wine is in the jug it follows that the jug is in itself; and so two bodies would be in the same. Consequently, it is clearly impossible for anything to be primarily in itself.

Notice, however, that sometimes something is said to be "in itself" not according to an affirmation but according to a negation, inasmuch as to be in itself signifies nothing more than not to be in something else.

443. Then [306] he settles certain doubts. First he destroys Zeno's reason which was appealed to as proof that place does not exist on the assumption that, if it did, it must exist in something else and so on *ad infinitum*. But this, as he says, is not difficult to answer after one knows the various ways in which something is said to be "in" something else.

For there is nothing to prevent our saying that place is in something: for while it

is not in something as in a place, it is in something in some other way, as form is in matter or an accident in a subject, inasmuch as place is a boundary of the container. And this is what he adds: as health is in the hot as a habit, and heat is in a body as a passion or accident. Hence it is not necessary to proceed to infinity.

444. Then [307] he also settles the doubts mentioned above about the nature of place (namely, whether it be form or matter) by appealing to his proof that nothing exists in itself primarily and *per se*. For it is clear from this proof that nothing can be the vessel or place of that which is contained in it after the manner of a part such as matter or form is: for that which is in something and that in which something is must be primarily and per se distinct, as we have shown. Hence, it follows that neither form nor matter is place; rather place is something entirely different from the thing in place, whereas matter and form belong to the thing in place as intrinsic parts thereof.

Finally he concludes that the things said above about place were said as contesting it. Some of these oppositions have now been solved; others will be solved after the nature of place is manifested.

Lecture 5

Necessary previous notions for the definition of place.

445. After setting forth a preliminary discussion about whether place exists and what it is, and after solving some doubtful points on these matters, the Philosopher now begins the task of determining the truth about place.

> First he gives some presuppositions to be used in determining about place;
> Secondly, he shows what qualities a definition of place should have, at no. 447;
> Thirdly, he begins to determine about place, at no. 448.

446. He says first therefore [308] that it will be clear from the following just what place is. But we must first adopt as it were certain suppositions and self-evident principles, those namely, which appear intrinsic to place. Indeed, there are four such:

For all agree on this maxim, that place contains that of which it is the place, yet in such a way that place is not any part of the thing in place. He says this to exclude the containing force of form, which is part of a thing, but contains in a manner different from place.

The second supposition is that the primary place, i.e., that in which something exists primarily, is equal to, and neither greater nor less than, the thing in place.

The third supposition is that a place exists for everything in place, i.e., that everything in place has a place, but not in the sense that one and the same place

is never lost by one and the same thing capable of being in a place; for a place can be separated from a thing in place. However, when one place is lost by a thing in place, it acquires another place.

The fourth supposition is that in all places there is found, as a [specific] difference of place, an "up" and a "down," and that each body, when it is outside its proper place, naturally seeks it and, when it is in it, naturally remains there. Now the proper places of natural bodies are "up" and down," to which they are naturally borne and in which they remain. But he says this in keeping with the opinion of those who posited no body other than the four elements: for he has not yet proved the heavenly body to be neither light nor heavy—which he will prove later in *De Coelo*, I . From these presuppositions he proceeds to the consideration of what remains.

447. He then [309] shows what qualities should be found in a definition of place. And he says that in defining place our attention should be focused on four things which indeed are necessary for a perfect definition:

First, that one show what place is, for a definition is an expression indicating what a thing is.

Secondly, that one resolve conflicting arguments about place: for the knowledge of truth involves the solution of doubts.

Thirdly, that the given definition reveal the properties of place, which inhere in it, because a definition is the middle term in a demonstration, by which the proper accidents are demonstrated of the subject.

Fourthly, that from the definition of place the cause will be clear why there is disagreement about place and of all the conflicting things said about it. Such a procedure is the most beautiful way of defining anything.

448. Then [310] he determines about place;

First he shows what place is;
Secondly, at no. 487, he settles the doubts previously mentioned;
Thirdly, he assigns the cause of the natural properties of place, at no. 492.

About the first he does two things:

First he shows what place is;
Secondly, how something exists iu place, at no. 472(L.7).

As to the first he does two things:

First he mentions some facts preliminary to his hunt for the definition;
Secondly, he begins to investigate the definition of place, at no. 455 (L.6).

449. In regard to the first, be makes four preliminary statements, the first of which is that the question of place would never have arisen were there no motion in regard to place. For it was necessary to posit place as something distinct from the object in place, because two bodies are found successively in the same place, and, in like manner, one body successively in two places. (Similarly, it was the successive change of forms in one and the same matter that led to the knowledge of matter). For this reason some are convinced that the heavens are in place, since they are always in motion. Now, of motions, one is according to place per se, namely, the change of place; another is consequently related to place, namely, increase and decline, beeause as a body grows or decreases, it acquires a larger or a smaller place.

450. He gives the second [311], saying that some things are moved, *per se* in act as in the case with every body, while others according to accident. This latter can occur in two ways. For some things that could be moved essentially are de facto moved accidentally, as the parts of a body while they are in the whole body are moved *per accidens* but when they are separated they are moved *per se*. Thus, a nail, when it is embedded in a ship, is moved *per accidens*, but when it is extracted it is moved *per se*. Other things are not be moved *per se*, but only *per accidens*, as is the case with whiteness and knowledge, which change place as that in which they are changes place. This point was brought up because things are apt to be in place *per se* or *per accidens*, actually or potentially in the same way as they are apt to be moved in those ways.

451. He gives the third [312] when he says that someone is said to be in the heavens as in a place because he is in the air which indeed is in the heavens. Yet we do not say that anyone is in the entire air primarily and *per se*, but by reason of the ultimate boundary of the air containing him he is said to be in the air. For if the whole air were anything′s place, e.g., a man′s, the place and the thing in place would not be equal—which is against what was supposed above. But that in which something exists primarily is seen to be the boundary of the containing body; and this is what primary place means, i.e., equal.

452. He gives the fourth reason [313]. First, he mentions it; secondly, he proves it, at no. 453.

He says therefore first that whenever the container is not separate from the thing contained but is continuous with it, the latter is not said to be in it as in a place, but as a part in a whole; as, for example, when we say that one part of the air is contained by the totality of air. And he concludes this from what went before, because where there is a continuum there is no ultimate boundary in act, something that is required for place, as was stated above. But when the container is separated, and contiguous to the thing contained, this latter is in place and exists in the ultimate boundary of the container primarily and *per se*, of a container, that is, which is not a part of the contained and neither greater nor

less but equal in dimension. But how the container and the thing contained can be equal he shows by pointing out that the ultimate boundaries of things touching are together: whence, their ultimate boundaries must be equal.

453. Then he proves the fourth point by two arguments [314]. The first of these is that something contained that forms a continuum with the container is not moved in the container but with the container, as the part is moved simultaneously with the whole; but when it is separate from the container, then it can be moved in it, whether the container be moved or not—for a man is moved on a ship whether it be moving or at rest. Therefore, since something can be moved in a place, it follows that place is a separated container.

454. He gives a second argument for the fourth point [315], saying that when the thing contained is not separate from the container but continuous with it, then it is said to be in it as a part in a whole, as sight is in the eye as a formal part and the hand in the body as an organic part. But when the container and the thing contained are separate, then the latter is in it as in a vessel; as water in a barrel or wine in a cup. The difference between the example in the first case and in the second is that the hand is moved with the body, but not in the body, but the water is moved in the barrel.

Therefore, since we have said above that to be in place is to be there as in a vessel but not as a part in a whole, it follows that place is like a separated container.

Lecture 6

The definition of place

455. After positing the preliminary notions required for the search of the definition of place, the Philosopher now begins his search for the definition. About this he does three things:

First, he looks into each part of the definition;
Secondly, he shows that it is a good definition, at no. 471

As to the first he does two things:

First, he searches for the genus of place;
Secondly, for the differentia that will complete the definition, at no.467.

In searching for the genus of place he divides. In connection with this he does three things:

First he gives the division;
Secondly, he excludes three members of the division, at no. 457;

Thirdly, he concludes to the fourth member, at no. 466.

456. He says therefore first [316] that from the previous discussion the nature of place may already be clear. For it seems that according to what is ordinarily said of place that it is one of four things: namely, matter or form or the space between and within the boundaries of the container, or, if there is no space within the boundaries of the container which has its own dimensions over and above the dimensions of the body existing within the confines of the container, then it will be necessary to posit a fourth possibility, namely, that place is the boundary of the containing body.

457. Then [317] he excludes three members of this division.

First, he proposes what he intends, saying that it is clear from what follows that place is not any of these three;
Secondly, he pursues his intention, at no. 458.

First, that it is not form;
Secondly, that it is not space, at no. 460;
Thirdly, that it is not matter, at no. 464.

458, In regard to the first he does two things. First [318] he sets down why form seems to be place: it is because form is a container, and this seems to be a property of place. Now the boundaries of the containing body and those of the contained are together, since the container and the contained are contiguous. Thus it does not seem that the containing boundary, which is place, is separate from that of the body contained. Consequently, there does not seem to be any difference between place and form.

459. Secondly, [319], he shows that form is not place. For although place and form are alike in this, that each is a kind of boundary, nevertheless they are not the boundary of one and the same thing: for form is the boundary of the body of which it is the form, while place is not a boundary of the body of which it is the place, but of the body containing it. So, although the boundaries of the container and of the contained are together, they are not identical.

460. Then [320] he takes up the question of space.

First he sets down why space seems to be place;
Secondly, he shows that it is not place, at no. 461.

He says therefore first that frequently a body contained by place, and distinct from it, is changed from one place to another, and any number of bodies can succeed into its original place (but always in such a way that the container remains immobile) in the way that water goes out of a vessel. For this reason it seems that place is some middle space between the boundaries of the containing body, as though there were something there besides the body moved from one

place to another. For if nothing were there besides the contained body, it would follow either that place is not distinct from the thing in place, or that what exists within the confines of the container's boundaries cannot be place. Now just as place must be something over and above the contained body, so it must be something other than the containing body, due to the fact that place remains immobile, whereas the containing body and everything in it can be changed about. But in addition to the containing body and the contained body there is nothing present except the dimensions of space, which exist in no body. Consequently, because place is immobile, it seems that space is place.

461. Then [321] he shows that space is not place by two arguments. As to the first of these, he states it is not true that there is anything within the confines of the containing body other than the contained body which is transferred from place to place. Rather, within the confines of the containing body there happens a body of some kind, having, nevertheless, the following two characteristics: that it be a mobile body, and be naturally apt to touch the containing body. But if, in addition to the dimensions of the contained body, there were present a space which always remained in the same place, the embarrassing conclusion would follow that there would be infinite places together. The reason is because water and air have their own dimensions, and so does each body, and each part of a body. Now all these parts will do the same thing in the whole body that the whole water does in a vessel. According to those who hold the opinion that space is place, when the entire water is in the vessel there are present, in addition to the dimensions of the water, also other dimensions of space. Now every part of a whole is contained by the whole as a thing in place is contained by a vessel: the only difference being that the part is not separated from the whole, whereas the thing in place is separated frm place. If therefore a part be actually separated within the whole, it will follow that, in addition to the dimensions of the part, also other dimensions of the containing whole will be present.

But it cannot be said that such division would make new dimensions to exist: for division does not cause dimension; rather it divides dimension already existing. Therefore, before that part was divided in the whole, there were present other proper dimensions of the part, in addition to the whole's dimensions, which also penetrate that part. Now there will be as many sets of dimensions all distinct, some of which interpenetrate others, as there are parts obtainable by division of the whole, parts, namely, so divided that one contains another. But it is possible in a continuous whole to obtain *ad infinitum* parts which contain other parts, because a continuum can be divided *ad infinitum*, Consequently, we should have infinite dimensions mutually penetrating themselves. If, therefore, the containing body's dimensions, penetrating the thing in place, are place, it follows that there are infinite places together—which is impossible.

462. Then [322] he gives a second reason, which is the following. If the dimensions of the space which is between the boundaries of the containing body

are place, it follows that place can be transported. For it is clear that when a body is transported, as, for example, a jug, the space within the jug is transported, since that space can never be except where the jug is. Now whatever is transported to another place is penetrated (according to those who hold the doctrine of space as place) by the dimensions of the space into which it is transported. Therefore it follows that other dimensions enter the dimensions of the jug's space; consequently there would be another place of place, and many places would be existing together.

463. This unacceptable consequence arises from positing one place for the contained body, for example, the water; and another place for the vessel, for example, the jug. For according to the opinion we are discussing, the place of the water is the space within the boundaries of the jug, while the place of the whole jug is the space within the boundaries of the body containing the jug. We, however, do not assign a special place for the part, in which the part moves, as distinct from the whole, when the entire vessel is transported (by "part" he means the body contained in the vessel, as the water contained in the jug): because, according to Aristotle, the water is moved *per accidens* when the vessel is transported, and it changes place only inasmuch as the jug changes its place. Hence it is not necessary that the place into which the transfer is made, be the place of the part *per se*, but only inasmuch as it becomes the place of the jug. But according to those who hold the opinion about space as place, it follows that the new place would belong *per se* both to water and to the jug. Likewise, that space would be transported and would have a place *per se*, and not only *per accidens*.

Now although the containing body is sometimes moved, it does not follow according to the opinion of Aristotle, that the place is moved, or that there is a place of a place. For it does indeed happen that a containing body, in which something is contained, is sometimes moved, as are air or water or certain parts of the water, For example, if a boat is in a river, the parts of the water which surround the boat from below are in motion, but the boat's place is not moved. Hence, he adds, "but not that place where they occur,", i.e., that in which things occur as in a place is not moved.

How this is true he makes clear by adding, "which is a part of the place which is the place of the whole heavens." For although this container [e.g., the water surrounding the boat] be moved inasmuch as it is this body, yet in regard to its relation to the whole body of the heavens it is not moved: the body which succeeds it has the same order or position in relation to the whole heavens as had the body which previously flowed on. This therefore is what he says, namely, that although the water or the air be moved, not so the place, considered precisely as a certain part of the place of the whole heavens and as having a definite position in the universe.

464. Then [323] he continues by considering matter.

First he shows why matter seems to be place;
Secondly, that it is not place, at no. 465.

He says therefore first that matter appears to be place, should one consider the transmutation of the bodies which succeed each other in the same place, as this occurs in some, one subject that is at rest in a place, with attention being paid, not to the fact that place is separate, but only to the fact that the transmutation is occurring in one and the same continuum. For some continuous body, at rest according to place, when it is being altered in quality, now white, now black; now hard, while previously soft. Yet it remains one and the same in number. And on account of this transmutation of forms in the subject we say that matter is something that remains one whole change taken place with respect to forms. Because of this, place seems to be something, because in it as remaining different bodies succeed each other. Nevertheless we use different terminology when referring to these two cases: to designate matter or the subject, we say, "What is now water, was previously air"; to designate unity in place, we say, "Where water is now there was air previously."

465. Then [324] he shows that matter is not place, because, as we said above, matter is not separated from the thing of which it is the matter, nor does it contain the latter: both of which characteristics belong to place. Place, therefore, is not matter.

466. Then [325], having eliminated the first three members, he concludes to the fourth. And he says that since place is not any of these three, i.e., neither form, nor matter, nor some space which is other than the internal distances of the things in place, it must be the fourth of the above named, i.e., the boundary of the containing body. And lest anyone understand that the thing contained or in place is some middle space, he adds that the contained body is what is apt to be moved in respect to change of place.

467. Then [326] he tracks down the specific difference of place; namely, that it is immobile. In regard to this he does two things:

First, he shows that an error arose from improperly considering this difference;
Secondly, how we must understand the immobility of place, at no. 468.

He says therefore that it is a large undertaking and a difficult one to understand what place is, both because some have thought it is matter or form, both of which involve lofty speculation, as was said above (L.3), and because the change that occurs when things change place, occurs in something both at rest and containing, Now, since nothing seems to be containing and immobile except space, it seems that place is a sort of middle space distinct from the magnitudes

which are moved in respect to place. And the fact that air seems to be incorporeal helps to make this opinion credible: for where air is there appears to be no body but a certain empty space. Thus place seems to be not only the boundaries of a vessel but something between the boundaries as a vacuum or void.

468. Then [327], in order to exclude the aforesaid opinion, he shows how we must understand the immobility of place. And he says that a vessel and place are seen to differ in this, that a vessel can be transported but place cannot, Hence, just as a vessel can be called "a transportable place," so place can be called "an immobile (non-transportable) vessel." Therefore, when something is being moved in a body that is in motion, as a ship in a river, we speak of that in which it is being moved as a vessel rather than of a containing place, because place "wants to-be immobile," i.e., it is of the very nature and aptitude of the place to be immobile.. On this account it is better to speak of the whole river as being the place of the ship, because the river as a whole is immobile. Thus the whole river inasmuch as it is immobile is the common place.

However, since proper place is a part of common place, we must consider the proper place of the ship in flowing water, not the water inasmuch as it is flowing, but in its relation to the order or position which this flowing water has to the river as a whole: it is this order or position that remains constant, while the water flows on. Therefore, although the water materially passes on, yet, insofar as it has the motion of place, i.e. insofar as it is considered as having a certain order and position with respect to the whole river it does not change.

This also shows how we ought to consider how the boundaries of natural mobile bodies are place with respect to the entire spherical body of the heavens, which is fixed and immobile on account of the immobility of the center and of the poles. Therefore, although this part of air which contains, or this part of water, flow by and move as this water, yet, insofar as this water has the motion of place, viz., a position and order to the whole spherical body of the heavens, it always remains. This is like the same fire remaining as to its form, although as to its matter it is varied as wood is consumed and other wood added.

469. This removes an objection that could be lodged against positing place as the boundary of the container, for since the container is mobile, its boundary will also be mobile; consequently, a thing at rest will have diverse places. But this does not follow: because the boundary of the container is not place insofar as it is this surface of this particular mobile body, but by reason of the order or position it has in the immobile whole. From which it is evident that the whole notion of place in all containers is taken from the first container and locator, namely, the heavens.

470. Then [328] he concludes form the foregoing the definition of place, namely,

that place is the immobile boundary of that which contains first. He says "first" to designate proper place and exclude common place.

471. Then [329] he shows that the definition is well assigned, because the things said about place concur with this definition. And he gives three such things: The first is that, since place is an immobile container, the middle of the heavens, i.e., the center, and the boundary of circular change of place, i.e., of the bodies moved in a circle, namely, the boundary as to us, i.e., te surface of the sphere of the moon, is (namely, the latter) seen as "up", and the other (namely, the middle) as "down".

Things absolutely in place, and things in place in a certain respect and this last named (the middle or center) is seen to be said most properly of all. For the center of a sphere is always at rest.

Now that which is the boundary in relation to us of the bodies moved in a circle [namely, the surface of the sphere of the moon], although it moves in a circle, nevertheless remains, insofar as it remains in the same way, i.e., at the same distance from us. Hence, since natural bodies are moved to their proper places, it follows that light bodies naturally move "up", and heavy bodies "down"—for both the middle (center) and the containing boundary in the direction of the middle are called "down"; and likewise the boundary in the other sense [the surface of the sphere of the moon], and what is in the direction of that boundary, are called "up". He uses this manner of speaking, because it is the center that is the place of the earth, which is simply heavy, while toward the center the place of water is found. In like manner, the place of fire, which is simply light, is the outermost, while the place of air is toward the outermost.

He gives the second [330], saying that because place is a boundary, place seems to be like a certain surface and like a containing vessel, but not like the space [or volume] of the containing vessel.

He gives the third [331] when he says that, because place is a boundary, the place and the thing in place are together; for the limits of the thing in place and the boundary of the container, which is place, are together (for the boundaries of things that touch are together). This also explains why place is equal to the thing in place: namely, because they are equated as to their boundaries.

Lecture 7

How something exists in place

472. After defining place, the Philosopher now shows how something exists in place. About this he does two things:

First he shows how something is absolutely in place and how not;

Secondly, how a thing not absolutely in place. is in place in a certain respect, at 482.

473. He concludes therefore first [332] from the foregoing that, since place is the boundary of the container, whenever a body has another body outside it and containing it, it is in place absolutely and *per se*; if such a body does not have an external body containing it, it is not in place at all. The only body in the universe that exemplifies this second case is the outermost sphere, whatever it may be. Hence, according to this definition, it follows that the outermost orb is not in place.

474. But this seems to be impossible, because the outermost sphere is in motion in place and nothing is moved in place unless it is in place. Now this difficulty does not arise for those who hold the opinion that space is place. For they are not forced to say that, in order to be in place, the outermost sphere must have a body containing it; rather, the space penetrating the entire universe and all its parts is the place of the entire universe and of each of its parts, according to these Philosophers.

But this position is impossible, for one must admit either that place is not distinct from the thing in place, or that space has dimensions existing *per se* but yet penetrating the dimensions of sensible bodies—both of which positions are impossible.

475. Wherefore Alexander said that the outermost orb is not in place at all: for it is not necessary for every body to be in place, since place is not in the definition of body. For this reason he held that the outermost sphere is not in motion in place, neither as a whole, nor as to its parts.

But since every motion must fit into one of the genera of motion, Avicenna, following him, said that the motion of the outermost sphere is not motion in place but motion in *situs* [position in place]. This is against Aristotle, who says in Book V (L. 4) that motion is present only in three genera, namely, quality, quantity, and "where."

Avicenna's position is untenable because it is impossible that motion strictly speaking be in a genus the notion of whose species consists in an indivisible. For the reason why there is not motion in the genus "substance" is that the nature of every species of substance consists in an indivisible, due to the fact that the species of substances do not admit of more or less; on this account, since motion is successive, a substantial form is not made existent by motion but by generation, which is the terminus of motion. The case is different with whiteness and like things, which can be participated according to more or less. But every species of *situs* has a nature that consists in an indivisible, so that if anything be added or taken away the original species does not remain. Hence it is impossible for motion to exist in the genus of *situs*.

Besides, the same difficulty remains. For *situs* taken as a predicament implies the order of parts in place; although if it be taken as a difference in the genus of quantity it implies merely an order of parts in a whole. Therefore, whatever is moved according to *situs*, must be moved according to place.

476. Others such as Avempace said that place should be assigned in one way to a body moving in a circle and in another way to a body moving in a straight line. For since a straight line is imperfect, since it can be added to, a body moving in a straight line requires a place externally containing it, but because a circular line is perfect within itself, a body moving in a circle does not require an external place to contain it, but merely a place about w1hich it may revolve; hence it is that circular motion is said to be motion about a center. So therefore they say that the convex surface of the sphere contained is the place of the first sphere. But this is against the common suppositions about place already laid down; namely, that place is a container, and that it is equal to the thing in place.

477. And therefore Averroes said that the outermost sphere is in place *per accidens*. To understand this, one should consider that everything which has fixity by means of something else, is said to be in place *per accidens*, due to the fact that that by means of which it is fixed is in place, as it evident in the case of a nail fixed in a ship and of a man at rest in a ship. Now it is clear that bodies moving rotationally are fixed because their center is immobile; hence the outermost sphere is said to be in place *per accidens*, insofar as the center about which it is revolving has existence in place, The fact that the lower spheres have a *per se* place in which they are contained is incidental and not essential to a body moving rotationally.

But against this it is objected that, if the outermost sphere is in place *per accidens*, then it is in motion in place *per accidens*, and so *per accidens* motion is prior to *per se* motion. To this the answer is given that for rotational motion it is not necessary for a body moving *per se* rotationally to be in place *per se*, although it is necessary for straight line motion.

But this seems to be against Aristotle's definition, given above, of what is in place *per accidens*. For he said that some things exist or are in motion place *per accidens*, because that in which they exist is in motion. But nothing is said to be in place *per accidens* because something entirely outside it is in place. Now since the center is completely extrinsic to the outermost sphere, it seems ridiculous to say that the outermost sphere is in place *per accidens* because the center is in place.

478. And therefore I favor more the opinion of Themistius, who said that the outermost sphere is in place by means of its parts.

To understand this it must be recalled that Aristotle said above that there would be no discussion about place except for the act of motion, which reveals the

existence of place from the fact that bodies succeed one another in the same place. Hence, although place is not of the essence of body, yet it is necessary for a body moved according to place. In the case of a body moving locally, the reason it is necessary to assign a place is because in that motion a succession of diverse bodies in the same place is considered. Therefore, in the case of bodies moving in a straight line it is clear that one body succeeds another in the same place according to their totality, for one whole body leaves one whole place which is then occupied by another whole body. Hence a body which is in motion in a straight line must be in place in its entirety.

But in the case of rotational motion, although the whole body comes to be in different places as distinguished by reason, nevertheless the whole body does not change its place as to subject: for the place remains ever the same as to subject; but varies only according to reason, as will be said in Book VI (L.2). Nevertheless the parts change place not only as to reason but as to subject also. Therefore in the case of rotational motion there is not a succession of whole bodies in the same place but of parts of the same body. Therefore a rotating body does not essentially require a place according to its totality but according to its parts.

479. But against this there seems to be the objection that the parts of a continuous body are neither in place nor moved in respect to place; rather, it is the whole that is both moved and in place. But it is clear that the outermost sphere is a continuous body; therefore, its parts are neither in place nor in motion in place. Consequently, it does not seem to be true that place should be attributed to the outermost sphere by reason of its parts.

The answer to this objection is that, although the parts of a continuous body are not actually in place, they are so potentially, insofar as the continuum is divisible. For a part, if it is separated, will be in the whole as in a place; hence, in this manner the parts of a continuum are moved in place. This is clearly evident in liquid continua which are easy to divide—for example, in the case of water, whose parts are found to be in motion within the whole water. Consequently, because something is said of a whole by reason of its parts, insofar as the parts of the outermost sphere are potentially in place the entire outermost sphere is in place *per accidens* by reason of its parts: and to be in place in that way is enough for rotational motion.

480. If a further objection is raised that what is in act is prior to what is in potency and that consequently it seems Improper that the first local motion be that of a body existing in place by means of its parts which are potentially in place, the reply is that this is most fitting to the first motion. For it is necessary that the descent from the one immobile being to the diversity which is found in mobile things be made step by step. Now the variation based on parts existing in place potentially, is less than that of wholes existing in place actually. Hence the first motion, which is rotational has less deformity and retains greater uniformity,

being closer to the immobile substances. Now it is much better to say that the outermost sphere is in place on account of its intrinsic parts, than an account of the center which is entirely extrinsic to its substance; and this is more in agreement with Aristotle's opinion, as is clear if one considers the passage following, in which Aristotle shows how the heavens are in place.

481. For in regard to this he does two things:

First he shows how the outermost sphere is in place;
Secondly, he draws-a conclusion from what has been said, at 485.

About the first he does three things:

First, he shows that the outermost sphere is in place through its parts;
Secondly, how its parts are in place, at no. 481,
Thirdly, how the parts make the whole to be in place, at no. 434.

482. Therefore, because he had said that if a body does not have something outside of it containing it, it is not in place *per se*, he concludes [333] that if a body of this kind, such as the outermost sphere is, be water (which will more easily illustrate what we are about to say on account of its easy divisibility), its parts will be in motion inasmuch as one part contains another, thus making it exist in place after a fashion. But the entire water will be in motion in one sense and in another sense not. For it will not be in motion in such a way that the entire water will change its place as though being transferred to another place distinct as to subject, but it will be moved rotationally—a motion that requires place for the parts and not for the whole. And it will be moved, not up and down, but circularly: for some things are moved up and down and change place in their entirety, namely, rare and dense bodies, or light and heavy things.

483. Then [334] he indicates how the parts of the outermost sphere exist in place, saying that, as was mentioned above, some things are actually in place, others potentially. Hence in the case of a continuum of similar parts the parts are in place potentially, as in the case of the outermost sphere; but when the parts are separated and merely contiguous, as occurs in a pile of stones, the parts are in place actually.

484. Then [335] he shows how from this it follows that the entire sphere is in place. And he says that some things are *per se* in place—as any body that is *per se* in motion in place, whether it be in respect to local motion or increase, as was said above (L.5). But the heavens, i.e., the outermost sphere, are not in place in this manner, as was said, since no body contains them; but inasmuch as they are moved rotationally, with part succeeding part, place is attributed to the parts potentially, as was said, inasmuch as one part-is "had," i.e., is consecutive, with respect to another.

Certain things, indeed, are in place *per accidens*, e.g., the soul, and all forms;

and in this manner the heavens, i.e., the outermost sphere, is in place insofar as all its parts are in place, since each of its parts is contained under another in the rotation of the sphere. For in a non-round body the outermost part remains uncontained and merely containing; but in a round body each part is both container and contained, potentially however. Hence it is by reason of all its parts that a found body is in place. And this Aristotle takes to *per accidens*, namely, what is true of the parts, as above when he said that the parts of a body are in motion *per accidens* in place.

485. Then [336] he draws a conclusion from the foregoing. For since he had said that a body in rotational motion need not be in place in its entirety but only *per accidens* by reason of its parts, he concludes that the outermost body is moved only rotationally, because the whole in question is not anywhere; what is somewhere is itself something, and has something outside of it by which it is contained; but there is nothing outside the whole. For this reason all things are said to be in the heavens as in the outermost container, because the heavens are probably the containing whole. He says "probably," because it has not yet been proved that there is nothing outside the heavens. It is not to be thought that the very body of the heavens is a place; rather, it is a certain final surface of it turned toward us which is as a boundary in contact with the mobile bodies existing in it. For this reason we say that earth is in water which is in air, which is in either, i. e., fire, which is in the heavens, which are not in anything else.

486. However, according to the intention of Aristotle, this passage must be plained differently. For the example of water which he first adduced is not to be referred, according to him, to the outermost sphere only, but to the entire universe, which indeed is moved insofar as its parts are moved—some rotationally, as are the heavenly bodies; some up and down, as are the lower bodies. As to what he said later on, that some things are actually in place and other potentially, this is not to be referred to what he said previously but is to be taken independently. For since he had said that some things are in place according to their parts and others according to their totality, he adds after that, that some things are in place according to act and others according to potency; finally, he says that some things are in place per se and others *per accidens*.

In this connection note that according to Aristotle "the heavens" are to be taken in two senses here: first, they are taken for the entire universe of bodies and especially of the heavenly; secondly, for the outermost sphere. He says therefore that those things are in place *per se* which are in motion according to place, whether they are in motion according to their totality or according to their parts, as are the heavens, i.e., the universe; in place *per accidens* are the soul and the heavens, i.e., the outermost sphere. For it is necessary to say that all the parts of the universe are somehow in place: the outermost sphere *per accidens* and other bodies *per se*, inasmuch as they are contained by a body outside of them. And he

manifesto this up to the end.

Lecture 8

The definition of place is used to solve the original problems; the properties of place are justified.

487. After explaining what place is, the Philosopher now uses his definition to resolve the doubts that were raised about place (L.2). Now there were mentioned above six reasons to show that place does not exist. Of these he bypasses two: the one in which it was asked whether place be an element or a composite of elements; the other in which it was shown that place cannot be reduced to any genus of cause. He bypasses them because no one who posited place took it either as an element or as a cause of things. Hence he makes mention only of the four remaining.

488. One of these was that, since place never lacks a body, and a body never lacks a place, it seemed to follow that if the body grew, the place would grow.

Now this would follow if it were supposed that place were a space co-extensive with the dimensions of the body, so that, as the body increased, so would the space. But this does not follow from the aforesaid definition of place, namely, that it is the boundary of the container.

469. Another argument was that, if the place of a body be distinct from the body, then the place of a point would be distinct from the point; wherefore, it did not seem possible for place to be distinct from the body, since the place of a point is not distinct from the point. But this argument was based on the imagining of those who opined, that place, is the space coextensive with the volume of the body, so that a dimension of space would correspond to a dimension of the body and in like manner to each point of the body, This, however, need not be said if we suppose that place is the boundary of the container.

490. Another argument was that, if place is anything, it must be a body, since it has three dimensions. Consequently, there would be two bodies in the same place. But according to those who agree that place is the boundary of the containing body it is not necessary to say that two bodies would be in the same place, or that there is some bodily space intervening between the boundaries of the containing body, but that there is some body there.

491. Likewise another argument was that, if everything that exists is in place, it will follow that even a place is in place. This argument is easy to answer, if we suppose that place is the boundary of the container, For according to this it is clear that place is in something; namely, in the containing body, but it is there, not as in a place, but as a boundary in a finite thing, just as a point is in a line and a surface in a body. For it is not required that everything that is, be in

something as in a place; this is required only of a mobile body, for it is motion that led to distinguishing between the thing in place and the place itself.

492. Then [338] he uses his definition to give a reason for the properties of place.

> First, as to the fact that a body is naturally borne to its proper place; Secondly, as to the fact that a body naturally rests in its own place, at no. 493.

He says first therefore, that if place be taken to the boundary of the container, the reason why each body is naturally borne to its own place can be given: it is because the containing body (which is next to the contained and located body, and which is touched by it so that the boundaries of both are together not by compulsion) is akin to it in nature. For the order of *situs* in the parts of the universe follows upon the order of nature. For the heavenly body, which is supreme, is the most noble; after it, among the other bodies the noblest in nature is fire, and so on down to earth. Hence it is clear that the lower body which is situated according to position, next to the higher body, is akin to it in the order of nature. And therefore he adds, "not by compulsion," in order to point out the natural order of *situs* to which the order of nature corresponds and to exclude a compulsive order of *situs*, as when by compulsion a body of earth is above air or water. Two such bodies next to one another in the natural order of *situs* and which, in the natural order of natures, are disposed to be together, do not affect each other; i.e., when they are made continuous to each other and become one—and for this they have an aptitude on account of the similarity of their natures—then they do not interact. But when distinct things are in contact, their mutually interact on account of the contrariety of their active and passive qualities. Therefore it is the kinship of nature existing between the container and the thing contained that explains why a body is naturally moved to its own place: because the rank in natural places must correspond to the rank in natures, as was said. But such a reason cannot be assigned if place is taken to be space: because in the separated dimensions of space no order of nature can be considered.

493. Then [330] he gives the reason why bodies naturally rest in their own place. And he says that this happens reasonably, if we grant that place is the boundary of the containing body: because according to this the contained body is related to the containing body after the manner of a part to a whole—a separated part, however. This is abundantly clear in bodies that are easy to divide, such as air or water: for their parts can be moved by something in the whole just as a thing in place is moved in a place. And this also is not only true according to the figure of containing one under the other, but even according to the properties of their nature. For air is related to water as the whole, because water is like matter and air like the form: water is as the matter of air, and air is as the form of water. This is so because water is in potency to air absolutely.

Now while it is true that in some other ways air is in potency to water, as will be explained later in *De Generatione*, it is necessary for the present to accept this in order that we may explain our proposition. Here it is not declared as a certainty, but in the *De Generatione* it will be proved with greater certainty. For it will be said there that, when air is generated from water, it is corruption *secundum quid* and generation simply, because a more perfect form is being introduced and a less perfect one is being put off. But when water is generated from air, it is corruption simply and generation *secundum quid*, because. a more perfect form is being put off and an imperfect one being introduced. Consequently, water is in potency to air absolutely as the imperfect to the perfect; but air is in potency in water as the perfect to the imperfect. Hence air is as the form, and as the whole which is like the form; water, however, is as the matter and as a part, which pertains to the notion of matter. Therefore, although the same thing is both matter and act, because the water contains both in itself; yet properly speaking, the latter, i.e., the water, is in potency as an imperfect thing, but the former, i.e., the air, in act as a perfect. Hence water will be related to air somewhat as part to whole. And therefore these things, the air and the water, when they are distinct things, they are in contact; but when they form a unity, by one passing into the nature of the other, then coupling, i.e., continuity occurs. Therefore, just as the part naturally is at rest in the whole, so also a body naturally rests in its natural place.

Note, however, that the Philosopher is speaking here of bodies according to the substantial forms which they have under the influence of the heavenly body which is the first place, and which gives to all other bodies the power to act as places. But if we consider active and passive qualities, there is contrariety among the elements and one tends to destroy another.

Finally he concludes in summary that it has been stated that place exists and what place is.

Lecture 9

The void—reasons for and against

494. Having discussed place, the Philosopher now begins to treat of the void. Concerning it he does two things:

> First he manifests his intention:
> Secondly, he executes it, at no. 497.

As to the first, he does too things:

> First he shows that it is proper for the natural philosopher to deal with the void;

Secondly, he shows what order should be followed in determining the matter of the void, at no. 495.

He says therefore, first [346] that it is the task of the natural philosopher to determine about the void just as it was his task to determine about place: whether it exists, what it is. For the same reasons have led to belief or disbelief in the existence both of place and of the void. For those who posit a void think of it as a place and vessel, which vessel or place seems to be full when it has within it the mass of some body; but when it does not it is said to be a void. It is as though the same thing as to subject is place and void and full, any differing among them being only in the mind.

495. Then [341] he shows what order must be followed in determining about the void. And he says that we must begin by giving the reasons of those who claim that the void exists; then the opinions of those who claim it does not exist; and then the general opinions about the void; namely, what belongs to the notion of the void.

496. Then [342] he begins to follow this program:

First sets down preliminary notions that are necessary for discovering the truth about the void;

Secondly, he begins to search for the truth, at no. 520 (L.11).

About the first he does two things:

First he gives the reasons of those who posit or deny the existence of the void;

Secondly, the common opinion about the void, showing what is included in its notion, at no. 506 (L. 10).

As to the first he does two things:

First he gives the reason of those who deny the existence of the void;
Secondly, the reasons of those who affirm it, at no. 499.

497. He says first therefore [342] that some of the earlier philosophers desirous of demonstrating that the void does not exist erred by not arguing against the reasons given for the existence of the void. For they did not show that the void does not exist, but gave their reasons to show that something full of air is not a void, as is evident from Anaxagoras and others who reasoned like him. In order to destroy the void they wanted to demonstrate that air is something, and thus, since te void is that in which nothing exists, it followed that something full of air is not a void.

In debating with their adversaries, they showed that air is something by means of wine skins which, when inflated, could support a weight, and which would not happen unless air were something. This also showed that air has strength. Also

they showed it by taking the air in *clepsydras*, i.e., in vessels that absorb water; in these vessels water is drawn in by drawing in air, or water is prevented from entering, unless the air be withdrawn.

It is clear therefore that they are not objecting against those who posit a void, because all such claim it is empty space in which no sensible body exists, for they assume that whatever exists is body perceptible to sense, and thus, where no sensible body exists, they believe nothing exists. Hence, since air is a body scarcely perceptible to sense, they thought that where there was nothing but air the void existed.

498. Therefore, to destroy their position it is not enough to show that air is something, but also one must show that there is no space without a sensible body. Space was supposed to be a void in two ways: first, as something separated from bodies, as though we were to say that the space within the confines of a house is a void; secondly, as something existing In act between bodies, preventing them from being continuous, as Democritus and Leucippus and many of the other natural philosophers held. For they imagined that if the totality of being were continuous, all things would be one: for there would be no more reason for distinguishing bodies at one point rather than another.. Hence between all distinct bodies they posited intervals of empty sapce in whie~i no being existed. And since Democritus posited that bodies are composed of many indivisible bodies, he posited between those indivisibles certain empty places which he called "pores".- in this way he explained that all bodies are composed of the full and of the empty. Or if the entire body of the world are continuous and no such empty place existed between the parts of the universe, they yet posited a void existing outside the universe.

It is evident therefore that the aforementioned philosophers who tried to reject the void did not answer the problem as laid down by others. For they should have shown that the void does not exist in any of those ways.

499. Then [343] he sets forth the reasons of those who posited a void.

First, those who spoke of the void naturally;
Secondly, of those who spoke of it non-naturally, at no. 505.

As to the first he does two things:

First he mentions the reason given by those who held that the void is a space separated from bodies;
Secondly, by those who held for a void in bodies, at no. 502.

Concerning the first he does two things:

First he gives the reason of those who posited a void;
Secondly, how Melissus used that reason conversely, at no. 501.

500. He says therefore first [343] that those who affirmed the existence of the void gave more opposite reasons. One of which was that motion is respect of place, i.e., change of place and increase, as was said above, would not exist if there were no void. They showed this in the following manner: If something is in motion according to place, it cannot be moved into what is full because a place filled with one body cannot receive another. For, if it received it there would then be two bodies in the same place—and the same would follow for any [additional] body: for there is no reason why many bodies could not be in the same place if two could. And if that were to happen, i.e., that any number of bodies were in the same place, it would follow that the smallest place could receive the largest body—because many small things form one large thing. Hence, if any small equal bodies could exist in the same place, then also many could. And so, having proved this conditional position that there is motion, there is a void, they argue (by positing the antecedent): "But there is motion; therefore, there is a void."

501. Then [344] he shows how Melissus, supposing the same conditional, argued in a contrary manner from the denial of the consequent, and reasoned thus: if motion exists, there is a void; but there is no void; therefore motion does not exist. Consequently, the totality of being is immobile.

Thus the foregoing is one way in which some proved that the void exists after the fashion of something separate.

502. Then [345] he lists three reasons given by those who held that the void exists in bodies. The first of these is based on things that condense. For in the case of things that can be compressed it seems that the parts come together and fit in together and press down and compress each other so that, as is held, casks will hold as much wine with the wine skins as without, especially if the wine skins are thin, because in the wine skins the wine seems to become condensed. This condensation they believed to take place as though in the condensed body the parts entered into certain empty spaces.

503. The second reason he gives [346] is based on increase: For a body grows on account of food, which is a body. But two bodies cannot exist in the same place. Therefore there must be, in the body which has grown, certain voids in which the food may be received. Consequently, there must be a void in order that food be taken in,

504. The third reason [347] is based on a vessel full of ashes being able to absorb as much water as the empty vessel. This would not be the case unless there were empty spaces between the parts of the ashes.

505. Then [348] he gives the opinions of the non-natural philosophers about the void. And he says that the Pythagoreans also posited a void which entered into the parts of the universe from the heavens, on account of the infinite void which they supposed existed outside the heavens—a void like some infinite air or

infinite spirit [i.e. breath]: just as a person who breathes divides by means of his breath certain things that are easy to divide, such as water or similar things, so it was that the things of this world became distinct by some being as though through breathing. They did not understand this to except through a void, as was mentioned in regard to Democritus—as though the void were nothing other than the distinction between things. And because the first distinction and plurality is found in numbers, therefore they first of all posited a void in numbers, so that it is through the nature of the void that one unit would be distinct from another—so that number would not be continuous but would have a discrete nature. But because they spoke of the void in a quasi-equivocal manner, calling the distinction of things "a void" Aristotle does not discuss this opinion below.

Finally, in summary, he concludes that we have given the reasons why some posit a void and why some do not.

Lecture 10

The meaning of "void"—refutation of those positing the void

506. The Philosopher had said above that we I must start with three things. So now, having finished two of them, by giving, namely, the opinions of both of those who posited and of those who rejected the void, he now enters upon the third, by showing, namely, the general notions people have about the void.

Concerning this he does three things:

First he shows what is meant by the word "void";
Secondly, how some thought that the void exists, at no. 513;
Thirdly, he rejects the reasons given by those who posit that a void exists, at no. 515.

As to the first he does two things:

First he reveals his intention;
Secondly, he executes it, at no. 509.

507. He says first, therefore [349], that since it was pointed out that some people affirmed a void and others denied it, in order to get at the truth we must begin by the meaning of the word "void." For just as, when there is question about some property existing in a subject, we must begin by agreeing what the thing is, so when there is question about the existence of something, we must begin by taking as the middle form the meaning of the word. For the question of what something is comes after the question of whether it exists.

508. Then [350] he shows that it meant by the word "void".

First he gives the more common meaning;

Secondly, what the Platonists took it to mean at no. 512.

As to the first he does three things:

First he shows what the word "void" means;
Secondly, what should be added to that meaning at no. 510;
Thirdly, he clears up a doubt, at no. 511.

509. He says therefore that according to common opinion, the void seems to signify nothing more than a place In which there is nothing. The reason for this is because properly that is said to be a void in which there is not any body, and since only a body can be in place, void seems to mean nothing more than a place without any thing in it. But because people suppose that every being is a body, it follows that according to their opinion where there is not body, there is nothing.

And further they believe that every body is tangible, i.e., that it has tactile qualities. And a body of this kind is heavy or light: for in their time it was not yet known that a heavenly body is different in nature from any of the four elements. Hence since it is the very nature of the void to be a place in which there is not a body, it follows that the void is that in which there is neither a light nor a heavy body. However, this is not to say that it belongs to the notion of the void according to the primary meaning of the word, but rather by reason of a certain syllogistic deduction that starts with the general opinion of people that every body is either heavy or light; just as the common opinion of people that every being is a body, leads to the conclusion that the void is that in which there is nothing.

Consequently, the meaning of this word "void" is three-fold: one is proper, namely, that the void is that in which there is not any body; the others come from the general opinion of people: the first is more common, namely, that the void is a place in which nothing exists; the second is more restricted, namely, that the void is a place in which there is neither a heavy nor a light body.

510. Then [351] he shows that must be added to this meaning. For he says that it is not correct to say that a point is a void, even though in a point there is no tangible body. So we must add that the void to a place in which there is not a tangible body, but which has in it space to receive a tangible body, just as a blind person is said to be one who lacks sight but to apt to have it. And so he concludes that in one way the void is called a space which is not full of a body that is sensible by touch, i.e., a body that is heavy or light.

511. Then [352] he clears up the following difficulty; If there is color or sound in a certain space, should it be called a void or not? This question arises because the definition first given says that the void is that in which there is nothing. And he answers by saying that if the space in which there is just sound or color has room for a tangible body, it is a void; if not, not. The reason is that the proper

definition of the void is not "that in which there is nothing," and such a definition is held only by people who believe that where no body is, nothing is.

512. Then [353] he gives the meaning of "void" as used by the Platonists. And he says that there is another meaning of the void: that in which there is no "this something" or any corporeal substance. Now a "this something" comes about on account of the form. Hence some claim that the matter of a body, insofar as it is apart from its form, is the void. These are the same who claim that matter is place, as was stated above (L.3). But this is poor judgment, for matter is not separable from the things of which it is the matter; whereas men inquire about place and the void as being separable from bodies in place.

513. Then [354] he tells how some posited existence of a void;

> First, what they said the void was;
> Secondly, why they posited it, at no. 514.

He says therefore first that since the void is a place without a body in it, and since we have already decided how place exists and how it does not (for we have said that place is not a space but the boundary of a container), it is clear that the void is neither a space separated from bodies nor intrinsic to them as Democritus supposed. This is so because those who suppose that space exists in either of those two ways, intend the void to be not a body, but the space of a body. For they thought that the void was something because place was something, and just as place seems to be space, so also the void. But if place is not a space outside of bodies, neither can the void be a space outside of bodies. And since it is the very nature of the void to be a bodily space existing outside of bodies, as was said above, it follows that the void does not exist.

514. Then [355] he shows why they posited a void. And he says that they admitted the existence of the void for the same reason that they admitted place, namely, on account of motion, as we said above: for it comes about that local motion is saved, both for those who assert that place is something over and above the bodies which are in place and for those who claim that the void exists. But for those who deny place and the void, there cannot be local motion. Consequently, some believed that the void is a cause of motion in the way that place is, i.e., as that in which motion takes place.

515. Then [356] he rejects the arguments of those who posit existence of the void. He does not, however, intend here to give a true solution to the aforesaid arguments, but to bring an objection which at a glance shows that their arguments do not conclude with necessity.

> First therefore he rejects the reasons given by those who posit a separated void;
> Secondly, the arguments of those who posit a void existing in bodies, at no.

517.

516. He rejects the first reason in two ways: First, because even though motion exists, it does not necessarily follow that the void exists. And if we speak generally of any species of motion, it is clear that the void is not necessary at all. For nothing prevents the full from being altered [i.e., having motion in quality], since only local motion seems to be excluded if the void is not posited. Yet Melissus did not see this, for he believed that if there were no void, no motion of any kind could exist.

Secondly, he rejects the same reason on the ground that not even local motion is destroyed, if there is no void. For, assuming that there is no separable space over and above moving bodies, local motion can take place, if bodies make room for one another by contracting: thus they would be moving into the full rather than into the empty. This is evident in the generations of continuous bodies, especially in liquids, such as water. For if a stone is thrown into a large surface of water, circles appear around the place of entry as long as one part of the moving water agitates another part and enters it. Hence, because a small portion of water by a process of diffusion enters a larger section, the circles grow from small to large until they cease entirely.

517. Then [357] he rejects the reasons given by those who posit a void in bodies. And first of all the reason based an condensation. And he says that bodies happen to become condensed, and parts of a body mutually penetrate, not because the invading part is entering an empty place but because there were certain openings, full of a more subtle body which escapes under condensation, just when water is compressed and contracted, the air that was present is expelled. This takes place manifestly in a sponge and other like porous bodies. Therefore this solution does not give the reason for condensation (he will give this later [L.14]: but it does show that also in this way, the need of a void can be clearly eliminated.

518. Secondly [358] he rejects the argument based on growth. And he says that growth occurs not only by the addition of some body invading the growing body so as to make the void necessary but also by alteration, as, when air comes to be from water, the quantity of air becomes greater than the quantity of water. This too is not the true solution of their argument but merely an objection showing that it is not necessary to posit a void. The true solution is given in the book "*De Generatione*, where it is shown that food does not pass into that which grows as to be a body distinct from it; rather it is converted into its substance, as wood added to fire is converted into fire.

519. Thirdly [351] he rejects together both the argument about increase [in growth] and that about water poured on ashes and says that each of these arguments blocks the other. This is evident as follows. For there is in respect to

increase this difficulty: it seems either that the whole body is not being increased, or that increase does not come about by the addition of body but by the addition of something incorporeal, or that two bodies can be in the same place. Now it is this difficulty, which seems to be against both these who posit a void and against those who do not, that they wish to solve. But they do not show that the void exists, or, if increase is due to the void, then they would have to say that the whole body is a void, since the whole body is increased.

Likewise, in regard to the ashes: for if a vessel full of ashes can take as much water as the empty vessel, then one has to say that the whole container must be a void. Therefore this is not due to empty space but to being mixed in with the water. For when water is mixed with ashes it condenses and part of it evaporates; moreover, parts of the ash are condensed on account of the moisture, and a sign of this is that not as much water can be recovered as was put in.

Finally, he concludes that it is clearly easy to solve the arguments by which they prove the existence of a void.

Lecture 11

From motion there is shown to be no separated void

520. Having gone over others′ opinions about the void and having indicated what is meant by the word "void," he now begins to search for the truth.

> First, he shows that the void does not have a separate existence;
> Secondly, that there is no void in bodies at no. 544 (L.14).

Concerning the first he does two things:

> First he used motion to show that a separate void does not exist;
> Secondly, by considering the void in itself, at no. 541.

As to the first he does two things:

> First, from the fact of motion he shows there is no void;
> Secondly from the fact of faster and slower motions, at no.527 (L.12).

521. In regard to the first point he gives six reasons. In regard to the first of which he says [360] that we must repeat that there is no separated void as some assert. He says "repeat," because this was already somewhat proved from the notion of place: for if place is not space, it follows that the void is nothing, as was said above. But now he proves the same point again from motion: for void was posited, as we said, on account of motion. But motion does not necessarily require a void. For it would seem especially to be the cause of local motion. But it is not necessary to posit a void in order to explain local motion, because all

simple bodies have natural local motions, as the natural motion of fire is upward and that of earth downward toward the center. Thus it is clear that it is the nature of each body that causes its local motion and not the void. The latter would be the cause if any natural bodies were moved due to the necessity of a void. But if it is not set down as the cause of local motion, it cannot be considered the cause of any other motion or of any other thing. The void therefore would exist without a purpose.

522. He then gives the second reason [361]. If a void be postulated, no reason can be assigned for natural motion and rest. For it is clear that a natural body is moved toward its own natural place and rests there naturally on account of the kinship it has with its place and because it has no kinship to the place from which it departs. But the void has no nature by which it could be akin or hostile to a natural body. Therefore, it there were a void, considered as a certain place without a body in it, one could not assign any part to which the body would be naturally moved. For we cannot say that it would be borne to just any part, because observation shows that this is wrong, for a body naturally goes from one place and naturally approaches another.

This same reason is valid against those who posit place as a separate space into which a mobile body is borne. For it would be impossible to explain how a body in such a place could either be moved or be at rest: for the dimensions of space have no nature to which a natural body could be similar or dissimilar. Deservedly, then, the same argument applies to the void as to "up" and "down," i.e., to place, whose parts are "up" and "down"; for those who posit a void call it place.

Moreover, not only are those who posit a void and those who posit place to be space unable to explain how something is moved and at rest In respect to place, but also how something exists in place or in the void. For if place is supposed to be space, then the whole body would have to be enclosed inside that space, and not as happens with those who agree that place is the boundary of the containing body and that a thing is in place as in something separate and as in a body that contains and sustains it. Indeed, it seems to be of the very nature of place that something be in place as in something separated and existing apart from it: for if any part of a body is not laid down as separated from the body, it will exist in that body not as in a place but as in the whole. Therefore, it pertains to the very nature of place and of the thing in place that one be separated from the other. But this does not happen if place is space into whose entirety the entice body is immersed. Therefore space is not place. And if space is not place it is clear that no void is place.

523. He gives the third reason [362] saying that, whereas the early philosophers claimed that the void had to be, if motion existed, the very opposite is the case: for if there were a void there would be no motion. And this he proves by a simile. For some have said that earth comes to rest at the center on account of the

likeness of the parts on the whole circumference: consequently, earth, having no reason to be moved toward one part of the circumference more than another, rests. The same reason would cause rest in a void. For there would be no reason for earth to be moved to one part rather than to another, since the void, as such, does not have differences among its parts—for non-being does not possess differences.

524. He gives the fourth reason [363]as follows. Natural motion is prior to compulsory since compulsory motion is only a departure from natural motion. Therefore, remove natural motion and all other motion is removed; for when the prior is removed, all that follows is removed. But if the void is posited, natural motion is removed; because the differences among the parts of place would be taken away and it is toward such parts that natural motions tend The same holds if the infinite be posited, as we said above.

There is, however, this difference between the void and the infinite, that after granting the infinite there is no way of positing "up" or "down" or "center," as we pointed out in Book III; but after granting a void, these places could be posited, but it would not be because they were mutually different: for no difference can be assigned in the realm of nothing and non-being and, consequently, of the void, which is a non-being and a privation. Yet natural changes of place do require difference of place, because diverse bodies are moved to diverse places. Consequently, natural places must be different one from the other. Therefore, if a void be posited, nothing could undergo a natural change of place; and if there is no natural change of place, there will be no change of place of any sort. Hence, if there is any change of place, there can be no void.

525. The fifth reason is then given [364]. in regard to this it should be considered that some question exists about projectiles: for the mover and the thing moved must be always together, as will be proved below in Book VII (1-3). Yet a projectile is found to be in motion even after it is separated from the projector, as is evident in the case of a stone that is thrown, or of an arrow shot from a bow. Now on the supposition that there is no void this difficulty is solved by attending to the air with which the medium [the field of trajectory] is filled. And it is solved in two ways. For some assert that projectiles remain in motion even after they are no longer contact with what gave them impulse on account of *antiperistasis*, i. e., repercussion or counter-resistence: for the air that has been pushed, pushes against other air, and that against other air, and so on, and it is on account of this impact of air against air that the stone is moved.

The other explanation is that the continuum of air that received the impact from the projector pushes the impelled body with more speed than the speed of the motion by which the projectile is naturally borne to its proper place. Hence the speed of the air movement prevents the projectile, for example, the stone, or some other such, from falling downward; but it is carried along by the impulse of

the air.

Now neither of these explanations could be alleged if there were a void; consequently, a projectile could be moved only as long as it was carried, for example, in the hand of the one casting it: but as soon as it was released from the hand it would fall. But it is the opposite that happens. Therefore, there is not a void.

526. He then gives the sixth reason [365]. If motion were in a void, no one could give a reason why the moving object should stop anywhere. For there is no reason why it should stop at one part of the void rather than another. This is true both in the case of objects that are moved naturally, because there is no difference among the parts of the void, as we have said, and in the case of objects moved by a compulsory motion. For now we say that a violent compulsory motion ceases when repercussions or impulsions of the air are lacking, on account of the two reasons already given. Therefore it will have to be admitted either that every body is at rest and nothing in motion or that, if anything be in motion, it will remain In motion to infinity unless it runs into a more powerful body that could impede its compulsory motion.

In support of this reasoning, he gives the reason why some posit motion in the void. It is because the void yields to and does not resist the mobile; hence since the void yields in the same way, in all directions, a mobile thing should be moved in all directions *ad infinitum*.

Lecture 12

From the fastness and slowness of motion, a separated void is disproved

527. Here the Philosopher, arguing from the fast and slow in motion, shows that the void does not exist.

About this he does two things:

First he assigns the causes of fastness and slowness in motion;
Secondly, he uses these reasons to argue to his point, at no. 529.

He says therefore first that one and the same heavy body, and any other thing, for example, a stone or something of this sort, is in faster motion for two reasons: either on account of the medium in which it is being moved, e.g., air or earth or water; or on account of differences in the object, namely, that it is heavier or lighter, all other things being equal.

528. Then [367] he argues to his point from the aforesaid causes.

First from the differences of the medium;
Secondly, from the differences in the mobile object, at no. 539,

As to the first he does two things:

First he gives an argument;
Secondly, he recapitulates, at no. 533.

Concerning the first he does two things:

First he gives his argument;
Secondly, he shows that the conclusion follows from the premises, at no. 532.

529. Therefore, he first gives this argument: The ratio of motion to motion in regard to speed is equal to the ration of medium to medium in respect of subtlety. But there is no ratio between empty space and full space. Therefore, motion in a void has no ratio to motion in the full.

First of all he explains the first proposition of this argument. And he says that the medium through which a body is in motion is the cause of its fastness or slowness because it acts as an obstacle to the body in motion. The greatest obstacle occurs when the medium is in a contrary motion, as is evident in the case of a ship whose movement is impeded by the wind. The medium is an obstacle in a secondary way even if it is not in motion, because if it were in motion with the object it would not be an obstacle but a help, as the water which carries a ship downstream. But among obstacles a greater impediment is offered by things that are not easy to divide, such as the grosser bodies. He explains this by an example. Let the body in motion be A, and let the space through which it is being moved be B, and the time in which A is being moved through B be C. Let us posit another space, D, of the same length as B, but let D be full of a subtler body than the one in B, so that a certain analogy, i.e., ratio, exists between the bodies which impede the motion (for example, let B be full of water and D full of air). Now to the extent that air is subtler than water and less condensed, to that extent will the mobile A be more quickly moved through D than through B. Therefore the ratio of the velocities will equal the ratio of the subtlety of air to the subtlety of water. And the greater the velocity, the less the time: because that motion is faster which covers the same interval in less time, as will be shown in Book VI (L.3). Hence if air is twice as subtle as water, the time it takes A to be moved through B (full of′ water) will be twice the time for A to pass through D (full of air). Consequently, the time C in which it travels the distance B will be twice the time it takes E to pass through D. Therefore, we can take it as a general rule that in whatever ratio the medium (in which something is in motion) is subtler and less resistant and more easily divisible, in that ratio will the motion be faster.

530. Then [368] he explains the second proposition, and says that the void is not exceeded by the full according to some certain ratio. And he proves this by the

fact that a number does not exceed nothing [zero] by any ratio, for ratios can exist only between one number and another, or between a number and unity; as four exceeds three by one, and exceeds two by more yet, and one by still more. Hence there is said to be a greater ratio existing between four and one, than between four and two, or four and three. But four does not exceed nothing according to any ratio.

This is so because anything exceeding is necessarily divided into that which is exceeded and into the excess, i.e., that in which it exceeds; for example, four can be divided into three, and into one, which latter is the amount by which four exceeds 3. But if four exceeds nothing, it will follow that four can be divided into so much and nothing; which is unacceptable. For a same reason one could not say that a line exceeds a point unless it were composed of points and divided into points. In like manner, it cannot be said that the void has any ratio to the full; because the void is not a part of the full.

531. Then [369] he concludes that there can be no ratio between a motion in the void and a motion in the full: but that if any body is in motion in the subtlest of mediums over such and such a distance for such and such a time, the motion in the void will exceed any given ratio.

532. Then [370], because he had deduced the above conclusion in direct line from the assumed principles, he now, lest any doubt arise about those principles, and to make the process more certain, proves the same conclusion by deducing to the impossible.

For if it be claimed that the speed of a motion taking place in the void has a ratio to the speed of a motion taking place in the full, then let the empty space be Z, which shall be equal in magnitude to the space B, full of water, and to the space D, full of air.

Now if it is supposed that a motion through Z has a certain ratio in respect of speed to the motions through B and D, then it must be admitted that the motion through Z (the void) takes place in some definite portion of time, because velocities are distinguished according to the quantities of the times consumed, as was said above. If therefore we say the object A passes through the empty space Z in a definite time, let that time be I, which must be less than the time E required for A to pass through D, which is full of air. Then the ratio of the motion through the empty to the motion through the full will equal the ratio of time E to time I. But during time I, the mobile A will pass through a definite space that is full of a subtler body than exists in D, i.e., than D. And this will happen, if one can find a body which differs in subtlety from air (of which D is full) in the ratio that the time E has to the time I. For example, say the space Z, which had been originally empty space, ir now full of fire. If the body of which Z is full is subtler than the body of which D is full, in the amount that the time E exceeds the time

I, it will follow that the mobile A, if it is in motion through Z (which is the space now full of a most subtle body), and through D (which is the space full of air), it will pass through Z conversely at a greater speed in a time I. If therefore no body exists in Z but it is again considered to be empty space, as previously, it will have to move even faster. But this is against what was laid down, namely, that the motion through Z (empty space) required time I. Consequently, since in time I it passes over the same space when it is full of the most subtle of bodies, it follows that during the same time the same mobile passes through one and the same space, when that space is empty and when it is full.

It is clear therefore that if it took a definite time for the mobile to pass through an empty space, the impossibility follows that in equal time it will pass through full and empty space, because there will be some body having the same ratio to some other body as one time has to another time.

533. Then [371] he summarized that in which the force of the previous reasoning consists. And he says that we can now say in recapitulation that the reason why the conflict mentioned in the above occurs is clear: it is because every motion has a ratio to every other motion in respect to speed. For every motion requires time, and any two periods of time, if they are finite, have a ratio one to the other. But there is no ratio between the empty and the full, as we proved. Hence the supposition that motion occurs in the void leads to the conflict mentioned.

In a final summary [372] he concludes that the above mentioned conflicts occur if the different species of motion are taken according to differences of the media.

534. But several difficulties arise against this reasoning of Aristotle. The first is that it does not seem to follow that if motion takes place in the void that it has no ratio to motion in the full. For every motion has its definite velocity from the ratio of the motive energy to the mobile, even if no obstacle exists. And this is evident both from an example and from reason. From an example, indeed, in the heavenly bodies, whose motion encounters no obstacle and yet they have a definite velocity depending on the amount of time. From reason also: for, since it is possible to point out a "before" and "after" in the magnitude through which the motion takes place, so also one can take a "before" and "after" in the motion from which it follows that motion is in a determined time. But it is true that this velocity can be diminished on account of an obstacle. Yet it is not necessary therefore to make the ratio of motion to motion in respect of velocity be as the ratio of obstacle to obstacle, so as to make the motion occur in no time, if there be no obstacle; rather, the ratio of one slowing up to another slowing up must correspond to the ratio of obstacle to obstacle.

Hence on the assumption that motion takes place in the void, it follows that no slowing up happens to the natural speed, but it does not follow that a motion in the void will have no ratio to motion in the full.

535. Averroes attempts to counter this objection in his commentary. First he tries to show that this objection proceeds from false imagination. For he says that those who make the above objection imagine that an addition in slowness of motion occurs just like an addition in the magnitude of a line, where the added part is distinct from the part to which the addition is made. For the above objection seems to proceed as though slowing up takes place by adding one motion to another motion in such a way that if you were to subtract the motion that was added through the obstacle which slows, the quantity of natural motion would then be left. But this is not the case, because when a motion is slowed up, each part of the motion becomes slower, whereas each part of a line does not become larger.

Then he attempts to show how Aristotle's argument concludes with necessity. And he says that the speed or slowness of a motion does indeed arise from the proportion of the mover to the mobile; but the mobile must in some manner resist the mover, as the patient is in a certain way contrary to the agent. This resistance can arise from three sources: First, from the *situs* of the mobile; for from the very fact that the mover intends to transfer the mobile to some certain place, the mobile, existing in some other place, resists the intention of the mover. Secondly, from the nature of the mobile, as is evident in compulsory motions, as when a heavy object is thrown upwards. Thirdly, from the medium. All three are taken together as one resistance, to constitute one cause of slowing up in the motion. Therefore when the mobile, considered in isolation as different from the mover, is a being in act, the resistance of the mobile to the mover can be traced either to the mobile only, as happens in the heavenly bodies, or to the mobile and medium together, as happens in the case of animate bodies on this earth. But in heavy and light objects, if you take away what the mobile receives from the mover, viz., the form which is the principle of motion given by the generator, i.e., by the mover, nothing remains but the matter which can offer no resistance to the mover. Hence in light and heavy objects the only source of resistance is the medium. Consequently, in heavenly bodies differences in velocity arise only on account of the ratio between mover and mobile; in animate bodies from the proportion of the mover to the mobile and to the resisting medium—both together. And it is in these latter cases that the given objection would have effect, viz., that if you remove the slowing up caused by the impeding medium, there still remains a definite amount of time in the motion, according to the proportion of the mover to the mobile. But in heavy and light bodies, there can be no slowing up of speed, except what the resistance of the medium causes—and in such cases Aristotle's argument applies.

536. But all this seems quite frivolous. First, because, although the quantity of slowing up is not parallel to the mode of continuous quantity, so that motion is added to motion, but parallel to the mode of intensive quantity, as when something is whiter than something else, yet the quantity of time from which

Aristotle argues is parallel to the manner of continuous quantity—and time becomes greater by the addition of time to time. Hence if you subtract the time which was added on account of the obstacle, the time of the natural velocity remains.

Then, because if you remove the form which the generator gives to light and heavy bodies there still remains in the understanding "quantified body," which from the very fact that it is a quantified body existing in an opposite *situs* offers resistance to the mover. For we cannot suppose in heavenly bodies any other resistance to their movers. Hence, as he [Averroes] presents the case, even in the case of heavy and light bodies the reasoning of Aristotle would not follow.

Therefore it is better and briefer to say that the argument brought forward by Aristotle is an argument aimed at contradicting his opponent's position and not a demonstrative argument in the absolute sense. For those who posited a void did so in order that motion be not prevented. Thus, according to them, the cause of motion was on the part of a medium which did not impede motion. And therefore Aristotle argued against them as though the total cause of fastness and slowness derived from the medium, as he clearly shows above when he says that if nature is the cause of the motion of simple bodies, it is not necessary to posit the void as the cause of their motion. In this way he gives us to understand that they supposed the total cause of the motion to depend on the medium and not on the nature of the mobile.

537. The second difficulty against [Aristotle's] argument is that if the medium which is full impedes, as he says it does, then it follows that there will not be any pure unimpeded motion in this lower medium—and this seems unfitting. To this the Commentator replies that the impediment that arises from the medium is required by the natural motion of heavy and light bodies, so that there can be resistance of the mobile to the mover, at least on the side of the medium.

But it is better to say that every natural motion begins from a place that is not natural and tends to a natural place. Hence until it reaches its natural place it is not unfitting if something unnatural be attached to it. For it gradually departs from what is against its nature and tends to what is in keeping with its nature. And for this reason a natural motion accelerates as it nears its end.

538. The third objection is that since in natural bodies there is a fixed limit of rarity, it does not seem that one can keep supposing a rarer and rarer body according to any given proportion of time to time.

In reply it should be said that a fixed rarity in natural things is not due to the nature of the mobile body insofar as it is mobile, but to the nature of specific forms that require specific rareness and density. But in this book we are dealing with mobile body in general, and therefore Aristotle frequently uses in his arguments things which are false if the specific natures of bodies are considered,

but possible if the nature of body in general is considered.

Or it can be replied that he is here also proceeding according to the opinion of the earlier philosophers who posited the rare and the dense as the first formal principles. According to them, rarity and density could be increased *ad infinitum* since these did not depend on other previous forms according to whose exigencies they would be determined.

539. Then [373] he shows there is no separated void, arguing from the speed and slowness of motion, insofar as the cause is taken entirely from the viewpoint of the mobile.

And he says that what he is about to say will follow logically, if we attend to the difference of speed and slowness insofar as bodies in motion exceed one another. For we see that over a given equal space, greater speed is shown by bodies having a greater inclination due either to heaviness or lightness, whether they are greater in quantity but equally heavy or light, or whether they are equal in quantity but unequal in heaviness or lightness. And I say this if they are similar in shape. For a wide body is moved more slowly if it be deficient in heaviness or size than a body with a pointed shape. And the ratio of the velocity corresponds to the ratio which the moving magnitudes have to one another in respect to their weight or in respect to their magnitude. And this will have to be true also if the motion occurs in the void, namely, that a heavier body or a lighter body or a more pointed body will be moved faster through an empty medium. But this cannot be, since it is impossible to explain why one body would be moved faster than another. For if the motion takes place within a space filled with some body, an explanation for the greater or lesser speed can be given—it will be due to any of the aforesaid causes. The explanation is that a greater body will on account of its strength divide the medium more quickly, either an account of its shape, because what is sharp has greater penetrating power; or on account of a greater inclination traceable either to the heaviness or lightness of the body; or even to the force imparted by that which projects it. But the void cannot be cleaved faster or slower. Hence it will be moved through a void with equal speed. But this clearly appears as impossible.

And so from a consideration of the velocity of motion, it is evident that the void does not exist.

It should be observed that in this reasoning process there exists the same difficulty as in the first one. For he seems to suppose that difference in velocity in motions is due only to the different ways in which the medium can be cleaved, whereas the fact is that there are differences of velocity among the heavenly bodies in which there is no full medium resisting which has to be cleaved by the motion of the heavenly body. But this difficulty should be solved as the above one was.

540. Finally [347] he summarizes, and concludes that from the foregoing it is clear that in regard to the philosophers who posit a void, the contrary of what they supposed as a reason for proving it occurs. For they proceeded on the assumption that motion could not take place unless there was a void. But the contrary has been proved; namely, that if there be a void, there is no motion. Thus, therefore, those philosophers believe that the void is some distinct and separate thing—a space having separate dimensions—and they believed it was such a space that had to exist if local motion were to be possible. However, to posit such a separated void is the same as saying that place is a kind of space distinct from bodies—which is impossible, as was shown in the treatise on place.

Lecture 13

Non-existence of the void from the void itself

541. Now the Philosopher taking his arguments from the void itself, without any mention of motion, shows that the void does not exist. He shows this by three reasons. He says therefore first [375] that even considering the void on its own merits, without motion, it will be seen that the void spoken of by some is just what the name "void" implies. For "void" means something empty and non-existent—and the claim that it exists is vain and without reason and truth. And he shows this as follows.

If anyone places a cubic body in water (i.e., a body having six square surfaces) an amount of water equal to the quantity of the cube must be displaced. And what is true of water is true of air, although it is not so evident, because water is more perceptible to sense than air. By the same reasoning applied to the case of any body that can be displaced, in some part, it must, if the parts are not compressed, or enter into each other, be dislodged either (1) according to the state of a yielding body (when it has free exit); for example, if it is a heavy body such as earth it will yield downwards, and if it is a light body such as fire it will yield upwards, and if it is a body which is light in relation to one body and heavy in relation to another, it will yield in both directions, such as do air and water; or (2) because the body yields on account of the condition of the newly imposed body, i.e., when the yielding body is prevented by the imposed body, i.e., when the yielding body is prevented by the imposed body from being moved according to its demands but is moved according to the demands of the imposed body. And in general it can be held as true that a body must yield to an inserted one, lest two bodies be in the same place.

But this will not be true in the case of the void, i.e., that it must yield to the inserted body, since the void is not a body, whereas whatever is moved in any manner whatsoever is a body. But if there be empty space and a body inserted therein, then the inserted body must pass through that space which previously

was empty and cohabit the same space as the void—just as if water or air were not to yield to a wooden cube, but were to pass into the cube in such a way that the air and water would penetrate that cubic body and cohabit with it.

But it is impossible for a wooden cube to exist with empty space; for the wooden cube has the same magnitude as the empty space, which is supposed to be a certain dimensional space without a sensible body. And even though the wooden cube be hot or cold, heavy or light, nevertheless the cubic body is other in notion from all the sensible qualities, that are its accidents, although it be not separable from them in reality. Now what is in conception distinct from the qualities is the body of a wooden cube, i.e., that which pertains to its corporeity. Now if this body be separated from whatever is distinct from it in notion, so that it is neither heavy nor light, it follows that it will occupy a volume of empty space equal to itself. Thus in the same part equal to it, which is part of the place and of the void, the body of the wooden cube will be.

On this assumption it does not seem possible to find a difference between the body of the cube and the dimensions of the place or void. For just as the dimensions of the place or void exist without sensible qualities, so too the dimensions of the cubic body, at least according to notion, are distinct from its sensible qualities. But two magnitudes of equal quantity can differ only in *situs*. For we cannot imagine one line as distinct from another of equal length, unless we imagine one in one *situs* and the other in another. Hence, if two magnitudes are imagined together, it does not seem that they can differ: consequently, if two bodies of equal dimensions are together, whether accompanied by their sensible qualities or not, it follows that two bodies are one, or if the cubic body and the space which is the place or void remain two, but are still together, there is no reason why any number of bodies cannot be there. In that case, just as the cubic body is together with the space of the place or void, along with both a third or even a fourth body ought to be able to be inserted. This, of course, is impossible. For we cannot say that it is because of matter that some other sensible body cannot exist together with the wooden cubic body, for place does not belong to a body because of its matter, except in the sense that the matter is contained under dimensions. Hence the impossibility for two bodies to be together is not on account of the matter or of the sensible qualities, but only on account of the dimensions, in which no diversity can be found if they are equal except a diversity based on *situs*, as was said. Wherefore since there are dimensions in empty space just as there are in a sensible body, then, just as two sensible bodies cannot be together, so neither can a sensible body be together with empty space. So this is one unacceptable result and impossibility that follows from the aforementioned premiss: namely, that two bodies would be in the same place.

542. He then gives the second reason [376], saying that it is clear that a cube which is transferred to an empty space has what all other bodies have, namely, dimensions. If therefore the dimensions of the cube do not differ from the

dimensions of the place according to conception, why is it necessary to find for a body a place distinct from its own body, if place is nothing more than "impossible body," i.e., a body without sensible qualities? In view of the fact that a body has its own dimensions, there seems to be no necessity for it to be surrounded by other dimensions of a space equal to its own dimensions. Consequently if the void is presumed, or place as a certain separated space, it follows that bodies do not have to be in place.

543. He gives the third reason [377] when he says that if there were a void, it would have to be evident in mobile things. But there is no evidence of a void anywhere in the world, because what is full of air seems to be a void, though it to not. For air is something, although not perceptible to sight. Now if fish were made of iron and had the same appearance as water, our sight would not be able to distinguish them from water; but it would not follow that the water, or even the fish, were non-existent: for it is not only by sight but also by touch that we can discern what is touched. Consequently, it is evident that water is something, because touch can perceive whether it be hot or cold.

From all this it appears that there is no separate void either within or outside the universe.

Lecture 14

There is no void within bodies

544. Having shown that there is no separated void, the Philosopher here shows that there is no void inherent in bodies. As to this he does three things:

First he gives the reason proposed by those who posit such a void;
Secondly, he disproves their position, at no. 546;
Thirdly, he dissolves their argument, at no. 551.

545. He says therefore first [347] that there have been some philosophers who believed that there is a void in bodies, basing their argument on the existence of rarity and density. For they believed that rarefaction and condensation took place on account of a void inhering in bodies. If rarity and density did not exist, they say, the parts of bodies could not "go in," i.e., enter each other, and "harden," i. e., be compressed by condensation. But if this does not take place, they deduced certain difficulties both in respect to local motion, and in respect to the motions of generation and corruption, or alteration.

In respect to local motion, because it would be necessary to admit either that motion does not exist at all, or that the whole universe is moved with one motion, as says Xuthus, a philosopher. This would be because if a body were moved locally, when it approached a place full of another body, this body would

have to be expelled, and tend toward another place and the body found there would have to go to yet another place, so that, unless there were condensation of bodies, all bodies would have to be in motion.

In regard to generation or alteration, this difficulty arises that there would also be an equal change of air into water and of water into air: for example, if air be generated from one cupful of water, it would be necessary that from a same amount of air as was generated, an amount of water be generated somewhere else. The reason is that there is now a greater amount [i.e. volume] of air than there previously was of water from which it was generated. The generated air therefore occupies a greater place than the water from which it was generated. Consequently, either the whole body of the universe would have to occupy a greater place, or else as much air in some other place would have to be converted into water, or else finally, it must be admitted that there is a void within bodies to allow them to be condensed, because these philosophers supposed that bodies could not become condensed and rarefied unless there was a void existing in them.

546. Then [379] he rejects this position:

> First according to one interpretation;
> Secondly, according to another interpretation, at no.547.

He says therefore that those who posit a void within bodies can give this two interpretations: the first is that in each body there are, as it were, many empty openings, each existing separate in respect to *situs* from the other full parts, as can be seen in a sponge or in pumice or things of this sort. The second interpretation is that the void is not separate in respect to *situs* from the other parts of the body; as if we should say that the dimensions, which they said were the void would penetrate all the parts of the body.

The refutation of their claim as to the first way of the void's being in bodies is evident from what went before. For the very argument that shows there is not a separate void outside of bodies nor any place having such a space proper to itself over and above the dimensions of bodies. The same argument can be used to prove that there is no body so rarefied that it would have within itself any empty spaces distinct from the other parts of the body.

547. He then [380] disproves the aforesaid position as to the second interpretation and gives four reasons for rejecting it. He says, therefore, that if the void is not in bodies in such a way as to be separable and distinct from the other parts but is nevertheless present in bodies, the situation is less impossible, because the difficulties mentioned above against a separate void do not arise; yet against this also certain discrepancies do arise. First of all, the void will not be the cause of every local motion, as the maintained, but only of upward motion—for the void, according to them, is the cause of rarity, and the rare in turn is found to

be light, as is evident in fire, and what is light travels upwards; consequently, the void will be the cause only of upward motion.

548. He gives the second reason [381] when he says that according to those who posit a void in bodies the void is the cause of motion, not as that in which something is moved (in the way that those who held for a separate empty space posited the void as a cause of motion), but as the cause of motion in such a way that the empty space within the bodies transports them: it is analogous to the case of inflated wine-skins, which, due to the fact that they are carried upward on account of their lightness, also carry upward whatever is attached to them. And in this way the void inherent in bodies carries with it the body in which it is.

But this seems impossible: because then it would follow that the void would have to be subject to motion and that there would exist a certain place for the void. And since the void and place are the same, it will follow that of an interior void there will be an exterior void into which it is transported—which is impossible.

549. The third reason [382] is given when he says that if the cause of upward motion is the void carrying a body upward, then since there is nothing to carry the body down, there would be no explanation of why heavy bodies are carried downwards.

550. Be then gives the fourth reason [833], and says that if the rare causes upward motion on account of emptiness, then the rarer and more empty a thing is, the faster it should be carried upward. And if it were completely empty, it should move with a maximum speed.

But this is impossible, because what is completely empty cannot be moved, for the same reason by which it was shown above that motion is impossible in an empty space; for there is no way to compare the speeds of the empty and of the full (whether you consider the space or the mobile) according to some definite ratio, because there is no ratio between the full and the empty. Therefore the void cannot be the cause of upward motion.

551. Then [385] be answers a previous argument:

> First he repeats it, explaining it more extensively;
> Secondly, he solves it, at no. 552.

He says therefore first that because we do not admit a void either in bodies or outside of them, we must answer the arguments of our opponents, because they present a real difficulty.

First of all on the side of local motion: either (1) local motion will not be if there is not rarity and density, which they believed could not be produced without the void; or (2) we will be forced to say that whenever a body is moved, the very heavens or some part of them are borne outward, which he calls the "bulging" of

the heavens.

Secondly, from the viewpoint of generation and corruption a transformation of water into air will always have to be balanced by an equal transformation of air into water somewhere else; for since more air is generated from water it is required (unless condensation takes place which they thought impossible without a void) either (1) that the body which was held to be outermost according to common opinion, namely, the heavenly body, be pushed outward by the swelling of lower bodies; or (2) that somewhere else there must be an equal amount of air converted into water, so that the entire bulk of the universe remain always equal.

But because one could in a certain way elude what he had said about local motion, he mentions this [evasion] again in order to exclude it. Thus he repeats, "Or it follows that nothing is moved." Now according to the foregoing a disturbance of the heavens occurs whenever anything is transmuted. And this is true unless the motion is rotational: for example, let A be in motion to place B, and B to place C, and C to place D, and again D to place A. In this case, on the assumption of rotational motion, it will not be necessary, if one thing moves, that the whole universe be disturbed. But we do not see every local motion of natural bodies to be rotational, but many are in a straight line. Hence, there will be still disturbance of the heavens, unless condensation and the void be admitted.

This then is the argument which prompted some to posit the void.

552. Then 385] he answers this argument. Now the entire force of this argument consists in this, that rarefaction and condensation take place by means of the void. Accordingly, Aristotle meets this by showing that rarefaction and condensation can take place without a void.

First, he reveals his proposition;
Secondly, he introduces the conclusion be mainly intends, at no. 557.

As to the first he does three things:

First he explains his proposition by an argument;
Secondly, by examples, at no. 555;
Thirdly, by the effects of rarity and density, at no. 556.

As to the first he does two things:

First he premisses certain things necessary for his proposition;
Secondly, he proves his proposition, at no. 554.

553. Now [385] he lays down four preliminary statements which he takes from the "subjects," i.e., the presuppositions of natural science, and which were already explained in Book I.

The first of these is that the matter of contraries is one; for example, of the hot and the cold, or of any other natural contrariety—for contraries are apt to affect the same thing.

The second is that whatever is in act had to come into being from what was in potency.

The third is that matter is not separable from contraries so as to exist without them—but yet, according to motion, the matter is distinct from the contraries.

The fourth is that matter is not, by virtue of being, now under one contrary, now under another, other and other, but numerically one.

554. Then [386] from these preliminaries he proves his point in this way: The matter of contraries is one in number. But the large and the small are contraries in respect of quantity. Therefore the matter of the large and the small to numerically the same.

And this is clear in substantial transmutation. For when air is generated from water, the same matter which previously was under the water, came to be under air, not receiving anything that it previously lacked, but rather that which was previously in potency in the matter was reduced to act. And the sam is true in reverse, when from air water is generated. But there is this difference: when air is generated from water, there is a change from small to large; because the quantity of air generated is larger than the quantity of water from which it was generated. But when, from air, water is made, there is produced contrariwise a transmutation from largeness to smallness. Therefore when a large amount of air is reduced to a smaller amount by condensation, or from a small amount to a larger amount by rarefaction, it is the same matter which becomes both in act, namely, large and small, while being previously in potency to them.

Therefore condensation does not take place by certain parts moving into others, or rarefaction by inhering parts being extracted, as those thought who posited a void within bodies. Rather it is because the matter of the same parts now has greater, now lesser, quantity: hence, to become rare is nothing other than for matter to receive greater dimensions by being reduced from potency to act; and the opposite for becoming dense. For just as matter is in potency to definite forms, so it is in potency to definite quantity. Hence rarefaction and condensation do not proceed *ad infinitum* in natural things.

555. Then [387] he makes the same thing clear from examples. And because rarefaction and condensation pertain to the motion of alteration, [i.e., change in quality] he gives an example of other alterations.

And he says that just as the same matter is changed from cold to hot and from hot to cold, because both were in the matter potentially, so also something passes from hot to hotter, not because some part of the matter previously not

hot becomes hot which was not so when It was less hot, but because the entire matter is reduced into the act of being more or less hot.

He gives another example of a quality in the matter of quantity. And he says that if the circumference and convexity of a larger circle are brought in to that of a smaller circle, they become more curved. This happens not because an "ambit," or curvature, begins to exist in some part that previously was not curved but straight, but because the same that was previously less curved, becomes more curved.

For in alterations of this sort things do not become more and less by "defect," i. e., by subtraction, or addition but by the transmutation of one and the same thing from perfect to imperfect, or from imperfect to perfect. This is evident in the case of what is absolutely and uniformly "such and such": it is impossible to find in it any part lacking that quality, just as it is impossible in a flame to find any part lacking heat and "whiteness," i.e., clarity. So also prior heat comes to a later heat, not because a part previously not hot became hot, but because what was less hot became hotter.

So too the largeness and smallness of a sensible body is not extended or increased in rarefaction and condensation by the matter receiving some addition, but by the matter which was previously in potency to large and small being transmuted from one to the other. Therefore the rare and the dense are not produced by the addition of penetrating parts or by their removal, but by there being one matter of the rare and of the dense.

556. Then [388] he manifests his proposition by the effects of the rare and of the dense. For from a difference in rarity and density there follows a difference in other qualities; namely, in heaviness and lightness, hardness and softness. Consequently, rarity and density diversify qualities and not quantities.

He says therefore, that lightness follows rarity, and heaviness density. And with good reason: for rarity arises from matter receiving greater dimensions, density from matter receiving lesser dimensions. Consequently, if you take diverse bodies of equal quantity, one being rare and the other dense, then the dense has more matter. Now it was said above in the treatise on place that the contained body is related to the container, as is matter to form; consequently, a heavy body which tends toward the middle [i.e., center]contained is with good reason more dense because it has more matter. Just as, therefore, the circumference of a larger circle, when it is restricted to a smaller circle does not receive concavity in a part not previously concave, but rather a part previously concave was reduced to a greater concavity, and just as any part of fire that anyone may take will be hot, so also it is the whole body that becomes rare or dense by the "conduction," i.e., contraction, or expansion of one and the same matter, accordingly as it is moved to greater or smaller dimensions.

This is clear from what follows from rarity and density, namely, qualities. For the heavy and the hard follow from density. Why heaviness follows density has already been explained. Why hardness follows is easy to explain: that is hard which is better able to resist both pressure and cleavage; but what has more matter is less divisible, because it is less obedient to something acting upon it, on account of its being more remote from actuality. Contrariwise, lightness and softness follow upon rarity.

But the heavy and the hard fail to coincide in some things: for lead is heavier, but iron is harder. The reason for this is that lead has more of the element "earth" in it, but what there is of "water" in it is less perfectly congealed and distributed.

557. Then [389] he concludes his chief proposition. And he says it is clear from the foregoing that there is no separate empty space: it is not anything existing absolutely outside a body; or in a rarefied thing after the manner of empty holes; or in potency in a rarefied body, according to those who did not posit a void that exists in bodies as something separated from the fullness of the body. Consequently, in no way is there a void, unless someone simply wants to call matter the void, since it is somehow the cause of heaviness and lightness, and consequently the cause of motion in respect of place. For density and rarity are causes of motion according to the contrariety of heavy and light; but in regard to the contrariety of hard and soft, passible and non-passible are the causes: for the soft is that which easily suffers division and the hard contrariwise, as was said. However, this does not pertain to local motion but rather to [the motion called] "alteration."

And so he concludes that it has been determined in what way the void exists and in what way it does not.

Lecture 15

Does time exist, and is there the same "now" in the whole of time?

558. Having arrived at conclusions concerning Place and the Void, the Philosopher now concluded concerning Time.

> First he tells what his intention is and the order he will follow;
> Secondly, he carries out his proposal, at no. 559.

He says therefore first [390] that our plan now calls for us to "attack" time, by which he signifies how difficult the subject is. And as in previous discussions, so in the case of time one must begin by presenting extraneous reasons, i.e., the opinions of others, as well as sophistical arguments, dealing with the question of whether time exists or not and, if it does, what is its nature.

Then [391] he begins the discussion of time:

First by arguing against [existence of time];
Secondly, by presenting the truth, at no. 571 (L.17).

In regard to the first he does two things:

First he inquires whether time exists, arguing against it;
Secondly, what it is, at no. 565 (L.16).

As to the first he does two things:

First he gives two reasons which show that time does not exist;
Secondly, he inquires about the "now": asking whether there is one "now" in the whole of time or several, at no. 561.

559. He says then [391] that two reasons could lead us to suppose either that time does not exist at all or that it is something that can scarcely and only in an obscure way be conceived. Here is the first reason: anything that is composed of things which do not exist cannot have any existence or any substance; but time is composed of what does not exist—for part of time is the past which no longer exists, and the rest is the future, which does not yet exist (and these two things comprise the whole of time considered as infinite and everlasting). Therefore, it is impossible for time to be anything.

560. The second reason [392] is as follows: As long as any divisible thing is existing there must exist some part of it or a number of parts. But time does not meet these requirements—for some parts of time are already past and others are in the future, so that no divisible part of time is actually existing. And the "now" which is actual is not a part of time: for a part is either a measure of a whole, as two is the measure of six, or at least it is a component of the whole, as four is a part of six (although not its measure) since from it and two, six is composed. Time however does not have "nows" as its parts, as will be proved later (Book VI). Therefore, time is not anything.

561. Then [393] he inquires whether there be the same "now" through the whole of time. About this he does three things:

First, he raises the question;
Secondly, he objects to one side of the question, at no. 562;
Thirdly, he objects to the opposite side, at no. 563.

He says therefore first that it is not easy to be certain whether the "now" which is seen to distinguish the past from the future always remains identical with itself throughout the whole of time or whether it is other and other.

562. Then [394] he gives a reason to show that the "now" is not other and other. Two parts of time which are not the same cannot be existing together unless one contains the other, as a greater period of time contains a smaller, e.g., as a year

contains the month and the month the day (for the day and the month and the year exist together). But one "now," since it is indivisible, does not contain another. If, therefore, we are to accept two "now's" in time, then that "now" which existed before the present one and no longer exists, ceased to be sometime, and so two "now's" are never together. However, anything that ceased to be, did so in some "now." But it cannot be that the prior "now" ceased to be in that prior "now," because the prior "now" was existing then, and nothing ceases to be while it is. Likewise, it cannot be said that the prior "now" ceases to be in a later one: for it is impossible to have two "now's" together as "had," i.e., so as to follow immediately one upon the other, just as the same thing is impossible in the case of two points. (This is supposed now, but will be proved in Book VI). Thus, between any two "now's" there are an infinity of "nows." If, therefore, that prior "now" ceases to be in some later "now," it follows that the prior "now" was existing along with all the intermediate "now's"—which is impossible, as we have said. It is impossible, therefore, that the "now" be other and other.

563. Then [395] he gives two reasons to show that there cannot be just one "now." The first is that no finite divisible thing can have just one boundary; whether it be a divisible of one dimension, as a line; or of more than one dimension, as a plane or a solid. For the boundaries of one finite line are two points and of a surface the boundaries are several lines, and of a body several planes. But the "now" is a boundary of time. Since therefore it is possible to conceive of a finite time there must be more than one "now."

564. He gives a second reason [396].Those things are said to be together in time, and neither previously nor later, which are in the same "now." If therefore it is the same "now" that persevere throughout time, it follows that things which existed a thousand years ago are together with things that exist today.

Summarizing, he concludes that these are the conflicting opinions about the "now's" which exist in time.

Lecture 16

Dialectical inquiry into what time is, and how related to motion

565. After inquiring whether time exists, the Philosopher now inquires dialectically what it is.

First he disproves the opinions of others;

Secondly, he inquires how time is related to motion, which seems to be something most akin to time, at no. 568.

About the first he does two things:

First he gives various opinions of others about time;
Secondly, he disproves them, at no. 566.

He says therefore first that what time is and what is the nature of time cannot be gathered from what is handed down from the earlier philosophers nor from any piecing together of what they concluded about it. For some said that time is a motion of the heavens; others that it is a heavenly sphere itself.

566. Then [398] he disproves their opinions, first of all, the first; then the second, at no. 567.

In regard to the first opinion he gives two counter-arguments, of which the first is: If a circular revolution in time then part of that revolution is a circular revolution, because a part of time is time. But part of a circular revolution is not a circular revolution. Therefore time is not a circular revolution.

Then [399] he gives a second argument: The number of motions corresponds to the number of mobiles; if therefore there are many heavens, there are many circular revolutions. And thus if a circular revolution is time, there are many times together—which is impossible. For no two parts of time are together unless one contains the other, as we have said. (Those who posited time as a circular revolution were led to do so because they observed that times occur over and over in a kind of cycle.

567. Then [400] he rejects the second opinion. And he says that some thought the sphere of the heavens in time, because all things are in time and all things are also in the sphere of the whole, because the heavens contain all things. Hence they wished to conclude that the sphere of the heavens is time. But there were two things wrong in their reasoning: first, because something is not said univocally as being in time and in place; secondly, because they were using two affirmative premises in a Second Figure syllogism. Therefore he says that their position is too foolish to consider the impossibilities that follow upon it. For it is clear that all the parts of the sphere exist simultaneously, whereas the parts of time do not.

568. Then [401] he inquires how time is related to motion.

First he shows that time is not motion;
Secondly that time does not exist independently of motion, at no. 570.

In regard to the first he gives two reasons to show that time is not a motion or a change (for it certainly seems to be such). Here is his reason: Every change and motion is certainly only in the thing being changed or in the place where the changer and changed are. The first of these is mentioned because of motion in substance and quantity and quality; the second because of motion in the predicament "where," called motion in place." But time is everywhere and exists among all things. Therefore time is not a motion.

569. He gives the second reason [402]: Every change and motion is either slow or fast; but time is not either. Therefore time is neither a motion nor a change. He explains the minor premise thus: Slow and fast are determined by time—because that is fast which is moved a great distance in a short time and that is slow which is moved a short distance in much time. But time is not determined by either according to its quantity or its quality, because nothing is its own measure. Therefore, time is neither slow nor fast. And since he had proposed that change is fast or slow, without mention of motion, he adds that for the present it does not matter whether one says "motion" or "change." Their difference will be shown in Book V.

570. Then [403] he shows that although time is not motion, it is not independent of motion: for when men are not changing according to what they apprehend, they are changing without being aware of it, then it does not seem to them that time is passing. This is clear in the fable about the city in Asia called Sardo. In Sardo certain people were said to sleep among the Heroes,,i.e., among the gods. For they called the souls of the good and the great "Heroes," and worshipped them as gods, as in the case of Hercules and Bacchus and the like. Certain ones were rendered insensible by means of incantations and said to sleep among the gods, because then they awoke they claimed to have seen marvelous things and foretold future events. These persons, returning to themselves, were not aware of the time which elapsed while they were thus absorbed; because that first instant in which they began to sleep they joined to the instant in which they awoke, as if it were one instant—but the time that elapsed escaped them. Therefore just as there would be no intervening time between "now's," if the "now" of time were always the same and not other and other, so also when two "now's" are fused in our apprehension, the elapsed time is not apprehended, and there seems to have been no intervening time. If, then, we are apt to think that no time has elapsed when we do not perceive any changes, and that we are in one and the same indivisible "now," but we then perceive time to be elapsing when we sense and determine, i.e., motion and change, it clearly follows that time is not independent of motion and change.

In summary he concludes that time is not motion, nor is it without motion.

Lecture 17

The definition of time, given and explained

571. After treating of time dialectically, the Philosopher here begins to determine the truth.

First, he determines the truth concerning time;

Secondly, he brings up and solves some objections concerning the

truth determined, at no. 625 (L.23).

In regard to the first he does two things:

First he determines concerning time absolutely.
Secondly, in relation to things measured by time, at no. 600 (L.20).

As to the first he does three things:

First he makes clear what time is;
Secondly, what the "now" of time is, at no. 582 (L.18);
Thirdly, from the definition he gives of time, he explains the things said about time, at no. 593 (L.19).

About the first he does two things:

First he gives the definition of time;
Secondly, he explains it, at no. 581.

The first point is divided into three parts according to the three parts which he investigates of the definition; The second part begins at no. 575; The third part at no. 580.

572. First [404] therefore he investigates this part: that time is "something of motion." He says that since we are investigating what time is, we must begin by understanding what aspect of motion time is. That time is something of motion is manifested by the very fact that we sense motion and time together. For it happens that we perceive the flow of time even though we are not sensing any particular sensible motion; for example, if we are in the dark and do not see any external object moving. And if while we are in this situation, we are not undergoing any bodily changes brought about by an external agent, then we are not sensing any motion of a sensible body. Yet if there is a motion within our soul, such as a succession of thoughts and imaginings, suddenly it appears to us that some time is elapsing. Thus by perceiving any sort of motion we perceive time and, vice-versa, when we perceive time we are simultaneously perceiving a motion. Hence, although time is not a motion, as we have already shown, yet it is somehow connected with motion.

573. What has been just said about the perceiving of time and of motion raises a difficulty. For if time follows upon some sensible motion outside the mind, it follows that whosoever does not sense that motion, does not sense time; whereas the opposite of that is said here. And if time depends upon some motion of the mind, it follows that things are not connected to time except through the medium of the mind: thus time will not be a thing of nature but a notion in the mind like the intention of genus and species. But if time follows upon any and every motion, then there are as many times as there are motions—which is impossible, for there cannot be two times together as we said above.

574. In order to clear up this difficulty it must be remembered that there is one first motion which is the cause of every other motion. Hence whatever is in a transmutable state possesses that state on account of the first motion, which is the motion of the first mobile being. Whosoever, therefore, perceives any motion, whether it exists in sensible things or in the mind, is perceiving transmutable being and consequently is perceiving the first motion, which time follows. Thus anyone who perceives any motion whatsoever is perceiving time, although time follows upon just the one first motion by which all other motions are caused and measured. Consequently, there remains only one time.

575. Then [405] he investigates the second particle placed in the definition of time. For supposing that time is something of motion, namely, that it follows upon motion, there still remains the task of investigating according to what does time follow upon motion; the answer being that it follows upon motion "according to before and after." As to this then he does three things:

First he shows how "before and after" are found in motion;
Secondly, how they are related to motion, at no. 578;
Thirdly, he shows that time follows motion according to "before and after," at no. 579.

About the first he does two things:

First he shows that the continuity of time is due to the continuity of motion and magnitude;
Secondly, that the same is true of the "before and after" of time, at no.577.

576. He says therefore first that everything that is being moved is being moved. from something to something. But of motions the first is local motion, which is from place to place along a magnitude. But it is the first motion that time follows upon, and therefore, to investigate time, one must take local motion. Since, then, motion according to place is motion according to a magnitude from one place to another, and since every magnitude is continuous, motion must follow magnitude in regard to its continuity, so that, just as magnitude is continuous, so also is motion. Consequently time also is continuous: for the quantity of the first motion and the quantity of time correspond. For time is not measured according to the quantity of just any motion, since something is being moved over a small distance In a large amount of time, and a fast object, vice-versa. Time however corresponds only to the quantity of the first motion.

577. Then [406] he shows that the same order prevails in respect to "before and after," saying that "before and after" are first of all in a place or in a magnitude. This is so, because a magnitude is a quantity having position; position, however, implies "before and after." Hence from its position place has"before and after." And because there is "before and after" in magnitude, it follows that there is a "before and after" in motion corresponding to the things which are there, i.e., in

magnitude and place. Consequently, there is a prior and subsequent also in time: for motion and time are so related that the one always follows the other.

578. Then [407] he shows how "before and after" are related to motion. And he says that the "before and after" of these, namely, of time and of motion is, as to what it is, motion; yet in conception, it is distinct from motion and not motion. For it is the notion of motion that it be the act of a being in potency; but that there be in motion a "before and after" occurs in it by reason of the order of the parts of the magnitude. Accordingly, "before and after" are the same as motion as to subject but they differ from it as to notion. Hence the task remains to inquire, since time follows motion, whether it follows upon it inasmuch as it is motion, or inasmuch as it has a "before and after."

579. Then [408] he shows that motion follows upon time by reason of "before and after." For it has been shown that the reason why time follows motion is that we recognize both simultaneously. Therefore time follows motion according to that which, when it is perceived in motion, time is perceived. But it is then that we perceive time, when we distinguish a "before" and "after" in motion; and it is then that we say time is passing when we have a sense of the "before" and "after" in motion. Consequently time follows motion according to "before and after."

580. Then [409] he shows what aspect of motion time is, and says that it is "the number of motion." He explains this by using the same means as before, namely, our knowledge of time and motion. For it is clear that when we take in motion something different from something other and understand that there is something between them, then it is that we determine that time exists. For when we perceive the differing boundaries of something and the mind calls them two "now's," one being before and the other after, as though the mind were counting the "before's" and "after's" in a motion, that is what we call time. For time seems to be determined by the "now." (This statement is taken for granted at present, but later it will be explained). When therefore we sense one "now" but do not discern a "before" and "after" of motion, or when we in discerning a "before" and "after" take the same "now" as the end of the prior and the beginning of the subsequent, no time seems to exist because no motion seemed to exist. But when we discern a "before" and "after" and count them, then we say that time is produced. This is so because time is nothing less than "the numbering of motion according to before and after": for we perceive time, as was said, when we count the "before and after" of motion. it is clear there fore that time is not motion, but accompanies motions inasmuch as it is counted. Hence time is the number of motion.

But if someone objects against this definition and says that "before and after" are determined by time, and consequently, that the definition is circular, he should remember that "before and after" are placed in the definition of time inasmuch as

they are caused in motion by magnitude, and not inasmuch as they are measured out of time. That is why Aristotle had previously shown that "before and after" are present in magnitude before they are so in motion, and they are in motion before they are in time, to exclude this objection.

581. Then [410] he clarifies the aforesaid definition in two ways, and first by a sign. Now that which is a standard of judging something to be more and less is a number of it. But the standard for judging whether a motion is greater or smaller is time. Therefore, time is a number.

Secondly, [411] he makes clearer what has been stated by distinguishing number, saying there are two. First there is that which is actually numbered which can be, as when we say ten men or 100 horses, and this is called "number numbered," because it is a number applied to the things that are numbered. Then there is the number by which we count, i.e., number considered absolutely, such as two, three, four [the counting numbers]. Now time is not a counting number; otherwise the number of anything would be time; rather it is a number numbered, because it is the number of before and after in motion that we call "time," or else the things that are counted before and after.

Therefore, although number is discrete quantity, time is nevertheless a continuous quantity on account of the thing counted, just as ten measures of cloth is a continuous quantity, even though ten is a discrete quantity.

Lecture 18

How the same "now" is or is not in a whole time

582. After explaining what time is, the Philosopher here explains the "now."

> First he determines whether the "now" in a whole time is always the same or other and other, which was brought up as a problem above;
> Secondly, after settling this he gives the reason for what is said above the "now," at no. 588.

As to the first he does three things:

> First, he declares that the "now" is somehow always the same and somehow not;
> Secondly, he explains this, at no. 584;
> Thirdly, he proves it, at no. 585.

583. He says therefore first [412] that since time is the number of motion, then, just as the parts of motion are always other and other, so also the parts of time. But that which always exists throughout the whole of time is the same, namely, the "now," which as to its nature is always the same. While in conception it varies

accordingly as it is prior and subsequent. Thus the "now" measures time, not inasmuch as it is always the same thing, but inasmuch as in conception it is other and other, and "before" and "after".

584. Then [413] he explains what he had just said and declares that the "now" is somehow always the same and somehow not. For insofar as it is always being considered as being in something other and other in the succession of time and of motion, in that sense it is other and not always the same. And this is what we stated above, namely, that "it is other in motion." for this is the *esse* of the "now," i.e., it is according to this that its notion is taken, namely, as considered in the succession of time and motion. But insofar as the "now" is a certain being, from that viewpoint it is always the same thing.

585. Then [414] he proves what he has just said. First he proves that the "now" is always the same as to subject but other and other in conception; secondly, that it is the "now" that measures time, at no. 587.

He says therefore, first that, as was said above, in respect of continuity and in respect of "before" and "after", motion follows upon magnitude and time upon motion. Let us imagine, therefore, after the manner of geometers, that a point in motion is making a line: then, just as there is something that remains identical in this motion, so there must be something that remains identical throughout time. If the moving point should make a line, it is by the moving point that we discern the motion and the "before" and "after" in it. For motion is perceived only because the mobile thing is in other and other states: according to what pertains to the previous position of the mobile, we judge something as "before" in motion, and according to what pertains to a subsequent position, we judge something as "after" in motion. Therefore this thing which is being moved, by which we recognize that there is motion and by which we discern a "before" and "after" in it, whether it be a point or a stone or anything else, insofar as it is a certain being, whatever it may be, is the same, namely as to subject—but in conception it is other. And this is the way the Sophists use the term "other" when they say that Coriscus in the forum is other than Coriscus in the theater, arguing thus: according to the fallacy of accident: to be in the forum is other than to be in the theater; but Coriscus is now in the forum and now in the theater; therefore he is other than himself. In like manner, it is plain that that which is being moved is other according to conception insofar as it is now here, now there—while remaining the same as to subject.

Now just as time follows upon motion, so the "now" follows that which is being moved. This is so because it is through the mobile that we know the "before" and "after" in motion. For when we see the mobile in some certain part of a magnitude through which it is being moved, we judge that the motion which passed through one part of the magnitude has ceased to be before and that motion through another part will follow after. In like manner, in the counting of

motion (which counting is done by time), that which distinguishes the "before." and "after" of time is the "now," which is the end of the past and the beginning of the future. Thus the "now" is related to time as the mobile in to motion. Therefore also, by commuting the proportion, we get that time is to motion as the "now" is to the mobile. Hence, if the mobile remains the same as to subject throughout the entire motion—though differing in conception—the same will be true of the "now": it too will remain the same as to subject but will be other and other in conception. For that by which "before" and "after" are discerned in a motion is the same as to subject but differing in conception, the mobile; and that according to which "before" and "after" are counted in time is the "now."

586. This train of thought makes easy an understanding of eternity. For the. "now," insofar as it corresponds to a mobile that is continually other and other, distinguishes the "before" and "after" in time and by its flow makes time, just as a point makes a line. But if that varying status of the mobile be removed, the substance remains always in the same state; whence the "now" is then understood as always standing still and not as flowing nor as having a "before" and "after." Therefore, just as the "now" of time is understood as the number of the mobile, so the "now" of eternity is understood as the number, or rather the unity of a thing always remaining in the same state.

587. Then [415] he shows whence the "now" derives its function of measuring time. And he says it is because that which is best known in time is the "now", and what is best known in any genus is the measure of everything in that genus, as is said in *Metaphysics* X. He also shows this from the relation of motion to the mobile: for motion is perceived through something being moved and local motion is perceived through observing something being moved locally; after the manner of the better known manifesting the less known. This is so because that which is being moved is "this something," i.e., a certain thing stable in itself—a characteristic which does not belong to motion. Hence the mobile is more known by us than the motion, and motion is known through the mobile object. In like manner., time is made known through the "now." Thus, he reaches the conclusion principally intended: that what is called the "now" is always the same in one way, and in another way not, because it is similar to the mobile, as was said.

588. Then [416] he explains the reason for the things which are said of the "now":

> First, why it is said that nothing of time exists but the "now";
> Secondly, why the "now" is said to separate and continue the parts, of time, at no. 590;
> Thirdly, why it is said that the "now" is not a part of time, at no. 592.

589. He says therefore first that it is plain that if there is no time, there will be no

"now," and if no "now," no time. This is explained by the relation of motion to the mobile. For just as the change of place and that which is being changed are together, so the count of that which is being changed accompanies the count of the change of place. But time is the number of a local motion, while the "now" is related to what is being moved, not as its number (since the "now" is indivisible), but as the unit of number. It follows therefore that time and the "now" are not one without the other. Notice that time is always compared to a local motion, which is the first of all motions: for time is the number of the first motion, as was said.

590. Then [417] he explains why itis said that time is continued and, divided according to the "now."

> First he explains it by considering motion and the mobile;
> Secondly, by considering a line and a point, at no. 591.

He says therefore first that what we have already said makes clear that time is made continuous with the "now," i.e., by the "now," and is divided by the "now." This fact also follows from what is found in local motion (the number of which is time) and in the object that is being moved according to place which corresponds to the 'how"). For it is clear that every motion derives its unity from the object being moved, since that which is being moved remains one and the same throughout the whole course of the motion. And it is not a matter of indifference whether that which is moved, in the course of one motion, be any being at all, but rather it must be that same being which first began to be moved, for if it were another being that was later moved, the former motion would have failed and there would now be another motion of another mobile. So it is clear that it to the mobile that gives unity to the motion, which unity constitutes its continuity.

But it to true that the mobile is other and other according to conception. And it to in this way that it distinguishes the prior and the subsequent part of motion: because insofar as the mobile is considered under one aspect or disposition it is recognized that whatever disposition was in the mobile previous to its present state pertained to the prior part of the motion; whatever disposition will come after this state will pertain to the subsequent part of the motion. Thus it is that the mobile both continues the motion and distinguishes its parts. And the same holds for the "now" in relation to time.

591. Then [418] he explains a case of the same in the matter of line and point. And he says that the conclusion drawn about time and the "now" in the preceding section follows in a way from what is found in a line and a point; for the point continues the line and distinguishes its parts, inasmuch as it is the beginning of one part and the end of another.

But there is a difference in the case of line and point, and in the case of time and the "now". For both the point and the line are something stationary; whence a

person can consider the same point twice and use it as two [give it two interpretations] namely, as both a beginning and an end. When we thus use the point as two, rest occurs, as is evident in a reflex motion, in which that which was the and of the first motion is the beginning of the second and reflected motion. It is on this basis that we shall prove in Book VIII that a reflex motion is not continuous but that an intermediate pause occurs.

But the "now" is not stationary, because it corresponds to the mobile which is always being carried along during the motion—which also accounts for the "now" having to be always other and other in conception as was said above. Therefore since time is the number of motion, it does not number motion in the sense that some same time is taken as the beginning of one and the end of another, but rather it numbers motion by taking two boundaries of time, namely, two "nows," which are nevertheless not parts of time.

The reason why this method of counting is used in numbering time, rather than the method used when a point numbers the parts of a line (where the same point is considered both a beginning and an end), is that, as was stated, in the latter method we use the point as two things and this brings about an intermediate pause, which cannot exist in time or in motion. Now this does not mean that the same "'now" is not the beginning of the future and the end of the past, but that we do not perceive time by counting motion in terms of one "now" but in terms of two, as was said; otherwise, in our counting of motion the same "now" would be employed twice.

592. Then [419] he explains why it is said that the "now" is not a part of time. And he says it is plain that the "now" is not a part of time, just as what distinguishes a motion is not a part of the motion, namely, some disposition in the mobile itself, just as points are not parts of a line. For two lines are the parts of a line.

Now he manifests the properties of time from the properties of motion and of line because, as was said above, motion is continuous on account of the magnitude, and time on account of the motion.

He concludes, therefore, finally that the "now," insofar as it is a certain boundary, is not time but it happens to time, as a boundary does to that which is bounded; but insofar as time or the "now" numbers other things, the "now" is the number of things other than time. The reason is because a boundary can only be of that of which it is the boundary; but a number can be applied to various thing, as the number of ten horses is also that of other things. Thus therefore the "now" is the boundary only of time, but it is the number of all mobiles that are being moved in time.

Lecture 19

From the definition of time certain things are clarified

593. Having defined time, the Philosopher now, in the light of the definition which he has given, gives an explanation of those things that are said about time. About which he does four things:

First, he shows in what sense there to found in time a smallest part, and in what sense there is not;
Secondly, why time is said to be "much" and "little," "short" and "long", but not "fast" and "slow," at no. 595;
Thirdly, in what sense time is the saw, and in what sense it is not [ever the same again] at no. 596;
Fourthly, how time to known through motion and vice-versa, at no. 597.

594. He says therefore first [420] that the previously given definition of time makes clear that time is "the number of motion according to before and after," as was expounded above, and that time is a type of continuum, as is likewise manifest from what has gone before. For although it does not have continuity insofar as it is a number, yet it has continuity by reason of that of which it is the number: for it is the number of a continuum, namely, of motion, as was said above. For time to not a number absolutely but a number of something numbered.

Among absolute numbers there is unequivocally a least to be found, namely, two. But if we consider owe certain number, namely, the number of something that is continuous, then there is in one sense a minimum and in one sense no minimum, because in the order of multitude [plurality] there is a least, but not in the order of magnitude. For example, in a plurality of lines there is a minimum according to plurality, i.e., one line or two lines (one if you consider what is the minimum in number absolutely; two if you mean that which is least in the genus of number, having the notion of number). But in respect of magnitude there is no minimum in lines, so that there would be namely, some smallest lines—because it is always possible to divide any line whatsoever.

A parallel situation is found in time, for there is a minimum according to multitude, namely, one or two, for example, one year or two years or two days or two hours. But in the order of magnitude there is no minimum, because of any given time there are parts into which it may be divided.

595. Then [421] he gives a reason why time is not said to be slow or fast, but great and small, short and long. For it has already been shown that time is both a number and a continuum. Insofar, therefore, as it is the latter, time, is said to be "long" and "short", insofar as it is a number, it is said to be "great" and "small." But to be "fast" and "slow" in no wise belongs to number, neither to number

absolutely, as is plain, not to the number of some things. For to be "fast" or "slow" is said of something accordingly as it is numbered: for a motion is called "fast" insofar as it is counted off in a short time—and "slow" conversely. Hence it is clear that in no sense can time be called "fast" or "slow."

596. Then [422] he shows how time is the same and how not the same.

> First, how it is the same or not the same absolutely;
> Secondly, how it is the same in a certain respect, at no. 597.

He says therefore first that the time existing at a given moment is the same everywhere, i.e., it is the same in respect to everything that is being moved anywhere. For it is not diversified by reason of the diverse mobiles, but by reason of the diverse parts of the same motion. For which reason a prior time and a later time are not the same. Why? Because the first and present motion, of which time is primarily and principally the number, is one; but one part of this motion has already taken place and is past, and another will be in the future. Hence there is one time which is past, and another time which is future. This is so because time is not number absolutely but the number of something numbered; namely, of the "before" and "after" in motion. And this number always varies and is "before" and "after," because the "now's," as before and after, are always other. But if time were number absolutely, then the time corresponding to the change which is past and the time corresponding to the change which is to come would be the same, for number absolutely is one and the same of different things counted as, for example, in the case of 100 horses and 100 men. But number numbered varies with different things. For 100 horses are not the same as 100 men. Since time is the number of "before's and "after" in motion; and since the "before" and "after" of a past motion are not the same as those of that which follow, therefore the past time and the future time are other and other.

597. Then [423] he shows how the same time returns in a certain respect. And he says that in the same way that one and the same motion may be repeated, so may one and the same time. For one and the same motion can be duplicated specifically, but not numerically; for it is from the same sign of the Ram that the sun first moves [at the vernal equinox] and later will move the following year; therefore, just as there has been winter or spring or summer or fall, so also there will be, not, indeed, the same one in number, but in species.

598. Then [424] he shows that just as we know motion from time, so also time from motion.

> First, by reason of number and the thing numbered;
> Secondly, from the likeness existing between magnitude and motion, at no. 599.

He says therefore first that we not only measure time by motion but motion by

time, because each is defined in terms of the other. For one must take the quantity of the one according to the quantity of the other. Now that time should determine motion comes about because it is the number of motion; but conversely, as to us, motion determines time. For we sometimes perceive a quantity of time by means of motion, as when we declare a time to be long or short according to a measure of motion, certain to us; because sometimes we know a number through the things that can be counted, and conversely. For we know by this number a multitude of horses and likewise by one horse we know the number of horses. For we would not know how many thousands there were unless we know what a thousand was. The same holds for time and motion. For when a quantity of time is certain to us, but the quantity of motion unknown, then by the time we measure the motion; but we do the opposite when the motion is known and the time unknown.

599. Then [425] he shows the same thing by comparing motion and magnitude. And he says that what has been just said of time and motion happens reasonably because just as motion imitates magnitude in quantity and continuity and divisibility, so also does time imitate motion; for the latter [quantity, continuity and divisibility] are found in motion on account of their presence in magnitude, and they are found in time on account of their presence in motion. For we measure magnitude by means of motion, and motion by means of magnitude. For we say that a road is long when we notice that our motion over it was long; and conversely, when we consider the magnitude of the road, we say that our motion was long. The same holds when relating time and motion, " we said above.

Lecture 20

How things are, and are not, in time

600. After determining the question of time in itself, the Philosopher now discusses it in relation to things that are in time. As to this, he does two things:

First he compares time with things that exist in time;
Secondly, with things that exist in the "now," at no. 612 (L.21).

Concerning the first he does two things:

First he compares time to motion;
Secondly to other things that are in time, at no. 602.

601. In regard to the first, note that motion is related to time in a way different from the way other things are related to it. For motion is measured by time both as to what it is and as to its duration i.e., its existence. But other things, such as a man or a stone, are measured by time as to their existence or their duration

insofar as they have a changeable existence; but as to what they are in themselves, they are not measured by time; rather it is the "now" of time that here corresponds, as was said above (L. 18).

He says therefore [426] that time is the measure of motion itself, and "of being moved," by which he means the duration of motion.

Now time measures motion by a certain part of the motion's being determined by time, which part then measures the whole motion. And this is necessary, because each thing is measured by something of the same genus, as is said in *Metaphysics* X. This is evident in the measures of lengths. For a cubit can measure the entire length of a piece of cloth or of a road, because the cubit determines some part of the length—which part then measures the whole. Likewise by means of a part of motion, time measures an entire motion: for by means of the motion of one hour, the motion of a whole day is measured, and by means of the daily motion the yearly motion is measured. Therefore, since motion is measured by times, for motion to be in time is, nothing more than for it to be measured by time, both as to what it is and as to its duration—because according to both aspects it is measured by time, as was said.

602. Then [427] he shows how it is related to other things:

> First, how other things are in time;
> Secondly, what things belong in time, at no. 603.

He says therefore first [427] that since for motion to be in time is for it to be measured by time, both as to itself and as to its existence, it is clear that it is likewise the same for other things to exist in time and to be measured by time, i. e., not as to what they are, but as to their existence: for motion is essentially measured by time but other things only insofar as they have motion.

He proves, in the following way, that for a thing to exist in time is to have its existence measured by time: To be in time can mean two things; first, as something is said to exist in time, because it co-exists with time; secondly, as something is said to exist in time in the way that things are said to exist in number. And this latter also has two meanings: for in a number something is present (1) as a part, as 2 is in 4; and as a property, such as even and odd, or whatever else that belongs to number; or (2) it can be there, not because it is anything pertaining to number, but because number belongs to it as numbered, as men may be said to be in such and such a number.

But because time is a number something can be present tn time in both ways. For the "now," and "before" and "after," and things of this sort, exist in time as unity exists in number, of which it is a part, and as do even and odd, which are properties of number, and as do "superfluous" and "perfect." (A number is called "perfect," if the sum of the parts measuring it equals the number; for example,

six is measured by one, two, and three, which, added together, equal six. A number is called "superfluous" if its divisors total up to a number which exceeds it: for example, 12 is measured by one, two, three, four, and six, which, when added together equal 16.) And that is the way in which some things exist in time, namely, as being something of time . But things that are not something of time are said to be in time as things numbered exist in number. Consequently these latter things that are in time must be contained under time as under a number, just as things in place are contained under place as under a measure.

Then he explains the very first way of something's existing in time. And he says it is clear that it is not the same thing to exist in time, and to exist when time exists [i.e., to co-exist] just as it is not the same to be in motion and in place and to be in existence when place and motion exist. Otherwise, it would follow that all things would be in anything; for example, the heavens would be in a grain of millet, because when the millet exists, the heavens exist.

There are two differences between these situations: for when something is said to be when something else exists, it is incidental to the one that it exists at the same time as the other; but that in which something exists as in a measure follows necessarily [upon that which is in it], as time necessarily follows upon that which is in time, and motion upon that which is in motion, so that they are together.

603. Then [428] he shows to what things it belongs to be in time;

> First he shows that not all beings exist in time;
> Secondly, that not all non-beings do, at no. 611.

As to the first he does two things:

> First he shows that things which are always do not exist in time;
> Secondly, that nevertheless things that are at rest are, as such, in time, at no. 606.

As to the first he does two things:

> First he mentions the facts from which he proceeds to the manifestation of his proposition;
> Secondly, he concludes to the proposition, at no. 605.

Now he mentions two things. The first of these [428] is that, when something is in time as the numbered is in a number, then necessarily there is some time that can be taken larger than everything that exists in that time, just as it is possible to take a number larger than everything that is numbered. Consequently, all things that exist in time are of necessity contained under time and comprehended under it just as things in place are comprehended under place.

604. The second thing is then mentioned [429] and it is that whatever exists in

time suffers something under time in tl;e- ie-nee of "suffering" fpassic7 as what pertains to defect. And he proves this from the way people ordiiiarily speak. For we are wont to say that length of time "wastes things away," i.e., decays and corrupts them, and again that on account of time all things that exist in time grow old, and that on account of time forgetting occurs - for things we have recently learned remain in the memory but with length of time they slip away.

And lest anyone should say that perfections also are attributed to time as well as defects, he subsequently forestalls this, giving, in effect, three reasons over and above the three aforesaid.

Complementing his statement that forgetting occurs on account of time, he add-s that no one learns on account of time; for if a person should neglect study for a long time, he does not on that account learn, while he does on account of time forget.

In keeping with his statement that all things grow old in time, he adds that nothing becomes new on account of time; for a thing is not renewed on account of a long existence; rather, it becomes antiquated.

To match his statement that time wastes things away, he adds that time does not make a thing good, i.e., whole, and perfect, but rather wasted and decayed. The reason for this is that time corrupts things even when there is no other manifest corrupting agents. All this is due to the very nature of time: for time is the number of motion—and it is of the nature of motion to put a distance between what now is and the condition it was in previously. Consequently, since time is the number of the first motion, which causes mutability in all things, it follows that length of time causes all things that exist to time to be removed from their former condition.

605. Then [430] he concludes to his proposition from the foregoing premises, and first of all, from the first. For it has been shown that whatever exists in time is contained under time while whatever things are always, are not contained under time as exceeding time. Neither is the being, i.e., the duration, of such things measured under time, since they endure to infinity, and the infinite cannot be measured. Therefore those things that exist forever, are not in time. But this is true insofar as they exist always. For the heavenly bodies exist forever according to the being of their substance, but not in regard to "where" they are; consequently, their duration is not measured by time, yet their local motion is.

Secondly [431] he proves the same point from the second of the points laid down before. And he says that a sign that those things which exist forever do not exist in time is that they do not suffer from time, as though not existing in time. For they neither waste away nor grow old, as was said of things that exist in time.

606. Then [432], because he had shown that those things which exist forever do

not exist in time, while those things which are at rest also remain the same way someone might think that things at rest are, as such, not measured by time. Therefore to obviate this, he shows that time is also the measure of rest. And in regard to this he does five things:

First he proposes what he intends, and says that because time is the measure of motion *per se*, it will also be *per accidens* the measure of rest; for all rest is in time just as all motion is.

607. Secondly [433] he excludes something that might lead one to think that rest is not measured by time. For since time is the measure of motion, someone might suppose that a thing at rest, because it is not in motion, is not in time. Consequently, to exclude this, he says that not everything in time need be in motion, in the same way that everything in motion has necessarily to be moved. For time is not a motion but the number of motion. Now it occurs that not only what is being moved, but also what is at rest, may be in the number of motion.

608. Thirdly [434] he proves the proposition that a thing at rest is in the number of motion, as to be measured by time. To do this, he adduces that not every immobile thing, i.e., not every thing that is not in motion, is at rest; rather, a thing at rest is something deprived of motion, but which is nevertheless by nature disposed to be moved, as it was said above in Book III that that is moved whose immobility is rest—for rest is not the negation of motion, but its privation. Consequently, it is evident that the being [existence] of a thing at rest is the being of a mobile being. Hence, since the being [existence] of a mobile being is in time and is measured by time, the being of a thing at rest is measured by time. Now here we are saying that a thing is in time as in a number, because there is some number for that thing, and because its existence is measured by the number of time. Thus it is clear that a thing at rest exists in time and is measured by time, no insofar as it is rest but insofar as it is a mobile being. That is why he said in the beginning that time is *per se* a measure of motion but *per accidens* a measure of rest.

609. Fourthly, [435] he shows in what sense a mobile and a thing at rest are measured by time. And he says that time measures what is moved and at rest not insofar as it is a stone or a man, but insofar as it is in motion and at rest. For measuring is properly due to quantity; therefore, time is properly the measure of that whose quantity is measured by time. Now, from the measuring done by time, are known both the quantity of motion and the quantity of rest, but not the quantity of the thing in motion. Hence the thing in motion is not measured by time according to its own proper quantity, but according to the quantity of its motion. From this it is clear that time properly is the measure of motion and of rest—of motion *per se*, but of rest *per accidens*.

610. Fifthly, [436], he adduces a certain corollary from the foregoing. For if

nothing is measured by time except insofar as it is in motion or at rest, it follows that whatsoever things are neither in motion nor at rest, e.g., the separated substances, are not in time; for this is to be in time, namely, to be measured by time. But time is the measure of motion and of rest, as is clear from the foregoing.

611. Then [473] he shows that not all non-beings are in time. He says it is clear from the foregoing that neither is every non-being in time, as in the case of things that cannot be otherwise [whose contradictory cannot be], e.g., that a diagonal be commensurate with the side of a square: for this is impossible, because it can never be true. Now such things are not measured by time. And he proves it in this way: Time is primarily and *per se* the measure of motion, and anything else is measured by time only *per accidens*. Consequently whatever is measured by time must be capable of motion and rest. Hence things generable and corruptible, and all things that sometimes exist and sometimes do not, since they are "in motion and rest," exist in time, for same time can be found that is greater than they are and which exceeds their duration, and for that reason measures their substances, not in regard to the nature of the substances, but in regard to their existence or duration.

But among things that do not exist but are nevertheless contained by time, some things existed at one time, as Homer; others will exist, as some future event; or, if they are contained both by past and present time, they both will be and were. But things that are in no way contained by time neither are, nor were, nor will be. Such are things that forever are not, and whose opposites forever are; for example, that a diagonal be not commensurable to the side, forever is; whence it is not measured by time. And for this reason neither is its contrary measured by time, i.e. that the diagonal is symmetrical, i.e., commensurable. The reason why it forever is not, is that it is the contrary of what forever is.

But of whatever things the contrary does not always exist, such things can exist and not exist, and are subject to generation and corruption; such things are measured by time.

Lecture 21

The meaning of "now" and related terms

612. After showing how time is related to things that exist in time, the Philosopher here shows how, in virtue of their relations to the "now," certain words derived various meanings with respect to time. About this he does two things:

First he explains the meaning of "now";

Secondly, the meaning of certain other words that are determined by

the "now, " at no. 615.

As to the first be does two things:

First be gives the proper and principal meaning of "now";
Secondly, be gives a secondary meaning, at no. 614.

613. In regard to the first be says three things about "now." The first of these [438] is that the "now" joins past time to the future, insofar as it is the boundary of time—the beginning of the future and the end of the past, although this is not so evident in the "now" as in a point. For a point is stationary and therefore can be considered twice: once as a beginning, and once as an end. But this does not occur with the "now," as was said above.

Secondly [439], he says that time is divided according to the "now" as a line is divided according to the point. But yet the "now" divides time insofar as it, the "now," is considered to be many in potency, i.e., as it is, namely, taken separately as the beginning of this time, and separately as the end of that time. And insofar as it is taken in this way, the "now" is taken as other and other; but insofar as it is taken as linking time and giving it continuity, it to taken as one and the same. And he shows this from a similar situation in mathematical lines, in which it is more evident. For in mathematical lines the point in the middle of a line is not always taken as the same: for insofar as the line is divided, there is understood one point which is the end of one line, and one point which is the end of the other. For lines, insofar as they are actually divided, are considered as contiguous—and contiguous things are those whose boundaries are together. But insofar as the point continues the parts of the line, it is one and the same—for continuous things are those whose boundary is the same. And this is the situation with the "now" in respect of time: for it can be taken in one way as potentially dividing time; in another way, as the common boundary of two times, uniting them, and making them continuous.

Thirdly [440], he says that the "now" that divides and continues time is one and the same as to subject, though differing in conception, as the foregoing has made clear. So much for the first meaning of "now."

614. Then [441] he gives a secondary meaning of "now," saying that "now" has another meaning, for it can be taken, not as the boundary of time continuing the past with the future, but as the time near to the present "now," whether that time is past or future, as when we say, "He will come not," because he will come today, or when we say, "He has come now," because he came today. But we do not say that the Trojan war has happened "now," nor that the Flood took place "now," because, although the whole of the time is continuous [with the present] nevertheless it is not close to the present "now."

615. Then [442] he explains certain things that are determined by the "now." And

first, what "then" signifies. About this he does two things:

First he gives its meaning;
Secondly, he raises a difficulty, at no. 616.

He says therefore first (442) that "then" signifies a time determined by some previous "now," whether near or remote. For we can say that Troy was destroyed "then," and that the Deluge took place "then." For what is said to have taken place "then" must be included between some preceding "now" or instant [and the present]. For it will be necessary to say that there is a time period of definite quantity from the present time to that "now" which was in the past. In this wise it to evident that "then" differs from the second meaning of "now" in two ways: first, because "then" always refers to the past and it matters not whether it to the near past or the remote past; but "now" refers to the near, and it matters not whether it be past or future.

616. Then [443] he raises a difficulty in the light of the foregoing and solves it. For he had said that the time which is called "then" is included within a past "now" and the present: hence all time called "then" must be finite. But there is no time which cannot be called "then." Therefore all time is finite. Now all finite time runs out. It seems therefore that one must say that time runs out. But if motion is always and time is the measure of motion, it follows that time will not run out. Therefore, we shall be forced to say, if all time is finite, either that time is always other and other, or that the same time is repeated over and over. And this situation must exist in time just as it is in notion. For if there is some eternally one and the same motion, then there will have to be one and the same time; but if there is not one and the same motion, there will not be one and the same time.

617. According to his opinion, as will be clear in Book VIII, motion never had a beginning, and will never end. Thus one and the same motion is being repeated, not numerically but specifically. For it is not numerically the same revolution that is taking place now and which took place in the past, but it is specifically the same one. Nevertheless, the whole notion is one in continuity, because one revolution is continuous with the next, as will be proved in Book VIII. And what was said of motion must also apply to time.

From this he shows that time will never fail. For it is evident from the foregoing that the "now" is both a beginning and an end, although not in relation to the same thing; but it is an end with respect to the past and a beginning with respect to the future. Accordingly, the situation with respect to the "now" is like that of the circle, in which its concavity and convexity are the same thing in reality, but differ according as they are related to diverse things. For convexity is had in a circle with respect to things outside it, and concavity with respect to things inside it. And because nothing of time can be taken but the "now" (as was said above) it follows that time is always at a beginning and at an end. And for this reason

time seems to be other and other, for the "now" is not the beginning and end of the same time, but of different times; otherwise, opposite things would be true of the same thing according to the same aspect. For "beginning" and "end" have opposite notions; consequently, if the same thing were a beginning and an end with respect to the same, opposites would exist in the same thing according to the same aspect.

He further concludes from the foregoing that since the "now" is both a beginning and an end of time, time will never fail: for time cannot be understood without a "now," and the "now" is the beginning of a time: hence time is always existing in a beginning of itself. But what is at its beginning is not failing; therefore time will not fail. By the same reasoning it can be proved that time did not commence from the point of view of the "now" which is the end of time.

But this reasoning proceeds on the supposition that motion is always, as he says. On this supposition, one would have to say that any "now" of time is a beginning and an end. But if it be said that motion had a beginning, or that it will cease, it follows that some "now" will be a beginning of a period of time and not an end, and some "now" will be an end but not a beginning, as happens also in a line. For if there were an infinite line, any point designated in it would be a beginning and an and. But if the line is finite, some point in it is a beginning only, or an end only. But this will be investigated more in detail in Book VIII.

618. Then [444] he shows what is meant by the words "presently" or "just"; and that they have the same meaning of "now." For "presently" and "just" refer to what is near the present indivisible "now", whether it is part of the future or part of the past. It refers to a part of the future, when I say: "When will he leave?" "Presently"—because the time in which this will take place is close. It refers to the past when I say "When are you going?" and it is answered,—"I have just gone". However in regard to events that are distant, we do not say "presently" or "just"; for example, we do not say that Troy has "just" been destroyed, because this is very remote from the present "now."

619. Then [445] he explains certain other words referring to time. And he says that "just now" [*modo*] signifies that a period of the past is near the present "now", as when, if it is asked, "When did so-and-so come?" the answer is "just now," if the past time is very close to the present. But we say "long ago", when the time past is far from the present. Finally, we say that something occurs "suddenly", when the time in which it takes place is imperceptibly small.

Lecture 22

How Corruption is attributed to Time—All Motion and Change are in Time.

620. After comparing time and the "now" to things that exist in time, the Philosopher here explains some things that were touched upon above.

First, how corruption is attributed to time;
Secondly, how every motion and change exist in time, at no. 623.

Concerning the first he does two things:

First he makes his proposition clear by an argument;
Secondly, by a sign, at no. 622.

621. He says therefore first [446] that every change of its very nature removes from its natural disposition the thing that is changed: but both generation and corruption take place in time. And therefore some attributed generations in things to time, as in the case of learning and the like, saying that time is "very wise" because the generation of science takes place in time. But a certain philosopher by the name of Parus, a Pythagorean, claimed on the contrary that time was "wholly unteachable," because with length of time comes forgetfulness. And he was more right: for, as was said above, time *per se* is more a cause of corruption than of generation. The reason is that time is the number of motion, and change is *per se* destructive and corruptive. It does not cause generation and existence except *per accidens*. For from the fact that something is moved, it departs from the state in which it was. But that it arrive at some disposition is not implied in the notion of motion insofar as it is motion but insofar as it is finished and perfect. And this perfection is brought about by motion on account of the intention of the agent which moves to a predetermined end. Therefore corruption is attributed rather to change and time, whereas generation and being attributed to the agent and generator.

622. Then [447] he explains the same point with a sign, and he says that a sufficient sign of his claim is that nothing is found to come into being independently of an agent and a mover, but that a thing can corrupt without any mover in evidence. And such corruption we are accustomed to attribute to time, as when someone fails through old age from a corrupting internal cause that is not apparent; but when someone is killed with a sword, his corruption is not attributed to time. However, in generation the generator is always evident, because nothing is generated by itself. That is why generation is not attributed to time, as is corruption. Nevertheless, corruption is not laid to time in such a way as that time should cause it; but rather as occurring in time, while the corrupting influence is latent.

Finally [448], he asserts in a summary way that it has been explained that time exists, and what it is, and how "now" is used in various senses, and what are the meanings of "then" and "just now" and "presently" and "long ago" and "suddenly."

623. Then [449] he above by two arguments that all change occurs in time. The first of these is that in every change is found the distinction of "faster" and "slower." But these are determined by time—because that is said to be changed "faster," which is changed first to a designated term, over a same distance, provided that both motions are subject to the same rule; e.g., in the case of local motion, if both motions are circular, or both in a straight line. But if one were along a circle and the other straight, the fact that one reached its terminus before the other would be no reason for saying that one moved "faster" than the other. And the same is to be understood of other types of change. It follows, therefore, that every change exists in time.

624. He then gives a second reason [450], but in this proof he makes use of the proposition that "before" and "after" exist in time. He manifests this proposition in the following way. "Before" and "after" are said according to the distance from the "now," which is the boundary of the past and of the future. Both "now's" exist in time; therefore both "before" and "after" exist in time, because that in which the "now" is, and that in which the distance from the "now" is, must be the same; just as it is in the same thing that there are a point and the distance taken in relation to that point, for both are in a line.

And because he had said that "before" and "after" are determined by the distance to the "now," he shows how this occurs in a contrary manner with the past and the future. For in the past, that is "before" which is farther from the "now" but "after" which is nearer; but in the future it is just the opposite. If therefore "before" and "after" exist in time, and "before" and "after" follow upon every motion, then necessarily every motion exists in time.

Lecture 23

The Problems are Solved as to the Existence and Unity of Time.

625. After determining the truth about time, the Philosopher now settles certain doubts about time:

First in regard to the existence of time;
Secondly, in regard to the unity of time, at no. 630.

As to the first he does two things:

First he raises the doubts;
Secondly, he solves them, at no. 626.

He says therefore first [451] that certain problems require diligent consideration: namely, that of how time is related to the soul; and that of how time seems to be everywhere, i.e., an earth, on the sea, and in the air.

626. Then [452] he answers these questions:

First he answers the second question, because it is easier;
Secondly, he answers the first one, at no. 627.

He says therefore [452] that time is a certain accident of motion, because it is its number (an accident is wont to be called a "possession" [*habitus*] and "property" [*passio*]: hence, wherever there is motion, time must be. Now all bodies are mobile, if not with other motions, at least with respect to local motion, because all things are in place.

And because someone could say that although they are mobile, they are not all being moved, but some are at rest, and thus time does not seem to be in all, to counter this he adds that time accompanies motion, whether motion be actual or potential. For things that are capable of motion, and are not actually being moved, are at rest. But time measures not only motion but rest as well, as was said above. Hence, wherever there is motion either actually or potentially, there time is.

627. Then [453] he answers the first question, and as to this he does three things:

First he raises the question;
Secondly, he gives an objection to the question, at no. 628;
Thirdly, he resolves the question, at no. 629.

The question, therefore, is this: Would time exist if no mind existed?

628. Secondly, [454] he objects, to say it would not. For if it were impossible for something able to count to exist, it would be impossible for some thing countable to exist, i.e., able to be counted. But if there is nothing countable, then there is no number, because number does not exist except in that which is being actually counted or which is potentially countable. Consequently, if there is no one able to count, there is no number. But only the soul is disposed by nature for counting, and among the parts of the soul only the intellect; for counting consists in comparing the things counted with one primary measure, and comparing is a function of reason. Consequently, if there is no intellective soul, there is no number. But time is a number, an was said. If therefore, there is no intellective soul, there is no time.

629. Then [455] he answers the question. And he says that it is necessary to say either that time is not, if the soul is not; or to say what is truer, that time is still some sort of being even without the soul's existing, similar to motion's existing without the soul's existing. For as motion is posited, so is it also necessary to posit time, because "before" and "after" exist in motion, and it is these things, namely, the "before" and "after" in motion, insofar as they are numberable, that are time.

To make this solution more evident it must be considered that once a series of numbered things is posited, it is necessary to posit number. Hence just as counted things depend on someone's counting, so also their count [or number]. However, the existence of counted things does not depend on an intellect, unless it be an intellect which is the cause of things, as is the divine intellect, It does not depend on the intellect of the same. Hence neither does the number of things depend on the intellect in the human soul; only the counting of them, which counting is an act of the soul, depends on the intellect in the soul. Consequently, just as there can be things perceptible to sense even though no sense exists, and intelligible even though no intelligence exists, so there can exist both numberable [countable] things, and number even though no counter exist.

But perhaps the conditional he first mentioned is true, namely, that if no counter could exist, nothing countable could exist, just as the proposition is true that if there could be no one to sense, there could be nothing sensible. For if there is something sensible, it can be sensed, and if it can be sensed, there can be something to sense it—although it does not follow that if there is something sensible, there is something sensing. In like manner, it follows that if there is something countable, there can be someone to count. Consequently, if no one to count could exist, nothing countable could exist. However, it does not follow that if there is no one counting, there is nothing countable, which is the objection raised by the Philosopher.

Therefore, if motion had a fixed existence in reality, as a stone or a horse has, one could say unqualifiedly that, just as with no soul existing there exists a number of stones, so also with no soul existing, there would exist a number of motion, which is time. However, motion does not have a fixed existence in reality, nor is anything actual of motion found in things but a certain indivisible of motion which divides motion; indeed, the totality of motion comes to be on account of the mind considering and comparing a previous state of the mobile to a subsequent state. According to this, then, time also has no existence outside the soul except according to its indivisible; while the totality of time is had by an ordering process of the mind enumerating the prior and subsequent in motion [i. e., "before" and "after"], as was said above. And therefore the Philosopher said significantly that with no soul existing time is a being "of a sort," i.e., imperfectly; this is similar to the statement that motion exists imperfectly without a soul existing.

So this answers the arguments mentioned earlier, to show that time does not exist on the ground that it is composed of parts that do not exist. For it is clear from the foregoing that like motion it does not have perfect existence outside the soul.

630. Then [456] he raises a question about the oneness of time, or about the

relation of time to motion. As to this he does three things:

First he raises the question;
Secondly, he answers it, at no. 631;
Thirdly, he explains something he took as a presupposition, at no. 637.

So he says first [456] that there is question, since time is the number of motion, of whose, or of what sort of, motion it is the number. Then [457] he answers the question.

First he rejects a false solution;
Secondly, he gives the true one, at no. 634;

In regard to the first he does three things:

First he gives the false answer;
Secondly he disproves it by leading to a discrepancy, at no. 632;
Thirdly, he shows that this discrepancy is really an Impossibility, at no. 633.

631. The first solution, therefore, is that time is the number of any motion whatsoever. To prove this he brings up that every motion exists in time; namely, generation, and increase, and alteration, and local motion. Now what is found in every motion belongs to motion as such. But to exist in time is to be numbered by time. Consequently, it seems that every motion as such has a number; hence, since time is the number of motion, it seems to follow that time is the number of each and every continuous motion and not of some definite motion.

632. Then [458] he disproves this solution. For let us assume two things that are moving together: if, therefore, time to the number of any motion at all, it will follow that of two simultaneous motions each will have its own time, and so it will further follow that two equal times exist at once—e.g., two days or two hours. Now it is not strange for two unequal times to exist at once, e.g., a day and an hour.

633. Then [459] he shows that it is impossible for two equal times to exist at once. For every time that is simultaneous and similar , i.e., equal, is one; but time that is not simultaneous is not numerically one, although it is one in species, as day with day and year with year.

And he explains this by a similarity in other things that are numbered. For if there are seven horses and seven dogs, there is no difference so far as the number is concerned, but the difference is due to the species of the things counted. In like manner, for all motions which have simultaneous terms both as to their beginning and as to their end, there is the same time; yet the motions differ according to their proper notions, in that, perchance, one is fast and the other slow, one is local motion and the other alteration. But the time is the same if the number of the alteration and of the local motion is the same, supposing, of course, that they

are simultaneous. Consequently, motions must be distinct from one another, but the time in all of them is the same— because there is one and the same number for all those that are equal and simultaneous, no matter where they occur.

634. Then [460] he gives the true solution. Concerning this he does three things:

First he prefaces certain facts required for the solution;
Secondly, from these he arrives at the solution, at no. 635;
Thirdly, he makes the solution clear by appealing to the statements of others, at no. 636.

In regard to the first he mentions three preliminary facts. The first of these is that among motions, the first and more simple and regular is local motion, and among these, circular motion, as will be proved in Book VIII. The second is that each thing is numbered by something near it, i.e., by something homogeneous with it, as units by a unit and horses by a horse, as is clear in *Metaphysics* X; hence time must be measured by some definite time, as we see that all times are measured by the day. The third presupposition is that time is measured by motion, and motion by time, as was said above. This is so because it is in terms of some definite motion and some definite time that the quantity of any motion and time is measured.

635. Then [461] he concludes from the foregoing that if something that is first is the measure of all things that are near it, i.e., of all the things in its genus, it is necessary that circular motion, which is regular above all, be the measure of all motions. Now a motion is called "regular," if it is one and uniform. But such regularity cannot be found in alteration and growth, because they are not incessantly continuous or of equal [constant] speed. But regularity can be found in change of place, because there can be a local motion that is continuous and uniform, and the only such motion is circular motion, as will be proved in Book VIII.

Now among circular motions the most uniform and regular is the first motion which turns the whole firmament in a daily cycle; hence that revolution, as being the first and simplest and most regular, is the measure of all motions. But a regular motion must be the measure and number of the others, because every measure ought to be most certain—and those that are uniform are such. Consequently, from this we can gather that if the first circular motion measures every motion, and motions are measured by time insofar as they are measured by some motion, it has to be said that time is the number of the first circular motion, according to which time is measured, and in relation to which are measured all other motions that are timed.

636. Then [462] he corroborates his solution by appealing to the opinions of others, and first of all by the opinion of those who were led to assert that the movement of the heavenly sphere is time, on the ground that all other motions,

and time itself, are measured by that movement; for it is evident that we speak of a complete day or year by reckoning from the motion of the heavens.

Secondly [463] from a common saying. And he says that because of this, namely, that time is the number of the first circular movement, it comes about that people are want to say that there is a cycle in human affairs, and in other things that move naturally and come into being and pass away. This is so because all such things are measured by time, and have a beginning and an end in time, as if time moved in a circle, because time itself seems to be a certain circle. And this again seems to be so because time is a measure of circular movement and is also measured by such a circular movement. And therefore, to say that of things which take place in time there is a certain circle, is nothing other than to say that time is a certain circle—which occurs because time is measured by a circular movement. For that which is measured is not seen to be different from its measure: but rather many measures are seen to make one whole, as many units make one number, and many measures of cloth one quantity of cloth. And this is true when a homogeneous measure is taken.

From all this it is clear that time first measures and numbers the first circular motion and through it measures all other motions. Consequently, there is but one time, due to the oneness of the first motion; and yet whoever perceives any motion whatever, perceives time, because from the first motion there is caused, mutability in all mobile- things, as was said above.

637. Then [464] he explains how something he mentioned above is to be understood. For he said that the number of seven dogs and seven horses is the same number. How this is true he now explains. And he says that it is correct to say, if the number of certain different things is equal, for example, of sheep and dogs, that the number is the same—for example, if the sheep and the dogs are both 10. But it cannot be said that to be 10 is the same for the dogs and sheep, for 10 dogs are not the same 10 as 10 sheep. The reason for this is that a genus can be predicated, with the addition of unity or identity [i.e., as "one genus" or "the same genus"], of several individuals of the same species; and in like manner, the remote genus can be predicated of several species existing under one proximate genus; but neither can the species be predicated of individuals, nor the proximate genus of diverse species, with the addition of unity or identity.

And he then gives an example of what he means. For there are two species of triangle, equilateral, i.e., having three equal sides, and scalene, i.e., having three unequal sides. Now "figure" is the genus for "triangle." We therefore can not say that equilateral and scalene are the same "triangle," but we can say that they are the same "figure," because both are contained under "triangle" which is one species of "figure." He gives the reason for this, which is that since "identical," and "diverse" or "different," are opposed, we can speak of identity whenever no difference is found, but we cannot speak of identity where there is a difference.

But it is clear that equilateral and scalene differ mutually by reason of a difference that divides "triangle," because they are diverse species of triangle. But "equilateral" and "scalene" do not differ in respect of the difference "figure"; rather, they are contained er one and the same difference that divides "figure."

And this is clear thus. If we divide "figure" into its species which are brought about by differences, it will be found that one species is a circle, another a triangle, and so on for the other species of figure. But if we divide "triangle," we will find that one species is "equilateral," another "scalene." It is clear, therefore, that equilateral and scalene are one "figure," because they are contained under the one species of "figure," the species "triangle," but they are not one "triangle," because they are diverse species of "triangle."

The same thing applies to our proposition. For number is divided into diverse species, one of which is 10. Therefore all things that are 10 are said to have one number, because they do not differ from the other in regard to the species of their number, since they are contained under one and the same species of number. But we cannot say that they are the same 10, because the things being called "10" are different, since some are dogs and some horses.

Aristotle seems to have brought up this point so that no one, in trying to uphold the unity of time, would be content with saying that there is one number for things that are equal in number, even though the things be diverse; for although one might have a same 10 or 3 on account of a unity of species, yet it is not the same 10 or 3 on account of the diversity in number as based on matter. Hence, according to this reasoning, it would follow that time would be specifically, but not numerically, one. Therefore to get at the true unity of time, we must have recourse to the unity of the first motion, which is the first thing measured by time, and by which time itself is measured.

Finally, in summary, he concludes that we have finished with our consideration of time, and of the things that are proper to a consideration of time.

BOOK V

Lecture 1

Per se notion is distinguished from *per accidens*

638. After discussing motion and the things that accompany motion in general, the Philosopher now undertakes to give various divisions of motion. And his treatment falls into two parts:

In the first he divides motion into its species;
In the second he divides motion into quantitative parts in Book VI.

In the first he makes two parts:

First he divides motion into its species;
Secondly, he discusses unity and opposition of motion, at L. 5.

The first is divided into two sections:

In the first he distinguishes motion *per se* from *per accidens*;
In the second he divides motion into its species, at L. 2.

The first is divided into two parts:

In the first he distinguishes *per se* motion from *per accidens*;
In the second he shows that *per accidens* need not be discussed but that *per se* motion must, at 647.

In regard to the first he does two things:

First he distinguishes per se from per accidens motion;
Secondly, he makes a summary at 646.

In the first part he distinguishes *per se* motion from *per accidens* motion in three ways:

First, on the side of the mobile;
Secondly, on the side of the mover, at 640;
Thirdly, on the side of the termini of motion, at 641.

639. He says therefore first (465) that whatever changes, i.e., whatever is being changed, is described as doing so in three ways. First, *per accidens*, as when we say that a musician is walking, because the person who is walking happens to be a musician. Secondly, a thing is described as being changed without qualification even though only some part of it is changing, i.e., in statements which refer to part of the thing in question: thus the body is said to be restored to health, because the eye or the chest, which are parts of the body, are restored to health. Thirdly, there is the case of a thing that is in motion neither accidentally nor in

respect of something that belongs to it as a part but in virtue of its being directly and *per se* in motion. And he says "directly" to exclude motion of a part, and *per se* to exclude motion that is *per accidens*. Now this *per se* mobile is a different thing according to the various kinds of motion: for example, it may be a thing capable of alteration—in which case it is called alterable—or it may be capable of growing—in which case it is called augmentable. Again, in the sphere of alteration it is called heal-able, if it is moved in respect of health, and heat-able, if it is moved in respect of heat.

640. Then at (466) from the side of the mover he distinguishes *per se* from *per accidens* motion, And he says that the preceding distinctions which were posed from the side of the mobile can be found in the mover. For a thing is described in three ways as causing motion. First, *per accidens*, as "the musician is building". Secondly, by reason of a part (when some part of the mover causes motion), e. g., the man is said to strike, because his hand strikes. In a third way, something is described as acting or moving directly and *per se*, as "the healer heals".

641. Then at (467) looking at the terminus of motion, he divides motion once more in the same manner.

> First he lays down some presuppositions;
> Secondly, he gives his division, at 645.

About the first he does three things:

> First he declares how many things are required for motion;
> Secondly, he mutually compares them, at 642;
> Thirdly, he settles a question, at 644.

He says therefore (467) that five things are needed for motion, First, there must be a first mover, i.e., a source from which the motion originates; secondly, a mobile that is being moved; thirdly, a time in which the motion occurs. In addition to these three are required the two termini; one from which the motion starts and another into which the motion tends; for every motion is from something into something.

642. Then at (468) he compares these five things:

> First he compares the mobile to the two termini;
> Secondly, he compares one terminus with the other, at 643,

He says therefore (468) that whatever is being moved directly and *per se* is distinct from the terminus into which the motion tends and from the terminus from which the motion begins, as is evident in these three things: wood, hot and cold. For in the motion called heating, the wood is the mobile subject, whereas the hot which is the terminus into which, is something else, as is the cold, which is the terminus from which.

Now he says that what is moved directly is distinct from both termini, because there is nothing to prevent what is being moved *per accidens* from being either of the termini: for a subject, such as wood, is what becomes hot *per se*; but the privation, which is a contrary, namely, cold, is what becomes hot *per accidens*, as was explained in Book I.

That the mobile is distinct from each terminus he proves on the ground that motion is in its subject, for example, in the wood, and not in either of the termini, i.e., not in the species "white" or in the species "black". This is clear from the fact that that in which the motion exists is what is being moved. But the terminus of motion neither moves nor is moved: whether the terminus be a quality, as in alteration, or a place, as in local motion, or quantity, as in the motion called growing and decreasing. However, the mover moves the subject, which is being moved, into the *terminus ad quem*, Therefore, since motion exists in the subject being moved but not in the termini, it is clear that the mobile subject is distinct from the termini of the motion,

643. Then at (469) he compares one terminus with the other. And he says that a change gets its name from the *terminus ad quem* rather than from the *terminus a quo*; for example, a change into non-being has the special name "corruption', while, on the other hand, "generation" is the change into being, even though it starts from non-being. Consequently, the name "generation" pertains to being and "corruption" to non-being. The reason for this is that through change the *terminus a quo* is taken away, but a *terminus ad quem* is acquired: for which reason, motion seems to have a repugnance for the *terminus a quo* and a kinship to the *terminus ad quem*—that is why it gets its name from the latter.

644. Then at (470) he settles a doubt, About which he does three things:

First, he mentions two things that are clear from the foregoing: first, that we have already pointed out in Book III what motion is; secondly, that in the immediately foregoing we have said that qualities and place and passible qualities that are the termini of motion are not themselves being changed, since there is no motion existing in them, as we have already said and as is clear from heat, which is a passible quality, and from science, which is a quality.

Secondly, at (471) he mentions a matter about which there is doubt, saying that someone may wonder whether passible qualities, such as heat and coldness and whiteness and blackness might not be types of motion, since none of them is a subject of motion.

Thirdly, at (472) he mentions a discrepancy that would arise if such a view were posited. For since whiteness is a terminus into which a motion tends, then if whiteness itself were a motion, it would follow that there is motion in the terminus of a motion, which cannot be, as will be proved later. And from this he arrives at the truth that it is not whiteness but whitening that is motion, But he

adds "perhaps" because he has not yet proved that a motion cannot end up in a motion.

645. Then at (473) from the fact that termini of motion are distinct from the mover and from the mobile, he shows that in addition to the divisions of motion taken on the side of the mover and of the mobile, there is a third, i.e., one taken on the side of the terminus. And since it is from the *terminus ad quem* rather than from the *terminus a quo* that motions are named, he develops his division not on the side of the latter but of the former. And he says that even on the side of the termini it is possible to find in motion (1) a goal that is so *per accidens* or (2) partially, i.e., with reference to a part or to something other than itself or (3) directly and not with reference to something else.

And first of all, *per accidens*: when it is said of what is becoming white that it is being changed into something that can be understood or recognized by someone —that will be *per accidens* for it is accidental to the color white that it is recognized.

But if it is said of what is becoming white that it is being changed into a color— this will be according to a part: for it is said to be changing into a color because it is becoming white, which is a part of the genus color. Likewise, if I should say of someone who is going to Athens that he is going to Europe, for Athens is a part of Europe.

However, if it is said of what is becoming white that it is being changed into the color white, this will be directly and *per se*.

The Philosopher does not divide motion from the viewpoint of time (which was one of the five things required for motion) because time is related to motion as an extrinsic measure.

646. Then at (474) he summarizes what he has said. And he says that it is clear how something is in motion *per se* and how *per accidens* and how in respect of something not its entire self, i.e., in respect of a part, and again how what is referred to as directly and *per se* is found both in the mover and in the mobile, For it has been said what a direct and *per se* mover is and also what is being moved directly and *per se*. Finally, we have said that there is no motion in the quality which is the terminus of motion; rather motion is in what is being moved, i.e., in the actually mobile, which is the same thing.

647. Then at (475) he shows which kind of motion needs to be discussed.

First he states his proposition;
Secondly, he explains something he said, at 648.

He says therefore first that *per accidens* change will not be the subject of our discussion, whether it be *per accidens* on the side of the mover or of the mobile

or of the terminus. The reason for this is that *per accidens* motion is indeterminate: for it is present in all things, in all termini, in all times, in all subjects and in all movers, and an infinity of things can be *per accidens* in something. But a change that is not *per accidens* is not found in all things; it is found only in situations (1) that involve contraries or the intermediate between contraries in respect to motions that affect quantity, quality and place, or (2) that involve contradictories, for example, generation and corruption, whose termini are being and non-being—and all this is evident by induction. Now art concerns itself only with things that are determinate, and there is no art to deal with the infinite.

648. Then at (476) he explains his statement that motion can be in the intermediates. And he says that an intermediate may be a starting point of change and go to either of two contraries, inasmuch as we can take the intermediate as being contrary to both extremes. For the intermediate, inasmuch as it is akin to both extremes is in a sense either of them. Hence, we speak of the intermediate as in a sense contrary relatively to the extremes and of either extreme as a contrary relatively to the intermediate; for instance, the central note is low relatively to the highest and high relatively to the lowest, and grey is light relatively to black and dark relatively to white.

Lecture 2

The species of change; which one is motion

649, After distinguishing *per se* from *per accidens* motion, the Philosopher now divides *per se* change and motion into its species.

Here it should be noted that in Book III when Aristotle defined motion, he took it as being common to all species of change. It is in this sense that he now uses the word "change". And he is beginning to use the word "motion" in a stricter sense, i. e., for a certain species of change. Therefore, this section is divided into two parts:

> In the first he divides change into its various species, of which one is motion;
> In the second he subdivides motion into its species, at L. 3.

About the first he does two things:

> First he gives his division of change;
> Secondly, he explains the parts of the division, at 654.

About the first he does three things:

> First he states certain things that must be mentioned before dividing

change;
Secondly, from these he concludes to the division of change, 651;
Thirdly, he answers an objection at 652,

650. He says therefore first (477) that since every change is from something to something—as is clear from the very word "change" which denotes something after something else, i.e., something earlier and something later—it follows from all this that what changes must change in one of four ways. (1) For both termini might be affirmed, in which case something is said to be changed from subject to subject; or (2) the *terminus a quo* is affirmed and the *terminus ad quem* negated, in which case something is changed from subject to non-subject; or (3) on the other hand, the *terminus a quo* is negated and the *terminus ad quem* affirmed, in which case something is moved from non-subject to subject. Finally (4), both termini might be negated, in which case something is said to be changed from non-subject to non-subject. (Here the word "subject" is not taken in the sense of that which sustains a form; rather, anything that is affirmatively expressed is here called a "subject".

651. Then at (478) he derives from these premisses his division of change. And he says that it necessarily follows from these premisses that there are three kinds of change: one is from subject to subject, as when something is changed from white to black; another is from subject to non-subject, as when something is changed from being to non-being; the third is from non-subject to subject, as when something is changed from non-being to being,

652. Then at (479) he precludes a possible objection. For someone might object that since he mentioned four ways in which change can take place, he should have derived four kinds of change and not merely three. But he dismisses this objection by saying that there cannot be any kind of change from non-subject to non-subject, because every change takes place between opposites and two negations are not opposites. For they are neither contrary nor contradictory. A further proof of this is that any pair of negatives may chance to be true of one and the same thing at the same time; for example, a stone is neither healthy nor sick. Hence, since *per se* change occurs only between contraries and contradictories, as was pointed out above, it follows that there is no *per se* change from one negation to another. Such changes would always be *per accidens*, for when something changes from white to black, it changes at the same time, but *per accidens*, from non-black to non-white. This is the way that something is changed from non-subject to non-subject. However, what is *per accidens* in any genus cannot be a species of that genus. Therefore, there can be no species of change from non-subject to non-subject.

653. Then at (480) he explains the parts used in his division. About this he does three things:

First he explains the first two parts;
Secondly, he shows that neither of them is motion, at 656;
Thirdly, he concludes that the remaining part is motion, at 659.

About the first he does two things,,

First he explains one part of the division;
Secondly, he explains a second part, at 655.

654. He says therefore first (480) that the change from non-subject to subject takes place between contradictories and is called generation, which is the change from non-being to being. Now this can take place in two ways: one is unqualified generation, by which something comes to be in the strict sense of the word; the other is a particular kind of coming to be, i.e., in a qualified way, And he gives an example of both kinds. First of all, of the second kind, saying that when some thing is changed from non-white to white, it is not an unqualified coming to be of the whole thing, but a mere coming to be of its whiteness. Then he gives an example of the first: and he says that generation from non-being to being in the order of substance is generation in an unqualified way, in regard to which we say that a thing comes to be without qualification. And since generation is a change from non-being to being, a thing is said to be generated when it is changed from non-being to being.

However, when something passes from non-white to white, it is not being changed from absolute non-being to absolute being. For, speaking strictly, what is being changed is the subject, and the subject of white is an actually existing being. Hence, since the subject remains throughout the whole change, there already was an actually existing being at the beginning of the change, although it was not a being actually existing as white. Consequently, it was not a case of unqualified coming to be but a coming to be white. But the subject of substantial form is not an actual being but a merely potential one, namely, prime matter, which at the beginning of generation is under privation and at the end under forms And so, in the case of a substance being generated, it is said that something comes to be in an unqualified sense.

From this it can be concluded that when it is a case of the coming to be of a form that presupposes another form remaining in the matter, it is not unqualified generation but generation in a particular way; because each form makes a being actual.

655. Then at (481) he makes clear the other part of the division and states that that change which is from subject to non-subject is called "corruption". Rut there is a corruption which is so absolutely speaking and which, namely, is from substantial being to non-being; while there is a certain corruption which is into the opposite negation of any affirmation, as from white to non-white, which is the corruption "of this", as has already been said of generation.

656. Then at (482) he shows that neither of these cases is motion.

First that generation is not motion;
Secondly, that corruption is not motion, at 658.

He proves the first by two arguments. In the first of which he says: What is not unqualifiedly a "this something" cannot be moved, because what does not exist is not moved; but what is unqualifiedly generated is not a "this something" for it is strictly speaking a non-being. Therefore, what is unqualifiedly generated is not being moved. Hence, unqualified generation is not motion.

In explanation of the first premiss he says that non-being is spoken of in three senses: in the first two senses, non-being is not subject to motion, but in the third it is subject to *per accidens* motion.

In one sense, being and non-being refer to the affirmation and negation of a predicate in a proposition, where they refer to truth and falsity; in which sense being and non-being exist only in the mind, as is said in VI *Metaphysics*. Hence, they are not subject to motion.

In another sense, what is in potency is called non-being insofar as being in potency is the opposite of unqualified being in act. Taken in this sense no motion is possible,

In a third sense, that is called "non-being" which is in potency, in such a way as to exclude not unqualified actual existence, but actually being such-and-such; for example, when non-white is called nonbeing and non-good. Such non-being is subject to motion *per accidens*, inasmuch as such non-being is attached to an actually existing thing subject to motion; as when a man is said to be non-white.

Now, why is it that what is not unqualifiedly a "this something" is not subject to motion at all, i,e., neither *per se* nor *per accidens*? It is because it is impossible for the non-existent to be moved, Consequently, it is impossible for generation to be a motion; for generation concerns itself with what is not. And although it was said in Book I that something comes to be *per accidens* from non-being and *per se* from a being in potency, yet it is true to say of what is absolutely coming to be that, strictly speaking, it is non-being; hence, such a thing cannot be moved and, for the same reasons cannot be at rest. Hence, generation is neither motion nor rest,

But if anyone insists that generation is motion, he will be forced to admit the strange proposition that non-being can be moved and can be at rest.

657. At (483) he gives a second reason: Whatever is moved is in a place; but what does not exist is not in a place, otherwise its place could be pointed out, Therefore, what does not exist is not moved.

The truth of the first statement is evident from the fact that since local motion is the first of all motions, whatever is moved has to be moved in respect of place and, consequently, must be in a place. But if you remove the previous, you remove whatever depends upon it.

658. Then at (484) he proves that ceasing-to-be is not a motion, because nothing is contrary to a motion but motion and rest, whereas the contrary of ceasing-to-be is generation, which is neither motion nor rest, as we have shown. Therefore, ceasing-to-be is not a motion.

659. Then at (485) he concludes that the remaining member of the above-given division is motion: for since motion is a definite kind of change, because there is in it something following something (which pertains to the very idea of motion), whereas motion is neither generation nor ceasing-to-be (which are changes between contradictories), it follows of necessity, since there are only three species of change, that motion is from subject to subject.

By two subjects is understood two that are affirmative, whether they be contraries or intermediates; because even privation is a kind of contrary that is expressed affirmatively, as nude, which is a privation, and as white and black, which are contraries.

Lecture 3

Per se motion is not in other predicaments than quantity, quality, and place

660. After dividing change into generation, ceasing-to-be and motion, the Philosopher now subdivides motion into its parts. And because it is the same science that deals with a thing and with its opposite,

He first derives the species of motion;
Secondly, he explains the various senses of immobile, at 683,

About the first he does two things:

First he posits a conditional proposition in the light of which he deduces the parts of motion;
Secondly, he explains this conditional proposition, at 662.

661, He concludes therefore (487) from the previous lecture that, since motion goes from subject to subject, and subjects are involved in certain genera of the predicaments, the species of motion must be distinguished according to the genera of predicaments, especially since motions derive their nature and name from the terminus, as was said above. Therefore, if the predicaments are divided into ten genera of things; namely, substance, quality, etc. (as is explained in the

book of *Predicaments* and in V *Metaphysics*) and motion is found in three of these genera, there must be three species of motion, i.e., in the genus of quantity and in the genus of quality and in the genus of where, which is motion in respect of place.

The way in which motion is present in these three genera as well as how it is related to the predicaments of action and passion has been explained in Book III. Hence it is enough to mention briefly that a motion is in the same genus as its terminus, not that the motion itself would be in the genus, for example of quality, but it is placed there by reduction. For just as potency is reduced to the same genus as its act, inasmuch as every genus is divided by potency and act; so it is necessary for motion, which is an imperfect act, to be reduced to the genus of its perfect act. But when motion is regarded as being in something, though originating from something else, or as originating from one thing and being in something else, then it belongs to the predicaments of action and passion.

662. Then at (487) he explains the conditional proposition.

> First, that there is no motion in any but the three genera mentioned;
> Secondly, how motion is present in those three genera, at 678.

About the first he does three things.,

> First he shows that motion is not in the genus of substance,
> Secondly, that it is not in the genus of relation, at 666;
> Thirdly, that it is not in the genera of action and passion, 668.

He passes over the three predicaments of *when*, *situs* and *habitus*. For *when* expresses existence in time, which is the measure of motion, Hence for the same reason that there is no motion in action and passion which pertain to motion, there is no motion in *when*. *Situs* denotes order of parts, and order is a relation; in like manner, *habitus* bespeaks a relationship existing between a body and what is adjacent to it. Hence there can be no motion in *situs* and *habitus* any more than in relation.

That motion (487) is not found in the genus of *substance* he proves by saying that every motion is between contraries, as we have said; but nothing is contrary to substance. Therefore, there is no motion in re8pect of substance.

663. Now, there seems to be a disagreement between this doctrine of the Philosopher and what he says in the book *On Generation*, that fire is contrary to water. And again in the book *On the Heavens* he says that the heaven is capable neither of coming to be nor ceasing to be, because it does not have a contrary—which seems to imply that things which cease to be are either contrary or composed of contraries.

To reconcile this, some assert that one substance can be contrary to another, as

fire to water, in respect to form but not in respect to their subject. But if that were so, Aristotle's proof at the end of 662 would be worthless; for then there would be motion in substance as long as the substantial forms were contrary. For motion is from form to form, because even in alteration subject is not contrary to subject, but form to form.

Consequently, another explanation must be given; namely, that fire is contrary to water in respect of their active and passive qualities, which are hot and cold, wet and dry, but not in respect of their substantial forms. For it cannot be said that heat is the substantial form of fire, since in other bodies it is an accident in the genus of quality. And substance cannot be an accident of something.

But even this answer presents a difficulty. For it is clear that properties originate from the principles of the subject, i.e., from matter and form. Now, if the properties of fire and water are contrary, then since the causes of contraries are themselves contrary, it seems that the substantial forms are contrary. Moreover, it is proved in X *Metaphysics* that every genus is divided by differences that are contrary, and differences are traced to the forms, as VIII *Metaphysics* explains. Therefore, it seems that there is contrariety between substantial forms.

664. Consequently, it must be asserted that contrariety of differences are all the genera is based on the common root of contrariety, which is excellence and defect, to which set of contraries all others are reduced, as was explained in Book I. For all differences that divide a genus are so related that one is like abundance and the other is like defect in relation to the first. For which reason Aristotle says in VIII *Metaphysics* that the definitions of things are like numbers in which the addition or subtraction of unity makes a different number. However, it is not necessary that there be in every genus the same detailed contrariety between species as exists in some genera; for a contrariety of excellence and deficiency is enough. For since contraries are things most distant, then in order to have contrariety in a genus there must be found two extremes that are most distant, so that between them fall all the things in that genus.

Yet that is not enough for positing motion in a genus, unless it is possible to pass without a break from one extreme to the other. Now these two conditions are lacking in some genera; for example, in numbers. For although all numbers differ according to excellence or defect, yet there cannot be found in that genus two extremes that are most distant; for it is possible to find a lowest number, i.e., 2, but not a greatest. In like manner, there are breaks between the species of number, for each number is formally constituted by unity, which is indivisible and not continuous with another unity.

Likewise, in the genus of substance. For the forms of diverse species differ in respect to excellence and defect, inasmuch as one form is more noble than another, for which reason diverse qualities can be caused by diverse forms, as

the objection mentions.

Yet one form of a species is not contrary to another, if you consider it in regard to its own specific nature. First of all, because when you are speaking of substantial forms, there is no maximum distance between any two forms, such that you must pass through an orderly array of intermediate forms to go from the one extreme to the other. Rather, matter when it doffs one form can indiscriminately receive any other form in just any order. For which reason Aristotle says in II *On Generation* that when fire comes to be from earth, it is not necessary that the intermediate elements be involved at all.

Secondly, because, since the substantial essence of anything consists in an indivisible, no continuity can be found in substantial forms so as to make a continuous motion from one form to another by one form growing weak and the other growing strong.

Hence the proof by which Aristotle shows that there is no motion in substance because contrariety is absent is a demonstration and not merely a probability, as the Commentator seems to suggest, However, besides the reason given above, there is another which proves that in substance there is no motion, and it is this: that the subject of substantial form is merely a being in potency.

665. In qualities of the third species, the two above-mentioned characteristics of contraries (namely, continuity and maximum distance between the extremes) are clearly manifest: first, because qualities can be weakened and strengthened so as to make for a continuous motion from quality to quality, and, secondly, because there exists a maximum distance between two definite extremes of one genus, as black and white in the genus of color, and sweet and bitter in the genus of taste.

However, in quantity and place one of these two characteristics is evident; namely, continuity, but the other, which is max mum distance between definite extremes is not found in them, if you seize upon the general notion of quantity and place. But it is found, if you look for it in a definite thing. For example, in a definite species of animal or plant there is a minimum quantity at which the motion of growing begins and a maximum at which it is terminated. Likewise, in place there are involved two termini that are most distant in respect to some particular motion: from one of them motion begins and at the other it is terminated, and this happens whether the motion be natural or compulsory.

666. Then at (488) he shows that there is no motion in the genus *to something*, i, e., relation. For in any genus in which *per se* motion exists, nothing can newly arise in that genus without its being changed, just as new color is never found in a colored object without that object's being changed. But it does happen that something can be newly said truly of one thing relative to another, where the latter is changed but the former not. Therefore, in relation motion is not found *per se* but only *per accidens*, inasmuch as a new relation follows upon some

change; for example, equality or inequality accompany a quantitative change and resemblance or dissimilarity qualitative change.

667. What has just been said seems to offer difficulty in respect of some types of relation and not of others. For there are some relations that do posit no reality at all in the thing of which they are predicated. This happens sometimes on the side of both extremes, as when it is said that the same thing is the same to the same: for this relation of identity would be multiplied ad infinitum, if each thing were the same as itself through an added relation, since it is evident that each thing is the same as itself. Consequently, this relation exists only in the reasoning power, inasmuch as the reason takes one and the same thing as the two extremes of the relation. The same thing is true in many other relations.

But there are some relations in which one relation is really in one of the extremes but only according to reason in the other; for example, knowledge and the knowable. For "knowable" is a relative term, which is applied to an object not because it is related to something else by reason of a relationship existing in the object but because that something else is related to it, as is clear in V *Metaphysics*. In like manner, when a pillar is said to be on the right of an animal: for right and left are real relations in the animal (because animals possess definite energies on which these relations are based), but in the pillar they are not present in reality but only according to reason, for the pillar lacks the energies which are the basis of these relations.

Again, there are relationships in which both extremes possess a real relation; for example, in equality and resemblance, for both extremes possess the quantity or the quality, which serve as the root of the relationship. The same is apparent in many other relationships.

Now in those relations which put something real in only one of the extremes it is not hard to see that if the extreme in which the relation really exists undergoes a change, something new will be said correlatively of the other extreme, even though it remains unchanged, since nothing really happened to it. However, in those cases in which the relation is really found in both extremes, it is hard to see how something relative can be said of A if B changes but A does not, for nothing can be newly acquired by A without A being changed.

Hence it must be said that if some change in X makes him equal to me (even though I do not change at all), that equality was in a sense in me in advance as in its root, from which that equality has real existence: for since I have such and such a quantity, it belongs to me to be equal to anything having the same quantity. Hence, when X newly acquires that quantity, that common basis of equality reaches to him: that is why nothing new happens to me, when I begin to be equal to X, as he changes.

668. Then at (489) he proves that motion is not in the genera of action and

passion. For action and passion do not differ really from motion, but they add to it something of reason, as we said in Book III. Hence, it is the same thing to say that motion is present in acting and being acted upon as to say that motion is present in motion, Therefore in regard to this he does 3 things:

First he proposes what he intends;
Secondly, he proves his proposition, at 669;
Thirdly, he posits a distinction that will explain the proposition, at 677.

Accordingly, he says at (489) that just as motion is not found in something relative, so also there is no motion of an agent or a patient and, strictly speaking, not even of the mover and moved: for there cannot be motion of motion or a coming-to-be of coming-to-be, which are types of change, nor even a change of change (which is the genus) or a ceasing-to-be of a ceasing-to-be.

669. Then at (490) he proves that there cannot be change of changes. And he does this with six arguments.

The first of which is that there are two ways of interpreting change of change. In one sense it means that there is a change of a change, i.e., of the subject which is being changed, as there is change of a man, because the man is being changed, for example, from white to black. In this interpretation there would be a motion or change of a change or motion as of a subject, in such a way that the motion or charge are changed; for example, that the change gets hot or cold or changes place or grows or decreases. This, however, is impossible, because change is not listed among the subjects of change, for it is not a substance existing by itself. So there cannot be change of change in this sense.

670. In another way it can be interpreted that there be change of change as of a terminus, so that subject A is moved from one type of change to another; for example, from getting hot to getting cold or healthy, so that two changes are understood to be the termini of one change, as sickness and health are taken as the two termini of a change when a man is changed from health to sickness. But it is not possible for a subject to be moved *per se* from one change to another but only *per accidens*. And that it is impossible *per se*, he proves in two ways: for every motion is a change from one definite form to another definite form. Even generation and ceasing-to-be, which are co-divided with motion, have their definite termini; but there is this difference, namely, that generation and ceasing-to-be are to opposite termini "thus", i.e., according to contradiction, whereas motion tends to an opposite terminus "not in a like way" but according to contrariety.

Therefore, if a subject should be passing from one change to another, for example, from getting sick to getting white, while it is at the same time changing from health to sickness, it will be passing from one change into another change. For while the subject is still partially in the *terminus a quo* it is being moved to

the *terminus ad quem,* just as while it still health it is being moved to sickness.

Now, if the very motion from health to sickness is the terminus a quo of some motion, then while that change (from health to sickness)is still going on, the subject is at the same time passing from this change into another change, which succeeds in the subject to the first change. But it is evident that when the first change shall have ended, i.e., when someone has now already changed from health to sickness, subsequently some other change could succeed it, And this is not strange: for after the first change is over, the subject might remain at rest or it might be affected by another change, Therefore, if there is a passing from the first to the second change, it will follow that the motion goes from the first change to an indeterminate goal. And this is against the true nature of *per se* motion, because every motion is from a definite terminus to a determinate goal, for a body does not change *per se* from white to just anything but to black or to something intermediate. It is evident, therefore, that two changes cannot be the *per se* termini of a change.

671. He proves this same point again with another argument: If the passing from a previous changing to a subsequent change were motion *per se*, it would not be necessary that the passing be always to a "contingent" change, i.e., one which could co-exist with the previous change: as becoming white can co-exist with becoming sick, but getting well cannot co-exist with getting sick, because these are contrary changes. But it is possible that just as becoming white can follow becoming sick in the same subject, so also could becoming well. And this is what he says: that the passing from one change to another will not always be to a contingent change, since it is sometimes to a non-contingent, and that non-contingent change proceeds from something to something else, that is, it is between two other termini, Hence that non-contingent change into which something passes from the change called "getting sick" will be "getting well", which is the opposite of "getting sick".

Now that this is strange is evident from what we have said above, that while the first change is still going on, it is being changed to the second change: therefore, while something is being moved to sickness, it will be changing to another change called "getting well". Hat the goal of getting well is health (for it is from something to something, as was said). Hence it remains that while something is being moved to sickness it is at the same time being moved to health, which means it is being moved toward two contraries at the same time and intends them at the same time—which is impossible. Consequently, it is clear that no change from one change to another is *per se*.

However, that such a thing can take place *per accidens*, as he had said before, he makes clear, when he says that this can happen *per accidens*, as when a subject is now affected by one change and later by another; for example, if someone is changed *per accidens* from remembering to forgetting or to any other

change: because the subject of the change is sometimes changed to knowledge and sometimes to something else, for example, to health.

672. Before giving the second of the six reasons he promised, he presents (491) two conditional propositions: the first of which is that if there is change of change and generation of generation, in either case it would be necessary to go on *ad infinitum*; because, for the same reason the second generation will have another generation, and so on ad infinitum.

The second conditional is that if generations and changes are so arranged that there is change of change and generation of generation, then, if there is a last change or generation, there necessarily had to be a first.

This second conditional he now proves: Let fire be the thing that is unqualifiedly generated; if, then, there is a generation of generation, it is necessary to say that that unqualified generation was itself generated and that its coming-to-be came to be. When, however, that coming-to-be was being generated, the fire was not existing (for it is being assumed that the fire is being unqualifiedly generated): because a thing does not exist while it is coming to be, but it exists for the first time after it has come to be. Therefore, as long as the coming-to-be of fire was in the state of coming to be, the fire had not yet come to be; therefore, it was not yet existing. And again the very coming-to-be of its coming-to-be was itself (for the same reason) coming to be. Consequently, just as when the coming-to-be of the fire was coming to be, the fire did not exist, so also as long as the coming-to-be of the coming-to-be was taking place, the coming-to-be of the fire was not existing.

From this it is clear that coming-to-be of fire cannot exist till that coming-to-be is completed and, for the same reason, the previous coming-to-be of the coming-to-be of the fire and so on to the first. Consequently, if there was no first coming-to-be, there will be no last, i.e., no coming-to-be of the fire. But if an infinite process be posited in cases of coming-to-be, there will be no first change and no first coming-to-be, because in the realm of the infinite there is no first. Hence, it follows that there is no sequence at all among generations and among changes. But if there is no generation or change, nothing comes to be and nothing changes. Consequently, if there were coming-to-be of coming-to-be or change of change, nothing ever comes to be or changes.

Note, however, that this argument does not exclude the possibility of one change following another ad infinitum. *per accidens*: which has to be admitted according to the opinion of Aristotle, who posited eternal motion. But the argument intends to show that there is no *per se* change *ad infinitum*, for in that case a present change would depend on an infinitude of preceding changes and would never end.

673. He gives the third reason at (492) and it is this. One and the same motion

has as its contraries both motion and rest; for example, both descending and rest in the lower place are contrary to ascending. In the same way are generation and ceasing-to-be contrary. But contraries are apt to affect the same thing. Therefore, whatever comes to be can cease to be. But if there is coming-to-be of coming-to-be, then coming-to-be must come to be. Therefore coming-to-be ceases to be. But what ceases to be must be: for just as it is what is not that comes to be, so it is what is that ceases to be. Therefore, it is necessary that when what comes to be comes to be, i.e., when something-comes to be and the coming-to-be exists, then the very coming-to-be ceases to be, not indeed as soon as the coming-to-be is finished or some time after it is finished, but during the coming to be-which seems absurd.

But it should be observed that coming-to-be is as a terminus of what comes to be as a substance does, because coming-to-be is a change tending to substance. But the subject of coming-to-be is not what comes to be but its matter. Hence Aristotle is not departing from his proposition that there is no change of change, as of a terminus.

674. At (493) he gives the fourth reason, In every coming to be there must be matter from which that which comes to be is generated, just as every change requires some matter or subject: for example, in alteration the subject is the body, if you are dealing with bodily qualities, or the soul, if you are dealing with soul qualities. If, therefore, coming-to-be comes to be, there must be some matter involved which passes into the form coming to be as the matter of generated fire passed into the form fire. However, such matter is not discoverable.

In the same vein he makes use of another medium: namely, that in every coming-to-be or change there must be involved a goal toward which something is moved. And this goal must be something definite and capable of being pointed out. But neither change nor coming-to-be is such a goal. Therefore, it is not possible that there be either change of change or coming to be of coming-to-be.

675. At (494) he gives the fifth reason: Genus is to genus as species is to species. If, therefore, there is coming to be of coming-to-be, then the coming to be of teaching is itself teaching. But this is evidently false: for teaching is the generation of science and not of teaching. Therefore, neither can there be a coming to be of coming-to-be.

676. The sixth reason is given at (495) and it is this: If there is change of change, whether as of a subject or as of a terminus, then, since there are three species of motion, as was said above (motion to where and quantity and quality), it will follow that one of these species could be the subject and terminus of some other species or even of its own species. Therefore, it will follow that local motion can be altered or even be moved locally. Such a thing is more plainly absurd when you get down to cases than when you speak in general. Therefore, it cannot be

admitted that there is change of change or coming to be of coming-to-be.

677. Then at (496) he shows in what sense there can be change of change. And he says that since there are three ways in which something can be moved, (namely, in respect to an accident or in respect to a part or *per se*, it is only *per accidens* that there could be change of change, i.e., only inasmuch as the subject of the change changes: for example, if someone, while he is becoming healthy, would run or learn; for then the healing process would be running or learning *per accidens*, just as a musician builds *per accidens*. But it is not our intention to treat of *per accidens* motion, for we have already decided to pass it by.

Lecture 4

Motion is solely in quantity, quality, and place

678. Having shown that there is no motion in substance or in relation or in action and passion, the Philosopher now tells in which genera motion does exist. And about this he does three things:

> First he arrives at the intended conclusion;
> Secondly, he shows how motion is found in each of three genera, 679;
> Thirdly, he answers a difficulty, at 682.

He says therefore first at (497) that since motion is neither in substance nor in relation nor in acting and being-acted-upon, as has been explained, there remain but three genera in which there is motion: *quantity*, *quality* and *where*, for in each of these genera there is apt to be the contrariety which motion requires.

He has already explained both why he omits the three genera of *when*, *situs* and *habitus* and how there is contrariety in the three genera in which motion is found.

679. Then at (498) he explains how motion is found in the three genera:

> First in quality;
> Secondly, in quantity, at 680;
> Thirdly, in where, at 681.

He says therefore first that motion in the genus of quality is called "alteration". And he refers to this genus a common name—alteration; for in Latin the word *alterum* (other) is customarily applied to things that differ in respect of quality. And we are speaking of quality not in the sense in which it is found in the genus of substance, where the substantial difference is said to be predicated in regard to that which qualifies, but in the sense of a passive characteristic (contained in the third species of quality) in virtue of which something is said to receive or not receive a quality such as hot and cold, black and white, and so on. It is in respect to these that things are said to be "altered", as will be shown in Book VII.

680. Then at (499) he shows how there is motion in quantity, And he says that motion in respect to quantity does not have a name for its genus, as quality has the generic name "alteration". Rather it is named according to its species, which are "growth" and "decrease". For the movement from imperfect size to perfect is called "growth"; the one from perfect size to imperfect is called "decrease".

681. Then at (500) he explains how there is motion in where. And he says that motion in respect of place has neither a common name for its genus nor a particular name for its species, yet he gives it the general name *latio*—although this is not the generic name of every type of local motion. For it is properly used of things which are so moved in respect of place that it is not due to their own power that their local motion stops; in other words, things that are moved not by themselves but by others.

The reason why the common name could be applied to motion in quality is that qualities are contrary in the very notion of their species according to which they are contained under the genus of quality. But quantities are contrary, not according to the very characteristics of their species, but according to "perfect" and "diminished"; and it is according to these that the species of quantity derive their name. However, in place the only contrariety that exists is founded on motion in respect to which two termini are most distant, Consequently, because such contrariety is based on something entirely foreign to place, no motion in this genus could possess a name based either on the genus, or the species under the genus.

682. Then at (501) he clears up a point about which there could be doubt and shows to which species of motion should be reduced a change from lesser to greater or greater to lesser; for example, when something white becomes less white or more white. For at first sight it might seem that it should be reduced to the motions called "increase" and "decrease". But he shows that it should be reduced to alteration, saying that any change within the same species of quality, for example, change to whiteness or to more or less whiteness, is alteration.

He proves this by the fact that alteration, which is change from one contrary to the other in respect of quality, can occur in two ways: first, unqualifiedly, as when something changes from white to black or vice versa; or secondly, qualifiedly, when something changes from more white to less white, and vice versa. And that such a change is a change from contrary to contrary he now proves: for when something is changed from more white to less white, such a thing is said to be changed from one contrary to its opposite, because it is approaching the true contrary, which is black. And when it is changed from less white to more white, it is as though it were changed from one contrary to its opposite, namely, from black to white. For it becomes more white by becoming further removed from black and acquiring more perfect possession of whiteness.

In order for there to be alteration, it makes no difference whether the change is unqualifiedly from contrary to contrary, or from more to less or less to more, except that in the former case the termini of the alteration must be two actual contraries; whereas the change in regard to more and less involves the subject's having or not having in a greater or lesser degree one or another of the contraries.

At the end of (502) he concludes that it is now clear that there are only these three kinds of motion.

683. Then at (503) he explains the various senses of "immobile", giving three. The term "immobile" is applied in the first place to what is absolutely incapable of being moved, as God; just as we correspondingly apply the word "invisible" to sound', In a second sense, it is applied to what is moved with difficulty (in two ways) either because, after it has begun to be moved, it continues slowly and with great difficulty (as when we call a lame person "immobile") or because it is difficult to get it started both on account of the labor and time involved, as when we say that a mountain or a large rook is immobile, In a third sense something is called "immobile", when it is capable of being easily moved, but it is not in motion when and where and in the manner in which it is capable. This alone is called "rest", because rest is the contrary of motion. Here "contrary" is used in a wide sense, i.e., in the sense that includes even privation. Hence he concludes that rest is privation of motion in that which is capable of motion. For "contrary" and "privation" are applied only to things that are susceptible of opposites.

Finally, at (504) he summarizes and says that it is now clear what motion is and what rest is and what are the varieties of change and which of them can be called motion.

Lecture 5

The definitions of "in contact," "consecutive," "continuous"

684. After dividing change and motion into its species, the Philosopher now begins to discuss the senses in which motion is said to be one, and the senses in which motions are said to be contrary. About this he does two things:

> First he establishes a background of preliminary notions that will be of use;
> Secondly, he pursues his main objective, at L. 6.

About the first he does three things:

> First he states his intention;
> Secondly, he pursues it, here at 684;
> Thirdly, he makes a summary, at 694.

He says therefore first that we must now define the terms *together*, *extraneous* or *separate*, *touching* [in contact], *intermediate* [or between], *consecutive to*.

The reason for positing these definitions now is that they will be used in later demonstrations, just as in the beginning of Euclid are posited definitions that serve as principles of later demonstrations.

685. Then at (5o6) he carries out his plan.

First he defines the terms he mentioned;
Secondly, he compares one to the other, at 692.

About the first he does three things:

First he defines those that pertain to *contact*, i.e., *touching*;
Secondly, those which pertain to *consecutiveness*, at 686;
Thirdly, those that pertain to *continuum*, at 691.

Since "together" occurs in the definition of in contact, the Philosopher defines it first (506) and says that those things are said to be together in respect of place which are in one first place, where first place refers to proper rather than common place. For things are said to be *together* not because they are in one common place but in one proper place; otherwise, we should be able to say that all bodies are together, since they are all contained under the heavens.

He speaks of such things that are together in respect of place, in distinction to those that are said to be together in time—a point we are not now discussing, Conversely, whatever things are one in one place, and another in another place, are said to exist *separate* or *apart*.

But in contact is said of things whose termini are together. The termini of bodies are surfaces and of surfaces, lines, and of lines, points. Therefore, if two lines are in contact as to their termini, the two points of the two lines in contact will be contained under one point of the place containing them. From this, however, it does not follow that the thing in place is greater than the place, for point added to point does not make anything larger. And the same holds for the others.

686. Then at (507) he defines the things that pertain to *consecutiveness*, About this he does three things:

First he defines *between*, which is placed in the definition of *consecutive to*;
Secondly, he defines *consecutive to*, at 689;
Thirdly, he draws a corollary, at 690.

He says therefore first (507) that the between is what a naturally and uninterruptedly changing thing is apt to arrive at before it reaches the ultimate terminus of the motion, into which terminus it is being changed; for example, if something is changing from A to C through B, then, provided it is a continuous

motion, it reaches B before C.

In some cases there are a number of "betweens" to be traversed as you pass from one extreme to the other, as from black to white there are many colors between; but there must be at least three things involved, two of which are extremes and one the *between*. Consequently, the *between* is what must be passed through before arriving at the terminus of a change: but the terminus of a change is a contrary; for it has already been stated that motion goes from contrary to contrary.

687. Because the definition of between made mention of continuity of motion, he now shows what continuous movement means. Now continuity of motion may be viewed from two aspects: first, from the time during which the movement occurs and, secondly, from the thing through which the motion takes place for example, the magnitude, in local motion.

For a motion to be continuous it is required that there be no interruptions in time, because even the slightest interruption of the motion as to time prevents the motion from being continuous.

But on the side of the magnitude through which the motion passes there can be slight variations without prejudice to the continuity of the motion. This is clear in crossings over streets, at which stones are placed slightly distant from each other, and over which a person passes from one side of the street to another without interrupting his motion. This, therefore, is what he says: that continuity of motion is present when there is no gap or only the slightest in the thing, i.e., when there is no interruption in the thing over which the motion passes or, if there is, it is very slight. But there cannot be the slightest interruption of time, if the motion is to be continuous.

How there can be a gap in continuous motion he explains by adding that a motion will be continuous even if there is a gap in the material, as long as there is no time-gap; for example, if in playing the harp one strikes the highest note immediately after having sounded the lowest and none of the intermediate ones. But this is not a gap in time, but in the material in which the motion takes place.

What has been said about the continuity of motion applies not only to local motion but to all the others as well.

688. But because it is not evident how the terminus of a local motion is a contrary, since one place does not seem to be contrary to another, he now gives an explanation. And he says that the contrary in respect of place is the greatest rectilinear distance, where greatest distance is taken in relation to the motion and the mobiles and the movers, for example, for the motion of heavy and light things the distance from the center of the earth to the extremity of the sky is the greatest distance, while in regard to my motion and your motion, the greatest

distance is the interval between where we start and where we intend to arrive.

What he means by the phrase "in a straight line" he explains by adding "that the shortest line is definitely limited". To understand this, consider that the shortest distance between two points is a straight line, for between any two points there is only one straight line. But there are any number of curved lines between two points, where by curved lines we mean the arcs of major or minor circles, Now since every measure should be finite (otherwise there would be no way of knowing the quantity of a thing—for that is the purpose of measuring), the greatest distance between two objects is not measured by a curved line but by a straight line which is finite and determinate.

689. Then at (508) he defines what is meant by consecutive to and a species of it, namely, contiguous. And he says that two things are required in order that something be called consecutive to another. One is that it be after the first and in a certain order: either according to position, as things that are in order in place; or according to species, as 2 comes after 11 or in any way in which things can be in order, as according to virtue, according to dignity, according to knowledge, and so on. The other requirement is that between that which is consecutive and that to which it is consecutive there not be anything of the same kind intervening; for example, one line is consecutive to another, if there is no line between—likewise from one unit to another and one house to another. However, this does not forbid something else intervening. For example, an animal could be found between two houses.

Why he said "to which it is consecutive" and "that it is after the first" he explains by adding that whatever is said to be consecutive is so in respect to something else, not as being prior to it but as following it. For 1 is not said to be consecutive to 2, or a new moon to a second new moon; rather, it is just the opposite.

Then he defines a certain species of consecutive called *contiguous*. And he says that not everything consecutive is also contiguous, but only when it is consecutive and in contact, so that there is nothing at all between, i.e., nothing of the same genus or of any other genus.

690. Then at (509) he concludes from the foregoing that since the *between* is that through which something is changed into what is final, and since every change is between opposites which are either contrary or contradictory, although there is no between in contradictories, it follows that it is between contraries that the *between* is found.

Then at (510) he shows what a *continuum* is and he says that it is a species of the contiguous. For when the terminus of two things in contact is one and the same, then something is continuous. And the very word "continuum" denotes this. For "continuum" is derived from "continere" (to hold together): when, therefore, many parts are held together in a unit and, as it were, keep

themselves together, then there is a continuum. But this cannot be while the endings are two but only when they are one.

From this he further concludes that continuity can occur only in things from which a unity through contact is naturally apt to come about. For in whatever way a whole is naturally one and continuous in the same way is a continuous unity formed from many things, whether by riveting, by glueing or by any form of contact that makes one terminus for two parts, or even by being born of another, as fruit is born of a tree and forms a sort of continuum with it.

692. Then at (511) he compares three of the foregoing with one another; namely, the consecutive to the continuous, and the continuum. About this he does three things:

> First he compares consecutiveness to contact;
> Secondly, contact with continuum, at 693;
> Thirdly, he draws a corollary, at 694.

He says therefore first (511) that it is clear why among these three, *consecutiveness* is naturally first in the order of nature, for in the cases of contact there is always consecutiveness, since there must be an order, at least of position, among things that are in contact. Bat not all cases of consecutiveness involve contact, for an order can exist among things in which there is no contact, as in substances separated from matter. Hence, consecutiveness is present in things that are prior in definition, for it is found in numbers, in which there is no contact, which is present only among continua. Numbers, however, are prior to continuous quantities in definition, for they are more simple and more abstract.

693. Then at (512) he compares *in contact* with continuous and says that for the same reason in contact is prior to continuous, because if a thing is continuous it must be in contact, but it does not necessarily follow that if it is in contact it is continuous,

And he proves this from the definitions of the two. For it is not necessary that the endings of things be one (which is implied in the notion of continuum), if they are together (which is implied in the notion of contact). But, on the other hand, if the endings are one, they must be together, for what is one is together unto itself.

However, if "together" implies a relationship between distinct things, then things that are together are not one: and according to this, continua are not in contact. But they are, if we do not speak so precisely. Hence he concludes that natural junction, i.e., continuity, in which one part is joined to another at one terminus, is last in coming to be, in the sense that what is specific comes to be after what is general, as animal comes to be before man. And, therefore, I say that natural junction is last, because things must mutually touch if their extremities are naturally united; however, it is not necessary that all things that touch be

naturally joined to one another. But in regard to things which cannot touch, it is clear that continuity is impossible.

694. Then at (513) he draws a corollary from the preceding: i.e., if point and unit have an independent existence of their own, as some say who suppose a separated existence for mathematical objects), it follows that unity and point are not the same.

And this is clear for two reasons: first, because points are present in things that are capable of mutual contact and certain things touch at points; but in units contact is never found, but only consecutiveness. Secondly, because there must be something existing between two points, but between two unities there is not necessarily anything

between. For it is evident that between the two unities that form 2 and the very first unity, which is 1, there is nothing intermediate.

Finally, at (514) he makes a summary and says that we have defined what is meant by together and apart, contact, between, consecutiveness, contiguous and continuous. Also we have shown in which circumstances each of these terms is applicable,

Lecture 6

Generic, specific, and numerical unity of motion

695. After positing some definitions to be used later, the Philosopher now proceeds to discuss unity of motion and contrariety of motions.

First he treats of the unity and diversity of motion;
Secondly, of its contrariety, which is a kind of diversity, L.8,

About the first he does three things:

First he shows how motion is said to be generically one;
Secondly, how it is specifically one, at 697;
Thirdly, how it is numerically one, at 699.

696. He says therefore (515) that there are a number of ways in which a motion is one, just as one itself has many senses: i.e., generically, specifically and numerically. A motion is said to be generically one according to the different predicaments. For all motions that are assigned to one and the same predicament can be called generically one; thus every local motion is one generic motion, because each is in the predicament where, and differs generically from alteration, which is in the predicament quality, as has been said above.

697. Then at (516) he shows how motions are specifically one.

First he shows this;
Secondly, he raises a question, at 698.

He says therefore first (516) that a motion is called specifically one when, besides being a generic one, it also takes place in a species incapable of subdivision. For some species can be subdivided into other species, as color, which is a species of quality, is capable of differences that make for sub-species. Hence motions in regard to color can be diverse in species, as whitening and blackening; but all cases of whitening are specifically the same (just as all cases of blackening are), for there are no sub-species of whitening.

But when it happens that the species is at the same time a genus, then the motions found in a subalternate species are qualifiedly one, although, strictly speaking, they are not of the same species. Thus science is a species of knowledge, as well as a genus of the various types of science. Hence all indoctrination, which is a movement toward science, is in some sense specifically the same, although, strictly speaking, it is not, for the indoctrination by which grammar is taught is absolutely different in species from that by which geometry is taught.

Now it should be observed that in the foregoing the Philosopher has based the unity and diversity of motion on the genera and species in which motion can occur, because motion is in a certain way reduced to the genus in which the motion is.

698. Then at (517) he raises a question about the foregoing: Whether a motion is specifically one and the same when the same thing changes frequently from the same to the same, e.g., when a point (according to the geometers who imagine that a point can be moved) changes again and again from this place to that. Now according to the foregoing it seems that the answer should be Yes. For if all motions that tend to the same species, e.g., whiteness, are specifically the same, a fortiori two motions from the same origin to the same terminus should be specifically one. But if that were so, then it would follow that a rectilinear motion is specifically the same as a circular motion. For it is possible to pass from this place to that by means of a circular motion, i.e., by describing an arc, and after by going in a straight line. Likewise, it would follow that in the motions of animals, walking (which is in a straight line) would be specifically the same as whirling, which consists in turning oneself in circles.

However, he answers this difficulty in the light of the foregoing. For it has been decided that if that in which the motion takes place is specifically different (as in the present instance the circular path is specifically different from the straight), the motion itself is also different. Consequently, in order that two motions be specifically the same, not only must the goal be specifically the same but also that through which the motion passes. Now it is clear that a straight line is

specifically different from the curved. Consequently, a circular and a rectilinear motion, as well as walking and whirling, are not specifically the same, even though they tend to the same goal, because the paths are not specifically the same.

But if the goals are identical and the paths specifically the same, then the motions are specifically the same; and much more so, if the goals and the path are numerically the same, the same repeated motions will be specifically the same.

699. Then at (518) he posits the third way in which a motion is said to be one; namely, numerically. About this he does two things:

First he explains when a motion is numerically one;
Secondly, he raises some question on this point, at 700.

He says therefore first at (516) that in the first two senses motions are not unqualifiedly one, but they are one only in a sense, i.e., in genus and species. But in the third sense a motion is unqualifiedly one, i.e., when it is numerically one in its essence.

Which motion is one in this way will be clear, if we distinguish the things required for motion: for numerically there are three things on which the unity of a motion depends: first, the subject which is being moved; secondly, the genus or species of the motion; thirdly, the time in which the motion takes place. And he explains each of these individually.

A subject of motion is required, because in every case of motion there must be something that is being moved, as a man or gold or some body. Likewise the subject must be affected by some genus or species of motion, such as place or a passible quality. Again, the time must be considered, because whatever is moved is moved in time.

Now among these three things, the generic or specific unity of the motion can depend on the thing in which there is motion; for example, on the place or quality. But the time does not account for the generic or specific unity of the motion, for there is only one specific time; rather it accounts for the continuity of the motion, i.e., that it flows on without interruption.

But unity of motion, in the sense of unqualified unity, depends on all three. For that in which the motion exists must be one and indivisible in the way that a species incapable of further subdivision is said to be one. Further, the time during which the motion occurs must be continuous without any breaks. Thirdly, the subject in motion must be one.

However, there are two types of unity of subject which are not sufficient to guarantee that the motion is unqualifiedly one. The first type is accidental: for

example, Coriscus and white are accidentally one, but the motion proper to Coriscus in not the same as the motion proper to white. For the proper motion of white is to become black and the motion proper to Corisicus is to walk; and these are different. The second type is generic and specific unity. For in order that a motion be numerically one, it is not enough that the subject be one as something common either generically or specifically. For it is possible that two men are being healed during the same period of time in regard to the same thing; for example, from inflammation of the eye, so that the time is one and the species of motion is one, and the subject is one in species. Yet these two healings are not one numerically but only specifically.

700. Then at (519) he raises a question. And about this he does three things:

> First he mentions what at first glance seems to be a motion numerically one;
> Secondly, he raises a question about this, at 701;
> Thirdly, he gives the true solution, at 702.

He says therefore first (519) that it is possible for one mobile, e.g., Socrates, to be altered at two different times with respect to the same specific disease, for example, if he is twice healed of eye-inflammation. This repeated healing will at first sight be numerically one motion, if the health acquired is numerically the same in both cases. And this will be so, if it is possible for that which ceased to be to come again into being as the same numerical thing—which seems impossible. For the health acquired after the first alteration was later lost and the same numerical health cannot be regained.

But it seems that if the same numerical health were regained, the second alteration would be numerically the same motion as the first; whereas if the same numerical health is not regained, the motion will not be numerically the same but specifically.

701. Then at (520) he raises another difficulty on this point. It is this: if someone continually perseveres in health or any other accident, could the health, or any other habit or passion in bodies, be one? It seems not, because certain philosophers believe that all subjects that possess certain qualities or habits are in continuous motion and flux.

If, therefore, in the case of a person who remains healthy, there is one and the same health at dawn and at noon and in the evening, there seems to be no reason why in the case of a person who gets sick and then recovers, the health recovered is not numerically the same as the one previously possessed.

Aristotle does not settle this question: first, because it is not *ad rem*, since it pertains to metaphysics, whose province is to consider the one and the many, the same and the diverse; and, secondly, because this difficulty is based on the false assumption that all things are in a state of continuous change and flux, as

Heraclitus believed—an opinion which Aristotle refutes in IV *Metaphysics*. Moreover, the two cases are not the same: for as long as health remains in spite of fluctuations in degree, the original health is not interrupted, as it is in the case of one who completely loses his health.

?02. Then at (521) he determines the truth in regard to the case mentioned in 700. For he mentioned there that if it is the same quality that is recovered, the second alteration will be numerically the same motion as the first; if the same numerical quality is not recovered, then it is not numerically the same act.

Having presented a certain difficulty as though giving a reason for what was set down above, he adds that the reason for raising the difficulty was that at first sight it seemed that the same argument would hold good for the unity of quality and of motion.

But there is a difference: for it does follow that if two motions are the same in the manner in which a motion is said to be numerically one, then the habit, i.e., the quality, acquired by the motion is one; because numerically the same quality is produced by an act numerically one. However, if the quality that returns is one, not everyone would agree that the act is one; for if the terminus of two motions is numerically one, it does not mean that the motions were numerically one. This is evident in local motion. For when a person interrupts his walk, the act of walking ceases; but when he resumes, the act resumes. Now, if you were to say that the whole journey is one act of walking that ceases to be and is then revived, then it would follow that one and the same thing can exist and cease to exist any number of times—which is impossible. In like manner if the same numerical health is again and again recovered, it does not follow that the second healing was the same motion as the first, any more than a second walk is the same as a first, even though both go toward the same numerical goal.

Finally, he concludes that these difficulties lie outside the present enquiry and are for that reason to be passed over.

Lecture 7

Numerical unity of motion (continued)

703. After positing that three things are required in order that a motion be unqualifiedly one, namely, unity of time, unity of that in which the motion takes place and unity of subject, the Philosopher now intends to prove this.

Now while there are a number of ways in which things are unqualifiedly one, one being the way in which an indivisible is one and another the way in which a continuum is one, no motion can be unqualifiedly one in the way that an indivisible is one, because no motion is indivisible. Consequently, it remains that a

motion is one to the extent that it is continuous and that, insofar an a motion is concerned, to be continuous is to be unqualifiedly one, so that the very continuity of motion suffices for its unity. For if it is continuous, it is one. Accordingly, whatever is required to make a motion be continuous is also required to make it one.

704. Now, in order that a motion be continuous, three things are required. The first of these is oneness in species. For there will not be continuity between one motion and another indiscriminately any more than there is continuity between just any two continuous things chosen at random in any other sphere. There can be continuity only when the extremities of the two things are one—this is implied in the very notion of continuity, as was explained above. Now, some things have no extremities at all; for example, forms and all indivisibles. Therefore, in regard to such things there can be no continuity. Other things have extremities which are divisible and have quantity. Some such things are equivocal, i.e., not agreeing in name and notion. Such things afford no means of forming continuity; indeed, in many cases no contact is possible. For how could a line and walking be in contact, or how could they possess a common extremity, so as to make continuity possible?

This shows that continuity is impossible with things that belong to genera or species that are diverse.

However, motions that differ generically or specifically can follow one upon the other, as a person immediately after running can start to get a fever—running and getting a fever being in diverse genera. And even in the same genus, e.g., in local motion, one change of place could follow upon another without the motion being continuous, as is evident in the spreading of the lamp (the torch-race), when the torch is passed from hand to hand. In this case we have diverse non-continuous motions. Or the phrase "spreading of the lamp" could refer to the local motion of the flame—which is signified by the word "lamp"—which is moved according to the local motion of the fuel that feeds the flame—such local motion being called spreading.

Therefore the changes mentioned in the preceding paragraph, since they differ either generically or specifically, are not continuous, since they cannot have one extremity, which is required for a continuum. Consequently, motions that differ generically or specifically may be consecutive and "had", i.e., in contact somehow without any time interruption, inasmuch as time is continuous and has its continuity in the same way that motion has, namely, because there is one extremity (joining two parts). Now there is nothing to prevent one motion from being ended and another of an entirely different kind from beginning at the same instant that two parts of time are being joined. In that case the two motions will be contiguous but not continuous. Therefore, according to our premises, it follows that in order that a motion be continuous, it is necessary that it be one in

species: this unity of species being in the motion from the thing in which the motion is, insofar as it is incapable of division according to species.

705. In the second place, continuity of motion requires unity of subject, for the motions of diverse subjects cannot be continuous, though they can be contiguous, as was said about transferring a lamp from hand to hand.

706. Thirdly, in order that a motion be continuous and one, it must be one as regards the time, so that no period of immobility or rest intervene. For if there is a time in which it was not moving, then it was at rest during that time, and if a state of rest intervenes, the motion is not one but many; for motions that are interrupted by rest are not one but many. Consequently, if a motion is interrupted by rest, it will be neither one nor continuous. But it is interrupted by rest, if there is a time in the middle of it, as was shown. Hence for continuity of motion, there must be one continuous time.

But mere continuity of time is not enough, because a motion that is not specifically one is not continuous, even though time is not interrupted: for although it be one in regard to time, it will be other in regard to species. In other words, in order that a motion be one and continuous, it must be specifically one; but it does not follow that a motion specifically one is unqualifiedly one,

Thus, it is clear that the three aforementioned things are required in order that a motion be unqualifiedly one. And so he concludes that we have now explained which motion is unqualifiedly one.

707. Then at (523) having posited the three principal ways in which a motion is one, he mentions two secondary ways, although these pertain more to a certain form of unity than to unity itself. The second of these is given at 708.

He says therefore first (523) that whether a motion be one in genus or in species or in substance, i.e., numerically one, it is also called one if it is perfect, just as in other things, "perfect" and "whole" pertain to the notion of unity. For we do not speak of one man or one shoe, unless they are whole.

However, there are times when we speak of something imperfect as being one, provided it is continuous. And the reason for this is that unity can be regarded from the viewpoint of quantity, in which sense mere continuity suffices for the unity of a thing, or from the viewpoint of the substantial form, which is the perfection of the whole. Thus, what is perfect and whole is said to be one.

708. Then at (524) he gives the other secondary way; that a motion is called one when it is regular, i.e., uniform, just as in other things an object is said to be one, if its parts are alike. About this he does three things:

> First he posits this mode of unity in the sense that a regular motion is one;
> Secondly, he shows in which motions regularity and irregularity are found,

at 709;
Thirdly, he explains the modes of irregularity, at 710.

He says therefore that in addition to the above-mentioned rays of being one, a motion is called one, if it, is regular, i.e,,, uniform. For an irregular or non-uniform motion does not seem to be one, whereas a regular, i.e., uniform motion does (as a motion which is entirely straight is uniform).

The reason why an irregular motion does not seem to be one is that it can be divided into parts which are not alike, whereas indivisibility pertains to the notion of unity, because that which is one is undivided. However, an irregular motion is one in a sense. But the unity of irregular and regular motions seem to differ according to more and less: because a regular motion is more perfectly one than an irregular one; just as a body whose part's are alike is more perfectly one than a body of parts that are not alike.

709. Then at (525) he shows in which motions irregularity and regularity are found. And he says that they are found in every genus and species of motion: for some things can be altered in a regular manner, as when the entire alteration is uniform, and some things can be moved along a magnitude that is regular and uniform, as things that are in circular motion or in rectilinear motion. The same is true of growing and decreasing.

710. Then at (526) he approaches the task of deciding about irregular motion.

First he mentions ways of being irregular;
Secondly, he shows how an irregular motion is one, at 713.

About the first he does two things:

First he assigns two ways in which irregularity is present in motions;
Secondly, he draws certain conclusions from all this, at 712.

He says therefore first (526) that the variations that make for irregularity in motion are caused sometimes from the thing in respect to which there is motion, as is evident especially in local motions for it is impossible for a motion to be regular and uniform unless it passes over a magnitude that is regular, i.e., uniform. Now a magnitude is said to be regular or uniform when each part of it follows its neighbor in a uniform manner, so that any part could be superimposed upon any other, as is clear in the case of arcs or straight lines. But a magnitude is irregular, if one part does not uniformly follow another, as is evident in two lines that form an angle, of which one part does not fit perfectly over the other in the way that one part of a line fits perfectly over another,

Therefore, a circular motion is regular and so is a rectilinear one: but reflexed or oblique motions, whose path forms an angle, are not regular and do not take place on a uniform magnitude; likewise any motion on a magnitude that is not

such that any part of it taken at random fits on any other taken at random, For if the part (of the motion) that contains the angle is superimposed on a part that does not form an angle, they will not match,

711. The second difference that makes for irregularity is found neither in the place nor in the time nor in the goal (for the goal of a motion is not merely a place but also quality or quantity) but in the manner of the motion, For in some cases the motion is differentiated by swiftness and slowness; because a motion that has the same velocity throughout is said to be uniform, while one in which one part is swifter than another is said to be irregular.

712. Then at (527) he draws two conclusions from the foregoing. The first of which is that swiftness and slowness are neither species of motion nor specific differences, because they can be found in all types of motion, since they determine regularity and irregularity, which follow upon each species of motion, as was said above. And no species or difference is common to every species of a genus.

The second corollary is that swiftness and slowness are not the same as heaviness and lightness, because each of the latter has its own motion, for the motion of earth, which is heavy, is always toward a downward place and the motion of fire is always toward an upward. On the other hand, swiftness and slowness are common to diverse motions, as was said.

713. Then at (528) he shows how an irregular motion is one; Secondly, he draws a corollary at 714.

He says therefore first that an irregular motion can be said to be one insofar as it is continuous, but it is less perfectly one than a regular motion, just as a line having an angle is less perfectly one than a straight line. This is especially clear in a reflected motion, which seems to be, as it were, two motions.

Now, since an irregular motion is less perfectly one, it appears to share in the notion of multitude, for a thing is said to be less, because it has an admixture of the contrary, as what is less perfectly white has an admixture of black, at least in being closer to black than a perfectly white object is.

714. Then at (529) he concludes from the immediately foregoing the conclusion which he had previously proposed; namely, that motions which are specifically diverse cannot form a continuity. For every motion that is one can be either irregular or regular. But a motion that is composed of specifically distinct motions cannot be regular. For how could a regular motion be composed of alteration and local motion? For in order that a motion be regular its parts must agree. Consequently, the conclusion is that diverse motions that are consecutive but not all of the same species do not form a motion that Is one and continuous, as was stated above and explained by examples.

Lecture 8

Contrariety of motions

715. After discussing unity and diversity of motions, the Philosopher now discusses contrariety of motions, which is a kind of diversity, as is evident from Book I of *Metaphysics*. His treatment is divided into two parts:

In the first he shows how to understand contrariety in motion and in rest;
In the second he raises some questions about such contrariety, at 742.

About the first he does two things:

First he settles the problem of contrariety of motion;
Secondly, about contrariety of states of rest, at 727.

About the first he does three things:

First he distinguishes diverse ways according to which contrariety of motion might be taken;
Secondly, he rejects some of these ways, at 717;
Thirdly, he assigns the true way in which motions and changes are contrary, at 722.

716. He says therefore first (530) that it is now time to decide how one motion is contrary to another, as well as how rest is contrary to motion and rest to rest.

But in this treatment we must first distinguish the ways according to which the idea of contrariety in motions can be taken universally. And he distinguishes five ways. The first of which is that one idea of contrariety in motions is based on one motion approaching a definite terminus and another departing from the name terminus. And this is what he says: "...whether contrary motions are motions respectively from and to the same thing, e.g., a motion from health and a motion to health". According to this, generation and ceasing-to-be seem to be contrary, because generation is a motion to being, and ceasing-to-be from being.

The second way is that the idea of contrariety of motions is based on contrariety of the termini from which the motions begin. And this is what he says: "...or motions respectively from contraries, e.g., a motion from health and one from sickness".

The third way is that contrariety of motions is based on the contrariety of the goals at which they are terminated. And this is what he says: "...or motions respectively to contraries, e.g., a motion to health and a motion to sickness".

The fourth way is to take contrariety of motions according to the contrariety existing between the start of one and the goal of the other. This is what he says:

"...or motions respectively one from a contrary and the other to a contrary, e.g., a motion from health and one to sickness".

The fifth way is based upon contrariety on the part of both termini of each motion. This is what he says: "...or motions respectively from a contrary to its opposite and from the latter to the former, e.g., a motion from health to sickness and a motion from sickness to health".

Now contrariety among motions is necessarily based either on one of these five ways or on more than one, for there is no other possible way of one motion being contrary to another.

717. Then at (531) he rejects two of these five:

> First of all the fourth, which based contrariety on the opposition between the start of one and the goal of the other;
> Secondly, the second, which based contrariety on the opposition between the start of one and the start of the other, at 716.
> Thirdly, he concludes how two of the remaining ways are related, at 721.

He says therefore first (531) that a motion which begins at one contrary cannot be called contrary to a motion that tends to the opposite contrary, so as to say that a change from health is contrary to a change to sickness. For nothing is contrary to itself; but a motion from health is one and the same as a motion to sickness, although they differ in thought inasmuch as a change from health is not the same idea as a change to sickness—for one stresses the starting point and the other the goal of the same notion. Consequently, contrariety of motion must not be taken from the viewpoint of the contrariety existing between the start of one and the end of the other.

718. Then at (532) he shows that contrariety must not be taken from the contrariety existing between the two starting points of two motions: and this for three reasons, of which the first is the following. Two motions that tend to the same goal are not contrary; but two motions that start from contraries can tend to one and the same goal, for a motion can go either to a contrary or to what is intermediate between the contraries, as will be said later. Thus two motions that start from contraries could terminate at the same intermediate. Consequently, motions are not contrary just because they start at terms that are contrary.

719. He gives the second reason at (533), which is this. The idea of contrariety in motion must be based on that which more evidently makes the motion contrary, but contrariety between goals at which motions end seems to be a greater cause of contrariety in motions than is contrariety between termini at which motions start. For when I say that motions begin at contrary terms, I am stressing the removal of contrariety, but when I say that motions are approaching contrary goals, I am stressing the receiving of contrariety. Therefore, contrariety of

motions is not based solely on the termini at which they start.

720. He gives the third reason at (534) and it is this. Things receive contrariety from that from which they take their name and species, for contrariety is a difference based on form, as in clear in Book X of *Metaphysics*. But every motion gets its name and species from the goal more than from the starting point, as healing is a motion to health and getting sick is a motion to sickness. This point was mentioned before. Therefore, contrariety of motions is taken rather from the goal than from the terminus at which they start. Thus our conclusion is the same as before.

721. Then at (535) he concludes that having rejected the two ways that were based on the contrariety of termini, there remain two other ways, namely, the third and the fifth. Of these, one is based solely on the contrariety of goals and the other on the contrariety of both sets of termini. Way #1 was not based on any contrariety of termini but on approach and departure from the same terminus. He further concludes that perhaps these two remaining ways are really the same, because motions that tend to contrary goals also start at contraries; but perhaps they are not the same in conception, on account of the various relationships that exist between motions and their termini, as was said above. For example, a motion to health is really the same as a motion from sickness, but they differ in conception. The same is true for a motion from health and a motion to sickness.

722. Then at (536) he explains how to take contrariety in motion.

> First, when the motion tends toward a contrary;
> Secondly, when it tends toward the intermediate, at 726.

About the first he does two things:

> First he explains what makes for contrariety in motions;
> Secondly, in changes, at 724.

About the first he does two things:

> First he explains his proposition with a syllogism;
> Secondly, by induction, at 723.

As to the first, he gives this reason at (536): The contrariety of things is based on their specific nature and definition. But the specific definition of motion is that it is a change which takes place from a definite affirmed subject to a definite affirmed subject and that two termini are involved—on this point, motion differs from change, which does not always require two affirmed termini. Therefore, we are left with the fact that for contrariety of motion there must be contrariety on the side of both termini. In other words, a motion which goes from contrary to contrary is, strictly speaking, contrary to one that is from contrary to contrary; for

example, one that is from health to sickness is contrary to one from sickness to health.

723. Then at (537) he proves the same by induction. And first of all in bodily alterations: for to fall ill is contrary to getting well. In these two examples the first is from health to sickness and the other from sickness to health. This is also evident in changes that occur in the soul: for to learn is contrary to being led into error (not by oneself but by another). These two motions are also from contraries to contraries, because learning is a motion from ignorance to knowledge, and being deceived is from knowledge to ignorance.

He says "not by oneself", because just as, in the case of knowledge, it is possible for a person to acquire it by himself (and this is called "discovery) or with someone's help (and this is called "learning"), so also it can happen that a person is led into error sometimes by himself and sometimes by another. It is the latter that is properly opposed to learning.

Continuing, we take an example from local motion: for an upward motion is contrary to a downward (and these are contraries in respect of length); a motion to the right is contrary to one to the left (and these are contrary in respect of breadth); and a motion to the fore is contrary to one to the rear (and these are contrary in respect of depth).

But notice that Aristotle is here speaking of differences of position as they apply to man: for up and down are measured in respect to man's length; left and right in respect to his breadth; fore and after in respect to his thickness, which is called height or depth.

Moreover, it should be noted that even in natural motions, there is a contrariety based on up and down; but in regard to right and left, or fore and aft, the contrariety is not according to nature but according to motions that originate from the soul, which has motions toward these contrary directions.

724. Then at (538) he shows how there is contrariety in changes.

> First he explains how to take contrariety of change in things in which contrariety is found;
> Secondly, how to take it in things in which there is no contrariety, at 725.

He says therefore first (538) that if contrariety is taken merely from the goal so that what tends to a contrary is said to be contrary, such a process does not make for contrariety of motion, but of change, which is generation and ceasing-to-be, as becoming white and becoming black are contrary. Now the contrariety of these instances of generation is not based on the contrariety of starting point; because in generation the starting point is not something affirmed but something negated, for the white comes to be from the non-white and not from something affirmed. For a change from subject to subject is not change but motion.

Then at (539) he shows that in things in which there is no contrariety, for example, in substances and the like, contrariety of change is based on approach and departure from the same terminus, as accession to the form of fire, which pertains to the generation of fire, and receding from the same form, which pertains to its ceasing-to-be, are contraries. Hence generation is contrary to ceasing-to-be and any loss is contrary to any gain, But these are changes, not motions.

It is evident, therefore, that of the five ways listed above, the second and fourth are of no use; one of the remaining is suitable for knowing contrariety of motions, and the other two are suitable for contrariety of changes.

726. Then at (540) he decides about contrariety of motion from the viewpoint of the intermediate between contraries. And he says that wherever a pair of contraries admit of an intermediate, motions to that intermediate must be held to be somehow motions to one or other of the contraries, for the intermediate serves as a contrary for the purposes of motion, no matter in which direction the change may be. For example, grey in a motion from grey to white takes the place of black as starting point, but in a motion from white to grey, it takes the place of black as goal. For the middle is, in a sense, opposed to either of the extremes, as has been said above.

Finally, he concludes what he mainly intended; namely, that motions are contrary to one another, only when one is a motion from a contrary to the opposite contrary and the other is a motion from the latter to the former.

Lecture 9

Contrariety of rest to motion, and of rest to rest

727. After discussing contrariety of motions, the Philosopher now determines about contrariety of states of rest.

> First, in motions;
> Secondly, in changes, at 732.

About the first he does two things:

> First he shows how rest is contrary to motion;
> Secondly, which is contrary to which, at 728.

He says first (541) that since not only motion but also rest seem to be contrary to motion, we have to decide how rest is contrary to motion, for, strictly speaking, it is motion that is perfectly contrary to motion. However, even rest is opposed to motion, since it is the privation of motion, and privation is somehow a contrary. For privation and possession form the fundamental contraries, as is said in Book

X of *Metaphysics*, since the idea of privation and possession are involved in every type of contrary, inasmuch as in any set of contraries, one of them is as privation in respect of the other; for example, black in relation to white and sweet in relation to bitter.

728. Then at (542) he shows which rest is contrary to which motion. About this he does three things:

First he phrases the question;
Secondly, he determines the truth, at 729;
Thirdly, he proves it, at 731.

In the question which he proposes (542) he assumes that not any state of rest is indiscriminately opposed to just any state of motion, but a definite type of rest to a definite type of motion; for example, rest in place is opposed to motion in regard to place. But because the question here is a general one, there still remains another problem: whether the opposite of that rest which consists in possessing its goal, for example, whiteness, is the motion to whiteness, i.e., whitening, or the one from whiteness, namely, blackening.

729. Then at (543) he determines the truth.

First as to the contrariety of motion to rest;
Secondly, as to the contrariety of rest to rest, at 730.

He says therefore first (543) that since motion is between two affirmed termini, the contrary of a motion from A to its contrary B is rest in A; for example, the contrary of a motion from whiteness to blackness is rest in whiteness, while the contrary of a motion from the contrary B to A is rest in B. For example, the contrary of a motion from black to white is rest in black.

730. Then at (544) he treats of the contrariety of one state of rest to another. And he says that those states of rest which are in contrary termini are mutually contrary. For it is not suitable to have motions contrary to one another and states of rest not contrary. And how states of rest in opposites are opposite, he explains with the example that rest in health is the opposite of rest in sickness.

731. Then at (545) he proves what he had said about the contrariety of rest to motion. And he says that the opposition of a motion from health to sick is rest in health; for it is not reasonable that rest in health be the opposite of a motion from sickness to health. This he now proves: Rest in the very goal toward which something else is in motion is the consummation and perfection rather than the opposite of that motion. And that rest in the goal toward which there is motion is its perfection is evident from the fact that the state of rest is coming to be during the motion, because the very movement toward the goal means that rest is coming to be. Hence, since motion is the cause of that rest, it cannot be its opposite, because a thing is not the cause of its opposite. Now the contrary of a

motion must be either rest in its goal or rest in the starting point. For it is not reasonable to say that rest in some other species is contrary to a given motion or rest, any more than rest in whiteness is contrary to rest in health or motion to health. Consequently, since rest in the goal is not contrary to motion toward that goal, the only thing that remains is that it is contrary to rest in the starting point.

732. Then at (546) he determines about contrariety of rest in changes. About this he does three things:

First he repeats what has already been said about contrariety of changes;
Secondly, he shows that the opposite of change is not rest but non-change, at 733;
Thirdly, how non-change is contrary to change, at 736.

He repeats therefore first (546) that in changes that do not involve termini that are contrary, for example, in the generation and ceasing-to-be of substance, opposition is based on approach and departure from the same terminus. For a change from A is opposed to a change to A, as a change from existence, i.e., corruption, is opposed to a change to existence, i.e., generation. However, neither of these is called motion.

733. Then at (547) he shows that these changes do not have an opposing state of rest. About this he does three things:

First he proposes what he intends;
Secondly, he interposes a question, at 734;
Thirdly, he proves his proposition, at,133-5.

He says therefore first (547) that changes which do not pass from contrary to contrary have no states of rest opposed to them; rather what is opposed to them in the way that rest is opposed to motion can be called non-change.

734. Then at (546) he interposes a question on this matter. For it has been said that a change to being is contrary to a change from being, which is really a change to non-being. Now the expression "non-being" has two senses: In one sense, it implies a subject, which is either an actual being, as when non-white is in a body, or a potential being, as when privation of substantial form is in first matter. In a second sense, non-being can imply that no subject is involved, i.e., that we are dealing with absolute non-being.

If non-being is taken in the first sense, i.e., that a subject. is implied, then it would be possible to find out how one non-change is contrary to another non-change: for it could be said that a non-change in being is opposed to a non-change in non-being. For, since non-being has a subject, there is nothing to prevent that subject from persevering in non-being, which is the same as not changing.

Rut if there is nothing which is not, i.e., if non-being has no subjects then the question remains: to which non-change is the non-change or rest in being contrary? For what does not exist at all cannot be said to be at rest or to be unchangeably permanent. And since some kind of non-change must be contrary to non-change or rest in existence, it follows that that non-existence from which generation begins and toward which ceasing-to-be tends is a nonbeing that has a subject.

735. Then at (549) he explains something he had supposed, namely, that the opposite of generation and of ceasing-to-be is not rest. For if it were, then either of two things would follow: first, that not every rest is contrary to motion, or, secondly, that generation and ceasing-to-be are motions. So it is clear that whatever it is that is opposed to generation and ceasing-to-be, it is not rest, unless generation and ceasing-to-be are motion—which they are not, as we have proved above.

736. Then at (550) he shows how non-change is contrary to change. And he says that there is a parallel between the contrariety of non-change to change and that of rest to motion: for a non-change An being is contrary, either to no non-change (which would be, if non-being has no subject) or to that non-change which is in nonbeing (if non-being has a subject). And this contrariety is like the opposition between one rest and another.

Or we can say that a non-change in being is the opposite of corruption, as rest is of motion. However, it is not the opposite of generation, because corruption departs from non-change and rest in being, whereas generation tends to it. And we already know that the opposite of motion and change is not rest in the goal but rest in the starting point.

Lecture 10

Certain difficulties are resolved

737. After discussing the contrariety of motions and of rests, the Philosopher now raises some questions concerning these matters, About this he does two things:

First he raises questions and solves them;

Secondly, he explains certain matters that may still be doubtful in regard to these questions, at 747.

The first part is divided into three sections, one for each question he raises. About the first point he does two things;

First he raises a question;

Secondly, he solves it, at 740.

738. Therefore he first (551) raises the question why it is that in the genus of local motion, but not in the other general there are found some motions and rests that are according to nature and some not according to nature. For example, why in it that there are alterations according to nature but none not according to nature? For getting well does not seem to be according to nature or not according to nature any more than getting sick, since each originates from a natural intrinsic principle. The same is true in regard to getting white and getting black or in growing and decreasing, for the former motions are not so contrary to one another that one is according to nature and the other not, since each is a natural process. Nor is growing contrary to growing in such a way that one is according to nature and the other not. The same is true of generation and ceasing-to-be: for generation cannot be said to be according to nature and ceasing-to-be not according to nature, for growing old--which is the road to ceasing-to-be-is according to nature. Nor does it appear that one generation is according to nature and another not.

739. Now it seems that what he says here is opposed to a declaration in *On the Heavens*, that old age and every defect and ceasing-to-be are against nature. But it must be said that old age and ceasing-to-be and decreasing are against nature in one sense and according to nature in another. For if we consider the specific nature of anything, i.e., its particular nature, it is clear that all ceasing-to-be and all defects and decrease are against nature: because each thing's nature tends to preserve the subject in which it exists, whereas the contrary of this happens when the nature is weak or defective.

But if we consider nature in general, all these things are the result of a natural intrinsic principle, as the destruction of an animal results from the contrariety of hot and cold; and the same is true for all the others.

740. Then at (552) he answers this question by invalidating it. About this he does two things:

> First he shows that things according to nature and not according to nature are found in every genus;
> Secondly, how these two things are contrary when they occur in motions and it states of rest, at 742.

About the first he does two things:

> First he determines the truth;
> Secondly, he removes an objection, at 741.

He says therefore first (552) that since what takes place through compulsion is contrary to nature (because compulsion arises from a principle outside a thing in such a way that the thing suffering compulsion does not cooperate, whereas what is natural comes from an intrinsic principle) it follows that compulsive

ceasing-to-be is contrary to natural ceasing-to-be, just as a ceasing-to-be that is outside of nature is opposed to one according to nature.

According to the same argument, he concludes that some generations are compulsory and not according to fate, i.e., not according to the order of natural causes (because the order of natural causes. can be called "fate"), as when a person grows roses or fruits by artificial means out of season or when the generation of frogs or other natural things is procured artificially. Consequently, since these generations are compulsory, they are outside of nature and are contrary to generations according to nature.

He shows the same for growing and decreasing. For some cases of growth are compulsory and unnatural, as is evident in persons who reach the state of puberty in an abnormally short time, on account of soft living or on account of the food, i.e., they are fed abundantly and delicately. The same is also apparent in the growing of wheat, for sometimes the grains grow unnaturally through abundance of moisture and are not compact, i.e., made thick and solid by normal digestion.

Likewise in alterations. Some are compulsory and some natural, as is especially evident in the process of getting well. For some recover from fever on the critical days and some not on the critical days. The former are cured according to nature and the latter not according to nature.

741. Then at (553) he raises an objection against the foregoing. For since what is outside the nature is contrary to what is according to nature, then if there are generations that are according to nature and some not, and the same for ceasing-to-be, it follows that instances of ceasing-to-be are contrary not to generation but to one another, because one thing cannot be contrary to two.

But he solves this by saying that there is nothing to prevent generation from being contrary to generation, and ceasing-to-be to ceasing-to-be. This is true, even if you were to abstract from the contrariety between what is according to nature and what is against nature. For if you take the case of something sweet coming to be and then ceasing to be, and the case of something sad coming to be and ceasing to be, the two cases of coming-to-be would be contrary and the two of ceasing-to-be would be contrary. (When he speaks of the coming to be and the ceasing to be of the "sweet", he means when "something more noble comes to be from the less noble that has ceased to be, as when fire is generated from air; on the other hand, the coming to be and ceasing to be of the "sad" refers to the less noble coming to be from the ceasing-to-be of the more noble, as when air is generated from fire).

Now even though ceasing-to-be is contrary to ceasing-to-be, it does not follow that it is not opposed to coming-to-be, for ceasing-to-be is opposed to coming-to-be when both are taken generically, while ceasing-to-be is opposed to ceasing-to-

be in a specific sense. For example, avarice is contrary to liberality in the way that a vice is contrary to a virtue, but it is opposed to prodigality as one species to another. So that what he concludes is this: ceasing-to-be is contrary to ceasing-to-be, not in a generic sense, but one ceasing-to-be is this and another that, i.e., compulsory and beyond nature, or sweet and sad.

742. Then at (554) he explains contrariety in motion and rest on the basis of their being outside nature and according to nature. And he says that not only coming-to-be is contrary to coming-to-bg and to ceasing-to-be from the viewpoint of being outside nature and according to nature, but in general all motions and rests are contrary in this way. For example, an upward motion is contrary to a downward one (because up and down are contrarieties of place) and each of these motions is natural to certain bodies: for fire is naturally carried upward and earth downward. And again in regard to each of these motions, one can take as contrary differences that which is according to nature and that which is outside the nature. And this is what he means when he says that "these contrarieties in motion are differences", or he might mean that in respect to the very bodies that are moved there are contrary differences in their motions, namely, according to nature and outside their nature. For an upward motion is natural to fire but a downward not. So it is clear that a motion which is according to nature is contrary to one that is outside nature.

Likewise for states of rest. For rest which is above is contrary to a downward movement. But rest above is not natural to earth, whereas a downward motion is. According to the foregoing then, it is clear that rest which is outside the nature is contrary to the natural motion of the body involved, for even in the same body, motions ate mutually contrary, in the sense that the natural motion of one body is contrary to an unnatural motion of the same body. The same is true of rest; for some contrary rests will be according to nature, as rest above for fire and rest down for earth; others are outside the nature? as down for fire and up for earth.

743. Then at (555) he raises the second question; Has every state of rest that is not eternal a becoming, which becoming is called a *coming to a standstill*? The answer seems to be "no" for two reasons. First of all, if there is coming-to-be of every state of rest that is not eternal, it will follow that there is coming-to-be for states of rest which are outside nature (as when earth is at rest above). Now rest can be produced only by a previous motion, and the motion preceding an unnatural state of rest is compulsory. Consequently, it follows that when earth is violently projected upwards, it is then that rest comes to be. But this cannot be, because "the velocity of that which comes to a standstill seems always to increase", i.e., when rest is being generated through motion, it is true that as the state of rest gets closer, the motion gets swifter. For since the perfection of coming-to-be is the thing produced, and since each thing gets stronger and more intense as it gets closer to its perfection, it follows that the motion through which rest is produced is swifter the more it approaches rest, as is abundantly clear in

natural motions.

But in things that are moved by compulsion the contrary happens: for the motion grows less intense the closer it gets to the state of rest. Consequently, compulsory rest is not generated. This is what he means when he says that some things come to rest by compulsion "without having become so", i.e., in such a way that their rest is not generated.

744. He gives the second reason at (556) and it is this: *Coming to a standstill*, i, e., the coming-to-be of rest, is either entirely the same as the natural motion by which something is carried to its natural place or it is something that happens to accompany it. Now it is clear that both are the same reality though differing in conception. For the goal of a natural motion is to be in a natural place, but to be in a natural place and to be at rest in it are really the same thing. Consequently, a natural motion and the coming-to-be of rest are the same thing in reality and differ only in conception. However, it is evident that compulsory rest is not brought about by a natural motion. Therefore, coming to a standstill is not present in compulsory states of rest, i.e., such states are not generated.

745. Then at (557) he raises a third question about a point mentioned in Lecture 3, that rest in A is contrary to motion from A. Now this seems to be false, because when something is moved from A as from a place, or A is being abandoned, as in the case of a quality or quantity, while it is being moved it still seems to have that which is cast off or left behind. For a thing does not leave its entire place all of a sudden but successively; likewise, it is only gradually that it loses whiteness. Therefore, while it is being moved it still retains something of the starting point. If, therefore, the state of rest whereby something remains in a starting point is contrary to the motion by which departure is made therefrom, it follows that two contraries are together—which is impossible.

746. So at (558) he solves this difficulty. And he says that what is being moved by departing from its starting point is at rest therein not absolutely but in a certain sense only, i.e., in the sense that it is there not in its entirety but partly, because it is universally true that in all cases of motion, part of the mobile is in the *terminus a quo* and part in the *terminus ad quem*. Nor is it unacceptable that one contrary be mixed with another in a certain respect; but the less it is mixed, the more perfectly is it contrary. Therefore, a motion is more contrary to another motion (since they are never intermingled) than a rest is, which somehow intermingles.

Finally, in summary, he says that we have spoken about motion and rest and how unity and contrariety are found therein.

747. Then at (559) he states some things that will clarify the foregoing. (These passages are said not to be found in the Greek MSS. and, according to the Commentator, not even in the Arabic MSS.; consequently, these statements seem

to have been lifted from the sayings of Theophrastus or some other expositor of Aristotle). Three things are here posited in an attempt to clarify the foregoing.

The first pertains to the question previously raised about the generation of unnatural rest. And he says that someone may wonder about "Coming to a standstill", i.e., about the coming-to-be of rest, for if all motions that are outside nature have an opposing state of rest, i.e., an unnatural one, does that state of rest come to be? If it is held that there is no "coming to a standstill" in cases of compulsory rest, something unacceptable follows. For it is clear that a thing in compulsory motion will sometimes remain, i.e., come to rest, by compulsion. Consequently, it will follow that something will be at rest not eternally without having come to rest—which seems impossible. But it is plain that sometimes there is compulsory rest. For just as things are moved outside their nature, so also they rest outside their nature. Rut it should be observed that what is said here appears contrary to what was said above (at 743). Hence Averroes says that a solution is now being given to a question previously raised.

However, it is better to say that the previous doctrine contains more truth, although what is being said here is somehow true also. For compulsory rest is not, strictly speaking, generated in the sense that it proceeds from a cause that is essentially productive of rest, as happens when natural rests are generated. But compulsory rest is generated *per accidens* through lack of a productive force, because when the compulsion of the mover either ceases or meets an obstacle, the state of compulsory rest comes to be. This is why compulsory motions peter out at the end, whereas natural ones become more intense.

It should be noted also that there is found another text for this place, to which we should give our attention. For it reads., Someone may ask whether to a motion outside nature there is any contrary rest not according to nature? This does not inquire whether, properly speaking, a state of rest that is contrary to nature is opposed to a motion that is contrary to nature, as Aristotle taught above; rather, here one is now speaking in wide and loose terms in the sense of the general opposition between rest and motion. And he says that it seems unreasonable not to find unnatural states of rest. For it is clear that the violence of the mover will cease at some time and unless rest eventuates, the motion will not come to a standstill. Hence it is clear that. to compulsory motions are opposed compulsory states of rest, because to what is moved outside its nature there belongs to rest outside its nature.

748. Then at (560) he mentions a second fact to explain his doctrine on the contrariety of natural and compulsory motion. And he says that since certain things are subject to motions that are according to nature and outside their nature, as fire is moved upward according to nature and downward outside its nature, the question arises whether the natural upward motion of fire has for its contrary the compulsory downward motion of fire or the natural downward

motion of earth.

He answers that both are contrary to the natural upward motion of fire but not in the same way. For the downward motion of earth is contrary to the upward motion of fire as something natural contrary to something natural, whereas a downward motion of fire is contrary to the upward motion of fire as something natural contrary to something compulsory. The same is true for the contrariety of states of rest.

749. Then at (561) he mentions a third point to explain what he previously said about contrariety of rest to motion. And he says that perhaps motion is not strictly opposed to rest, but only in some sense. For when someone is being moved from A, in which he was at rest, and is doffing it, it seems to retain something of A. Hence if rest in this place is contrary to a motion from this place to a contrary place, it follows that contraries are together. But yet a thing is somehow still at rest while it perseveres in A; indeed, speaking generally of a thing in motion, part of it is in the *terminus a quo* and part in the *terminus ad quem*. Consequently, rest is less contrary to motion than a contrary motion is, as was explained above.

Finally, he sums up, as is clear of itself.

Now the fact that the same words that appeared in an earlier passage (see end of 246 above) are repeated, lends support to the possibility that they are not the words of Aristotle, but of some expositor.

BOOK VI

Lecture 1

No continuum is composed of indivisibles

750. After the Philosopher has finished dividing niotion into its species and discussing the unity and contrariety of motions and of states of rest, he proposes in this Sixth Book to discuss the things that pertain to the division of motion precisely as it is divisible into quantitative parts.

The whole book is divided into two parts.

In the first he shows that motion, as every continuum, is divisible;
In the second he shows how motion is divided, at L. 5.

The first part is subdivided into two sections:

In the first he shows that no continuum is composed solely of indivisibles; at L. 4.
In the second that no continuum is indivisible, near the end

The first is further subdivided into two parts:

In the first he shows that no continuum is composed of indivisibles only;
In the second (because the proofs for the first seem to be applicable mainly to magnitudes) he shows that the same proofs apply to magnitudes, to motion and to time, at L, 2.

In regard to the first part he does two things:

First he recalls some definitions previously given, with a view to using them in demonstrating his proposition;
Secondly, he proves the proposition, at 752.

751. He says therefore first (562) that if the previously given definitions of *continuum*, of that which is *touched*, of that which is *consecutive* to are correct (namely, that continua are things whose extremities are one; contigua are things whose extremities are together; consecutive things are those between which nothing of the same type intervenes), then it would follow that it is impossible for any continuum to be composed solely of indivisibles; i.e., it is impossible, for example, for a line to be composed of points only, provided, of course, that a line is conceded to be a continuum and that a point is an indivisible. This proviso is added to prevent other meanings being attached to point and line.

752. Then at (563) he proves the proposition:

First he gives two proofs of the proposition;

Secondly, he explains things that might be misunderstood in his proofs, at 756.

In regard to the first proof he does two things:

First he shows that no continuum is composed solely of indivisibles, either after the manner of continuity or of contact;

Secondly, or after the manner of things that are consecutive, at 754.

In regard to the first he gives two reasons, of which the first is: Whatever things a unit is composed of, either after the manner of continuity or of contact, the extremities must either be one or they must be together. But the extremities of points cannot be one, because an extremity is spoken of in relation to a part, whereas in an indivisible it is impossible to distinguish that which is an extremity and something else that is a part. Similarly, it cannot be said that the extremities are together, because nothing can be the extremity of a thing that cannot be divided into parts, whereas an extremity must always be distinct from that of which it is the extremity. But in a thing that cannot be divided into parts, there is no way of distinguishing one thing and another. It follows therefore that a line cannot be composed of points either after the manner of continuity or after the manner of contact.

753. The second reason is given at (564). If a continuum is composed solely of points, they must be either continuous with one another or touch (and the same is true of all other indivisibles, i.e., that no continuum is composed solely of them).

To prove that they are not continuous with one another, the first argument suffices.

But to prove that they cannot touch one another, another argument is adduced, which is the following: Everything that touches something else does so either by the whole touching the other wholly, or by a part of one touching a part of the other or the whole of the other. But since an indivisible does not have parts, it cannot be said that part of one touches either a part or the whole of the other. Hence if two points touch, the whole point touches another whole point. But when a whole touches a whole, no continuum can be formed, because every continuum has distinct parts so that one part is here and another there, and is divisible into parts that are different and distinct in regard to place, i.e., position (in things that have-position)—whereas things that touch one another totally are not distinguished as to place or position, It therefore follows that a line cannot be composed of points that are in contact.

754. Then at (565) he shows that no continuum is composed of indivisibles after the manner of things that are consecutive. For no point will be consecutive to another so as to form a line; and no "now" is consecutive to another "now" so as

to form a period of time, because consecutive things are by definition such that nothing of the same kind intervenes between any two. But between any two points there is always a line, and so, if a line is composed of points only, it would follow that between any two points there is always another, mediate, point. The same is true for the "now's"'. if a period of time is nothing but a series of "now's", then between any two "now's" there would be another "now". Therefore, no line is composed solely of points, and no time is composed solely of "now's", after the manner of things that are consecutive.

755. The second reason is given at (566) and is based on a different definition of continuum—the one given at the beginning of Book III—that a continuum is "that which is divisible *ad infinitum*". Here is the proof: A line or time can be divided into whatsoever they are composed of. If, therefore, each of them is composed of indivisibles, it follows that each is divided into indivisibles. But this is false, since neither of them is divisible into indivisibles, for that would mean they would not be divisible *ad infinitum*. No continuum, therefore, is composed of indivisibles.

756. Then at (567) he explains two statements he made in the course of his proofs. The first of these was that between two points there is always a line and that between two "now's" there is always time. He explains it thus:

If two points exist, they must differ in position; otherwise, they would not be two, but one. But they cannot touch one another, as was shown above; hence they are distant, and something is between them. But no other intermediate is possible, except a line between two points, and time between "now's": for if the intermediate between two points were other than a line, that intermediate must be either divisible or indivisible. If indivisible, it must be distinct from the two points—at least in position—and, since it touches neither, there must be another intermediate between that indivisible and the original extremities and so on *ad infinitum*, until a divisible intermediate is found. However, if the intermediate is divisible, it will be divisible into indivisibles or into what are further divisible. But it cannot be divided into indivisibles only, because then the same difficulty returns—how a divisible can be composed solely of indivisibles. It must be granted, then, that the intermediate is divisible into what are further divisible. But that is what a continuum is. Therefore, that intermediate will be a continuum. But the only continuous intermediate between two points is a line. Therefore, between any two points there is an intermediate line. Likewise, between two "now's" there is time; and the same for other types of continua.

757. Then at (568) he explains the second statement referred to at the beginning of 756, that every continuum is divisible into divisibles. For on the supposition that a continuum is divisible solely into indivisibles, it would follow that two indivisibles would have to be in contact in order to form the continuum. For continua have an extremity that is one, as appears from the definition thereof; moreover, the parts of a continuum must touch, because if the extremities are

one, they are together, as was stated in Book V. Therefore, since it is impossible for two indivisibles to touch, it is impossible for a continuum to be divided into indivisibles.

Lecture 2

Motion composed of indivisibles follows a continuum composed of indivisibles—impossibility of the former

758. Because the arguments presented in the previous lecture clearly apply to lines and other continua having position, in which continua contact is properly found, the Philosopher now wishes to show that the same reasoning applies to magnitudes and time and motion. And it is divided into two parts:

First he proposes his intention;
Secondly, he proves his proposition at 759.

He says therefore first (569) that any argument which shows that a magnitude is composed or not composed of indivisibles, and divided or not divided into indivisibles, applies also to time and motion; for whatever is granted in regard to any of them would necessarily be true of the others.

759. Then at (570) he proves this proposition:

First in regard to magnitude and motion;
Secondly in regard to time and magnitude, in L. 3.

About the first he does three things:

First he presents his proposition;
Secondly, he gives an example, at 760;
Thirdly, he proves his proposition, at 761.

The proposition is this: If a magnitude is composed of indivisibles, likewise the motion that traverses it will be composed of indivisible motions, equal in number to the indivisibles of which the magnitude is composed.

760. Of this he gives the following example at (571): Let the line ABC be composed of the 3 indivisibles A, B and C, and let 0 be an object in motion over the distance of the line ABC, so that DEZ is its motion. Now if the parts of the distance or of the line are indivisibles, then the parts of the motion are indivisibles.

Then at (572) he proves his proposition. About which he does three things:

First he lays down some premisses necessary for his proof;
Secondly, he proves that if a magnitude is composed of points, then the motion is composed not of motions but of moments, at 762;

Thirdly, he shows that it is impossible for motion to be composed of moments, at 763.

761. Therefore first he lays down two presuppositions. The first at (572) is that according to each part of the motion under consideration something must be in motion, and, conversely, if something is in motion, a motion must be in it. Now if this is true, then the mobile 0 is being moved through A which is part of the entire magnitude by means of that part of the motion that is D, and through B, another part of the magnitude) by that part of the motion that is E, and through C (the third part of the magnitude) by that part of the motion that is Z. In other words, single parts of motion correspond to single parts of the magnitude.

The second presupposition at (573) is that what is being moved from one terminus to another is not at the same time being moved and finished moving, any more than a man going to Thebes is, at the time while he is going, already there.

He presupposes these two statements as per se evident. For, as to the statement that when motion is present, something must be in the state of being moved, a like situation is apparent in all accidents and forms; for in order that something be white it must have whiteness, and, conversely, if whiteness exists, something is white. As to the statement that "being moved" and "having been moved" are not simultaneous, we appeal to the very successive nature of motion; for it is impossible that any two elements of time co-exist, as we explained in Book IV. Hence it is impossible that "having been moved", which is the terminus of motion, be simultaneous with "being in motion".

762. Then at (574) he uses these presuppositions to prove his proposition: For if it is true that whenever a part of motion is present, something has to be in motion, and if it is in motion, there must be motion present, then if the mobile 0 is in motion with respect to an indivisible part of the magnitude, namely, A, there is in 0 that part of the motion we called D. Accordingly, 0 is being moved through A and has completed its motion, either at the same time or not at the same time. If not at the same time but later, it follows that A is divisible; because while 0 was in motion, it was neither resting at A (with the rest preceding motion) nor had passed through the entire distance A—for then it would not still be in motion through A, since nothing is in motion through a distance it has already traversed. Consequently, it must be midway. Therefore, when it is in motion through A, it has already passed through part of A and is now in another part of A. Consequently, A is divisible —contrary to our supposition.

But if it is in motion through A and in the state of completed motion at the same time, it follows that it arrived while it was coming, and it will have completed its motion while it was being moved, which is against the second presupposition.

From this it is clear that no motion is possible when the magnitude is indivisible;

for there are only two choices: either things can be in motion at the same time that their motion is over, or, the magnitude must be divisible.

Therefore, assuming that nothing can be in motion through the indivisible A, if someone should say that a mobile is in motion through the entire magnitude ABC and that the whole motion by which it is in motion is DEZ, and moreover, that nothing can be in motion but only in the state of completed motion through the indivisible A, it follows that the motion consists not of motions but of moments. Now the reason why we say that "it follows that the motion is not composed of motions" is that, since the part of the motion that is D corresponds to the part of the magnitude that is A, then if D were a motion, the mobile should be in motion through A, because when motion is present, the mobile is being moved. But it was proved that the mobile is not in motion through A as indivisible, but in the state of having completed its motion when it had traversed this indivisible. Consequently, what remains is that D is not a motion but a moment. (The state of completed motion is called "moment", just as being moved is called "motion"; moreover, moment is related to motion as point is related to line). And the same holds for the other parts of the motion and of the magnitude. Consequently, it follows necessarily that if a magnitude is composed of indivisibles, then a motion is composed of indivisibles, i.e., of moments; and this is what he intended to show.

763. But since it is not possible for a motion to be composed of moments any more than a line be composed of points, then at (575) he exposes this impossibility by concluding to three impossibilities. The first of these is that if motion is composed of moments, and a magnitude of indivisibles, in such a way that through an indivisible part of a magnitude things are not in motion but in the state of completed motion, it will follow that something has completed a motion without having been in motion. For it was assumed that in regard to the indivisible, something arrived without going, because it was not able to be in motion at that indivisible. Hence it follows that something has finished a motion without previously being in motion. But this is no more possible than for an event to be past without having been present.

764. But because a person who claimed that motion is composed of moments might grant this strange state of affairs, Aristotle concludes to another impossibility, in the following argument: Anything capable of being in motion and at rest must be either in motion or at rest. But in our original example, while the mobile is in A, it is not being moved; likewise, when it is at B, and when it is at C; therefore, it must be at rest while at A and while at B and while at C. Therefore, it follows that a thing is at the same time continually at rest and continually in motion.

That this follows, he now proves; We have agreed that it is in motion throughout the entire length ABC and again that it is at rest in relation to each part. But what

is at rest in relation to each and every part is at rest throughout the whole. Consequently, it is at rest throughout the entire length. Thus, it follows, that throughout the entire length it is continually in motion and continually at rest—which is wholly impossible.

765. He gives the third impossibility at (577): It has been shown that if a magnitude is composed of indivisibles, so also the motion. Now those indivisibles of motion, namely, D and E and Z, are such that each of them is either a motion or not. If each is a motion, then, since each of them corresponds to an indivisible part of the magnitude (in which something is not in motion but in the state of completed motion), it will follow that a mobile is not in motion but at rest, even though a motion exists—which is against the first presupposition. If each is not a motion, it follows that motion is composed of non-motions, which is no more possible than that a line be composed of non-lines.

Lecture 3

Time follows magnitude in divisibility and conversely

766. After showing that it is for a same reason that a magnitude and a motion traversing it would be composed of indivisibles, the Philosopher shows the same for time and magnitude. And the treatment falls into two parts:

> In the first he shows that division of time follows upon division of magnitude, and vice versa;
>
> In the second that the infinity of one follows upon the infinity of the other, in L. 4.

About the first he does two things:

> First he states his proposition;
>
> Secondly, he demonstrates it, at 767.

He says therefore first (578) that time, too, is divisible and indivisible, and composed of indivisibles, just as length and motion are.

767. Then he proves his proposition, giving three reasons:

> The first of which is based on things equally fast;
>
> The second is based on the faster and the slower, at 769;
>
> The third uses one and the same mobile, at 776.

He says therefore first (579) that a mobile which is as fast as another traverses a smaller magnitude in less time. Therefore, let us take a divisible magnitude which a mobile traverses in a given time. It follows that an equally fast mobile traverses part of that magnitude in less time. Consequently, the given time must be

divisible. Conversely, if the time is given as divisible and a given mobile is in motion over a given magnitude, it follows that a mobile equally fast traverses a smaller magnitude in less time, urhich is part of the whole time. Consequently, the magnitude A is divisible.

768. Then at (580) he proves the same thing with two mobiles, one of which is faster and the other slower.

> But first he lays down some presuppositions to be used in proving his proposition.
> Secondly, he proves the proposition at 774.

About the first he does two things:

> First he explains how the faster and the slower compare with regard to being moved over a larger magnitude;
> Secondly, how they compare with regard to being moved over an equal magnitude, at 772.

About the first he does two things:

> First he states his proposition, repeating something mentioned previously but needed for the demonstrations that follow;
> Secondly, he demonstrates his proposition, at 770.

769. He repeats therefore (580) that every magnitude is divisible into magnitudes. And this is evident from a previous conclusion that it is impossible for a continuum to be composed of atoms, i.e., indivisibles; and every magnitude is a kind of continuum. From these it follows that a faster body is moved through a greater magnitude in equal time and even in less time. Indeed, that is the way in which some have defined the faster, that it is moved more in. equal and even in less time.

770. Then at (581) he proves his two presuppositions:

> First, that a faster thing is moved a greater distance in equal time;
> Secondly, that it is moved a greater distance in less time, at 771.

He says therefore first (581): Let A and B be two mobiles, of which A is faster than B, and let CD be the magnitude traversed by A in time ZI. Now let B, which is slower, and A, which is faster, pass over the same magnitude, and let them start together.

Therefore, under these conditions, the following argument is given: The faster is the one moved more in equal time; but A is faster than B. Therefore, when A shall have arrived at D, B will not have arrived at D (which is the terminus of the magnitude) but will be some distance from it; yet it will have covered part of tho magnitude. Now, since every part is less than the whole, what remains is that A

is moved through a greater distance in time ZI than B, which in the same time has traversed part of the magnitude. Consequently, the faster traverses more distance in equal time.

77l. Then at (582) he shows that the faster traverses more space in less time. For it was said that at the time when A arrived at D, B, which is slower, was still distant from D. Let us grant, therefore, that B arrived at E when A arrived at D. Now, since every magnitude is divisible, let us divide the remaining magnitude ED (which is how much the faster exceeds the slower) at T. It is eviJent that the magnitude CT is less than CD. But one and the same mobile traverses a smaller magnitude in less time. Therefore, since A arrived at D in the total time ZI, it arrived at T in less time.

Let that less time be ZK. Then the argument continues: the magnitude CT which A traversed is greater than the magnitude CE which B traversed. But the time ZK in which A traversed CT is less than the whole time ZI, in which the slower B traversed CE. Therefore, it follows that the faster traverses a larger space in less time.

772. Then at (593) he shows how the faster compares with the slower in regard to being moved through an equal magnitude.

> First he states his intention;
> Secondly, he proves his proposition here at 772.

He says therefore first (583) that from the foregoing it could be clear that a faster thing traverses an equal space in less time. Then he proves this with two arguments, to the first of which he prefaces two facts: one of which has already been proved, namely, that a faster thing traverses a greater magnitude in less time than a slower. The second is *per se* evident, namely, that one and the same mobile traverses a greater magnitude in a given time than in a shorter time. For let the mobile A, which is faster, traverse the magnitude LM in time PR and the part LX of the magnitude in less time PS, which is less than PR in which it traverses LM just as LX is less than LM.

From the first supposition he takes it that the whole time PR in which A traverses the entire magnitude LM is less than time H in which B (which is slower) traverses the smaller magnitude LX. For it was said that a faster object traverses a greater magnitude in less time.

With this background he proceeds to his argument: The time PR is less than time H (in which B, which is slower, traverses magnitude LX); moreover, time PS is less than time PR. Therefore, it follows that time PS is less than time H, for what is less than the lesser is less than the greater. Therefore, since it was granted that in the time PS the faster traverses magnitude LX and the slower traverses the same LX in time H, it follows that the faster traverses an equal magnitude in

less time.

773. Then, after these preliminaries, he gives his second argument, which is this: A thing that traverses an equal magnitude along with another mobile is moved through that magnitude either in equal time or less or more. If it is moved through that equal magnitude in greater time, it is slower, as was proved above; if it is moved in equal time through the equal magnitude, it is equally fast, as is *per se* evident. Therefore, since what is faster is neither equally fast nor slower, it follows that it is moved through an equal magnitude neither in more time nor in equal time. Therefore, in less time.

Thus, we have proved that necessarily the faster traverses an equal magnitude in less time.

774. Then at (586) he proves the proposition that one and the same reason proves that both time and magnitude are always divided into divisibles, or are composed of indivisibles. About this he does three things:

> First he lays down premisses to be used in the proof;
> Secondly, he states his proposition at 775;
> Thirdly, he proves it at 775,

Therefore (586) he lays down the premisses that every motion exists in time—this was proved in Book IV—and that motion is possible in any time—this is evident from the definition of time given in Book IV. Secondly, that whatever is being moved can be moved faster and slower, i.e., among mobiles some are moved faster and some slower. But this statement seems false, because the speeds of motions are fixed in nature; for there is one motion so fast that none could be faster, namely, the motion of the first mobile.

In reply it must be said that we can speak of the nature of anything in two ways: either according to its general notion or insofar as it is applied to its proper matter. Now, there is nothing to forbid something which is possible in the light of a thing's general definition to be prevented from happening when application is made to some definite matter; for example, it is not the general definition of the sun that precludes many suns, but the fact that the total matter of this nature is contained under one sun, Likewise, it is not the general nature of motion that prevents the existence of a speed greater than any given speed; rather it is the particular powers of the mobiles and movers.

Now, Aristotle is here discussing motion from the viewpoint of its general nature without application to particular movers and mobiles. Indeed, he frequently uses such propositions in this Sixth Book and they are true, if you limit yourself to a general consideration of motion, but not necessarily true, if you get down to particular mobiles.

Likewise, it is not against the nature of magnitude that. every magnitude be

divisible into smaller ones. Therefore, in this Book he goes on the assumption that it is possible to take a magnitude smaller than any given magnitude, even though in every particular nature there is always a minimum magnitude, since each nature has limits of largeness and smallness, as was mentioned even in Book I.

From these two premisses he concludes to a third one, namely, that in any given time, faster and slower motions than a given motion are possible.

775. Then at (587) from the foregoing he concludes to his proposition. And he says that since the foregoing are true, time must be a continuum, i.e., divisible into parts that are further divisible. For if that is the definition of a continuum, then if a magnitude is a continuum, time must be continuous, because the division of time follows upon division of magnitude, end vice versa.

Then at (588) he proves the proposition, namely, that time and magnitude are divided in a similar way. For since we have shown that a faster thing traverses an equal space in less time, let A be the faster and B the slower, and let B be moved more slowly through magnitude CB in time ZI.

It is plain that A, which is faster, traverses the same magnitude in less time ZT.

But again, since A, which is faster, has in time ZT traversed the entire magnitude CD, B, the slower, traversed a smaller magnitude CK in the same time. And because B, the slower, traversed the magnitude CK in time ZT, A, the faster, traversed the same magnitude in even less time. Thus the time ZT will be further divided. And when it is, the magnitude CK will also be divided, because the slower traverses less space in part of that time. And if the magnitude is divided, the time also is divided, because the faster will cover that part of the magnitude in less time. So we continue in this manner, taking a slower mobile after the motion of the faster, and after the slower taking the faster, and making use of the statement already proved that the faster traverses an equal space in less time and that the slower traverses a smaller magnitude in equal time. For by thus taking what is faster, we will divide the time, and by taking what is slower, we will divide the magnitude.

Therefore, it is true that such a conversion can be made by going from the faster to the slower and from the slower to the faster. And if such switching causes the magnitude and then the time to be divided, then it will be clear that time is continuous, i.e., divisible into times that are further divisible, and the same for magnitude; for both time and magnitude will receive the same and equal divisions, as we have already shown.

776. Then at (589) he gives a third reason to show that magnitude and time are correspondingly divided. But this time we shall consider one and the same mobile. And he says that it is clear from the ordinary reasons that if time is

continuous, i.e,, divisible into parts that are further divisible, then a magnitude is likewise divisible: because one and the same mobile in uniform motion, since it traverses the whole magnitude in a given time, will traverse half in half the time, and a smaller part in less than half the time. And the reason why this happens is that time is divided as magnitude is.

Lecture 4

Proof that no continuum is indivisible

777. After showing that magnitude and time are subject to similar divisions, the Philosopher now shows that if either is finite or infinite, so is the other. About this he does three things:

First he states the proposition;
Secondly, from this he settles a doubt at 779;
Thirdly, he proves the proposition at 780.

778. He says therefore first (590) that if either of these two, namely, time and magnitude, is infinite, so is the other; likewise, both will be infinite in the same manner.

He explains this by distinguishing two ways of being infinite, saying that if time is infinite in respect of its extremities, the magnitude, too, is infinite in that way. Now time and magnitude are said to be infinite in their extremities, because they lack extremities. It is as though we imagined that a line is not terminated at any points, or that time is not terminated at a first or final instant. Moreover, if time is infinite through division, so also is a length. And this is the second way in which something is infinite. But something is said to be infinite through division, because it can be divided ad infinitum; which, of course, pertains to the definition of a continuum, as was said. Consequently, if time is infinite both ways, so, too, is length.

It is fitting that these two ways of being infinite be set in contrast: for the first way is taken from the viewpoint of indivisible extremities that are absent; the second is taken from the viewpoint of the indivisibles which are intermediate, for a line is divided according to points within the line.

779. Then at (591) he uses these facts to refute Zeno, who tried to prove that nothing is woved from one place to another, for example, from A to B.

For it is clear that between A and B there is an infinitude of intermediate points, since a continuum is divisible ad infinitum. Therefore, if something were to be moved from A to B, it would have to bridge the infinite and touch each of the infinites, and this cannot be done in finite time. Therefore, nothing can be moved through even the smallest distance during a period of finite time, however great.

The Philosopher, therefore, says that this argument is based on a false opinion, for length and time and any magnitude are said to be infinite in two ways, as we have said; namely, according to division and according to their extremities. Accordingly, if there were things (namely, a mobile and a distance) infinite in regard to quantity, which is to be infinite at the extremities, they could not touch one another in finite time. But if they are infinite in respect of division, they will touch, because time also, which is finite in respect of quantity, is infinite in respect of division.

Hence two things follow: that the infinite can be traversed not in finite but in infinite time, and that the infinite points of a magnitude are traversed in the infinite "now's" of time but not in the finite "now's".

But it should be noted that this solution is *ad hominem* and not *ad veritatem*, as Aristotle will explain in Book VIII, L. 17.

78C. Then at (592) he proves what he stated above as a proposition.

> First he restates the proposition;
> Secondly, he proves it at 781.

He says therefore first (592) that no mobile can traverse an infinite distance in finite time nor a finite distance in infinite time; rather, if the time is infinite, then the magnitude must be infinite, and vice versa.

Then at (593) he proves the proposition:

> First that the time cannot be infinite, if the magnitude is finite;
> Secondly, that if the length is infinite, the time cannot be finite at 784.

781. He proves the first part of the proposition with two reasons, the first of which (593) is this: Let AB be a finite magnitude and let G be an infinite time. Take GD as a finite part of this infinite time. Now, since the mobile traverses the entire magnitude AB in the entire time G, then in part of this time, which is GD, it will traverse the part BE of the magnitude. But since the magnitude AB is finite and greater than BE, which is finite and less, then BE is either an exact measure of AB or it will be less or greater. (These are the only relationships that a lesser finite quantity can bear to a greater finite quantity, as is evident in numbers. For 3, which is less than 6, measures it twice, but 3 taken twice does not measure 5, which is greater than 3, but exceeds it, nor does it measure 7, but is less than 7. But if 3 were taken thrice, that product would exceed even 7). Now it makes no difference in which of these three ways BE is related to AB, for the same mobile will always traverse a magnitude equal to BE in a time equal to GD. But BE is either an exact measure of AB or will exceed it, if taken a sufficient number of times. Therefore, also GD should exactly measure the entire time G or exceed it, if GD is repeated frequently enough. Consequently, the whole time G (in which

the entire finite magnitude was traversed) must be finite; because for every segment of magnitude there was a corresponding segment of time.

782. The second reason is given at (782). It is this: Although it be granted that a mobile traverse the finite magnitude AB in infinite time, it cannot be granted that it will traverse any magn1tude at random in infinite time, because we see finite magnitudes being traversed in finite times.

So let BE be the finite magnitude which is traversed In finite time. But BE, since it is finite, will measure AB, which is also finite. Now, the same mobile will traverse a magnitude equal to BE in a finite time equal to that in which it traversed BE. Thus the number of magnitudes equal to BE that will form AB corresponds to the number of equal times required to form the entire time consumed. Hence the entire time was finite.

?83. This second reason is different from the first, because in the first, BE was taken to be part of the magnitude AB, but here it is taken as a separate magnitude.

Then at (595) he shows the necessity of this second reason. For someone could cavil by saying that just as the whole magnitude AB is traversed in infinite time, so would every part of it, and thus the part BE would not be traversed in finite time. But because it cannot be granted that any magnitude at random is traversed in infinite time, it was necessary to present the second reason in which BE is a different magnitude which is traversed in finite time. For if the time in which BE is traversed is finite and less than the infinite time in which AB is traversed, then necessarily, BE is less than AB, and must be finite, since AB is finite.

784. Then at (596) he posits that the same proof leads to an impossibility if the length is said to be infinite and the time finite, because a part of the infinite length will be taker, as finite, just as a finite part of infinite time was taken,

785. Then at (597) he proves that no continuum is indivisible.

> First he says that an inconsistency would otherwise follow;
> Secondly, he gives the demonstrations that lead to that inconsistency, at 786.

He says therefore first (597) that it is clear from what has been said that no line or plane or any continuum is indivisible: first of all on account of the foregoing, namely, that it is impossible for any continuum to be composed of indivisibles, although a continuum can be composed of continua; secondly, because it would follow that an indivisible can be divided.

786. Then at (598) he gives the proof which leads to this inconsistency. In this proof he makes use of certain facts already established. One of these is that in

any finite time the faster and the slower can be in motion. The second is that the faster will traverse more distance in equal time. The third is that there can be excess of speed over speed and of length traversed over length traversed according to varying proportions; for example, according to the proportion of 2 to 1, or 3 to 2, or any other proportion.

With these presuppositions he proceeds thus: Let this be the ratio of the faster to the fast, that the one is faster in the ratio of 3 to 2; and let the faster traverse one magnitude ABCD composed of 3 indivisible magnitudes AB, BC and CD. During the same time according to the given ratio, tae slower will traverse a magnitude of two indivisible magnitudes, which form the magnitude EZI. And because the time is divided as the magnitude, the time in which the faster traverses the 3 indivisible magnitudes must be divided into 3 indivisibles, because the equal magnitude must be traversed in equal time. So let the time be KLMN divided into 3 indivisibles. But because the slower, during that time, traverses EZI, which are 2 indivisible magnitudes, the time can be divided into 2 halves. Consequently, it follows that an indivisible has been divided. For the slower had to traverse one indivisible magnitude in 1 and a half indivisibles of time, since it cannot be said that it traverses one indivisible magnitude in one indivisible time, for then the faster would not have been moved ahead of the slower. Therefore what remains is that the slower traverses an indivisible magnitude in more than one indivisible and less than two indivisibles of time. Thus the indivisible time will have had to be divided.

In like manner, it follows that an indivisible magnitude is divided, if the slower manages to move through three indivisible magnitudes in three indivisible times. For the faster will in one indivisible time be moved through more than one indivisible of magnitude and less than two.

Therefore, it is clear that no continuum can be indivisible.

Lecture 5

The "now" as the indivisible of time. Everything that moves is divisible. Difficulties solved

787. After showing that no continuum is composed of indivisibles and that no continuum is indivisible, thus making it seem that motion is divisible, the Philosopher now determines about the division of motion.

First he states certain facts necessary for the division of motion;
Secondly, he treats of the division of motion, L. 6.

About the first he does two things:

First he shows that in an indivisible of time, there is neither motion nor rest;

Secondly, that an indivisible cannot be moved, at 796.

About the first he does two things:

First he shows that the indivisible of time is the ″now″;
Secondly that in the ″now″ nothing is being moved or is at rest, at 794.

About the first he does three things:

First he states his intention;
Secondly, he states facts from which his proposition can be reached, at 789.
Thirdly, he shows what follows from his proposition, ?90.

788. About the first (599) we must take into account that something is called ″now″ in relation to something else and not in relation to itself; for example, we say that what is being done in the course of a whole day is being done ″now″, yet the whole day is not said to be present according to its entirety but according to some part of itself. For it is evident that part of a whole day has passed and part is still to come, and neither of them is ″now″. Thus it is evident that the entire present day is not a ″now″ primarily and *per se* but only according to something of itself—and what is true of the day is true of an hour or any period of time.

He says therefore that what is ″now″ primarily and *per se* and not according to something else is necessarily indivisible and present in every time.

789. Then at (600) he proves his proposition, For it is evident that it is possible in regard to any finite continuum to take an extremity outside of which there is existing nothing of that of which it is the extremity, just as nothing of a line is outside the point which terminates the line. But past time is a continuum which is terminated at the present. Therefore it is possible to take something as the extremity of the past, so that beyond it there is nothing of the past, and previous to it nothing of the future. In like manner, it is possible to take an extremity of the future, beyond which there is nothing of the past. Now that extremity will be the limit of both, i.e., of the past and of the future; for since the totality of time is a continuum, the past and the future must be joined at one term. And if the ″now″ fits the description just given, it is clear that it is indivisible.

790. Then he shows what follows from these premisses. About this he does two things:

First he shows that on the supposition that the ″now″ is indivisible, the limit of the past and the limit of the future must be one and the same ″now″.
Secondly, that on the other hand, if each is the ″now1l, then the 11now″ must be indivisible, at 79-3.

About the first he does two things:

First at (601) he concludes from the foregoing that it must be the same "now" which is the limit of the past and of the future.

791. Secondly, at (602) he proves this statement with the following argument: If the "now" which is the beginning of the future is other than the "now" which is the end of the past, then either these two "now's" are consecutive and immediately follow one upon the other or one is apart from and distinct from the other. But it cannot be that they are immediately consecutive, because then it will follow that time is composed of an aggregate of "now's"—which cannot be, because no continuum is composed of indivisible parts, as was said above. Neither can it be that one "now" is apart from the other and distant from it, because then there would have to be a time between those two "now's". For it is the very nature of a continuum that there is something continuous between any two given indivisibles, just as there is line between any two given points of a line.

But that this is impossible, he proves in two ways. First of all, because if there were a period of time between the two "now's" in question, it would follow that something of the same kind would exist between the two, which is impossible, for it is not possible that between the extremities of two lines that touch or are consecutive, there be a line between. For that is against the nature of consecutive things, which were defined as things between which nothing like them occurs. And so, since future time is consecutive to past time, it is impossible that between the end of the past and the beginning of the future there be an intervening time.

He proves the same point in another way: Whatever is intermediate between the past and the future is called "now". If, therefore, there is any time between the limits of the past and future, it will follow that that will also be called a "now." But all time is divisible, as has been proved. Consequently, it would follow, that the "now" is divisible.

792. Although in the immediately foregoing he had laid down the principles from which it could be proved that the Now is indivisible, yet because he had not derived the conclusion from these principles, he now shows that the Now is indivisible at (603). And he does this with three arguments.

The first of these is that if Now be divisible, it will follow that something of the past is in the future and something of the future in the past. For since the Now is the extremity of the past and the extremity of the future, and every extremity is in that of which it is the extremity, as a point in a line, then necessarily the entire Now is both in the past as its end and in the future as its beginning. But if the Now be divided, that division must determine the past and the future. For any division made in time distinguishes past and future, since among any parts of time taken at random, one is related to the other as past to future. It will follow, therefore, that part of the Now is past and part future. And so, since the Now is

in the past and in the future, it will follow that something of the future is in the past and something of the past in the future.

The second argument he gives at (604): If the Now be divisible, it will be such, not according to itself, but according to something else. For no divisible is the very division by which it is divided. But the division of time is the Now. For that by which a continuum is divided is nothing but a term common to two parts. But that is what we understand by the Now, that it is a term common to the past and future. Thus, therefore, it is clear that what is divisible cannot be the Now according to itself.

The third argument is given at (605): Whenever time is divided, one part is always past and the other future. If, therefore, the Now is divided, necessarily part of it will be past and part future. But past and future are not the same. It will follow, therefore, that the Now is not the same as itself, i.e., something existing as a whole all at once (which is against the definition of the Now: for when we speak of the Now, we consider it as existing completely in the present); rather there will be much diversity and even succession in the Now, just as there is in time, which can be divided any number of times.

793. Therefore, having thus shown that the Now is divisible (as a consequence of supposing that the Now which is the extremity of the past and of the future is not identical), and having rejected this consequent, he concludes to the rejection of the antecedent. And that is what he says: If it is impossible for the Now to be divisible, then it must be admitted that the Now which is the extremity of the past and of the future is one and the same.

Then at (606) he shows that conversely, if the Now of the past and of the future is the same, then it must be indivisible; because if it were divisible, all the aforementioned inconsistencies would follow, And so, from the fact that the Now cannot be admitted to be divisible (as though the Now of the past were something distinct from the Now of the future) and is indeed not divisible, if the Now of the present is the same as the Now of the future, he concludes from the foregoing that it is clear that in time there must be something indivisible which is called the Now.

794. Then at (607) he shows that in the Now there can be neither motion nor rest.

> First he shows it for motion;
> Secondly, for rest, at 795.

He says therefore first (607) that it is clear from what follows that in the Now nothing can be in motion, for if anything were in motion in the Now, two things could be in motion then, one of which is faster than the other. So let N be the Now, and let there be a faster body being moved in N through the magnitude AB.

In an equal time, a slower body is moved a smaller distance. Therefore, in this instant, it traverses the smaller magnitude AG. But the faster will. cover the same distance in less time than the slower. Therefore, because the slower body traversed the magnitude AG in the very Now, the faster traversed the same magnitude in less than the Now. Hence the Now is divided. But it was already proved that the Now cannot be divided. Therefore, nothing can be moved in a Now.

795. Then at (608) he proves the same thing for rest, giving three arguments. The first of which is this: It was said in Book V that an object at rest is one that is naturally capable of being in motion, but is not in motion when it is capable of being in motion and in respect to the part by which it is capable of being in motion and in the manner in which it is apt to be in motion. For if a thing lacks what it is not naturally capable of having (as a stone lacks sight) or lacks it when it is not naturally due to have it (as a dog lacks sight before the ninth day) or in the part in which it is not naturally capable of having it (as sight in the foot or in the hand) or in the way in which it is not apt to have it (as for a man to have sight as keen as an eaglets), none of these reasons is sufficient for saying that a thing is deprived of sight. Now rest is privation of motion. Hence nothing is at rest except what is apt to be moved and when and as it is apt. But it has been shown that nothing is naturally capable of being moved in the very Now. Therefore, it is clear that nothing is at rest in the Now.

The second argument is given at (609): That which is being moved in an entire period of time is being moved in each part of that time, in which it is apt to be moved; likewise, what is at rest in a given period of time is at rest in each period of that time in which it is apt to be at rest. But the same Now is in two periods of time, in one of which the mobile is totally at rest and in the other of which it is totally in motion (as appears in that which is in motion after rest or at rest after motion). Therefore, if in the Now something is apt to rest and be in motion, it will follow that something is at once in motion and at rest which is impossible.

The third argument is given at (610): Rest is said of things which maintain themselves now just as they were previously, but in their entirety and in respect of all their parts. For it is on this account that a thing is said to be in motion, that now it is different from what it was previously, either in respect to place or quantity or quality. But in the Now itself, there is nothing previous; otherwise, the Now would be divisible, because the word "previous" refers to the past. Therefore, it is impossible to rest in the Now.

From this he further concludes that necessarily anything that is being moved and anything that is at rest, is being moved and is at rest in time.

796. Then at (611) he shows that whatever is in motion is divisible: For every change is from this to that. But when something is at the goal, it is no longer

being changed but has been changed, for nothing can be at the same time in the state of being changed and having been changed, as was said above. But when something is at the starting-point of change both in its entirety and in regard to all its parts, then it is not being changed; for it was said above that whatever maintains itself constant in its entirety and in regard to all its parts is not being changed but is at rest. He adds "In regard to all its parts", because when a thing is beginning to be changed, it does not emerge in its entirety from the place it previously occupied, but part emerges after part.

Moreover, it cannot be said that it is in both terms in its entirety and in regard to its parts, while it is being moved; for then something would be in two places at one time.

Nor, again, can it be said that it is in neither of the terms: for we are now speaking of the nearest goal into which a thing is being changed and not of the remotest; for example, if something is being changed from white to black, black is the remote goal, but grey is the nearer one. In like manner, if a line ABCD is divided into three equal parts, it is clear that a mobile, which in the beginning of the motion was in AB as in a place equal to itself, can during the motion be neither in AB nor in CD; for at some time it is in its entirety in BC.

Therefore, when it is said that what is being moved cannot happen to be in neither extremity while it is being moved, must be understood as referring not to the remotest extremity but to a nearer one.

What is left, therefore, is that whatever is being changed is, while it is being changed, partly in one and partly in the other; for example, when something is being changed from AB to BC, then during the motion, the part leaving the place AB is entering the place BC; likewise, when something is being moved from white to black, the part which ceases to be white becomes grey or light grey.

Consequently, it is clear that anything that is being moved, since it is partly in one and party in the other, is divisible.

797. But it should be mentioned that the Commentator here raises the problem that if Aristotle does not intend in this place to demonstrate that every mobile is divisible but only what is mobile in regard to motion (which he said is present in only three genera; namely, quantity, quality and where), then his demonstration will not be universal but particular; because even the subject of substantial change is found to be divisible. Hence, he seems to be speaking of what is subject to any and every type of change, including even generation and ceasing-to-be in the genus of substance. And this is evident from his very words: for he does not say "what is being moved", but "what is being changed".

But in that case his demonstration has no value, because some changes are indivisible, such as generation and ceasing-to-be of substance, which do not

consume time. In such changes it is not true that what is being changed is partly in one extremity and partly in the other, for when fire is generated, it is not partly fire and partly non-fire.

798. In the face of this problem he proposes a number of solutions, one of which is Alexander's, who says that no change is indivisible or in non-time, But this must be rejected, because it conflicts with an opinion that is held as probable and famous with Aristotle and all Peripatetics, namely, that certain changes are in non-time, such as illumination and the like.

He mentions also the solution of Themistius, who says that even if there be changes in non-time, they are hidden, whereas Aristotle appeals to what is evident, namely, that change occurs in time. But this he also rejects, because change and the changeable are divided in the same way, and the divisibility of a mobile is more hidden than the divisibility of change. Hence Aristotle's demonstration would not be valid, because someone could say that although things which changed by changes evidently divisible are themselves divisible, yet there are some hidden changeable beings which are indivisible.

He mentions, too, the solution of Avempace [Ibn-Bajja], who says that the problem here is not about the quantitative division of the things capable of change but of that division whereby the subject is divided by contrary accidents, one of which is changed into the other.

799. Then the Commentator adds his own solution: namely, that those changes which are said to occur in non-time are the extremities of certain divisible motions, It happens, therefore, that something should be changed in non-time, insofar as every motion is terminated in an instant. And because what is accidental is ignored when it comes to demonstrating, for that reason Aristotle proceeds in this demonstration as though every change were divisible and in time.

800. But if you consider the matter correctly, you will see that this objection is not to the point. For in his demonstration Aristotle does not use as his principle the statement that every change is divisible (since he proceeds rather from the divisibility of the mobile to the division of change, as will be clear later, for as he says later, divisibility is first in the mobile, before it is in motion or change). Rather he uses principles that are evident and which must be conceded in any and every case of change; namely, (1) that what is being changed in regard to a certain matter is not being changed in regard to that matter as long as it is totally and according to all its parts still in the starting point, and (2) when it is in the goal, it is not being changed but has been changed, and (3) that it cannot be entirely in both terms or entirely in either of them, as was explained. Hence, it necessarily follows that in any change whatsoever, what is being changed is, during the change, partly in one extremity and partly in the other.

But this occurs in various ways in various changes. For in changes between

whose extremities there is something intermediate, it can happen that the mobile is, during the change, partly in one extreme and partly in the other extreme, precisely as extremes. But in those between whose extremes there is nothing intermediate, that which is being changed does not have different parts in different extremities precisely as extremities, but by reason of something connected with the extremities. For example, when matter is being changed from privation of fire to the form of fire, then while it is in the state of being changed, it is indeed under privation as to itself, but yet it is partly under the form of fire, not inasmuch as it is fire, but according to something connected with it, i.e., according to the particular disposition for fire, which disposition it partly receives before it has the form of fire. That is why Aristotle will later prove that even generation and ceasing-to-be are divisible, because what is generated was previously being generated, and what ceases-to-be was previously ceasing-to-be.

Perhaps this was the sense in which Alexander understood the statement that every change is divisible; namely, either according to itself or according to a motion connected with it. So also Themistius understood by the statement that Aristotle took what was evident and abstracted from what was hidden, that the proper place for treating of the divisibility or indivisibility of changes would not be reached until later.

Nevertheless, in all divisibles and indivisibles, what Aristotle says here is true: because even changes that are called indivisible are in a sense divisible, not by reason of their extremities but by reason of something connected to them. And this is what Averroes wanted to say when he said that it is *per accidens* that some changes occur in non-time.

801. However, there is here another difficulty. For when it comes to alteration, it does not seem to be true that what is being altered is partly in one term and partly in the other, during the alteration. For the motion of alteration does not take place in such a way that first one part and then another is altered; rather the entire thing that was less hot becomes hotter. For which reason Aristotle even says in the book *On Sense and the Thing Sensed* that alterations are not like local motions. For in the latter, the subject reaches the intermediate before the goal, but such is not the case with things that are altered; for some things are altered all at once and not part by part, for it is the entire water that all at once freezes.

802. But to this it must be replied that in this Sixth Book Aristotle is treating of motion as continuous. And continuity is primarily and per se and strictly found only in local motion, which alone can be c;_ntinuous and regular, as will be shown in Book VIII. Therefore, the demonstrations given in Book VI pertain perfectly to local motion but imperfectly to other motions, i.e., only to the extent that they are continuous and regular.

Consequently, it must be said that what is mobile in respect of place always enters a new place part by part before it is there in its entirety; but in alteration, that is only partially true. For it is clear that every alteration depends on the power of the agent that causes the alteration—as its power is stronger it is able to alter a greater body. Therefore, since the cause of the alteration has finite power, a body capable of being altered is subject to its power up to a certain limit of quantity, which receives the impression of the agent all at once; hence the whole is altered all at once, and not part after part. Yet that which is altered can in turn alter something else conjoined to it, although its power in acting will be less forceful, and so on, until the power involved in the series of alterations is depleted. An example of this is fire which all at once heats one section of air, which in turn heats another, and thus part after part is altered. Hence in the book *On Sense and the Thing Sensed*, after the above-quoted passage, Aristotle goes on to say: "Yet if the object heated or frozen is large, part after part will be affected. But the first part had to be altered all at once and suddenly by the agent".

Yet even in things that are altered all at once, it is possible to discover some kind of succession, because since alteration depends on contact with the cause which alters, the parts closer to the body that causes the alteration will more perfectly receive at the very beginning an impression from the agent: and thus the state of perfect alteration is reached successively according to an order of parts. This is especially true when the body to be altered has something which resists the power of the altering cause.

Consequently, the conclusion (that what is being changed, is, while it is being changed, partly in the *terminus a quo* and partly in the *terminus ad quem*, in the sense that one part reaches the *terminus ad quem* before another does) is unqualifiedly and absolutely true in local motion. But in alteration it is qualifiedly true, as we have said.

803. Some on the other hand have held that the present doctrine is truer when applied to alteration than when applied to local motion, For they hold that the statement "what is being changed is partly in the *terminus a quo* and partly in the *terminus ad quem* is not to be interpreted as meaning that one part of the thing in motion is in one term and another in the other, but that reference is being made to the parts of the termini, i.e., that what is being moved has part of the *terminus a quo* and part of the *terminus ad quem*, as something in motion from white to black, is at the very beginning neither perfectly white nor perfectly black, but imperfectly partakes of both; whereas in local motion this does not seem to be true, except in the sense that the thing in motion, while it is between the two extremities, somehow partakes of both extremities. For example, if earth were to be moved to the place normal to fire, then while it was in the region proper to air, it would have a part of each extremity, (i.e., earth and fire), in the sense that the place of air is above that of earth, and below that of fire,

804. But this is a forced explanation and against Aristotle's opinion. For in the first place we need only look at the very words of Aristotle. For he says as a conclusion: "it follows therefore that part of that which is being changed must be at the starting-point and part at the goal". He is speaking therefore about the parts of the mobile and not about the parts of the termini.

In the second place it is against Aristotle's intention, For Aristotle brings to light facts that will prove that what is being changed is divisible—a statement that could not be proved, if you held to the interpretation given. Hence Avempace said that Aristotle does not intend here to prove that a mobile can be divided into quantitative parts but according to forms, in the sense that what is being moved from contrary to contrary has, while it in being changed, something from each contrary. But the intention of Aristotle is expressly to show that a mobile can be divided into its quantitative parts, just as any continuum, for he makes use of that fact in the demonstrations that will follow.

Nor can we heed the opinion that such an interpretation will help to prove that a mobile can be divided on the basis of continuity. Because the very fact that a mobile, while it is being moved, partakes of each terminus and does not perfectly possess the *terminus ad quem* all at once, reveals that change is divisible on the basis of continuity. And thus, since a divisible cannot exist in an indivisible, it follows that the mobile also can be divided as a continuum. For in the matters to follow, Aristotle will clearly prove that motion is divisible, because the mobile is divisible. Hence, if he intended to conclude that a mobile is divisible because motion is divisible, he would be arguing in a circle.

Thirdly, such an interpretation appears to conflict with Aristotle's own interpretation at (611 bis) where he says "here by 'goal' of change I mean that into which it is first changed during the process of change". This shows that he does not intend to say that it is partly in the *terminus a quo* and partly in the *terminus add quem* just because it is midway and, as it were, sharing in both extremities, but because in regard to one part of itself it is in one extreme, and according to another part in what is midway.

805. But with respect to this explanation of Aristotle, one might wonder why he says "that into which it is first changed" for it seems impossible to discover that into which it is first changed, since a magnitude can be divided *ad infinitum*.

Therefore, it must be said that "That into which it is first changed" in local motion is the place next to but not part of the place from which the local motion starts. For if we took it to mean a place that included part of the original place, we would not be assigning the first place into which it is being moved. The following example will illustrate this: Let AB be the place whence a mobile is being moved, and let BC be the adjacent place equal to AB. Now, since AB can be divided, let it be divided at D and take a point G near C so that the place GC is equal to BD. It

is clear that the mobile will arrive at DG before it reaches BC. Moreover, since AD can be divided, a place prior to DG can be take n, and so on *ad infinitum*.

Similarly, in regard to alteration, "the first into which something is changed" must be considered to be an intermediate; for example, when something is changed from white to black, the first into which the subject is changed is into grey, not into less white.

Lecture 6

Two manners of dividing motion. What things are co-divided with motion

806. Having established the facts needed for dividing motion, he now begins to treat of the division of motion. And the treatment is divided into two parts.

In the first he treats of the division of motion;
In the second he uses his conclusions to refute errors about motion, at L. 11.

The first part is divided into two sections:

In the first he discusses division of motion;
In the second, division of rest, at L. 10.

The first section is divided into two parts:

In the first he deals with division of motion;
In the second he discusses finite and infinite with respect to motion (for both, namely, "divisible" and "infinite" seem to belong to the continuum), at L. 9.

The first is divided into two parts:

In the first he shows how motion is divided;
In the second he treats of the order of the parts of motion, at L. 7.

In regard to the first he does two things:

First he lists two ways by which motion is divided;
Secondly, he mentions what else is divided when motion is divi-ded, at 812.

In regard to the first he does two things:

First he mentions the ways in which motion is divided;
Secondly, he explains them, at 808.

807. He says therefore first (612) that motion is divided in two ways. In one way it is divided according to time, because it has been shown that motion occurs not

in the "now" but in time. In a second way, it is divided according to the motions of the parts of the mobile. For let the mobile AC be divided, for any mobile can be divided, as we have shown. If therefore the entire mobile AC is being moved, then each of its parts AB and BC is in motion,

But notice that the dividing of motion according to the parts of the mobile can be understood in two ways, First of all, that part is being moved after part—which is not possible in that which is in motion *per se* in its entirety, for in the case of such a mobile all the parts are moved together, not in isolation from the whole, but in the whole. In the second sense, the dividing of motion according to parts of the mobile can be taken in the same sense that the division of an accident whose subject is divisible depends on the division of that subject; for example, if a whole body is white, then as the body is divided, the whiteness will be divided *per accidens*. And it is in this sense that we are taking division of motion according to the parts of the mobile, i.e., just as both parts of the mobile are in motion at the same time as the whole is, so the motions of both parts occur at the same time. This shows that division of motion according to the parts of the mobile is different from, that which is according to time, in which division two given parts of a motion do not occur at the same time. But if we were to compare the motion of one part to that of another part not absolutely but according to a fixed stage to be reached, then the motion of one part, will precede in time the motion of another part. For if the mobile ABC is moved in the magnitude EFG, so that. EY is equal to length ABC of the mobile, it is clear that BC will reach F before AB does. According to this the division of motion according to the parts of time and according to the parts of the mobile will be concurrent.

808. Then at (613) he explains these ways of dividing motion:

> First he shows that motion is divided according to the parts of the mob-ile; Secondly, that it is divided according to the parts of time, 8-1.71.

The first he shows by three arguments, of which the first is this: Since the parts are in motion by the fact of the wholes being in motion, let DE be the motion of the part AB and EZ the motion of the part BC. Therefore, just as the whole mobile is composed of AB and BC, so the whole motion DZ is composed of DE and EZ. Since, therefore, both of the parts of the mobile are being moved in accordance with both of the parts of the motion in such a way that neither part of the mobile is being moved in accordance with the motion of the other part (because then the entire motion would be the motion of one part, which would be moved by its own motion and by the motion of the other part), then it must be admitted that the whole motion DZ is the motion of the whole mobile AC; and thus the motion of the whole is divided by means of the motion of the parts.

809. At (614) he gives the second argument, which is this: Every motion belongs to some mobile. But the entire motion DZ does not belong to either of the parts,

because neither is being moved according to the entire motion, but both are being moved according to the parts of the motion, as we have said. Nor can it be said that the whole motion DZ is the motion of some other mobile separated from AC, because, if the whole of this motion were the motion of some other whole mobile, it would follow that the parts of this motion would belong to the parts of that mobile; whereas we have already agreed that the parts of the motion DZ belong to the parts of the original mobile, which are AB and BC, and to no other parts (for if they belonged to these and to others as well, it would follow that one motion would belong to several things, which is impossible), What remains, therefore, is that the entire motion belongs to the entire magnitude just as the parts of it belong to the parts of the magnitude. And thus the motion of the whole mobile is divided according to the parts off the mobile.

810. At (615) he gives the third argument, which is this: Everything that is being moved has a position. Therefore, if the whole motion DZ does not belong to the whole mobile AC, then some of the motion does, and let it be TI. Now, from this motion TI take away by division the motions of both parts, which must be equal to the motions that form DEZ, for the following reason: One mobile does not have but one motion, and, consequently, the parts′ motions which are taken away from the motion TI (which is the motion of a whole) cannot be said to be greater or less than DE and EZ, which we agreed are the motions of those same parts. Now the motions of the parts consume the whole motion TI or they are less or greater. If they consume the entire TI and are neither greater nor less, it follows that the motion TI is equal to the motion DZ (which is the motion of the parts) and does not differ from it. But if the motions of the parts are less than TI so that TI exceeds DZ by the amount KI, then the part KI of the motion does not belong to any mobile. For it is neither the motion of AC nor of any of its parts, because one thing has only one motion, and we have already assigned a different motion both to the whole AC and to its parts. Nor can we say that KI belongs to some other mobile, because the entire motion TI is one continuous motion and a continuous motion must belong to a thing that is continuous, as we have shown in Book V. Hence it cannot be that the part KI of this continuous motion belongs to a mobile not continuous with ABC.

A like difficulty follows, if it is said that the motion of the parts exceeds the divided motion TI, because it will follow that the parts exceed the whole—which is impossible. Consequently, if it is impossible that the parts either exceed or are less than to the whole, then necessarily the motion of the parts is equal to and is the same as the motion of the whole.

And so this division is based on the motions of the parts and such a partition must be found in motion, because everything that is being moved is capable of being divided into parts.

811. Then at (616) he shows in the following argument that motion is divided

according to the division of time; Every motion occurs in time and every time is divisible, as we have proved. Therefore, since there is less motion in less time, every motion must be capable of being divided according to time.

812. Then at (617) he shows what other things are divided when motion is divided. About this he does three things:

First he mentions five things that are co-divided;
Secondly, he shows that if the finite or infinite is found in any of them, it is found in all the others, at 816;
Thirdly, he shows in which of them is first found division and infinite, at 817.

About the first he does two things:

First he states his proposition;
Secondly, he explains the proposition, at 813.

He says therefore first (617) that since everything that is being moved is being moved in respect to some genus or species as well as in time and, moreover, since every mobile is capable of some motion, then necessarily the following five things must be divided at the same time that any one of them is divided: time and motion and the very "act of being moved" and the mobile which is being moved and "the sphere of motion", i.e., the genus or species in regard to which there is motion, i.e., place or quality or quantity.

Nevertheless, the divisions of the "spheres of motion" do not all occur in the same way but in some the division is *per se* and in others *per accidens*. The division is *per se*, if it is in the sphere of quantity, as it is in local motion and also in growth and decrease; but it is *per accidens* in the sphere of quality, as in the motion called "alteration".

813. Then at (618) he explains what he has said:

First the statement that time and motion are co-divided;
Secondly, that motion and the t1act of being moved" are, at 814.
Thirdly, that motion and the sphere of motion are, at 815,

About the first he does two things:

First he shows that with division of time, motion is divided;
Secondly, vice versa, at 814.

He says therefore first (618): Let A be the time in which something Is being moved, and let B be the motion occurring in this time. Now it is evident that if something is being moved through an entire magnitude in the whole time A, then in half the time, it will be moved through a smaller magnitude. But to be moved through the entire motion is the same as being moved through the entire magnitude, just as to be moved through part of the motion is the same as being

moved through part of the magnitude. Therefore, it is clear that if in the entire time it is moved through the whole motion, then in part of the time it will be moved through a smaller motion. And if the time be again divided, a smaller motion will be found, and so on indefinitely. And so it is evident that according to the division of time, motion is divided.

Then at (619) he shows that on the other hand, if the motion is divided, the time is divided. Because if it is being moved through the entire time, then through half the motion it will be moved through half the time and so on, as the motion is smaller, the corresponding time is also, provided of course that we are dealing with the same mobile or one equally fast.

814. Then at (620) he shows that motion and the "act of being moved" are co-divided. Regarding this he does two things:

> First he shows that "being moved" is divided according to the division of motion;
>
> > Secondly, that motion is divided in accordance with the division of "being moved", at 814.

He says therefore first (620) that in the same way, it is proved that "being moved" is divided in accordance with the division of time and motion. For let "being moved" be C. Now it is evident that a thing is not moved as much according to part of the motion as according to the whole of the motion. Therefore, according to half of the motion, part of the factor called "being moved" will be less than the whole factor and still less according to half of the half, and so on. Therefore, as time and motion are continually subdivided, so also the factor called "being moved".

Then at (621) he proves that conversely motion is divided according to the division of "being moved". For let DC and CE be two parts of a motion, according to both of which something is being moved. Then if the parts of the motion correspond to the parts of "being moved", then the whole corresponds to the whole, because if there were more in one than in the other, then the same argument would apply here that applied when we proved that the motion of a whole can be divided into motions of the parts in such a way that there is neither excess nor defect. In like manner, the parts of "being moved" can neither be less nor greater than the parts of tho motion; for since we must admit a "being moved" for each part of the. motion, then necessarily the entire factor called "being moved" is continuous and corresponds to the entire motion. And thus, the parts of "being moved" correspond to the parts of the motion and the whole to the whole. Consequently, one is divided in accordance with the other.

815. Then at (622) he shows the same for the sphere of motion, i.e., for the genus or species in which the motion takes place. And he says that in the same way it can be demonstrated that the length in which something is moved locally

can be divided according to the division of time and of motion and of "being moved". And what we say of the length in local motion is to be understood of every sphere in which there is motion, except that in some spheres the division is *per accidens*, as in the case of qualities in the motion, of alteration, as was said. And hence it is that all those things are divided, because the subject of change can be divided, as was explained above. Consequently, if one is divided, all the others must.

816. Then at (623) he says that just as the above-mentioned things follow upon one another in divisibility, so also in being finite or infinite, so that if one of them is finite, all the others are, and if one is infinite, so are all the others.

817. Then at (624) he shows in which of the five above-mentioned things divisibility and finite and infinite are first found. And he says that the subject of change is the first root from which the divisibility and finiteness and infinity of the others flow, because what is naturally first in motion is the mobile, which of its very nature has the properties called "divisibility", "finiteness" and "infinity". Hence from it divisibility and finiteness flow to the others.

But how the mobile is divisible and how the others are divided through it, we have already shown. How the mobile is infinite will be explained later in this Book VI.

Lecture 7

The time in which something is first changed is indivisible. How a first may, and may not, be taken in motion

818, After explaining how motion is divided, the Philosopher now discusses the order of the parts of motion.

> First he asks whether there is a first in motion;
> Secondly, he shows how the factors involved in motion precede one another, in L. 8.

About the first he does two things:

> First he shows that that into which something is first changed is indivisible;
> Secondly, how in motion a first can and cannot be found, 822.

About the first he does two things:

> First he mentions facts to be used in explaining the proposition;
> Secondly, he proves the proposition, at 821.

About the first he does two things:

First he mentions his proposition;
Secondly, he proves it, at 819.

819. He says therefore first (625) that because whatever is being changed is being changed from one term to the other, then when the subject of change has now been changed, it has to be in the *terminus ad quem*.

Then at (626) he proves this proposition with two arguments, the first of which is particular and the second universal.

The first argument is this: Everything being changed must either (1) be distant from the term at which the change starts, as is evident in local motion, in which the place from which the motion starts remains and the mobile gets to be distant from it; or (2) the *terminus a quo* must cease to be, as in the motion called alteration: for when something white becomes black, the whiteness ceases to be.

In order to explain this proposition he adds that either the process of being changed is the same as departing, or the latter is a consequence of change and, therefore, "to have departed" (from the *terminus a quo*) is a consequence of having been changed. But it is evident that they are the same in reality but different in conception. For "departing" is spoken of in relation to the *terminus a quo*, whereas "change" gets its name from the *terminus ad quem*. And in explanation of this, Aristotle adds that "both are related to both in a similar way", i.e., as "departing" is related to "being changed", so "having departed" is related to "having been changed".

From these premisses he argues to the conclusion, using as his example the species of change that involves terms contradictorily opposed, where the transition is between being and non-being, as in generation and ceasing-to-be. For it is evident from the foregoing that whatever is being changed departs from the *terminus a quo* and that whatever has been changed has already departed. When, therefore, something has been changed from non-being to being, it has already departed from non-being. But of anything at all it is true to say that it either is or is not. Therefore, what has been changed from non-being to being is in being, when the change is over. Likewise, what has been changed from being to non-being must be in non-being. Therefore, it is evident that in the change which involves contradictories, the thing which has been changed exists in that into which it has been changed. And if it is true in that type of change, then for an equal reason it is true in other changes. From this the first proposition is clear.

820. Then at (627) the second argument, a general one, is given, And he says that the same conclusion can be proved by considering any change at all. And he picks local motion; Whatever has been changed must be somewhere, i.e., either in the *terminus a quo* or in some other. But since what has been changed has already departed from that from which it has been changed, it must be elsewhere. Therefore, it must be either in that in which we are trying to prove it

is, i.e., in the *terminus ad quem* or elsewhere. If it is in the former, our point is proved; if not, then let us suppose that something is being moved into B and when the change is finished the thing is not in B but in C. Then we must say that from C it is also changed into B, because B and C are not consecutive. For a change of the type under discussion is continuous, and in continua one part is not consecutive to another, because between two parts there occurs a part that is similar to those two, as was proved above. Hence, it will follow, if that which has been changed is in C when it has been changed and from C it is being changed to B (which is the *terminus ad quem*), that when it has been changed, it is also being changed into what it has already become—which is impossible, For "being changed" and "having been changed" are never simultaneous, as we have shown above. Now it makes no difference whether the termini C and B are applied to local motion or to any other change. Consequently, it is universally true that what has been changed is (when it has been changed) in that into which it has been changed, i.e., in the *terminus ad quem*.

From this he further concludes that what has been changed is, as soon as it has been changed, in that into which it has been changed. He added "as soon as", because after it has been changed into something, it could depart from it and not be there; but as soon as it has been changed, it must be there.

821. Then at (628) he shows that "to have been changed" is first and *per se* in an indivisible; and he says that that time in which what has been changed was first changed must be indivisible. 'Why he adds "first" he explains by saying that A is said to have been first changed as soon as it is not said to have been changed merely by reason of any of its parts. For example, if we say that a mobile has been changed in a day, because it was changed in some part of the day. in that case it was not first changed in the day.

But that the time in which something has been first changed is indivisible he now proves: If the said time were divisible, let it be AC and let it be divided at B. Now three things are possible: either (1) the change is over in each part or (2) it is going on in each part or (3) in one part it is going on and in the other it is over. Now, if in each part it is over, then it was first completely changed not in the whole but in the part; but if it is being changed in each part, then it is also being changed in the whole (for the reason why something is said to be changing in a whole period of time is that the change was going on during each part of the whole time). But this is against our assumption that in the whole of AC it had been changed.

On the other hand, if it be supposed that in one part of the time it is being changed and in the other part it has been changed, the same difficulty ensues; namely, that it was not first changed in the whole time, because since the part is prior to the whole and something is in motion in a part of time before it is moved in the entire time, it follows that there was something prior to the first, which is

impossible. Consequently, it must be admitted that the time in which the thing was first completely changed is indivisible,

From this he further concludes that everything that has ceased to be and everything that has been completely made, was made and ceased to be in an indivisible of time, because generation and ceasing to be are the termini of alteration. Consequently, if a motion is terminated in an instant (for these two things are the same, i.e., the termination of a motion and to have been first changed), it follows that generation and ceasing-to-be occur in an instant.

822. Then at (629) he shows how to discern in a motion, that which is first. About this he does two things:

First he proposes the truth;
Secondly, he proves it at 823.

He says therefore first (629) that the expression "in which something has been first changed" has two interpretations: first, it can mean that in which the change is first complete or terminated —in which case it is true to say that something has been changed, when the change is now over. Secondly, it can mean that in which it first began to be changed, and not that in which it was first true to say that it has been changed.

Taken in the first sense, namely, according to the termination of the change, it is applied to instances of motion in which there exists a first in which something has been changed. For a change can be first terminated some time, because every change has a termination. It was in this sense that we understood that "that in which something was first changed" is an indivisible—which was proved on the ground that it is the end, i.e., the terminus, of the motion—and we know that every terminus of a continuum is an indivisible.

But if it is taken in the second sense, namely, according to the beginning of the change, i.e., according to the first part of the motion, then there is no first in which something has been changed. For no beginning of a change can be definitely pointed out, i.e., no part that is not preceded by some other part. In like manner, it is not possible to isolate a first time in which something is first being moved.

823. Then at (630) he proves that if one looks at the beginning of a motion, it is not possible to assign "a first in which something has been changed".

First with an argument from time;
Secondly, with an argument from the mobile, at 824;
Thirdly, with an argument from the sphere in which the motion occurs, at 825.

As to the first he gives this reason: If there is any element of time in which

something has been first changed, let it be AD. Now AD must be either divisible or indivisible. If the latter, two difficulties ensue. The first is that the "now's" in time are consecutive. This difficulty follows from the fact that time is divided just like motion, as was shown above. But if any part of the motion was present in AD, then AD must have been a part of time and, consequently, time will be composed of indivisibles. However, the indivisibles of time are the "now's". It will follow, therefore, that the "now's" are consecutive in time.

And there is a second difficulty. Let us suppose that in the time CA, which preceded AD, the same mobile that was being moved in time AD was entirely at rest. If, therefore, it was at rest in the entire time CA, it was at rest in A, which is an element of the time CA. If, therefore, (as we supposed) AD is indivisible, it' will follow that a thing is at rest and in motion at the same time; for we have already concluded that it was at rest in A and assumed that it was in motion in AD. But if AD is indivisible, then A is the same as AD. It will follow, therefore, that a thing is at rest and in motion in the same time.

It should be noted, however, that if a thing was at rest throughout an entire time, it does not follow that it was at rest in the last indivisible of that time; for we have already shown that in the "now" things are neither at rest nor in motion. But Aristotle concludes this here by arguing from what his adversary has proposed, namely, that the element of time in which the object was first being moved is an indivisible. And if it can be in motion in an indivisible of time, there is no reason why it could not also be at rest.

Therefore, having rejected the indivisibility of time AD, we are left with the fact that it is divisible. And since it is in AD that the object is said to be first moved, then it is being moved in any part of AD. This he now proves:

Let AD be divided into two parts, Then the object is being moved either in neither part or in both parts or in one part only. If in neither part, then not in the whole time. If in both parts, then it could be granted that it is being moved in the whole time. But if in one part only, it will follow that it is being moved in the whole time but not first, but by reason of the part. Therefore, since it is agreed to be moving in the whole time, it has been in motion in each part of the whole time. But time is divided infinitely just like any continuum; consequently, it is possible always to consider a part smaller than a previous one; for example, a day before a month and an hour before the day. Therefore, it is evident that it is impossible to find a time in which it is first being moved so that a previous could not be found. For if you were to assume that it is in a day that the object is first moved, that assumption would not be true, because it would have been first moved in the first part of the day, before it was moved in the whole day.

824, Then at (631) he establishes the same point by considering the mobile, and he concludes from the foregoing that neither in that which is being changed is it

possible to take something that is first changed. Now this is to be understood in the sense that some definite point is to be crossed 'through 'the motion of the whole or of the part: for it is evident that the first part of the mobile will first pass a given point, and a second part will pass it after that, and so on. Otherwise, if it were understood in the sense of the absolute nature of motion, what we have to say would not be ad rem: for it is clear that the whole is being moved at the same time as all the parts, but the whole does not pass a certain point all at once but part before part continuously. Hence, just as it is impossible to find a first part of the mobile than which there is not a previous smaller part, so also is it impossible to isolate a part of the mobile that would be first moved. And because time and mobile are correspondingly divided, as we have shown above, then what was concluded about time, he now concludes about the mobile. Here is his proof:

Let DE be a mobile and (because every mobile can be divided, as was proved above) let DZ be the part that is first being moved. And let DZ be moved so that it passes a definite point in the time TI. if, therefore, DZ has been changed in this whole time, it follows that what has been changed in half the time is both less than DZ and moved prior to DZ. And for the same reason there will be something prior to that and so on forever, because time can be divided infinitely, it is evident, therefore, that in the mobile one cannot find something that has been first changed.

Hence it is clear that a first cannot be found in motion, whether we consider the time or the mobile.

825. Then at (632) he proves the same thing by considering the sphere in which the motion occurs. But first he mentions that the situation with respect to the sphere in which the motion occurs is not exactly the same as it was with respect to time and the mobile. For since there are three things to be considered in change; namely, the mobile which is being changed (for example, a man) and that in which it is being changed, i.e., the time, and that into which it is being changed (for example, into white), two of these, namely, the time and the mobile are always divisible. But with white it is another story, because a white thing is not divisible *per se*, but it, and things like it, are divisible *per accidens*, inasmuch as the subject of whiteness or of any other quality is divisible.

Now the *per accidens* division of white can take place in two ways. In one way according to the quantitative parts, as when a white surface is split into two parts, the white will be divided *per accidens*. In another way, according to greater or less intensity, for the fact that one and the same part is whiter or less white is not due to the nature of whiteness (because if it existed in isolation, whiteness would be constant and never subject to more and less, any more than a substance is susceptible of more and less) but to the varying degrees in which a divisible subject participates whiteness. Therefore, neglecting what is divided *per*

accidens in the sphere of motion and considering only what is divided *per se* in those spheres, it is impossible to find a first.

And he proves this first of all in magnitudes in which there is local motion. Let the magnitude AC be divided at B, and suppose that C is that into which something is first moved from B. Now BC is either divisible or indivisible. If the latter, it follows that an indivisible will be touching an indivisible, for there is no reason why the second part of the motion will not be into an indivisible, since we can divide a magnitude just as the motion was divided, and as time was.

But if BC is divisible, it is possible to take a stage nearer to B than to C, and so the thing will be changed from B into that stage before it is changed into C and into a stage prior to that one, and so on, because there is no limit to the division of a magnitude. It is therefore evident that it is impossible to find a first stage into which a thing has been changed in local motion.

The same is true in change of quantity, i.e., growing and decreasing. For even these changes are in terms of a continuum, i.e., in terms of added quantity or subtracted quantity, in which no first is to be found, since there can be division *ad infinitum*.

And so it is clear that it is only in qualitative change that something is *per se* indivisible. But inasmuch as in this *per accidens* divisibility is found, likewise no first is discernible in such change. This is true whether the succession consists in part being altered after part (for it is evident that no first part of white can be found any more than a first part of magnitude can) or whether the succession is based on one and the same thing becoming more and more white or less and less white, for a subject can be modified in an infinite number of ways with regard to degrees of whiteness, Thus the motion involved in alteration can be continuous and not possess a first.

Lecture 8

Before every "being moved" is a "having been moved," and conversely

826. After explaining how a first is to be taken in motion and how not, the Philosopher now explains the order of precedence among the things present in motion.

> First he premises facts needed for explaining the proposition;
> Secondly, he explains the proposition, at 828.

827. He says therefore first (633) that whatever is being changed is being changed in time, as we have explained. But something is being changed in a time in two ways: in one way, first and *per se*; in another way, by reason of something else, i.e., by reason of a part, as when something is said to be

changed in a year, because it is being changed in a day.

With this distinction in mind, he states what he intends to prove: namely, that if something is being first moved in a time, it is necessarily being moved in some part of that time. This he proves in two ways:

First, from the definition of "first", for here something is said to be in a thing "first", if it belongs to it by reason of each and every part, as was said in the beginning of Book V.

Secondly, he proves the same thing with an argument: Let XR be the time in which something is being first moved and, since time is divisible, let XR be divided at K. Then of necessity in the part XK of the time, the object is either being moved or not, and likewise for the part KR. Now if it be said that it is being moved in neither of those parts, it follows that it is not being moved in the whole time but is at rest throughout that time, for it is impossible for a thing to be in motion in a time without being in motion in some part of it. But if it be supposed that it is being moved in just one part of the time, it will follow that it is not being first moved in the time called XR; because that would require motion in respect to both parts and not in respect to just one. Therefore, of necessity, it must be in motion in each part of the time XR. And that is what we want to demonstrate: namely, that if something is being first moved in a time, it is being moved in every part of it.

828. Then at (634) he sets about proving the main proposition. And about this he does two things:

> First he introduces the proofs of the proposition;
> Secondly, he concludes to the truth, at 838.

About the first he does two things:

> > First he shows that before each state of being moved there was a state of completed motion;
> > Secondly, that, conversely, before each state of completed motion there was a state of being moved, at 832.

829. He proves the first with three arguments, of which the first is: Let KL be the magnitude through which a mobile has been moved in the first time XR. It is clear that an equally fast mobile, which began its motion with the first one, will have covered half the magnitude in half the time. Since the first mobile (which we have said covers the entire magnitude) is as fast as the second, it follows that even it has in half the time already been moved through, half the magnitude KL. It will follow, therefore, that what is being moved has been previously moved.

To get a better understanding of what we mean, it must be considered that just as "point" is a name for the terminus of a line, so "completed motion" is a name

for the terminus of a motion. Now, no matter what line or what part of a line you take, it is always true that before the consummation of the whole line, you can take a point according to which the line can be divided. Likewise, before any motion or part of a motion, you can take a "state of completed motion"; because while the mobile is being moved to its terminus, it has already passed a certain stage in respect to which the mobile is said to have been already changed. But just as a point within a line is in potency before the line is actually divided (for a point is the very division of a line), so also the thing called "completed motion" (within a motion) is in potency as long as the motion does not stop there; but if it does stop there, it will be actual. And since what is in act is better known than what is in potency, therefore Aristotle proves his proposition (that what is being continually moved has already been moved) by referring to an equally fast mobile whose motion has already been completed. This is like proving that in a certain line there is a point in potency by showing that a like line has been actually divided.

830. The second argument, which he gives at (635), is this: In the whole time XR or in any other, something is said to have been changed by the very fact that a final "now" of the time is taken, not that something is being moved in that "now", but that the motion is terminated then. Hence "having been moved" is taken here not for that which is at some time being moved but for the fact that the motion is ended. Now the reason why the motion must be terminated in the final "now" of the time that measures the motion is that that "now" terminates the time, just as a point terminates a line. And all time is midway between two "now's", just as a line is between two points. Therefore, since "being moved" occurs in time, it follows that "having been moved" occurs in the "now" which is the terminus of time. And if that is the case with a motion in a whole period of time, the same must be true of the parts of motion that occur in the parts of time. Now, we have already shown that if something is being first moved in the whole time, it is being moved in each part of the time. But whichever part of time you take, it is terminated at some "now". For the terminus of half of the time is the "now" which divided the time into two parts. Therefore, it follows that what is being moved through the whole is previously moved at the middle of time, on account of the 11nowlt which determines the middle. And the same reasoning applies to any part of time. For no matter how the time is divided, it will always be found that each part of the time is determined by two "now's", and after the first "now" of the time measuring the motion, no matter which other "now" is taken, the object has already been moved in that part of the time, for that "now"—whichever it is—is the terminus of the time measuring the motion.

Now, because every period of time is divisible into times and each period exists between two "now's", and because in any "now" that happens to be the ending of a time measuring the motion, something has been moved, it follows that whatever is being changed has been changed an infinite number of times,

because "having been changed" is the terminus of a motion, just as a point is of a line and a "now" is of a time.

Therefore, just as it is possible in any line to pick out point ahead of point ad infinitum and in any period of time "now" before "now" (because both line and time are divisible *ad infinitum*), so in any "being moved" it is possible to pick out infinitely many "having been moved's", because motion, too, is divisible ad infinitum, just as the line and time, as was previously proved.

831. The third argument is in (636): In the case of anything that is being changed (if it is not ceasing-to-be and does not cease to be moved, but is being continually changed), it is necessary that in each "now" of the time in which it is being moved, it is being changed or has been changed. But in the "now" nothing is being changed, as we have shown. Therefore, in each "now" of the time which measures continuous motion, the object has been changed, But in any portion of time there are an infinitude of "now's", because the "now" divides time, and time is infinitely divisible. Therefore, everything that is being changed has been changed an infinite number of times. And so it follows that before every state called "being moved" is a state called "having been moved", which, however, does not exist outside the state of "being changed" but is in it and terminates a part of it.

832. Then at (637) he proves that on the other hand a state of "being changed" precedes each state of "having been changed".

> First he proves it from the viewpoint of the time;
> Secondly, from the viewpoint of the sphere in which the motion occurs, at 836.

About the first he does three things:

> First he states the proposition;
> Secondly, he proves certain things needed for proving the proposition, at 833.
> Thirdly, he gives the proof of the main proposition, at 835.

He says therefore first that not only is it true that whatever is being changed had already been changed, but that every state of "having been changed" must be preceded by a state of "being changed", because the former is the terminus of the latter. Therefore, every "having been changed" must be preceded by a "being changed".

633. Then at (638) he states something needed for his proof of the proposition, i. e., that whatever is being changed from something to something was changed in time. But note carefully that here the words, "was changed", do not refer to the termination of motion, for it was explained above that the time in which a thing "was changed" is an indivisible. But here "was changed" signifies that something

was previously being moved, as though he said: "Whatever was being moved was being moved in time".

This he now proves: If our proposition is not true, then let there be something that was changed from A to B, i.e., from one term to another, in a "now". From this it follows that when it is in A, i.e., in the *terminus a quo* in the same "now" it was not yet changed, because it has already been proved that what was changed, when it was being changed is not in the *terminus a quo* but more in he *terminus ad quem*. Otherwise, it would follow that it was at once in A and in B. Therefore, it is necessary to say that in one "now" it is in A, and in another it was being changed. But between two "now's" there is a time, because two "now's" cannot be immediately connected, as we have shown. What remains, therefore, is that whatever is being changed is being changed in time.

334. But it seems that this conclusion has no application in generation and ceasing-to-be, between whose two termini there is nothing intermediate. For if between the "now" in which something is at the *terminus a quo* and the "now" in which it is at the *terminus ad quem* a period of time occurs, it will follow that there is something between being and non-being, because in that intermediate time the subject of change would be neither being nor non-being.

Nevertheless, because the argument which Aristotle gives here is demonstrative, it must be said that it applies somehow even to generation and ceasing-to-be but in the sense that such changes are also instantaneous, since there can be no medium between the termini.

So it must be said that whatever is being changed from non-being to being or vice versa is not in being and non-being at the same time. But, as will be said in Book VIII, there is no final instant in which what is generated is a non-being, but there is a first instant in which it is a being, so that in the entire time preceding that instant, it is non-being. However, between that "now" and the time preceding, there is nothing intermediate, so that between being and non-being there is no medium. Now, since the time which precedes the instant in which something is generated first, is the measure of some motion, it follows that just as that instant in which something is first generated is the terminus of the preceding time that measures the motion, so the first instant of the being of the thing generated is the terminus of a preceding change. If, therefore, generation is said to be the very beginning of being, it must be the terminus of a motion, and thus it takes place in an instant, because a motion's being terminated—which is the same as having been changed—occurs in an indivisible of time, as we have shown.

However, if generation is taken as the very beginning of being plus the entire preceding motion of which it is the terminus, then it occurs not in an instant but in time, so that what is being generated is a non-being during the entire

preceding time and a being in the final instant. And the same applies to ceasing-to-be.

835. Then at (639) he proves the main proposition with the following reason: Whatever has been changed was being changed in time, as we have proved; but time is divisible and whatever is being changed in time is being changed in part of time. Therefore, it is necessary to say that what has been changed in some entire period of time was previously being changed during half of the time and again during half of that half and so on, because time is divisible infinitely. Therefore, it follows that what has been changed was previously being changed. Consequently, before every state of "having been changed" there is a previous state of "being changed".

836. Then at (640) he proves the same point with an argument based on the sphere of motion.

> First as to motions in quantity;
> Secondly, as to other changes, at 837.

He says therefore first (640) that what was said, from the viewpoint of time, to be common to every change, becomes clearer from the viewpoint of magnitude, for magnitude is better known than time, and magnitude is continuous, as a line, and in it something is changed, namely, that which is according to place, or according to increase and decrease. Therefore, consider something changed from C to D. Now, it cannot be said that the whole of CD is indivisible, because CD has to be part of a magnitude, just as the motion from C to D is part of a whole motion, for there is a correspondence between division of magnitude and division of motion, as we have shown. But if an indivisible is a part of a magnitude, it follows that two indivisibles are immediate neighbors—which is impossible, as we have shown. Therefore, the whole CD cannot be an indivisible, Consequently, that which is between C and D is a magnitude and can be infinitely divided. And something is always first changed in part of a magnitude before it has been changed throughout the entire magnitude. Therefore, anything that has been changed was previously being changed, just as before any whole magnitude there are its parts.

837. Then at (641) he shows that the same point is true in those changes which do not take place in terms of a continuum; for example, alteration, which is between contrary qualities, and generation and ceasing-to-be, which are between contradictories. And although in those changes the demonstration is not derived from things in which the motion is, yet it is possible to take the time in which the changes occur, and then the demonstration will proceed the same way.

Thus in the three changes, which are alteration, generation and ceasing-to-be, only the first argument holds, while in the other three, namely, growth, decrease and local motion, both arguments hold.

838. Then at (642) he concludes to the main proposition:

> First, in general;
> Secondly, with special application to generation and ceasing-to-be, at 839.

He concludes therefore first (642) from the foregoing that everything which has been changed was previously being changed, and that everything which is being changed has previously been changed. Consequently, it is true that a state of "having been changed" preceded a state of "being changed", and vice versa. And so it is clear that a first something cannot be definitely pointed to.

The reason for this is that in motion an indivisible is not joined to an indivisible so as to make a motion be composed of indivisibles, because, if that were the case, we could discover a first. But it is not true, for motion is infinitely divisible just as a line is, which can be infinitely decreased by division and increased by addition opposite to the decrease, in the sense that what is taken from one is being added to another, as was shown in Book III. For it is evident that in a line, before each part of a line, one can take a point in its midst, and before that midpoint is a part of the line, and so on ad infinitum. However, the line is not infinite, because no part of the line is in front of the first point of the line.

Well, the same thing is true of motion. For since each part of motion is divisible, before each part of the motion there is in the midst of that part an indivisible, which is called "having been changed", and before that indivisible there is a part of the motion, and so on ad infinitum. Yet it does not follow that the motion is infinite, cause in front of the first indivisible of motion there was no part of motion. But note that the first indivisible is not one called "having been changed", any more than the first point of a line is a dividing point.

839. 'Then at (643) he comes to the same conclusion with reference to generation and ceasing-to-be. And he makes a special point of these changes, because the relation of "having been changed" to "being changed" in generation and ceasing-to-be is not the same as it is in other changes.

For in the others, the state of "having been changed" and the state of "being changed" occur in respect to the same thing; for example, to whiteness, in the case of alteration. For "to be being altered" is to be being changed in respect to whiteness, and "to have been altered" is to have been changed in regard to whiteness; and the same is true in local motion, in growth and in decrease. But in generation "having been changed" refers to one thing and "being changed" to another. For the former is based on the form, but the latter, though not based on negation of a form (which is not of itself susceptible of more and less) is based on something joined to such a negation, something, that is, which is susceptible of more and less, namely, a quality. Therefore, "to have been generated" is the terminus of "being altered" and the same is true of "having been corrupted". And

because motions get their name from the *terminus ad quem*, as we have said in the beginning of Book V, "to be altered" (since it has two termini, namely, substantial form and quality) has two names: for it can be called "to be altered", and "to come to be and cease to be".

And this is the sense in which coming-to-be and ceasing-to-be are substituted for "being altered", i.e., because the alteration terminates at being or non-being. And consequently, Aristotle says that what has been made was previously being made, and what is being made must necessarily have been made, provided that divisible and continuous things are involved. And Aristotle makes that addition (as the Commentator says) in order to exclude things that indivisibly come to be without continuous motion; for example, understanding and sensing, which are motions only in an analogous sense, as will be shown in Book III of *On the Soul*. But it could be that Aristotle made this addition in order to show that generation should include the entire continuous motion that precedes it.

840. But the statement "what is being made has been previously made" applies in different ways to different things. For some things, such as air and water, are simple and have simple generation—in these cases, part is not generated after part, but the whole and the parts are altered and generated at once. And it is in such that what has been made was previously being made and what is being made has been previously made, on account of the preceding alteration being continuous.

But other things are composites of unlike parts. In these cases, part is generated after part, as in an animal the heart is first generated, and in a house the foundation. In such things what is being made was not itself previously made, but a part was. And this is what he adds, namely, that it is not always so that what is being made has been itself previously made but something pertaining to it has been made, as the foundation of a house. But since we must come to a part that is entirely being made at once, then in some part, that which is being made has been made in relation to a terminus taken in the preceding alteration; for example, in the generation of an animal, the heart has already been made and while the heart is being generated, something has already been made—not indeed that there has been made some part of the heart, but some alteration ordained to the generation of the heart.

And what has been said of generation is to be understood with regard to ceasing-to-be. For immediately there is in something that is produced in being and is corrupted, something infinite, since it is continuous. For the very coming-to-be and the ceasing-to-be are continuous. Therefore, there is no "being produced in being", unless something has been previously made, and nothing has been made unless it was previously being produced in being. And the same is true of ceasing-to-be and having ceased-to-be. For a "having-ceased-to-be" is always prior to a "ceasing-to-be" and a "ceasing-to-be" prior to a "having ceased-to-be".

From this it is evident that whatever has been made was previously being made, and that all that is being made has in some way previously been made. And the reason is that every magnitude and every period of time are infinitely divisible. Consequently, in whatever period of time something comes to be, it is not coming to be in that time as in a first time, because it always possible to find a period previous. And what we have said of generation and ceasing-to-be is true also of illumination, which is the termination of the local motion of the illuminating body, just as generation and ceasing-to-be is the terminus of an alteration.

Lecture 9

Finite and infinite are found simultaneously in magnitude, time, mobile, and motion

841. After determining the division of motion, the Philosopher now determines about the infinite and finite in motion; for just as division pertains to the notion of continuum, so also do finite and infinite. But just as above he said that division is found simultaneously in motion, magnitude, time and mobile, so now he shows that the same is true of the infinite. Hence about this he does three things:

> First he shows that the infinite is found in the same way in magnitude and in time;
> Secondly, that it is found in the same way in the mobile, 846;
> Thirdly, and in motion, at 652.

About the first he does two things:

> First he shows that if a magnitude is finite, the time cannot be infinite;
> Secondly, that if the time is finite, the magnitude cannot be infinite, at 845.

in regard to the first he does two things:

> First he proposes what he intends;
> Secondly, he proves his proposition, at 843.

842. First, therefore, (644) he repeats two things that are needed for proving the proposition. One of which is that whatever is being moved is being moved in time. The second is that in more time a greater magnitude is traversed by the same mobile. From these two suppositions he intends to prove a third, namely, that it is impossible to traverse a finite magnitude in infinite time. This is to be understood in the sense that the thing in motion is not to retraverse the same magnitude repeatedly or any part of it, but must be moved through the entire magnitude in the entire time. And he added this to save himself from circular motion over a finite magnitude, which can occur in infinite time, as will be explained in Book VIII.

843. Then at (645) he proves his proposition:

> First by assuming a mobile of equal speed being moved over the whole magnitude;
> Secondly, if it is not being moved with a regular and uniform motion, at 844.

He says therefore first (645) that if a mobile of equal speed is traversing a whole, then if the whole is a finite magnitude, it must be traversed in finite time. For we can take one part of the magnitude and make it measure the whole; for example, a part that is one-third or one-fourth of the magnitude, If, therefore, a mobile is moved with equal speed over the whole and if the equally fast is what traverses an equal space in equal time, it follows that in a number of equal times that are determined by the number of parts into which the magnitude was divided, it will traverse the whole magnitude; for example, if one-fourth of the magnitude is taken, it will traverse it in a certain time and another fourth in an equal time, and so it will traverse the entire magnitude in four equal times.

Because, therefore, the parts of the magnitude are finite in number and each is finite in quantity, and in a given number of equal times the whole magnitude is traversed, it follows that the whole time in which the entire magnitude is traversed is finite. For it will be measured by a finite time, since it will be as many times as much as the time required to traverse one part, the whole magnitude being as many times as the quantity of each part. And thus the whole time will be the multiplication product of the length multiplied by the number of parts. But every multiplication product is measured by a denominator, as double is measured by half and triple by third, and so on. The time, however, required to traverse a part is finite, because if it were infinite, it would follow that the whole and the part were traversed in equal time, which is against the original assumption. Therefore, the whole time has to be finite, because nothing infinite can be measured by the finite.

844. But someone could say that although the parts of the magnitude are equal and measure the whole magnitude, it could happen that the parts of time are not equal, as when an equal speed is not maintained through the entire motion, and so the time required to traverse a part of the magnitude will not be a measure of the time required to traverse the whole.

Therefore at (646) He shows that this makes no difference to the proposition. For let AB be a finite space that has been traversed in infinite time CD. Now in every motion, one part must be traversed ahead of another and also one part of the magnitude is traversed in the prior part of time and another part in a subsequent part of time. And so, no two parts of the magnitude are ever traversed in one and the same part of time, and no two parts of time correspond to one and the same part of the magnitude. Consequently, if a certain part of the magnitude is traversed in a certain time, then in more time is traversed not only that part of

the magnitude but that part and another. And this will happen whether the mobile maintains constant speed or not, for in natural motions the speed is continually increased, while in compulsory motions it is diminished.

With these suppositions in mind, let AE be a part of the space AB and let it be an exact measure, say, one third or one fourth of AB. Therefore, this part of space has been traversed in a finite time. For it cannot be assumed that it was traversed in infinite time, because the whole space was traversed in infinite time, whereas less time is required to traverse a part than to traverse the whole. Likewise, let us take another part of the space and let it equal the part AE. This part, too, must be traversed in finite time, for it is the whole space that is being traversed in infinite time. Proceeding in this manner, let us take, in accordance with the parts of the entire space, a corresponding number of such times. From these will be constituted the whole time in which the entire space is traversed.

Now it is impossible that a part of an infinite measure the whole, either in the case of a magnitude or in that of a multitude, because it is impossible for the infinite to be composed of a finite number of parts, each of which is finite in quantity, whether those parts are equal or unequal—for whatever things are measured by some one thing, either according to magnitude or multitude, must be finite.

Now, I say "magnitude and multitude", because a thing of finite magnitude can still be measured, whether the measuring parts are of equal or unequal size. For when they are equal, then any part is a measure of the whole, whether the whole be a magnitude or a multitude; but when they are unequal parts, any part will measure a multitude but not a magnitude. So, therefore, it is evident that any time which has parts finite in number and quantity, whether they be equal or not, is finite. But a finite space is measured by as many finite parts as are necessary to form AB. Moreover, the parts of the time will be equal in number to the parts of the magnitude, and the parts will be finite in quantity. What remains, therefore, is that the entire space is traversed in finite time.

845. Then at (647) he shows that on the other hand, if the time is finite, so too the nagnitude, And he says that by the same reasoning it can be shown that infinite space cannot be traversed in finite time, and that rest cannot be infinite in finite time, no matter whether the motion is regular or not. For since the time posited is finite, it is possible to take as a measure of the whole time a part in which the mobile traverses a part of the magnitude but not the whole magnitude, which is traversed in the whole time. Then in an equal time it will traverse another part of the magnitude. And, in like manner, for each part of the time take a corresponding part of the magnitude, and let this be done whether the second part of the magnitude be equal to the first part (which happens when the speed is constant) or not equal to it (which happens when the speed varies). For whether they are equal or not makes no difference, as long as each part you take

of the magnitude is finite, which it must be; otherwise as much will be traversed in a part of time as in the whole time. According to this procedure, it is clear that by dividing time the entire infinite space will be exhausted as the finite parts are used up. For since the time is divided into finite equal parts and the number of magnitudinal parts must equal the number of parts of time, it follows that the infinite space will be consumed by making finite subtractions, since the magnitude has to be divided according to the way the time is divided. But this is impossible. Therefore, it is clear that an infinite space cannot be traversed in finite time, whether the magnitude of space be infinite in one direction or more, because in either case the same reason would hold.

846. Then at (648) he shows that infinite and finite are found in the mobile in the same way as they are found in magnitude and time. About this he does three things:

> First he shows that the mobile is not infinite, if the magnitude is finite and the time finite;
>
> > Secondly, that the mobile is not infinite, if the magnitude is infinite and the time finite, at 848;
> >
> > Thirdly, that the mobile cannot be infinite, if the magnitude is finite and the time infinitel at 849.

He proves the first point with two arguments. In regard to the first of these he says that, since it has been demonstrated that a finite magnitude is not traversed in infinite time nor an infinite magnitude in finite time, it is clear from the same causes that an infinite mobile cannot traverse a finite magnitude in finite time. For if you take any part of finite time, then during that part of time the finite space will be traversed not by the whole mobile but by a part, and during another part, it will be traversed by another part of the mobile, and so on. And so, it will be necessary to take as many parts of the mobile as parts of time. But the infinite is not composed of finite parts. Therefore, the mobile that is moved in a whole finite time is finite.

847. The second argument is given at (649) and it differs from the first, because in the first he took as his principle the same medium that he used in the previous demonstrations, but here he takes as his principle the conclusion reached above. For it has been shown above that a finite mobile cannot traverse an infinite space in finite time, Hence it is clear that for the same reason neither can an infinite mobile traverse a finite space in finite time. For if an infinite mobile traverses a finite space, it follows that a finite mobile can traverse an infinite space, because both the mobile and the space have dimensions. Now when two things having dimensions are involved, it makes no difference which is in motion and which is at rest. For it is clear that whichever is assumed as being in motion, it follows that the finite traverses the infinite. For let A be the infinite that is in motion and let CD be a finite part of it. When the whole is being moved, this finite part will be

at the part B of the space, and as the motion continues, another part of the infinite mobile will be at B and so on. Hence, just as the mobile traverses space, so space in a sense traverses the mobile, inasmuch as the various parts of the mobile are successively other and other in regard to the space. Hence it is evident that at the same time that an infinite mobile is being moved through a finite space, something finite is traversing something infinite. For there is no other possible way for an infinite to be moved through finite space than for the finite to traverse infinite space, either by having the finite moved over the infinite, as when the mobile is finite and the space infinite, or by making something finite measure the infinite, as when the space is finite and the mobile infinite. For then, even though the finite is not being moved over the infinite, yet the finite is measuring the infinite, inasmuch as a finite space is placed opposite each of the parts of the infinite mobile. Therefore, because this is impossible, it follows that an infinite mobile does not traverse a finite space in finite time.

848. Then at (650) he shows that there cannot be an infinite mobile, if the space is infinite and time finite. And this is what he says: that an infinite mobile cannot traverse an infinite space in finite time. For in every infinite there is something finite. Therefore, if an infinite mobile should traverse an infinite space in finite time, it follows that it traverses a finite space in finite time, which is against a previous conclusion.

849. Then at (651) ae says that the same demonstration holds if the time be infinite and the space finite. Because if an infinite mobile traverses a finite space in infinite time, it follows that in a part of that time it will traverse a part of the space. Consequently, the infinite will be traversing the finite in finite time, which is also against a previous conclusion.

850. Then at (652) ha shows that finite and.infinite are found in motion in the way that they are found in mobile, space and time. And he says that a finite mobile does not traverse an infinite space, nor an infinite mobile finite space, nor an infinite mobile infinite space, in finite time, From these facts, it follows that there cannot be an infinite motion in finite time. For the quantity of motion depends on the quantity of space. Hence there is no difference between saying that the motion is infinite and that the magnitude is. For it is necessary that if either is infinite, so is the other, because no part of a local motion can exist outside of a place.

Lecture 10

Things pertaining to the division of "coming to a stand" and "rest"

851. After finishing the things that pertain to the division of motion, the Philosopher now determines about things that pertain to the division of rest. And

because coming to rest is generation of rest, as we have said in Book V.

First he determines the things that pertain to coming to rest;
Secondly, the things that pertain to rest, at 856.

About the first he does three things:

First he shows that whatever is coming to rest is being moved!
Secondly, whatever is coming to rest does so in time, at 853;
Thirdly, how a first is spoken of in coming to rest, at 854.

852. He shows the first at (653): Everything apt to be moved must be either in motion or at rest at the time when it is apt to be moved and in the place in which it is apt to be moved and in the way in which it is apt to be moved. But what is coming to rest is not yet at rest—otherwise, it would happen that a thing would be at the same time tending to rest and actually resting. Therefore, whatever is coining to rest is in motion, when it is coming to rest.

853. Then at (654) he proves by two arguments that whatever is coming to rest is doing so in time. For whatever is being moved is being inoved in time, as has been proved. But whatever is coming to rest is being moved, as we have just proved. Therefore, whatever is coming to rest is coming to rest in time.

The second argument is that swiftness and slowness are determined according to time. But it can happen that something comes to rest either more swiftly or more slowly. Therefore, whatever is coming to rest does so in time.

854. Then at (655) he shows how "first" is spoken of in coming to rest. About this he does two things:

First he shows how something is said to be "first" coming to rest in a given time, where "first" is opposed to what is spoken of in reference to a part;
Secondly, he shows that in coming to rest, it is not possible to discern a first part, at 855.

Fe says therefore first (655) that if at a certain time something is said to be coming to rest first and *per se* and not by reason of a part, then it must be coming to rest in each part of that time. For time can be divided into two parts, and if it is said that it is coming to rest in neither, it will follow that it is not coming to rest in the whole time, in which it was assumed to be coming to rest. Therefore, something coming to rest is not coming to rest. Nor can it be said that it is coming to rest in only one of the parts, because then it would not be coming to rest first, but only by reason of a part. Hence it will remain that it is coming to rest in both. For it is said to be coming to rest in the whole time only because it is coming to rest in each part, as was said above about things in motion.

855. Then at (656) he shows that there is no first part in coming to rest. And he

says that just as it is not possible to find in time a first part in which a mobile is being moved, so also in regard to coming to rest, because in neither case can there be a first part.

If this is denied, then let AB be the first part of time in which something is coming to rest. This part cannot be indivisible, because it has been shown above that motion does not occur in an indivisible of time (for it is always true that whatever is being moved has already been moved, as we have shown above) and, moreover, whatever is coming to rest is being moved, as we have just now proved. Hence AB must be divisible. Therefore, there is a coming to rest in each part of it, for we have just shown that when in a given time something is coming to rest first and *per se* and not by reason of a part, it is coming to rest in each part of that given time. Therefore, since the part is prior to the whole, AB was not, the first in which there was a coming to rest. And because that in which something is coming to rest is a time and all time is divisible ad infinitum, it follows that it is impossible to find a first in which something is coming to rest.

856. Then at (657) he shows the same thing is true for rest. About this he does two things:

First he shows that there is no first in rest;
Secondly, he gives a method to distinguish motion from rest,

And because it is for the same reason that no first is found in notion and in coming-to-rest and in rest, therefore, he concludes the same thing for rest as he concluded for motion and coming-to rest. And he says that there is no first in which a thing at rest has been at rest. To prove this he repeats something previously proved, namely, that nothing is at rest in an indivisible of time. Likewise, he repeats the two reasons he used when he proved this. The first of which is that there is no motion in an indivisible of time. But to rest and to be in motion are in the same: because we do not say that something is resting, unless what is capable of being moved is not being moved when it is apt to be moved and in the sphere in which it is apt to be moved; for example, quality or place or something of thls sort. Hence it remains that nothing is at rest in an indivisible of time.

The second reason is that it is then that we say something is at rest when it maintains itself as it was previously: as if to say that we do not judge rest by reason of one factor only but by comparing two things to one another and seeing that there is a aimilar situation in both. But it is impossible to find in something indivisible a "now" and something previous, or any two things. Therefore, that element of time in which something is at rest is not indivisible.

Having established this, he proceeds further to prove the main. proposition. For if that in which something is at rest is divisible into parts that possess a prior and a subsequent, it follows that it is a time; for this is the very nature of time. And if it

is time, then it must be resting in each part of it. And this will be demonstrated in the same way that it was demonstrated in motion and in coming to rest; namely, that if it is not at rest in each part, it will be at rest in no part or in one only. If in no part, then not in the whole; if in one only, then in that part first and not in the whole first. But if it is at rest in each part of the time, it will not be possible to discover a first in rest any more than in motion.

The reason for this is that things are at rest and in motion in time. But in time there is no first any more than in a magnitude or in any continuum, for every continuum is divisible *ad infinitum* and, consequently, it is always possible to find a part smaller than another. And that is why there is no first in motion or in coming-to-rest or in rest.

857. Then at (658) he gives a way through which what is in motion is distinguished from what is at rest.

First he mentions it;
Secondly, he proves it, at 858.

In regard to the first he premises two suppositions, the first of which is that whatever is being moved is being moved in time. The second is that whatever is being changed is being changed from one terminus to another. From these two facts he intends to conclude a third; namely, that if you take a mobile, which is being moved first and *per se* and not by reason of its part only, it cannot remain one and the same with respect to that in which the motion is—for example, it cannot remain in one and the same place, or retain one and the same degree of whiteness—during a given period of time, provided that you take it as being in time according to itself and not according to something which is in time.

The reason why you must take a mobile which is being moved first and *per se* is that there is nothing to prevent a thing from being moved according to a part even though it remains in one and the same place throughout the entire time, as when a man sitting down moves his foot.

And the reason why he speaks of a time throughout which something is being moved *per se* and not by reason of some element of time is that while a thing is being moved it can be said that on such and such a day it is in one and the same place; but this would be said, because it was in that place not throughout the day but in some "now" of that day.

858. Then at (659) he proves the proposition. And he says that if what is being changed is throughout a definite period of time in one and the same state—for example, in one place—it follows that it is at rest, due to the fact that in that time there is present in one and the same place the entire mobile and each part of it; for we have already said that to be at rest means to be able to say of something that it and its parts are in one and the same state in different "now's", If,

therefore, this is the definition of being at rest and if nothing can be at rest and in motion at the same time, it follows that the whole which is being moved cannot be totally in one state, e.g., in one and the same place, during the whole time and not only in something of it.

Why this follows he now explains. Every period of time is divisible into diverse parts, of which one is prior to another. Hence if something is in one state throughout the entire period, it will be true to say that in one and in another part of the time the whole mobile and its parts are in one and the same state, e.g., place—and this is to be at rest. For if it is said to be in one and the same state not in different parts of time but throughout one "now", it does not follow that there is a time in which it is in one and the same state, but that there is a "now" in which it is in one and the same state.

For although from the fact that if something remains in one and the same state during a period of time, the conclusion can be drawnthat it is at rest, that conclusion cannot be drawn if it remains in one and the same state in just one "now". For whatever is being moved is always stable, i.e., existing, vis-a-vis something of that in which it is being moved in each "now" of the time in which it is being moved; for example, place or quality or quantity, Yet it is not for that reason at rest, because it has already been proved that neither rest nor motion can occur in a "now". But it is true to say that in the very "now" something is not being moved and that in the "now" even what is being moved is somewhere or according to something. But what is being moved in time cannot be under any aspect at rest, for then it would happen that something is at rest while it is in motion—which is impossible. What remains, therefore, is that whatever is being moved is never, as long as it is being moved, in one and the same state for two "now's" but for only one.

859. And this point is clear in local motion. For let AC be a magnitude divided in half at B and let 0 be a body equal to each half, i.e., to AB and to BC, and let that body be moved from AB to BC. If no part of one of these two places can be a part of the other, there will be only two places for that body on AC. But it is evident that 0 does not relinquish its first place and enter the second all at once but successively. Hence, because place is divisible ad infinitum, the places also are multiplied ad infinitum. For if the half part AB is again halved at D and the other half part BC at E, it is evident that DE will be a place distinct from both AB and BC. By continuing such divisions other and other places will be found.

The same point is clear in alteration. For what passes from white to black passes through an infinitude of shades of whiteness and blackness and intermediate colors.

However, it does not follow that since there are an infinitude of intermediates, the ultimate cannot be reached, because these intermediate places are infinite

not in act but only in potency, just as a magnitude is not actually divided infinitely but is potentially divisible.

Lecture 11

Zeno's arguments excluding all motion are resolved

860. After finishing with the division of motion and of rest, the Philosopher now refutes certain opinions that have been the source of error in regard to motion. About this he does three things:

First he answers the arguments of Zeno who absolutely denies that motion exists;

Secondly, he shows that an indivisible is not moved, against Democritus, who said that they are always in motion, at L. 12;

Thirdly, he shows that all change is finite, against Heraclitus, who said that all things are eternally moved, at L. 13.

About the first he does two things:

First he gives and rejects one of Zeno′s arguments, which pertains to what Zeno had accepted about motion;

Secondly, he explains all his arguments in order, at 863.

861. He says therefore first (660) that Zeno reasoned badly and used what had only the appearance of a syllogism to show that nothing is being moved, even what seems to be in rapid motion, as an arrow in flight. And this was his argument: Anything that is in a place equal to itself is either being moved or is at rest. But whatever is being moved is at each instant in a place equal to itself. Therefore, even at each instant it is either in motion or at rest. But it is not in motion, Therefore, it is at rest. But if it is not in motion at any instant but at rest, as it seems, then throughout the entire time it is at rest and not in motion.

Now this argument could be answered by appealing to something already proved; namely, that in an instant there is neither motion nor rest. But such a solution would not cripple Zeno′s intention, for he is satisfied to show that through the entire time there is no motiona fact that seems to follow, if there is no motion at any instant of the time. Therefore Aristotle answers in a different manner and says that the conclusion is both false and does not follow from the premisses.

For in order that something be moved in a given period of time, it has to be moved in each part of the time. But instants are not parts of time, for time is not made up of instants any more than a magnitude is made of points, as we have already proved. Hence it does not follow that a thing is not in motion in a given time, just because it is not in motion in any instant of that time.

862. Then at (661) he lists in order all the arguments that Zeno used for destroying motion. About this he does three things:

> First he shows how he destroyed local motion with his arguments;
> Secondly, how he destroyed the other types of change, at 870;
> Thirdly, how in particular he destroyed circular motiong at 871.

863- In regard to the first he lists four reasons, and this is what he says: Zeno used against motion four arguments which have caused difficulty for many of those1who tried to answer them. The first of which is this: If anything is being moved through a certain space, it must reach the middle before it reaches the end. But since the first half is divisible, half of it must be first traversed and so on indefinitely, since a magnitude can be divided ad infinitum. Infinites, however, cannot be traversed in finite time. Therefore, nothing can be moved.

Therefore Aristotle says that he has already answered this argument (in the beginning of this Book VI), when he proved that time is divided *ad infinitum* in the same way as a magnitude is. This answer is directed more to one who asks whether infinites can be traversed in finite time than to the question, as he will say in Book VIII, (L. 17) where he answers this argument by showing that a mobile does not use the infinites which exist in a magnitude as though they were actually existing, but only as existing potentially. For a thing in motion uses a point in space as actually existing, when it uses it as a beginning and as an end, and it is then that the mobile must be at rest, as will be explained in Book VIII. But if it had to traverse infinites that were actually existing, then it would never reach the end.

864. The second argument is given at (662) and he says that they called this one the "Achilles", as though it were invincible and unanswerable. The argument was this: If anything is being moved, it follows that a slower thing, if it started earlier, will never be caught by anything moving most rapidly. And it was proved in the following way: If a slower object began to be moved for some time before a very swift one, then in that time it has traversed some distance. Therefore, before the very swift one in pursuit could reach the slower, which is still running, it must leave the place first left by the pursued and reach the place which the pursued reached during the time the pursuer was not in motion. But the very fast pursuer must traverse this space in some time, during which the slower has meanwhile traversed a certain space, and so on forever. Therefore, the slower always has "something ahead", i.e., is always some distance ahead of the most swift pursuer, and so the swifter will never catch the slower. But this is unacceptable. Therefore, it is better to say that nothing is moved.

865. In solving this argument he says that it is the same as the first, which proceeded by dividing the distance into two halves and then continually halving one part of the remainder. But the difference between them is that in the second

the given magnitude of space is not divided into halves but according to the difference between the swift and the slower motion. For in the first period of time in which only the slower was in motion, there is a greater magnitude involved; in the second period (in which the faster traversed the distance covered by the slower between its start and the start of the faster), which is a shorter time period, a smaller magnitude was traversed by the slower, and so on forever. Hence, the.time and the magnitude are always being divided and that seems to be the reason why the slower is never caught by the swifter,

But this tends to the same thing as what was said of the division of the magnitude into halves; because in both arguments it seems that the mobile cannot reach a certain goal on account of the magnitude's being infinitely divided, no matter how it happens to be divided, i.e., whether according to halves, as happens in the first argument, or according to the excess of the faster over the slower, as in the second argument. However, in this second argument it is further added that the very swift cannot reach the slower, which it is pursuing. This "tragic" phraseology employs inflated language in order to excite wonder, but it does not do anything to the force of the argument.

Hence it is clear that the solution of the two arguments is the same. For just as a false conclusion was reached in the first argument, namely, that the mobile would never reach the end of the magnitude on account of the infinite division of the magnitude, so also what the second argument tries to conclude is false, namely, that the slower will never be,caught by the swifter, which is just another way of saying that a mobile will never reach its goal.

Now, it is true that as long as the slower is ahead, it is not yet reached by the swifter. But yet it will at some time be reached, if you concede that a finite magnitude can be traversed in finite time. For the swifter pursuing mobile will traverse the whole distance by which the slower is ahead and even more, in less time than the slower was meantime moving farther ahead. Proceeding in this way the swifter will not only catch but pass the slower. These therefore are the solutions to two of Zeno's arguments.

866. The third argument is given at (663) and he says that the third argument of Zeno was the one cited above (before he began to give the arguments): namely, that an arrow in flight is always at rest. And as was said above, this seems to happen, because Zeno supposed that time is made up of instants. For unless that be granted, the syllogism fails.

867. He sets out the fourth argument at (664). Concerning which he doea three things:

First he sets out the argument;
Secondly, the solution, at 868;
Thirdly, he explains it by an example, at 869.

First therefore he says that the fourth argument of Zeno proceeded from some bodies which move in a stadium so that there are two equal magnitudeE which are moved in an equal manner, that is, through a space in the stadium equal to both in quantity, and this motion is a contrary one, i.e., one of the equal magnitudes is moved through that space of the stadium toward one part, and the other toward the other part, in such a way, however, that one of the mobile magnitudes begins to move from the terminus of the stadium which is equal to it, and the other begins to move from the middle of the stadium or of a space in the given stadium; both move with equal velocity. This being given, Zeno held that it would result in a half time equalling a double time. Since this is impossible, he intended to infer further that it is impossible for anything to be moved.

868: Then at (665) he gives the solution. He says that Zeno was deceived in this, that he held that on the one hand the mobile is moved according to the moved magnitude, and on the other he held that it was moved according to a quiescent magnitude equal to the moved magnitude. Because an equal velocity of the moved bodies is supposed, he wanted to conclude that the motion of equally swift bodies in regard to equal magnitudes, one of which is in motion and the other standing still, is done in equal times This is seen to be false for the following reason:

When something is moved in relation to a quiescent magnitude, there is only one motion; but when something is moved in relation to a moving magnitude, there are two motions. If they are moving in the same direction it takes more, if they are moving in opposite directions it takes less time according to the amount of either motion. If the magnitude in relation to which something.mobile is moved, is moved in the same direction with an equal velocity or even a greater velocity, the other moving body can never pass it. If the magnitude moves with less speed, it will pass by it at a certain time, but it will take more time than if it were quiescent. It is quite the contrary if the magnitude is moved opposite the direction of the other body. The more swiftly the magnitude moves, the less time the other body takes to pass it, because both motions work together to pass each other.

869. Then at (666) he makes clear what he said in the latter part. Suppose that there are three magnitudes equal to each other, each designated as A, and these magnitudes are standing still; thus there might be a space of three cubits, each one of which is marked by an A. There are another three magnitudes all equal and designated as B, as there might be one moving unit of three cubits. These magnitudes begin to move from the middle of the space. There are also three other magnitudes, equal in number, size and velocity to B, and designated as 0. These begin to move from the last space, that is from the last A.

This being given, it occurs that the first R by its motion arrives at the last A and likewise the first C by its motion arrives at the first A, opposite the last. When this

has been done, it is evident that this first C has passed all the A′s, but B has passed by only half. Since, therefore, R and C are equal in velocity, and an equal velocity passes by a smaller magnitude in less time, it follows that the time in which B travels to the last A is half the time in which C arrives at the first A opposite; in equal times C and B pass each section of A.

This being supposed, namely, that the time in which B arrives at the last A is half the time in which 0 arrives at the first A opposite, it must be further considered how Zeno wished to conclude that this half time is equal to its double, For from the supposition that the time of the motion of C is double the time of the motion of B, it is supposed that, in the first half of the time, B was still and C moved, and thus C in that half of the time arrived at the middle of the space, where B was; and then B began to move to one part and C to another. When Rarrived at the last A it had to pass all the C′s, because at the same time the first B and the first C are at contrary ultimates; namely, one at the first A and the other at the last, and as he said, C is next to each B, in the same amount of time as it takes to pass each one of the A′s. This is so, because both, namely Rand C, pass one A in the same interval of time. Thus it seems that if B covers a time equal to that in which it passes C, that C, in an equal interval of time, passes B and A. Therefore, the interval in which C passes all B′s is equal to the time in which it passed all the A′s. The time in which C passed all the B′s is equal to the time in which C or B passed the middle of the A′s, as was said. But it was proved that the time in which B passed the middle of the A′s is half the time in which C reached all the A′s. Therefore, it follows that the half is equal to the double, which is impossible.

This is the argument of Zeno. But he falls into the aforesaid error; namely, he assumes the fact that C in the same interval of time crosses B moving in a counter direction and A quiescent, which is false, as was said above.

[In this description of St. Thomas, since 0 is supposed to pass all the A′s, he is careful to have Cc first begin from the last A and come to the middle, while meanwhile B is motionless. This is not in the text of Aristotle.]

870, Then at (667) he gives the argument by which Zeno rejected change between contradictories. For he said: Whatever is being changed is in neither of the extremities while it is being changed, because while it is in the *terminus a quo* it is not yet being changed, and while it is in the *terminus ad quem* it has already been changed. Therefore, if something is being changed from one contradictory to another, as from non-white to white, it follows that while it is being changed, it is neither white nor black—which is impossible.

Now although this strange conclusion would follow for those who posit that an indivisible can be moved, yet for us who posit that whatever is being moved is divisible, nothing impossible follows. For even though it is not totally in one or other of the extremes, it is not for that reason neither white nor non-white, For

one part could be white and the other non-white. For a thing is called white not only when all of it is white but also when very many or its main parts are white, i, e., the parts that are expected to receive whiteness, because it is one thing not to be something at all and another not to be entirely something, for example, white or non-white.

And what has been said of white and non-white is to be understood of unqualified being or non-being and of all things that are contradictorily opposed, as hot and non-hot and so on. For what is being changed must always be in one of the opposites, because it is described in terms of whichever opposite predominates in it, But it does not follow that it is always as a whole in neither of the extremities, as Zeno supposed.

Now it should be known that this answer is sufficient to refute Zeno's argument and that is what Aristotle's main intention is. But the truth of this matter will be more fully given in Book VIII. For it is not true in all cases that part is altered or generated after part, but sometimes the whole comes all at once, as was said above. In that case it is not this answer but the one in Book VIII that would apply.

871. Then at (668) he refutes the argument by which Zeno rejected spherical motion. For he said that it is not possible for anything to be moved circularly or spherically or in such a way that the motion is confined within the space occupied by the mobile. And he proved this with the following argument: Anything that is in its entirety and in respect of its parts in one and the same place for a period of time is not in motion but at rest. But all the above-mentioned fulfill these conditions, even when they are apparently in motion. Therefore, they are at once in motion and at rest—which is impossible.

The Philosopher attacks this argument on two points. First, as to the statement that the parts of the moving sphere are in the same place for some time. For Zeno was speaking of the place of the whole, and it is true that while the sphere is in motion, no part passes out of the place of the sphere, but Aristotle speaks of the particular place of each part, according as a part has a place. For it was said in Book IV that the parts of a continuum are in place potentially. But it is evident in spherical motion that a part does change its particular place, although it does not lose the place of the whole, because where one part was, another part succeeds.

Secondly, he attacks the statement that the whole remains in the same place for some time. Against this Aristotle says that even the whole is changing its place. For in order that two places be not the same, it is not required that one of them be entirely outside the other, but sometimes the second place is partly joined to part of the first and partly divided from it, as is clear in things moved in a straight line. For let a body of one cubit be moved from place AB to place BC—both places being one cubit each. While the mobile is being moved from one place to the

other, it must partly desert one place and enter the other; for example, it could leave the portion AD of AB and enter the portion BE of BC. Therefore, it is clear that the place DE is distinct from AB, although not entirely, but only partly separated from it.

But if it were assumed that that part of the mobile which entered the second place re-entered part of the place deserted, there would be two places, yet in no way separated—they would differ not really but only in conception, i.e., in the sense that the beginning of the place might be successively called by different letters each time the mobile re-entered it, namely, where the beginning of the mobile is, i.e., some spot in the mobile which is taken as a beginning, Thus there would be two places conceptually but one and the same in reality.

This is how we must understand whatAristotle says here, namely, that it is not the same revolution, when it is taken as beginning at A and as beginning at B and as beginning at C or any other mark, unless you insist that it is the same revolution as to subject, as in the case of "musical man" and "man", since one happens to the other. Hence it is clear that the mobile is always being moved from one circular place to another and is not at rest as Zeno tried to prove. And it is the same with the sphere and everything else whose motion is confined within the space it occupies, as in the case of a potter's wheel and a (rotating) pillar or anything of that sort.

Lecture 12

What is indivisible according to quantity is moved only *per accidens*

872. After answering the arguments of Zeno who tried to disprove motion, the Philosopher now intends to show that a thing incapable of being divided into parts cannot be moved. This will answer the opinion of Democritus, who posited atoms that are *per se* mobile. About this he does two things:

First he proposes his intention;
Secondly, he proves his proposition, at 876.

He says therefore first (669) that assuming what we have proved above, it must be said that a thing incapable of being divided into parts cannot be moved, except perchance *per accidens*, as a point is moved in a whole body in which there is a point, for example, in a line or a surface.

873. To be in motion as a result of something else being in motion can occur in two ways. In one way, when what is moved as the result of something else being moved is not part of the latter, as what is on a ship is being moved when the ship is being moved, and as whiteness is moved with the motion of body, since it is not of the body. In a second way, as a part is moved when the whole is moved.

And because "what is incapable of being divided into parts" has many senses, just as what is capable of being divided into parts" has, he shows how he uses the phrase here and says that here it means what is indivisible in respect of quantity. For some things are indivisible according to species, as when we say that fire or air are indivisible, because they cannot be further resolved into several bodies that differ in species. But in regard to such an indivisible there is nothing to prevent it from being moved. Consequently, Aristotle intends to exclude motion from what is indivisible according to quantity.

874. Because he had said that the part is being moved when the whole is, and someone might say that the part is not moved at all, he adds that there are some motions of parts precisely as parts, that are diverse from the motion of the whole, as a motion of the whole.

This difference is particularly clear in the motion of a sphere, because the speed of the parts near the center is not the same as that of those outside, i.e,, on the exterior surface of the sphere, the speed of whose parts is considered to be the speed of the whole. It is as if there is not just one motion but the motions of many parts involved. For it is evident that whatever traverses a larger magnitude in an equal time is faster. Now, while the sphere is rotating, it is clear that an external part describes a larger circle than an interior part; hence the velocity of the external part is greater than that of an interior part. Yet the velocity of the whole sphere is the same as the velocity of the interior and exterior part.

But this diversity of motions is to be understood in the sense in which motion is ascribed to parts of a continuum, i.e., in a potential sense, Hence, actually there is one motion of the whole and of the parts, but potentially there are diverse motions: those of the parts being different from one another and from the motion of the whole. And so, when it is said that a part is being moved *per accidens* with the motion of the whole, it is a *per accidens* which is in potency *per se*—which is something not true of motion *per accidens*, when it is taken in the sense that accidents or forms are said to be moved *per accidens*.

875. Having made a distinction among things that are moved, he explains his intention. And he says that what is indivisible in respect of quantity can indeed be moved *per accidens* when something else is moved, but it is not moved as a part, for no magnitude is made up of indivisibles, as we have proved. Now, something not a part of another is moved along with the other in the same way that one sitting in a ship is moved along with the motion of a ship. But *per se* the indivisible cannot be moved.

He had proved this point previously, not as a main proposition but incidentally. Hence, in addition to the reason cited earlier, he now gives a further explanation of the truth and adds reasons that are strong enough to prove the proposition.

876. Then at (670) he proves his point with three arguments. The first of which is

this: If it is insisted that an indivisible can be moved, let it be moved from AB into BC. (In this argument it makes no difference whether AB and BC are two magnitudes or two places, as in local motion and growth and decrease, or whether they are two qualities, as in the motion of alteration, or two things that are contradictorily opposed, as in generation and ceasing-to-be.) Let ED be the time in which something is changed from one terminus to the other first, i.e., not by reason of a part. In this time, then, it is necessary that what is being moved be either in AB, i.e., in the *terminus a quo*,or in BC, i.e., in the *terminus ad quem*; or else a part is in one terminus and a part in the other. For anything being moved must be in one of these three ways, as was said above.

Now the third situation is impossible; namely, that it be in each term according to its various parts, because then, the mobile would be divided into parts, and we have assumed that it is an indivisible mobile. Likewise, it cannot be the second alternative, i.e., that it be in BC, i.e., in the *terminus ad quem*, for when it is in the *terminus ad quem*, it has been already changed (as is clear from what we have said above), whereas we are assuming that it is being changed. What remains, therefore, is that in the entire time that the indivisible is being changed it remains at AB, i.e., in the *terminus a quo*, From which it follows that it is at rest, for resting is nothing more than to be in one and the same state throughout a definite period of time. For since there is a prior and a subsequent in time, if time is divisible, whatever for a period of time is in one and the same state keeps itself the same; namely, as it was previously—which is to rest. But it is impossible that a thing is at rest while it is being changed. Therefore, it cannot be that an indivisible is moved or changed in any way whatsoever.

The only way in which there could be motion of an indivisible thing is to have the time composed of "now's", because in the "now" there is always a condition called "having been moved" or "having been changed".

And because what has been moved, precisely as such is not now being moved, it follows that in the "now" nothing is being moved, but has been moved. But if time were made up of "now's", there would be a way in which motion could be nosited in an indivisible, because it could be granted that in each of those "now's" of which time is composed, it would be in one, and in the whole time, i.e., in all the "now's", it would be in many. And thus it would be in motion throughout the entire time, but not in one "now".

But it has been proved above that it is impossible for time to be made up of "now's". Indeed, we have proved that neither is time composed of now's nor a line of points, nor a motion of moments (where "moments" refers to states called "having been changed"). For anyone who says that an indivisible is being moved or that motion is composed of indivisibles is making time be composed of "now's" or a magnitude of points—which is impossible. Therefore, it is also impossible that a thing incapable of being divided into parts be moved.

877. The second argument is given at (671). He says that if we look at the consequences, it is clear that neither a point nor any indivisible can be moved. And this special argument applies to local motion. For whatever is being moved according to place cannot traverse a distance greater than the mobile itself before traversing one that is equal to or less than it; rather, a mobile always traverses a magnitude equal to itself or less than itself before one greater than itself. If this is so, then it is clear that a point, if it is being moved will first traverse a length less than or equal to itself, before it traverses one greater than itself. But it is impossible for it to traverse something less than itself, since it is indivisible. So it has to traverse a length equal to itself. Consequently, it must number all the points in the line; for the point, since it is being moved through a motion equal to a line, is by that very fact being moved through the whole line, and, consequently, is always measuring the whole line—and this it does by counting all the points. Therefore, it follows that a line arises from points. Therefore, if this is impossible, it is impossible for an indivisible to be moved.

878. The third argument is at (672) and is this: Since motion is always in a period of time and never in a "now", and since all time is divisible, as was shown above, then in every time in which something is . moved, there must be a lesser time in which a lesser mobile is moved. For, supposing the same speed, it is plain that in a lesser time the lesser mobile crosses a given mark than does a greater mobile, as in a lesser time the part than the whole, as is evident from what is above. If, therefore, a point is in motion, there must be a time less than that in which it is moved. But this is impossible, for it would follow that in that lesser time something less than a point would be moved, and thus the indivisible would be divisible into something less, just as time is divisible. This would be the only condition under which the indivisible could be in motion, namely, if it were possible for something to be moved in an indivisible "now", for just as there is nothing smaller than the "now" in time, so one cannot take a smaller mobile.

And so it is evident that in the two questions—that of motion in a "now" and that of an indivisible being moved—the same principle is involved. But it is impossible for motion to occur in a "now". Therefore, it is impossible for an indivisible to be moved.

Lecture 13

By nature, no change is infinite. How motion may be infinite in time

878. After showing that things which cannot be divided into parts are not moved, the Philosopher now intends to show that no change is infinite, This is against Heraclitus, who supposed that things are always in motion. About this he does two things:

First he shows that no change is infinite according to its own species;
Secondly, how there can be infinites in time, at 883,

About the first he does two things:

First he shows for all changes except local motion that no change is infinite according to its species;
Secondly, he shows the same thing for local motion, at 881.

880. The first reason is this: Every change is from something to something. Indeed, in some changes, namely, those which occur between contradictories, as do generation and ceasing-to-be, or between contraries, as do alteration and growing and decreasing, it is evident that they have pre-defined termini. Hence in changes that occur between contradictory termini, the terminus is either affirmation or negation, as the terminus of generation is a being, and that of ceasing-to-be, non-being.

Likewise, in regard to changes that are between contraries, the contraries are termini at which, as at ultimate goals, changes of this kind are terminated. Hence it follows, since every alteration is from contrary to contrary, that every alteration has some terminus.

The same must be said for growth and decrease, for the terminus of growth is perfect magnitude (and I say "perfect" in respect of the nature, for a different perfection of magnitude befits man from the one that befits a horse), and the terminus of decrease is the one that happens to a definite nature to be most removed from perfect magnitude.

Consequently, it is evident that each of the above-mentioned changes has a goal at which it is terminated. But such a situation precludes the infinite. Therefore, none of these changes can be infinite.

881. Then at (674) he proceeds to local motion. And first he shows that the argument in regard to local motion is not the same as for the other changes. For it cannot be proved that local motion is finite (as we have proved other motions are finite), because it is terminated at something contrary or contradictory, for not every local motion is between strict contraries, where contraries refer to things most distant.

There is a maximum distance in the strict sense in the natural motions of heavy and light bodies, for the place of fire is at a maximum distance from the center of the earth, in accordance with the distance that nature determines for such bodies. Hence, such changes are between strict contraries, Hence, it can be proved of such changes that they are not infinite any more than the others were.

But maximum distance in compulsory or voluntary motions does not depend strictly on certain definite termini but on the intention or energy of the one

causing the motion, who either does not desire to or cannot physically move something any farther. Hence, it is only in a qualified sense., ere is maximum distance and a consequent contrariety. Hence, if you stick with the termini, it cannot be proved that no local motion is infinite.

882. Consequently, this must be proved by another argument, which is this: What is impossible to exist divided cannot be divided, And because things are said to be impossible in many senses, name, what never can occur or what cannot occur except with great difficulty, he therefore explains his meaning of "impossible" here. And he means it in the sense of that which cannot happen at all. For the same reason, what is impossible to have been made, is impossible to make; for example, if it is impossible that contradictories be together, it is impossible that this be brought about. For the same reason, what is impossible to have been changed into something cannot be changed into it, because nothing tends toward the impossible. But everything that is being changed according to place is being changed into something. Therefore, it is possible through that motion to arrive at something. But the infinite cannot be gone through. Therefore, nothing is moved through the infinite. Thus, therefore, no local motion is infinite.

And so it is universally evident that no change can be infinite in such a way that it be not terminated by definite termini from which it derives its species.

883. Then at (675) he shows how motion can be infinite in time. And he says that we must consider whether motion can be infinite in time in such a way that it remains numerically one and the same motion. For there is nothing to prevent motion from enduring through infinite time as long as it is not one and the same motion. But he leaves that matter in doubt when he adds "perhaps", because he will settle the matter later. And he gives an example: Let us say that after a local motion there is an alteration, and after that a growing, and after that generation, and so on *ad infinitum*. In this way motion could always endure throughout infinite time. And it would not be one and the same numerical motion, because a series of such motions as are given in the example do not form one numerical motion, as we have proved in Book V. But that motion endure throughout infinite time in such a way that it remain one numerical motion can occur in only one species of motion, for a circular motion can endure as one and continuous throughout infinite time, as will be proved in Book VIII.

BOOK VII

Lecture 1

It is necessary that whatever is moved, be moved by another.

884. After discussing motion in itself, and the concomitants of motion, and the division of motion into parts, in the preceding books, the Philosopher now begins to treat of motion in its relationship to movers and things moved, i.e., the mobiles. The treatment falls into two parts;

In the first he shows that there is a first motion and a first mover;

In the second he investigates the properties of the first motion and of the first mover, in Book VIII.

The first part is divided into two sections:

In the first he shows that there is a first motion and a first mover.

And because things that belong to one order are mutually related, therefore in the second part he compares the various types of motion (L-7).

About the first he does three things:

First he mentions the pre-notes needed for proving the proposition;

Secondly, he proves the proposition (L. 2).

Thirdly, he proves something he took for granted (L. 3)

885. He proposes therefore first (676) that everything that is being moved is necessarily being moved by some other. In some cases this is indeed evident, for there are some things which do not possess in themselves the principle of their motion; rather the principle of their motion is from without, as in things which are being moved by compulsion. Therefore, if there is anything that does not have in itself the principle of its own motion but its principle of motion is from without, it is clear that it is being moved by some other. However, if there is a mobile which does have in itself the principle of its own motion, there could be doubt whether it too is being moved by some other. Accordingly, he devotes himself to showing that this type of mobile is being moved by some other. Therefore, if it is supposed that such a mobile is not being moved by some other, let AB be a mobile capable of being moved primarily and according to itself and not in the sense that some part of it is being moved; for then it would not be being moved according to itself, but according to a part. Now it is necessary that if something moves itself without having been moved by some other, that it be moved primarily and *per se*; for example, if something is hot not from some other source, it must be primarily and *per se* hot.

With this in mind, he proceeds to prove his proposition in two ways:

> First by excluding the most evident case in which it would appear that something is not being moved by some other;
>
> Secondly, by proving directly that nothing can be moved by itself, at 886.

The most evident reason why it seems that something is not being moved by some other is that it is not being moved by something outside itself but by an intrinsic principle.

He says therefore first (676 bis) that to believe that AB is being moved by itself because the whole is being moved, and this without being moved by anything outside of it, is like saying that, when one part of a whole is being moved and another part causes it to be moved, it is moving itself, because it is not evident which part is the mover and which is being moved. Such would be the case if a mobile DEZ is such that one part DE moves the part EZ and it is not seen which part moves the other, and which is being moved.

When he speaks of the first mobile AB as being moved as a whole by an intrinsic principle of motion, he means a living body which is, as a whole, being moved by the soul; but when he speaks of the mobile DEZ he means some body that is not being moved as a whole but one bodily part of it is the mover and another the moved. In this latter case, it is evident that what is being moved is being moved by some other. From this latter case he wants to prove of a living body that seems to move itself that it too is being moved by some other. For it seems to move itself inasmuch as one part moves another, i.e., as the soul moves the body, as will be more fully explained in Book VIII.

886. Then at (677) he proves directly that whatever is being moved is being moved by some other. This is his argument: Nothing that is being moved by itself rests from its motion on account of some other mobile's resting. (He takes this as *per se* evident). From this he further concludes that if a mobile rests on account of the rest of another, then the mobile is moved by another. On this ground he concludes that. necessarily whatever is being moved is being moved by some other. And that this follows from the premisses, he now proves.

That mobile which we have supposed as being moved by itself, i.e., ABI must be divisible, for whatever is being moved is divisible, as was proved above. Hence, because it is divisible, nothing prevents it from being divided. Therefore, let it be divided at the point C so that one part of it is PC and the other part AC. Now, if PC is part, of AB, then when the part BC rests, the entire AB must rest. But if upon the part resting, the whole does not rest, let us grant that the whole is being moved and one part is at rest. But because we have assumed that one part is resting, the whole could not be granted as being moved except by reason of the other part. Therefore, when BC (which is one part) is at rest, the other part AC is being moved. But no whole of which one part only is being moved is being

moved primarily and se. Therefore AB is not being moved primarily and *per se*, as we originally assumed. Therefore while BC is at rest, the entire AB must be at rest. Thus, what is being moved ceases to be moved upon the occasion of something else resting. But above we held that if something rests and ceases to be moved on the occasion of another's resting, it is being moved by that other. Therefore, AB is being moved by some other.

The same argument applies to any other mobile, for whatever is being moved is divisible and, for the same reason, if the part rests the whole rests. Therefore, it is clear that whatever is moved is moved by some other.

887. Many objections are leveled against this argument of Aristotle. For Galen objects against the statement that if just one part of a mobile is being moved and the others are at rest, then the whole is not being moved *per se*. Galen says this is false, because things that are being moved according to a part are moved *per se*.

But Galen was deceived by playing on the phrase "*per se*". For sometimes it is taken in opposition to *per accidens*, and then it is true that what is being moved according to a part is being moved *per se*, as Galen said. But sometimes *per se* is taken in opposition both to *per accidens* and to what is according to a part: and in this sense something is said to be not only *per se*, but also primarily so. And this is the sense in which it was being used by Aristotle in his proof. That he does so is clear, because after concluding, "therefore AB is not being moved *per se*," he adds, "whereas it had been assumed that it was being moved primarily and *per se*."

888. But a more serious objection is that of Avicenna who says against the argument that it proceeds from an impossible assumption, from which the impossible follows, and not from the assumption that something is being moved by itself. For if we assume that a mobile is being moved first and *per se*, it is natural that it be moved both according to the whole and according to the parts. Therefore, if it is then assumed that a part is at rest, that is the same as assuming what is impossible. And it is from this added assumption that there follows the impossibility which Aristotle deduces, namely, that the whole is not being moved first and *per se*, as was assumed.

One might obviate this objection by countering that although it is impossible for a part to rest if you confine yourself to a body of a definite kind, for example, the heaven or fire, yet it is not impossible, if you consider the general definition of body, for body as body is not prevented from being at rest or in motion.

However, Avicenna forestalled such a response. First, because for the same reason it could be said of a whole body that it is not being prevented from resting just because it is a body, just as it is said of the part. Thus it was superfluous to assume, in order to prove the proposition, the division of the mobile and the rest

of a part. Secondly, because some propositions are rendered impossible absolutely, if the predicate is repugnant to the subject by reason of its specific difference even though it be not repugnant to it by reason of its genus. For it is impossible for man to be non-rational, although he is not prevented from being non-rational from the fact of his being animal. Thus, therefore, it is impossible absolutely that a part of a body moving itself be at rest, for this is against the nature of any particular body, even though it be not against the common notion of body.

889. With this possible answer rejected, Avicenna solves it in another way. He says that a conditional whose antecedent is impossible and whose consequent is impossible can be true; for example, "If man is a horse, he is a non-rational animal." It should be conceded, therefore, that it is an impossible assumption that mobile be moving itself and yet have the whole or a part of itself at rest, just as it is impossible for fire not to be hot, for fire is its own cause of its heat. Hence this conditional is true: "If a part of a mobile moving itself is at rest, the whole is at rest." But Aristotle, if his words are carefully studied, does not speak of the rest of the part, except in a statement that has the force of a conditional. For he does not say, "Let BC be at rest," but "If BC is at rest, AB must rest," and "If the part rests, the whole rests": and from this true conditional Aristotle proves his proposition.

But, says Averroes, that demonstration is not an absolute demonstration but one of the type called "demonstrating by a sign" or a demonstration "quia", in which such conditionals are used.

However, this solution is agreeable in regard to what he says about the truth of a conditional but not in regard to the statement that it is a "quia" demonstration, for it seems to be a "propter quid', because it contains the cause why it is impossible for a mobile to move itself.

To see this, recall that to move oneself is nothing more than to be the cause of one's own motion. Whatever is its own cause of something must possess it primarily, i.e., first, because what is first in any group is the cause of what comes after it. Hence fire, the cause of heat for itself and for other things, is the first hot thing. But, in Book VII Aristotle showed that there is no first in motion, whether on the side of time or the magnitude or the mobile—for they are all divisible. Therefore, it is impossible to find a first whose motion does not depend on a prior, for the motion of the whole depends on the motions of the parts and is divided into those motions, as was proved in Book VI. Aristotle, therefore, thus shows the cause why no mobile moves itself: it is because there cannot be a first mobile whose motion does not depend on its parts any more than the first being can be a divisible, for the existence of any divisible depends on the parts. Hence this conditional is true "If the part is not being moved, neither is the whole," just as this one is true "If the part does not exist, the whole does not."

890. Hence even the Platonists, who assumed that some things move themselves, said that no body or divisible thing moves itself; rather to move itself is a prerogative of a spiritual substance which understands and loves itself (here all operations are being called "motions," just as Aristotle in Book III of *On the Soul* calls sensing and understanding by the name of "motions" in the sense that motion is the act of a perfect thing). However, in this Book VII he takes motion as the act of an imperfect thing, i.e., of a thing existing in potency. It is in this sense of motion that no indivisible is moved, as was proved in Book VI and is here taken for granted. And so it is clear that Aristotle, in stating that whatever is moved is moved by some other, and Plato, in stating that some things move themselves, are here not apart in their opinions but solely in their words.

Lecture 2

No process to infinity in movers and moved. One must arrive at a first mover unmoved.

891. After showing that whatever is moved is moved by some other, the Philosopher now turns to the proof of his main proposition, namelyq that there exists a first motion and a first mover. About this he does two things:

First he proposes what he intends;
Secondly, he proves his proposition, at 892.

He says therefore first (678) that since it has been proved for all cases that whatever is moved is moved by some other, it must be true even in regard to local motion that whatever is being moved with respect to place is being moved by something else. Now he applies to local motion in particular the very proposition which he proved universally true, because local motion is the first of the motions, as will be proved in Book VIII. Therefore, it is according to this motion that he now proceeds to demonstrate a first mover.

Therefore, let us take something that is being moved in regard to place. This thing is being moved by something else. Now that something else is in turn being moved by something else or it is riot. If it, is not, we have the proposition clinched; namely, that there exists a mover that is immovable, which is a property of the first mover. But if that something else is also being moved by something other, this other is being moved by still another which is itself being moved by yet another mover. This, however, cannot go on *ad infinitum*, but a halt must be made at some mover. Therefore, there will be a first mover which will be the first cause of the motion, and of such a nature that it is itself not being moved but moves the others.

892. Then at (679) he proves a statement not yet proved. About this he does

three things:

First he gives the proof;
Secondly, he shows that the proof he gives is insufficient, at 893;
Thirdly, he supplies what was lacking in the insufficient proof, at 894.

He says therefore first (680) that if it is not granted that there is a first cause of the motion, then, since whatever is being moved is moved by some other, it follows that an infinite series of movers and moved is involved. And he shows that such a situation is impossible.

Let A, then, be something that is being moved in respect of place and let it be moved by B; let B be moved by C, and C by D, and so on ad infinitum in ascending order. Now it is evident that, when something moves by virtue of the fact that it is itself being moved by another, then both the mover and the mobile are being moved simultaneously, just as, when the hand by its motion moves a stick, the hand and the stick are moved at one and the same time. Therefore, B is being moved simultaneously with A, and C with B, and D with C. Therefore, the motion of A and that of all the others exist together and at the same time. And we could have considered one by one each of these infinite motions. Likewise, although each one of these mobiles is being moved by some mover—not in the sense that one is being moved by all, but one by another—nevertheless, even though there be an infinitude of movers and mobiles, yet the motion of each of the mobiles is numerically one motion. And although all the motions are infinite in number, they are not infinite in a privative sense, i.e., as though lacking a boundary, but the motion of each mobile is finite and has its own definite boundaries.

That the motion of each one of the infinite mobiles is numerically one and finite, he proves by the fact that since whatever is moved is moved between two termini, i.e., from something to something, then necessarily according to the diverse ways in which the termini are identical, the motion itself will be one in diverse ways, i.e., numerically, or specifically, or generically.

Motions are numerically the same when they are from the same *terminus a quo* into the same numerical *terminus ad quem*, provided that it takes place in the same numerical time and that the numerically same mobile is involved. To explain what he means, he adds that a motion that is numerically one is "from the same into the same", for example, from this white, i.e., from the same numerical white, into this black, i.e., the same numerical black, and in this same numerical time—because if all the conditions but time were numerically the same, the motion would be not numerically, but specifically one.

But a motion is generically one, when it is in the same predicament, i.e., of substance or some other genus; for example, all generations of substance are generically the same, and all alterations likewise.

But a motion is specifically one, when it is from the same specific terminus to the same specific terminus; for example, every case of blackening, which is from white to black, is specifically the same, and every case of becoming depraved, i. e,, from good to bad, is specifically the same. All this was explained in Book V.

Keeping in mind, therefore, these two facts, namely, that the mover and the moved are being moved together, and that the motion of each of the mobiles can be taken as one and finite, let us take the motion of mobile A and call it motion E, and the motion of B and call it Z, and let the motion of C, D and of all the others following be called IT. Also let the time in which A is being moved be K. Now, since the motion of A is finite, then the time K of that motion is definite and not infinite, because we showed in Book VI that the finite in time corresponds to a finite in motion and an infinite in time corresponds to an infinite in motion. From what we have said, however, it is clear that in the very same time that A is being moved, B is being moved, and so for all the others; hence the motion of all, i.e., the motion EZIT, occurs in finite time. But this motion is infinite, since it is the motion of an infinite number. Therefore it will follow that an infinite motion occurs in finite time, which is impossible. Now why does our conclusion follow? Because in the very same time that A is being moved all the others are being moved and they are infinite in number.

It makes no difference, so far as our proposition is concerned, whether the motion of all the mobiles had equal velocity or not, or whether the lower mobiles move more slowly and in a greater time, because in any case it will follow that an infinite motion occurs in finite time—since each of the mobiles must have a finite rapidity and a finite slowness. However, it is impossible for an infinite motion to occur in finite time. Therefore, it is also impossible that we go to infinity in the series of mobiles and movers.

893. Then at (680) he shows that the foregoing argument is not conclusive. And he says that in the above way we seemed to have demonstrated the main proposition, namely, that one does not go to infinity in the series of movers and mobiles. Yet it is not an efficacious proof, because no impossibility flows from these premisses. For it is possible that there be an infinite motion in finite time, so long as the motion is not one and the same but other and other, insofar, namely, as an infinite number of things are being moved. For there is nothing to prevent an infinite number of things from being moved at once in finite time. And it was this that our argument concluded. For the infinite mobiles were diverse and so their motions were diverse, because for a motion to be one it is required not only that the time be one and that the termini be identical but also that the mobile be one, as was proved in Book V.

894. Then at (681) he shows how to make the argument efficacious.

First, how it can be made efficacious by making another assumption;

Secondly, how it is efficacious all by itself, at 895.

He says therefore first that what is locally and corporeally being moved first and immediately by a mobile mover must be touched by it, as a stick is touched by the hand, or must be continuous with it, as one part of the air is continuous with the next part, or as one part of an animal is continuous with another. And this seems to occur in all, i.e., that the mover is always in contact with the mobile in one of these ways.

Let us therefore take one of these ways, namely, that from all the infinite mobiles and movers there is formed one thing—namely, the whole universe—through some kind of continuity. Since this is something contingent, let us take it for granted and let that whole unit—which is a continuous magnitude—be called ABCD and its motion EZIT. And because someone could say that EZIT was the motion of finite mobiles and so not the motion of an infinite whole, he adds that, so far as our proposition is concerned, it makes no difference whether the magnitude is finite or infinite. For just as when A was being moved in a finite time K, each of the finite mobiles which are infinite in number were being moved at the same time, so also in the same time the entire infinite magnitude will be moved all at once. Therefore, an impossibility follows whichever one is taken, i.e., either a finite magnitude composed of magnitudes infinite in number, or an infinite magnitude whose motion occurs in finite time; for it has been proved above that an infinite mobile cannot be moved in finite time. Therefore the premiss from which this impossibility followed is itself impossible, i.e., that we go to infinity in the series of movers and things moved. It is clear, therefore, that the process of one thing being moved by another does not go on ad infinitum, but a halt must be made and there will exist a first mobile which is being moved by a mover that is immovable.

895. Since our proof depended on an assumption, namely, that all the infinite movers and moved form a continuum and constitute one magnitude, it might seem to someone that the conclusion is not absolute, Consequently, he adds that it makes no difference to the validity of this conclusion that it should have proceeded from this assumption. For an impossibility cannot follow from an assumption that is contingent, even if the assumption be false. Therefore, since the proof led to an impossibility, that impossibility did not follow from our contingent premiss but from some other cause which must be impossible, since an impossibility followed from it. So it is clear that in demonstrations that lead to an impossibility it makes no difference whether a false contingent assumption or something true be joined to what is impossible. For that is shown to be impossible which, by the addition of some false contingent statement, gives rise to an impossibility, just as if something impossible should follow from it by the addition of a true proposition. For just as an impossibility cannot follow from a true premiss, so neither can it from a contingent one.

896. But someone could say that for all mobiles to form one continuum is not contingent but impossible, for the elements cannot form a continuum with one another and with the heavenly bodies.

But it must be answered that "contingent" and "impossible" are taken in one sense when something is demonstrated about a genus and in another sense when something is demonstrated about a species. When a discussion is about the species, whatever is repugnant either to the genus or the specific difference, which forms the nature of the species, must be regarded as impossible. But when the discussion is about the genus, we can take as contingent anything to which the genus is not repugnant, even though the difference which constitutes a species of that genus is repugnant to it. For example, if I am speaking of animal, I can suppose as a contingent proposition that all animals are winged; but if I go a step further and consider man, it is impossible for this animal to have wings. Now since Aristotle is here speaking about mobiles and movers in a general way without making applications to particular mobiles, and to be in contact or to be continuous is a matter of indifference if you consider the general nature of mover and mobile, therefore he takes it as contingent that all mobiles mutually form a continuum, even though this is impossible if you consider the mobiles in their specific natures.

Lecture 3

In local motion mover and moved must be together

897. In the previous demonstration the Philosopher had assumed that a mover is continuous, or at least contiguous, with the mobile. This he now intends to prove.

First he proves his proposition;
Secondly, he proves something he had assumed in his proof, (L. 4)

About the first he does two things:

First he states his intention;
Secondly, he proves his proposition, at 898.

He says therefore first (682) that mover and moved are together. But something is said to be "moved" in two senses. In one sense as the end moves the agent, and such a mover is sometimes distant from the agent it moves; in another sense as that moves which is the actual beginner of the motion. It is of this latter that Aristotle speaks, and that is why he adds "not as that for the sake of which, but as that from which the source of motion is."

Again, a mover as principle of motion can be immediate or remote. Aristotle speaks of what causes motion immediately and calls it the "first mover" which refers not to what is first in the series of movers but to a mover that is immediate

to the mobile.

And because in Book V he had said that things in the same place are together, one might, conclude from that and from the statement that mover and moved are together, that when one body is moved by another they must both be in the same place. Therefore, to prevent this misunderstanding, he adds that "together" is not taken here in the sense of being in the same place, but in the sense that nothing is intermediate between the mover and the moved. It is in this sense that things in contact, or things that are continuous are together, because their extremities are together or are one and the same.

And because in the previous demonstration he proceeded solely along the line of local motion, this does not mean that his proposition is true only in cases of local motion. Therefore, to exclude this possible misunderstanding, he adds that the statement "mover and moved are together" must be taken in a sense common to all motions, for it is found in every kind of motion that mover and moved are together, in the sense explained.

898. Then at (683) he proves his proposition. About this he does two things:

First he enumerates the species of motion;
Secondly, he proves his proposition for each kind, at 899.

He says therefore first (683) that there are three kinds of motion: one is in respect to place and is called "local motion"; one is in respect of quantity and is called "growth and decrease; the third is in respect of quality and is called "alteration." He makes no mention of generation and ceasing to-be, because they are not motions, as was explained in Book V. However, since generation and ceasing-to-be are the termini of a motion, i.e., of alteration, as was proved in Book VI, then if he proves his proposition inbregard to alteration, it will also be proved in regard to generation and ceasing-to-be.

Now just as there are three kinds of motion, so there are three kinds of mobile and also three kinds of mover. And in all it is true that the mover and the moved are together, as will be shown for each case. But first it must be proved for local motion: which is the first of motions, as will be shown in Book VIII.

899. Then at (684) he proves his proposition for each kind of motion:

First in local motion;
Secondly, in the motion of alteration, in L. 4;
Thirdly, in the motion of growth and decrease, also in L. 4.

About the first he does two things:

First he shows the proposition in cases that are evident;
Secondly, in less evident cases, at 900.

He says therefore first (684) that we must say that whatever is being moved in respect of place is moved either by itself or by something else. To say that something is "moved by itself" can be taken in two senses: first, by reason of the parts, as when we shall prove in Book VIII that in things that move themselves one part moves and another part is moved; secondly, first and *per se*, i.e., so that the whole moves itself according to itself and as a whole, as when he proved earlier that in this way nothing moves itself. But if it be granted that something is moved by itself in both ways, it is clear that the mover will be in what is being moved, either in the way that a same thing is in itself, or as a part is in a whole, as a soul is in an animal. Thus it will follow that the mover and the moved are together in such a way that nothing exists between them.

900. Then at (685) he proves the same, in regard to things that are moved according to place by something else, in those cases where it is less evident. About this he does three things:

First he distinguishes the ways in which something happens to be moved by something else;
Secondly, he reduces these ways to two ways, at 906 bis;
Thirdly, he proves his proposition for these two ways, at 907.

About the first he does two things:

First he divides the ways in which something is moved by something else into four: pushing, pulling, carrying and twirling. For all motions that are caused by something distinct from the moved are reduced to these four.

901. Secondly, he explains these four ways. First he explains pushing as that which occurs when the mover makes a mobile be distant from him by moving it. Pushing is of two kinds: pushing on and pushing off. Pushing on occurs when the mover pushes a mobile but does not desert it but rather accompanies it to the place it is going. Pushing off (expulsion) occurs when the mover moves a mobile in such a way that it deserts and does not accompany it to the very end of the motion.

902. Then at (687) he explains carrying as a motion based on three other motions; namely, pushing, pulling and twirling, in the same way that what is *per accidens* is based on what is *per se*. For that which is carried is not moved *per se* but *per accidens*, inasmuch as something in which it exists is being moved; as, for example, when someone is carried by a ship on which he is, or carried by a horse upon which he is. That which carries is moved *per se*, since one does not proceed ad infinitum in things that are moved *per accidens*. And thus the first vehicle is moved *per se* on account of some motion which is either a push or a pull or a twirls. From this it is clear that carrying is contained in the other three motions.

903. Then at (688) he explains the third way, i.e., pulling. And note that pulling differs from pushing, because in the latter the mover is related to the mobile as *terminus a quo* of its motion, whereas in pulling he is related as the *terminus ad quem*. Therefore only what moves something to itself is said to "pull." However, the act of moving something to oneself in respect of place occurs in three ways: first in the way that an end moves, i.e., in the sense in which the poets declare that the end is said to pull, when they say that one's own desire pulls him. It is in this sense that a place may be said to pull what is naturally moved to a place.

In a second way something is said to pull something else, when it moves it to itself by altering it somehow, so that as a result the altered object is moved in respect of place. It is in this way that a magnet is said to pull iron. For just as the generator of a thing moves heavy and light things inasmuch as it gives them the form through which they are moved to their place, so the magnet confers some quality on the iron by which it is moved toward itself. That this is true he makes clear by three facts:

First, because a magnet does not draw iron from just any distance but within a certain limit of nearness. But if the iron were moved to the magnet only as to an end in the way that a heavy body is moved to its place, it should do so no matter how great the distance they are separated by.

Secondly, because if the magnet be covered with oil, it cannot draw the iron, because the oil impedes the altering quality or modifies it.

Thirdly, because in order that a magnet attract iron, the iron must first be rubbed by the magnet, especially if the magnet is weak. It is as though the iron receives from the magnet some power by which it is moved toward it. Thus a magnet pulls the iron not only as an end but as a moving cause and as an altering cause.

In a third way something is said to pull something else, because it moves it to itself in respect of local motion only. And it is in this sense that Aristotle here defines "pulling," i.e., in the sense that one body pulls another in such a way that the puller accompanies what it pulls.

904. This, therefore, is what he says, namely, that pulling occurs "when the motion of what pulls something toward itself or toward something else is swifter but not separated from what is pulled." And he says "toward itself or toward something else," because a voluntary mover can use something else just as itself; hence such a mover can both push something from something else as from itself, and pull something toward something else as toward itself. However, this does not happen in natural motions, where a natural push is always away from the pusher and a natural pull is toward the puller.

He said, "when the motion is swifter," because sometimes what is pulled is being moved toward its objective by its own motion, but is compelled by the puller to

move with a swifter motion. And since the puller acts by its own motion, the motion of the puller must be swifter than the natural motion of what is being pulled.

The reason for saying, "not separated from what is being pulled," is to distinguish it from a push. For in some pushes the pusher separates itself from the object pushed and in some not, whereas the puller is never separated from what is pulled; indeed, both the puller and the pulled are moved at once.

Finally he said, "to itself or to something else" because a pull can be toward the puller or toward something else, as was explained for voluntary motions.

905. Since there are motions in which the presence of a pull is not clearly evident, he shows that even those are reduced to the types mentioned, i.e., that they are directed toward the puller or toward something else. And this is what he says, namely, that all other types of pulling which are not called "pull" are reduced to these two types, because they are specifically the same as one or the other of these two, insofar as a motion derives its species from its terminus—for the motions he has in mind are either toward the puller or toward something else, as is evident in inhaling and exhaling. For "inhaling" is pulling air in, and "exhaling" is pushing it out; likewise, spitting is the pushing out of spittle. The same is to be said of all those other motions by which bodies are expelled or drawn inwards, because emitting is reduced to pushing out and receiving to pulling.

In like manner, *spathesis* is a type of pushing and *kerkisis* is a type of pulling. The former comes from the Greek word for sword; hence *spathesis* is to cut with a sword, which is done by pushing. *Kerkisis*, however, is from the Greek word "*kerkis*"—which refers to a weaver's tool which he pulls toward himself as he weaves, called in Latin "radius" (hence another text has "radiatio").

These two motions, and indeed all cases of emitting or receiving are either a gathering, which pertains to drawing toward, the gatherer being one who moves something to something else, or a scattering, a scatterer being one who pushes, for a push is a motion of one thing from another. In this way it is clear that all local motion is either a gathering or a scattering, because every local motion is either from something or toward something. Consequently, all local motion is either a pushing or a pulling.

906. Then at (689) he explains twirling as a motion composed of a pull and a push, for when something is twirled, it is on the one hand pushed, and on the other being pulled.

906 bis. Then at (690) he shows that the four general ways are reduced to pushing or pulling, and that whatever can be said of all four is contained in these two. For, since carrying consists of the other three, and twirling is composed of a

push and a pull, what remains is that every local motion caused by a mover is reduced either to a push or a pull. Hence it is evident that if the mover and moved are together in the motions of pulling and of pushing, so that the pusher is together with what is being pushed, and the puller with what is being pulled, then it is universally true that there is nothing between the mover, in respect of place, and what is moved.

907. Then at (691) he proves his proposition for these two motions;

> First he presents two arguments that prove the proposition;
> Secondly, he answers an objection, at 908.

The first argument is based on the definition of the two motions: for a "push" is a motion from the mover or from something else into something else; consequently, at the beginning of the motion the pusher must be together with what is being pushed, at least when the pusher removes from himself or from something else the object that is being pushed. A "pull," however, is a motion toward the puller or toward something else, as we have said; a motion, I say, in which the puller is not separated from what is being pulled. Hence it is clear that in these two motions the mover and the moved are together.

The second argument is based on gathering and scattering. For it was said above that pushing is scattering and pulling is gathering. Now, no one gathers (*synosis*) or scatters (*diosis*) without being present to the things he is gathering or scattering. Therefore, it is clear that in pulling and in pushing the mover and the moved are together.

908. Then at (692) he answers an objection that could be lodged against the push. For it was said of pulling that the motion of the puller is not separated from what is being pulled. But in pushing it was said that the pusher is in certain cases removed from the object pushed. Such a case of pushing is called "projection," which occurs when something is pushed with some force into the distance. Hence it seems that in this case the mover and the moved are not together.

To answer this he says that projecting occurs when the motion of what is thrown becomes faster than its natural motion on account of a strong impulse. For when something is projected by a strong push, the air is moved with a motion swifter than its natural motion, and with air's motion the projected body is carried along. And so long as the air stays pushed, so long does the projectile remain in motion. This is what Aristotle says, namely, that when such a push is made, so long as there remains in the air a motion stronger than its natural motion, so long does the projectile remain in motion.

Thus, with this objection answered, he concludes that the mover and the moved are together, and that nothing intervenes between the two.

Lecture 4

It is shown in alteration, and growth and decrease, that mover and moved are together

909. After showing that the mover and moved are together in local motion, he shows the same for alteration, i.e., that there is nothing between the thing altered and the cause of the alteration. This he proves first by induction at (693). For in all things that are altered, it is clear that the last thing altering, and the first thing altered, are together. However this seems to suggest a difficulty in certain alterations, e.g. when the sun heats the air without heating the intermediate orbs of the planets, or when a certain kind of fish held in a net shocks the hand of the one holding the net without shocking the net.

To this it must be said that things which are passive undergo the action of things that are active in their own special way, and therefore the intermediate between the first cause of an alteration and the last thing altered undergo something from the first cause, but perhaps not in the same way as the last thing affected. For the net undergoes something from the fish that causes the shock, but not a shock, because it is not capable of being shocked. And the intermediate orbs of the planets receive something from the sun, namely, its light, but not its heat.

910. Secondly, at (694) he proves the same thing by an argument, which is this: Every alteration is similar to an alteration which affects a sense. But in an alteration which affects a sense the cause of the alteration and the thing altered are together. Therefore, the same is true in every alteration.

To prove the major premiss, he says that every alteration takes place according to a sensible quality, which is the third species of quality. For bodies are apt to be altered in respect of those qualities by which bodies are primarily distinguished one from the other, i.e. in sensible qualities, such as heaviness, light-ness, hardness and softness, which are perceived by touch, sound and non-sound, which are perceived by hearing. (However, if sound is considered in act, it is a quality of the air, resulting from a local motion; consequently, it does not seem that there can be a primary and *per se* alteration according to a quality of this sort. But if sound is taken in an aptitudinal sense, then it is through some alteration that something becomes soundable or non-soundable.) There are also blackness and whiteness, which pertain to sight; sweetness and bitterness, which pertain to taste; dryness and wetness, density and rarity, which pertain to touch. The same goes for the contraries of these and for the intermediates. Likewise, there are others which are perceptible by sense, such as cold and heat, smoothness and roughness, which are apprehended by touch.

All these are passions contained within the genus of quality. And they are called "passions" because they produce a passion in the sense (i.e., the senses come to

be in the state of being acted upon) or because they are caused by certain passions, as is explained in the *Predicaments*. But they are called "passions of sensible bodies" because it is in respect of these that sensible bodies differ, inasmuch as one is hot and another cold, one is heavy and another light, and so on, or inasmuch as someone of them is present in two things, more so in one thing and less so in another. Fire, for example, differs from water by reason of the difference of hot and cold, and from air according to more and. less hot. Again, the difference of sensible bodies is based on the ability of some of them to receive one or the other of these qualities, although it not be in them naturally; for example, we say that heated objects differ from cooled objects and sweetened things from things made bitter, not because they are so by nature, but because they have been acted upon by these qualities.

The capacity to be altered in respect of qualities of these kinds is common to all sensible bodies both living and non-living. And some parts of living bodies are animate, i.e., capable of sensing, as the eye and the hand, and some parts inanimate, i.e., incapable of sensing, as the hair and bones, yet in either case all these parts are altered by qualities of this sort, because even the senses in sensing are acted upon. For the acts of the senses, such as hearing and seeing, are motions through the body and involve the sense being acted upon. For the senses have no action independent of a bodily organ, which is a body that is apt to be moved and altered. Hence passion and alteration are more properly spoken of in regard to the senses than to the intellect, whose operation does not take place through a bodily organ.

Thus it is evident that according to whatever qualities and according to whatever ways inanimate bodies are altered, animate bodies are altered according to the same qualities and in the same ways. But not vice versa: for an alteration is found in animate bodies that is not found in inanimate bodies, i.e., the one according to sense. For inanimate bodies do not perceive the alterations they undergo—something that would not be, if they were altered in respect of sense.

Lest anyone believe that it is impossible for something to be altered with respect to a sensible quality without a sensation of the alteration, he adds that this is true not only in inanimate things but also in the animate. For there is nothing to prevent living bodies from not perceiving that they are being affected by a quality, as when something happens in them without the sense being affected; for example, when they are altered in regard to non-sensitive parts.

From this, therefore, it is evident that if the passions of the senses are such that there is nothing intermediate between the agent and the patient, and if it is true that every alteration takes place through passions by which senses are apt to be altered, it follows that the cause of an alteration (when it is producing a passion) and the object acted upon are together, and there is nothing intermediate between them.

911. Then at (695) he proves a second point, namely, that in alterations of the senses, the altering cause and the sense affected are together, because the air is continuous with the sense, for example, of sight, i.e., they are in immediate contacts just as the visible body is in contact with the air. Indeed, the visible body's surface, which is the subject of color, is terminated at the light, i.e., at air which is illumined, which is terminated at the sense. And so it is evident that the altered air and what alters it are together, as are the altered sight and the air which alters sight. The same is true in hearing and in smelling, if you relate them to the first mover, namely, the sensible body, for these two senses are affected by an extrinsic medium. Taste, however, and its object are together, for they are not joined by means of an extrinsic medium, and the same goes for touch. Consequently, it remains that inanimate and insensible things are related in the same way, i.e., the cause of alteration and the thing altered are together.

912, Then at (696) he proves the same thing for the motion of growth and decrease. First of all in the motion of growth. For the cause of increase and the very thing that is increased must be together, because growing is a kind of "adding to," a quantity being increased by adding to it another quantity. The same is true of decrease, because the cause of decrease is the taking away of some quantity.

Now this proof can be understood in two ways. In one way, that the very quantity added or taken away is the immediate mover in these motions, for Aristotle says in *On the Soul* II that flesh increases because it is quantified. Thus it is clear that the mover and the moved are together, for nothing can be added or taken away from something unless it be together with it.

In another way, this argument can be understood in terms of the principal agent. For adding is a type of gathering and subtracting a type of scattering. But it was proved above that in the motions of gathering and scattering, the mover and the moved are together. Hence, what remains is that even in the motion of growth and decrease, they are together.

In this way, then, he concludes universally that between the last mover and the first moved there is nothing in between.

Lecture 5

Alteration is not found in the fourth species of quality (form and figure), nor in the first (habit and disposition)

913. Because the Philosopher had assumed in the preceding argument that every alteration takes place in respect of what is sensible, he now undertakes to prove this.

First he proposes what he intends;
Secondly, he proves the proposition, at 914.

He says therefore first (697) that from what will follow it must be considered that all things that are altered, are altered according to sensible qualities, and that, consequently, to be altered belongs only to those things which are *per se* affected by such qualities.

914. Then at (698) he proves his proposition a majori.

First he posits the proposition;
Secondly, he proves certain things he assumed, at 915-

He says therefore first (698) that in addition to the sensible qualities (the third species of quality), alteration seems to occur especially in respect to the fourth species of quality, a quality concerned with quantity, namely, form and figure, and to the first species, which contains habits and dispositions. For when such qualities are freshly removed or newly acquired, alteration seems to be involved—for these things seem unable to occur without some changes and a change in respect of quality is alteration, as was said above.

But in the above-mentioned qualities of the first and fourth species, there is no alteration primarily and principally but only in a secondary sense, for such qualities follow upon alterations of the primary qualities, as is clear from the fact that when the underlying matter becomes dense or rare, a consequent change of figure results, In like manner, when it becomes hot or cold, there follows a change in regard to health and sickness, which pertain to the first species of quality. Rare and dense, hot and cold are sensible qualities, and so it is clear that there is not alteration in the first and fourth species of quality primarily and *per se*; rather the receiving or removing of them are a consequence of some alteration affecting sensible qualities.

From this is also plain why he makes no mention of the second species of quality, i.e., natural potency and impotency. For it is clear that these latter are not received or lost without a change in the nature, which takes place through alteration. That is why he did not mention them.

915. Then at (699) he proves what he had assumed:

First, that alteration does not occur in the fourth species of quality;
Secondly, that it does not occur in the first species, at 918.

In regard to the first he gives two reasons, the first of which (699) is based on the way people speak. Here it must be considered that form and figure mutually differ in this, that figure implies termination of quantity, for the figure is that which is confined by the terminus or termini; but form is something which gives artifacts a kind of species, for the forms of artifacts are accidents.

He says therefore that that from which the form of a statue comes to be is not called a form, i.e., the matter of the statue is not predicated of the statue *in principali et recto*, and the same for the figure of a pyramid or of a couch; rather in all such cases the matter is predicated denominatively. For we say that a triangle is wooden or golden or waxen. But in things that are altered, we predicate of the subject the quality received by the alteration, for we say that brass is wet and strong and hot, and conversely we say that the wet thing or the hot thing is brass, i.e., we predicate the matter of the quality and the quality of the matter, In fine, we say that a man is a white thing and that some white thing is a man. Therefore, because in forms and figures the matter is not predicated conversely with the figure, so that either could be said of the other *in principali et recto*, but rather the matter is predicated of the figure only in a denominative way, whereas in things that are altered the subject and the quality are mutually predicated, it follows that in forms and figures there is not alteration but only in sensible qualities.

916. He gives a second reason at (700) and it is based on a property of a thing. For it is foolish to say that a man or a house or anything else is altered just because it receives the end of its perfection. For example, if a house is made perfect when it gets a roof or when it is decorated or enclosed with walls, it is ridiculous to say that the house is being altered when it becomes roofed. It is also clear that alteration does not affect things that come to be, precisely as coming to be; rather a thing becomes perfect and comes to be inasmuch as it receives its own form and figure. Consequently, alteration is not involved in the receiving of figure and form.

917. In order to make these reasons clearer, we should consider that of all qualities in a thing, it is figure that both follows upon the species and indicates the species. This is particularly evident in animals and plants in which there is no more sure way to judge a diversity of species than by a diversity of figure. The reason for this is that just as quantity is the nearest of all the accidents to the substance, so the figure, which is a quality affecting quantity, is nearest to the substantial form. Hence, just as some philosophers supposed that dimensions were the substances of things, so they supposed that their figures were their substantial forms. It is for this reason that an image, which is an express representation of a thing, is based especially on the figure rather than on the color or something else. And since art imitates nature, and an artifact is an image of a natural thing, the forms of artificial things are the figure or something close to the figure. And therefore, on account of the similarity of forms and figures to substantial forms, the Philosopher says that the receiving of form and figure is not alteration but perfection. And that is also why the matter is not predicated of them except denominatively, similarly to the case of natural substances—for we do not say that a man is earth but of earth (*terrenus*).

918. Then at (701) he shows that there is not alteration in the first species of quality.

> First in regard to habits and dispositions of the body;
> Secondly, in regard to habits and dispositions of the soul, (L. 6).

In regard to the first, he gives this argument: Habits which are in the first species of quality, even if they be bodily, are called virtues and vices. For in general the virtue of a thing is what makes it good and renders its work good; hence a virtue of the body is that according to which it is well kept in itself and acts well, e.g. health; or, on the other hand, it is a vice, as is sickness.

Now every virtue and vice is spoken of in reference to something else. And this he makes clear by examples. For health, which is a virtue of the body, is a definite harmony of the hot and the cold, and I say that this harmony is in respect to the due proportion of the things beneath, i.e., of the humors, of which the body is composed, both in relation to themselves and to what contains them, i.e., to the whole body. For a proportion of humors that would be health in a lion, would be not health, but destruction, for a man, for his nature would not stand it.

The Commentator refers the phrase "to what contains them" to the surrounding air. But the first explanation is better, because the health of an animal is not considered in relation to the air; rather the disposition of the air is called healthy in relation to the animal.

Likewise, beauty and agility are said in relation to something ("agility" is taken here for the disposition whereby one is disposed for motion and action). For such dispositions are in a thing that is perfect in its nature in comparison to the best, i. e., to the end, which is operation. For, as it was said, such dispositions are called virtues because they make their possessor good and his work good,. Therefore these dispositions are described in reference to their due work, which is the best of a thing.

There is no use trying to explain "best" in terms of something extrinsic, as in the case of what is most beautiful or most healthy, as the Commentator does, for it is accidental to beauty and health that they be related to something extrinsic disposed in the best possible manner; rather what is *per se* is their relation to a good work.

And lest anyone understand by "perfect" a thing that has already attained its end, he says that "perfect" is here taken in the sense of what is healthy and disposed according to nature. But it must not be supposed here that such habits and dispositions are of their very nature relations, for otherwise they would not be in the genus of quality. The point is that their definition depends on a relation Of some sort.

Therefore, because habits of this kind imply a relation, and in relation there is

neither motion nor generation nor alteration, as was proved in Book V, it is clear that in habits of this kind there is not alteration primarily and *per se*; rather a change follows upon a previous alteration of the hot and the cold or of something of this sort, just as relations begin to exist as a consequence of certain motions or changes.

Lecture 6

No alteration in the first species of quality as to habits of the soul

919. After showing that alteration does not occur in the first species of quality in respect of dispositions of the body, the Philosopher shows the same about the habits of the soul.

First as to the appetitive part of the soul;
Secondly, as to the intellectual part of the soul, at 923.

About the first he does two things:

First he shows that there is no primary and *per se* alteration in changes that affect virtues and vices;
Secondly, that changes involving virtue and vice are consequences of other alterations, at 921.

920. He concludes therefore first (702) from the foregoing that with respect to virtues and vices which pertain to the appetitive part of the soul there is no primary and *per se* alteration. And he mentions this as a conclusion, because he will proceed to prove it with the same arguments as he proved the previous points.

Accordingly, in order to prove this he makes the assumption that virtue is a kind of perfection. And this he proves in the following manner: A thing is perfect when it can attain to its own virtue (or power); for example, a natural body is perfect when it can make something like unto itself, and this is a virtue (or power) of the nature. He also proves this by the fact that a thing is most according to nature when it has the virtue of its nature (for virtue in a nature is a sign that the nature is complete), and when a thing has its nature completely, it is said to be perfect. And this is true not only in natural things, but also in mathematical, where their form is taken as the nature, for it is then that a figure is a perfect circle, namely, when it is most according to nature, i.e., when it has the perfection of that form. In this way, then, it is evident that since the virtue of a thing follows upon the perfection of its form, a thing is perfect when it possesses its virtue. Consequently, virtue is a kind of perfection.

With the premiss proved thus, the Commentator says that the full argument will be this: Every perfection is simple and indivisible; but no alteration or motion can

affect what is simple and indivisible; therefore, in respect of virtue there can be no alteration,

But this reasoning will not apply to what Aristotle adds about vices, which are the removal and ceasing-to-be of a perfection. For although a perfection is simple and indivisible, yet the departure from perfection is not simple and indivisible, but occurs in many different ways. Again, it is not the custom of Aristotle to ignore a fact on which the conclusion chiefly depends, unless that fact is implied by something else he mentions.

Therefore, it is better to say that the argument here must be like the one used above for form and figure. For nothing is said to be altered, when it is being made perfect, and for the same reason, when it is being corrupted. Hence, if virtue is a perfection and vice a corruption, there will be no alteration in respect of them any more than there is in respect of forms and figures.

921. Then at (703) he shows that a change in virtue and vice is a result of some alteration. And first he proposes what he intends and says that the receiving of virtue and the removal of a vice, or vice versa, take place when something is altered in such a way that on the occasion of that alteration, there follows the receiving and loss of virtue and vice. Nevertheless, neither of these is a primary and *per se* alteration.

Then at (704) he proves the proposition and says that it is clear from the following that something must be altered in order that it receive or lose a vice or a virtue.

This is seen to be proved in two ways. First, according to two opinions that men have about virtue and vice. For the Stoics declared that virtues are impassibilities and that no virtue can exist in the soul unless all the passions of the soul are first removed, i.e., fear, hope, and so on, For they said that such passions are disturbances and ailments of the soul, whereas virtue is a peaceful and healthy state of soul. Accordingly, they said that the very capacity to undergo emotion is an evil or vice of the soul.

However, the opinion of the Peripatetics, derived from Aristotle, is that virtue consists in a defined control of the passions. For a moral virtue establishes a mean in the passions, as is said in *Ethics* II. And according to this, even the vice opposed to a virtue is not any kind of passibility at all, but a certain inclination to the passions contrary to the virtue, which are reckoned in terms of excess and defect.

Now, whichever may be true, the reception of virtue depends on some modification in the realm of the passions, i.e., either that the passions be entirely removed or that they be controlled. But the passions themselves, since they exist in the sense appetite, are subject to alteration. What remains, therefore, is that

the receiving and loss of virtue and vice occur as a result of an alteration.

922. Then at (705) he proves the same thing in this way: Every moral virtue consists in some delight or sadness—for a person is not just unless he enjoys just works and becomes sad at their contrary; and the same is true of the other moral virtues. The reason for this is that the activity of every appetitive power, in which moral virtue exists, is terminated at delight or sadness, since delight follows upon the attainment of what the appetite seeks and sorrow upon the attainment of what the appetite dislikes. Hence, a person who desires or hopes is delighted when he attains what he desires or hopes. In like manner, the angry person is delighted, when he punishes. On the other hand, one who fears or hates something becomes sad when the evil he sought to escape occurs. But all sadness and delight are caused either by the actual presence of a thing or by the memory of a past thing or by hope of a future thing. Therefore, if delight concerns an actual present thing, the cause of this delight is a sense, for an agreeable thing does not delight unless it be sensed. Likewise, if the delight is based on memory or on hope, it proceeds from a sense, as when we remember sense pleasures we experienced in the past, or ones we hope to experience in the future. From which it is clear that delight and sadness are based on the soul's sensitive part, in which alteration occurs, as was said above. If, therefore, delight and sadness are involved in moral virtue and moral vice and it is possible to undergo alteration in respect of delight and sadness, then it follows that the reception and loss of virtue and vice are consequent upon some alteration.

It is significant that he said the whole of moral virtue consists in delights and sadnesses, in order to distinguish it from intellectual virtues, which also have their own delight. But that delight is not according to sense. Consequently, it has no contrary, nor can there be alteration in respect to it, except in a metaphorical sense.

923. Then at (706) he shows that alteration is not found in the intellectual part of the soul.

> First he proves this in general;
> Secondly, more in detail, at 924.

In regard to the first (706) he gives this argument. Knowing is especially spoken of as in relation "to something else," i.e., to the knowable, the likeness of which, existing in the knower, is science. This he now proves: It is only in "to something" (relation), and in no other genus, that something happens to a thing without its being changed; for something can become "equal" to something else without itself being changed, the other alone having been changed. Now we can see that even though no change occurs in the intellectual power, knowledge begins to exist in it—for merely on the occasion of something existing in the sensitive part science comes to be. In effect, from experiencing particular things,

which pertain to the sensitive part, we receive knowledge of the universal in the intellect, as is proved in *Metaphysics* I and in *Posterior Analytics* II. Therefore, since there is no motion in "to something," as was proved above, it follows that there is no alteration involved in receiving science.

924. Then at (707) he shows in detail that there is no alteration in the intellectual part.

> First in the case of one who already has science and speculates upon it, which is to use science;
>
> Secondly, in the case of one who receives fresh science, at 925

He says therefore first that, although there is no alteration in the intellectual part of the soul, it cannot be said that the use of science, which is to consider, is a type of generation, any more than we can say that when the eye externally regards an object or when one touches, there is generation. For just as seeing is the act of the visual, and touching is the act of the tactual, potency, so to consider is an act of the intellectual potency. Now, act does not imply that a principle is being generated, but rather that there is a proceeding from some active principle. Consequently, to understand is neither generation nor alteration. However, there is nothing to prevent an act from following upon generation and alteration, as, subsequent to its generation, fire heats, In like manner, on the occasion of a sense being altered by the sensible, the act of seeing or touching occurs.

925. Then at (708) he shows that there is not generation and alteration when science is newly received.

For whatever accrues to a thing solely through the subsiding of certain disturbances and motions does not accrue through generation and alteration. But science, which is speculative knowledge, and prudence, which is practical reason, accrue to the soul through the subsiding of bodily motions and sensible passions. Therefore, neither science nor prudence accrue to the soul through generation and alteration.

To elucidate this argument he gives examples. For let us suppose that some person who possesses science is asleep or drunk or sick. It is clear that he cannot at such a time use his science and act according to it. But it is also clear that, when the disturbance subsides and the mind returns to its normal state, he can then use his science and act according to it, Yet, we do not say that when a sleeping person is awakened, or someone drunk becomes sober, or when the life of a sick person is restored to due order by health, that he then becomes a knower as though science were newly generated in him, for there already existed in him a habitual potency "to the congruousness of science," i.e., to be restored to a congruous state in which he could use his science.

Now, he says that something like that happens when a person newly acquires science. For this seems to take place on account of a certain quieting and subsiding of "turbulence," i.e., of disordered motions, which are present in boys both in respect of their bodies, because their whole nature is undergoing change by reason of growing, and in respect of their sensitive part, because in them the passions rule.

Hence when he says "quieting," he seems to be referring to disturbances of the body, which are calmed when nature arrives to full estate; and when he rays "subsiding," he seems to refer to the passions of the sensitive part, which are not completely at rest but subside by reason of their being controlled by reason to the extent that they do not disturb the reason. It is in this way that we say that certain liquids have subsided when the dregs descend to the bottom and what is pure remains at the top.

Why is it that youths cannot learn by taking in what is said by others, and why is it they cannot with their internal senses judge about what they hear or somehow comes to their knowledge, as well as older persons can? It is because the former are subject to many disturbances and many commotions, as we said. But disturbances of this sort can be entirely removed or at least mitigated, sometimes by nature, as when a person reaches old age, in which motions of this kind are put to rest, and sometimes by other causes such as by training and habit. It is then that they can learn and judge well. That is why the exercising of the moral virtues, through which passions of this kind are bridled, is of great value in acquiring science.

Therefore, whether the passions are made to subside by the exercise of virtue or by nature, an alteration is involved, since these passions are located in the sensitive part, just as an alteration takes place in the body when a sleeping person arises, and becomes awake, and starts to act.

From this it is clear that newly to acquire science is not an alteration but is a consequence of an alteration.

From this, however, he further concludes universally that alteration can occur in the external senses, in sensible bodies, and in the entire sensitive part of the soul (which he says on account of the interior passions), but in no other part of the soul, except *per accidens*.

926. What Aristotle says here about receiving science seems to agree with Plato's opinion. For Plato taught that just as separated forms are the cause of the generation and existence of natural things, in the sense that corporeal matter participates these separated forms in some way, so also they are the cause of science in us, for our soul somehow participates of them, in such a way that it is the very participation of separated forms in our soul which is science. In this way, it will be true that science is newly acquired, not by its being generated in the

soul, but merely by the subsiding of bodily and sensitive passions, which prevented the soul from using its science. And in this way it will also be true that even though no change occurs in the intellect, a man becomes a knower by the mere presence of the sensible things of which he has experience, as occurs in relative things. This means that sensible things are not required for knowledge except for the purpose of arousing the soul.

However, Aristotle's opinion is that science comes to be in the soul through the intelligible species, abstracted by the agent intellect, being received in the possible intellect, as is said in *On the Soul* III. For which reason, he says in the same place that to understand is certain "undergoing" (*passio*), although the way the intellect "undergoes" differs from the way the senses do.

It is not unfitting that Aristotle should here make use of the opinion of Plato. For it is his custom to make use of the opinions of others before giving his own, just as in Book III he used Plato's opinion that every sensible body has heaviness or lightness, the contrary of which he will prove in *On the Heavens* I.

927. Nevertheless, these arguments based on the opinion of Aristotle are saved. To make this clear it must be considered that a receiver can be related in three ways to a form that is to be received.

For sometimes the receiver is in the final disposition for the reception of the form and no impediments exist either in it or in anything else. Under these conditions, as soon as the active principle is present, the receiver accepts the form without any further alteration, as is evident when air is illumined, the sun being present,

But sometimes the receiver is not in the final disposition required for receiving the form. In that case a *per se* alteration is required to put into the matter a disposition for this particular form, as, for example, when fire comes to be from air.

Sometimes the receiver is in the final disposition for the form but an obstacle is present, as when air is prevented from receiving light either by closing a shutter, or by the presence of clouds. In these cases, an alteration or changed is required *per accidens*, i.e., the removal of the obstacle.

Now the possible intellect, considered in itself, is always in the final disposition for receiving the intelligible species. Therefore, if there be no obstacle, then, whenever there are present objects received through experience, there will arise in the intellect an intelligible species, just as an image will appear in a mirror when a body is present. It was on this basis that Aristotle took his first argument, in which he said that science is "to something." However, if there be an obstacles as happens in youths, then these obstacles must be removed in order to allow the intelligible species to be received in the intellect. In this case an alteration is necessary *per accidens*.

Lecture 7

The comparing of motions; what is required

928. After the Philosopher has shown that it is necessary to posit a first in mobiles and movers, now, because things which are of one order seem capable of being compared, and because to be "prior" and "subsequent" implies a comparison, he wishes to inquire about comparison of motions. Concerning this he does two things:

First, he shows which motions can be mutually compared;
Secondly, how motions are mutually compared, (L. 9).

About the first he does three things:

First, he raises a question;
Secondly, he objects against both parts of the question, at 929;
Thirdly, he settles the question, at 933.

First he raises a general question (709) and asks whether just any motion at random may be compared to just any other motion or not. Then he raises a special question about motions in some one genus. Now if any motion at random may be compared to just any other motion with respect to swiftness and slowness (it having been said in Book VI that the equally swift is what is moved in equal time over an equal space), it will follow that a circular motion will be equal, or greater, or less, in swiftness than a rectilinear one, and further, that a curved line will be equal to a straight line in quantity, or larger or smaller, from the fact that the equally swift is that which traverses an equal distance in equal time.

Then he raises a question about motions in diverse genera. For if all motions may be compared with respect to speed, it will follow that if in an equal time A is altered, and B is moved locally, then a local motion is equal in swiftness to an alteration. Further, by virtue of the definition of the equally swift, it will follow that a passion, i.e., passible quality, in respect of which there is alteration, is equal to the length of the distance traversed by the local motion. But this is plainly impossibles because they do not agree in the same notion of quantity.

929. Then at (710) he raises objections against the question proposed:

First, he objects against comparing alteration with local motion;
Secondly, against comparing circular motion with rectilinear, at 930.

First (710), therefore, from the foregoing argument which leads to an impossibility, he concludes to the contrary of what he posited, as though saying that, since it has been said that it is not feasible for a passion to be equal to a

length, while whenever something is moved through an equal space in equal time, it is said to be equally swift, therefore, since no passion is equal to a length, it follows that a local motion is not equal in swiftness to an alteration, or greater or less. From this it may be further concluded that not all motions can be compared.

930. Then at (711) he considers the other part of the question, i.e., concerning circular and rectilinear motion.

> First he objects against a circular motion's being as equally swift as a rectilinear motion;
> Secondly, he takes the contrary position, at 932.

About the first he does two things:

> First he objects against the proposition;
> Secondly, he dismisses a quibbling response, at 931.

He objects first (711) in the following manner. Circular motion and rectilinear are differences of local motion, just as upward and downward are. But as soon as something is moved upwards and something else downwards, it is at once necessary that one be being moved faster or slower than the other—the same is true if the same thing is moved now upwards and later downwards. It seems therefore that in like manner we must say that a rectilinear motion is swifter or slower than a circular one, whether it be the same thing that is being moved in a straight line and in a circular one, or two different things.

It should be noted that in this argument he makes no mention of the equally swift but of the swifter and slower, because this argument is based on the likeness of an upward motion—whose principle is lightness—to a motion which is downward—whose principle is heaviness. Some, indeed, have held that heaviness and lightness are the same as swiftness and slowness—an opinion he rejected in Book V.

931. Then at (712) he rejects a quibble. For someone could concede on account of the foregoing reason that a circular motion is either swifter or slower than a rectilinear ones but not equally swift.

This he rejects, saying that it makes no difference, so far as the present discussion is concerned, once someone grants that it is necessary for what is being moved circularly to be moved more swiftly or more slowly than what is being moved in a straight line. For according to this the circular motion will be faster or slower than the rectilinear. Hence it follows that it could also be equal.

That this follows he now proves. Let A be the time in which the swifter traverses B, which is a circles and let something slower traverse the straight line C in the same time. Now, since the swifter traverses more in the same time, it will follow

that circle B is larger than the straight line—that is the way the swifter was defined in Book VI. But we also said in that place that the swifter traverses an equal distance in less time. Therefore, we can take of time A a part during which the circularly moving body will traverse a part of this circle B and during which it will traverse C, while the slower body is traversing C in the entire time A. It will follow, therefore, that that part of the circle is equal to the entire C, because one and the same object traverses an equal distance in equal time. And in this way, a circular line will be equal to a straight line and a circular motion will, consequently, be as fast as a rectilinear.

932. Then (713) he takes the contrary position. For if circular and rectilinear motions may be compared with respect to swiftness, it follows, as just said, that a straight line will be equal to a circular one, for the equally swift is what traverses an equal distance. But a circular line and a straight line cannot be compared, so as to be called equal. Therefore, neither can a circular motion be said to be as swift as a rectilinear.

933. Then at (714) he settles the difficulty he raised.

> First he asks in general what may be compared to what;
> Secondly, he adapts this to his proposition, (L. 8).

About the first he does three things:

> First he states one thing that is required for comparison;
> Secondly, a second thing, at 937.
> Thirdly, he concludes a third requirement, (at 939)

About the first he does three things:

> First he mentions what is required for comparisons;
> Secondly, he takes the contrary position, at 935;
> Thirdly, he settles the matter, at 936.

934. He says therefore first (714) that things seem to be capable of being compared so long as they are not equivocal, that is, in the line of things not predicated equivocally the subjects of predication may be compared. For example, "sharp" is an equivocal term: for in one sense it is applied to magnitudes, as when an angle is said to be "sharp" (acute) and when a pen-point is said to be "sharp"; in another sense it is applied to savors, as when wine is said to be "sharp" (dry); in a third sense it is applied to notes, as when the ultimate, i. e., highest, note in a melody, or a chord of a lyre is said to be "sharp."

Now, the reason why no answer can be made to the question, "Which of these is sharpest, the point, the wine or the voice?" is because "sharp" is predicated of them in an equivocal sense. But the highest note can be compared with respect to sharpness to another which is next to it in the scale, because in this case

"sharp" is not taken equivocally, but is predicated of both in the same sense.

Therefore, according to this, it could be replied to the proposed difficulty that the reason why a straight motion cannot be compared to a circular one is because the word "swift" is being used equivocally. And much less is the meaning of "swift" the same in respect to alteration and local motion. Consequently, these two are even less capable of being compared.

935. Then at (715) he objects against what was just said. And he says that at first sight it does not seem to be true that things may be compared so long as they are not equivocal. For there are some non-equivocal things which cannot be compared; for example, "much" is used in the same sense when applied to water and to air, yet water and air cannot be compared with respect to muchness.

Now if someone refuses to admit that "much" signifies the same thing on account of its general nature, he will at least grant that "double," i.e., twice as much as, which is a species of muchness, signifies the same thing in regard to air and to water; for in both cases it signifies the ratio of 2 to 1. Nevertheless, air and water cannot be compared in terms of double and half, so as to be able to say that the amount of water is double that of the air or vice versa.

936. Then at (716) he answers this objection. About this he does two things:

First he gives the solution;
Secondly, he confirms it by raising another question, at 937.

He says therefore first that it could be said that in "much" and "double" we discern the same reason for their inability to be compared, when they are applied to water and to air, as was discerned in "sharp" when it was applied to pen and wine and note; for "much" itself is equivocal.

Now, because someone could object against this on the ground that the same notion of "much" is referred to when it is applied to both, then in order to reject this, he states that even the notions, i.e., definitions, of certain things are equivocal. For example, if someone should say that the definition of "much" is that it is "this amount and yet more," "to be this amount" and "to be equal," which is the same thing, is equivocal, for "to be equal" is to have one quantity, but the definition of "one quantity" is not the same in all things. (The notion of "much," as used here, implies a comparison in the sense that it is the opposite of "a little," i.e., it is not taken in its absolute sense of being the opposite of "one.")

And what he said of "much" he says consequently of "double." For although the notion of "double" is that there is a ratio of 2 to 1, yet even that notion contains an equivocation, for it could be said that "one" is equivocal; and if "one" is equivocal, it follows that "two" is, because "two" is nothing more than "one" taken twice.

Now it should be observed that there are many things which, when considered in an abstract way in logic or mathematics, are not equivocal, but which are in a certain sense equivocal when they are taken in a concrete way, as the philosopher of nature takes them when he applies them to matter, for they are not taken according to the same aspect in all matter. For example, quantity, and unity (which is the principle of number) are not found according to the same aspect in the heavenly bodies, and in fire and air and water.

937. Then at (717) he confirms what has been said by raising a certain other question. For if it be held that there is one nature of "much" and of "double" and of other like things which cannot be compared, as there is also one nature of things that are predicated univocally, the question still remains, why it is that among things having one nature some can be compared and some not. For it seems that when things are similar, there should be a same judgment about them.

Then at (718) he answers this question by positing the second requirement for things to be compared. About this he does two things:

First he mentions the second requirement;
Secondly, he shows that even that one is not enough, at 938.

He says therefore first (718) that the reason why some things possessing one nature can be compared, while other things having one nature cannot, could be that when some one nature is received according to one first subject in diverse things, they will be comparable, as horse and dog can be compared with respect to whiteness, one being able to be said "whiter" than the other, because not only is the same nature of whiteness in both, but there is one first subject in which whiteness is received, namely, the surface. In like manner, the magnitude of each may be compared, so that one can be called "larger" than the other, because there is one same subject of magnitude in each, namely, the substance of a mixed body. But water and a note cannot be compared with respect to magnitude so as to say that the note is "greater" than the water or vice versa, because although magnitude in itself is the same, the receiver of it is not the same. For when magnitude is said of water, its subject is a substance, but when it is said of a note, its subject is sound, which is a quality.

938. Then at (719) he shows that this second requirement does not complete the list of requirements, for two reasons. The first of these is this: If things were comparable just because there is a non-differing subject, it would follow that all things have one nature, for it could be said of all things whatsoever that they do not differ except insofar as they exist in some one or other first subject. And according to this, it would follow that "to be equal" and "to be sweet" and "to be white" are one and the same nature, differing only by reason of being received in one or another receiver. And this is seen to be unacceptable, namely, that all

things have one nature.

But it should be noted that positing a diversity of things on the sole ground of diversity of subject is a Platonist opinion, which attributed unity to form and duality to matter, so that the entire reason of diversity came from the material principle. That was why he stated that "one" and "being" are predicated univocally, and that they signify one nature but that the species of things are diversified by reason of a diversity of receivers.

The second reason which he gives, at (720), is that not just anything is capable of receiving just anything else at random, but one is primarily the receiver of one; consequently, the form and what receives it are in proportion. Therefore, if there are many first receivers, there must necessarily be many natures capable of being received; or if one nature has been received, then necessarily there is one first receiver.

939. Then at (721) he concludes that there is a third requirement for things to be comparable. And he says that things which can be compared must be not only non-equivocal (which is the first requirement) but must also not possess any difference either on the side of the first subject in which something is received (which is the second requirement) or on the side of what is received, which is a form or a nature (and this is the third).

And he gives examples of this third requirement. For "color" is divided into various species of color; hence it cannot be compared solely on the ground that it is predicated of these colors, even though it be not predicated equivocally, and even though it have one first subject, which is a surface, and which is a first subject of the genus "color", but not of any species of color. For we cannot say which is more colored, white or black, because this comparison would not be in terms of some definite species of color, but in terms of color in general. But in terms of whiteness, which is not divided into various species, all white things may be compared, so that it can be said which one is whiter.

Lecture 8

Which motions may be compared

940. After pointing out in general what is required in order that things be able to be compared, the Philosopher now applies the truth found to the comparison of motions.

> First in general;
> Secondly, by comparing motions that belong to diverse genera, at 941;
> Thirdly, by comparing one motion to another in the same genus, at 942.

He says therefore first (722) that just as in other matters the requirements for

comparability are that the things compared be not equivocal, and that there be an identical first receiver, and that they be of the same species, so also in regard to motion, "equally swift" is said of things that are moved in equal time, through such-and-such an equal length, with respect to a change of the same kind.

941. Then at (723) he discusses the comparison of motions in diverse genera. And he asks, in keeping with what went before, "If one mobile be altered and another moved locally, can the alteration be said to be 'as swift as' the local motion?" To say "yes" would be unacceptable. The reason is that the two motions are of different species—and it has already been said that things not of the same species cannot be compared. Therefore, since local motion is not of the same species as alteration, the swiftness of the two cannot be compared.

942. Then at (724) he discusses the comparison of motions in some one species within some one genus.

> First as to change of place;
> Secondly, as to alteration, at 949;
> Thirdly, as to generation and ceasing-to-be, at 954.

(He makes no mention of growth and decrease, because they share with local motion the common characteristic of being according to some magnitude,)

In regard to the first he does three things:

> > First he shows what is required in order that two local motions be able to be mutually compared;
> Secondly, he shows that one factor which seems to be required is not, at 945;
> Thirdly, he concludes to what he chiefly intended, at 946.

About the first he does two things:

> > First he concludes to the impossibility that would follow if all local motions could be compared;
> Secondly, he tells why not all can be compared$ at 944.

943. He says therefore first (724) that if the equally swift are things moved locally through an equal magnitude in equal time, and if all local motions should be equally swift, it would follow that what is straight is equal to what is circular. Now, this statement may be understood in two senses: first, in respect to a rectilinear motion and a circular one, secondly, in respect to a straight line and a circular one. The latter is the better sense, because it follows from the foregoing. For if all rectilinear and circular motions are equally swift-and they are so when they traverse an equal magnitude in equal time—it follows that a straight line is equal to a circular one, a situation that must be rejected as impossible.

944. Then at (725) he investigates the reason why rectilinear motions cannot be compared with circular ones. For since he had concluded that if they are equal, then the magnitudes are equal—which is seen to be impossible—someone might wonder whether the reason for this inability to be compared is due to the motion or to the magnitude. And this is his question: "Is the reason why a straight motion is not as equally swift as a circular one due to the fact that change of place is a genus containing diverse species under it (for it was said above that things of diverse species are not comparable), or is it because line is a genus containing under it straight and circular as species?" Of course, time cannot be the reason, for all time is "atomic," i.e., indivisible, as to species.

To this question. therefore, he responds that both reasons hold, because in both cases is found a difference of species, but in such a way, nevertheless, that the diversity of species it local motion is due to the diversity of species of the magnitudes in connection with which the motion takes place. And this is what he says, namely, that if that upon which the motion occurs has species, it follows that the local motion will have species.

945. Then at (726) he rejects a factor that might seem to be required for identity of species and comparability in local motions. And he says that sometimes changes of place are diversified by reason of "that in which," i.e., by reason of that through which, as through an instrument, a local motion takes place; for example, if the feet are the instruments of local motion, it is walking, but if wings are, it is called flying. Yet this does not make for diversity of species in local motions but for a diversity of figure, as the Commentator says.

However, it could possibly better be said that Aristotle here intends to say that changes of place are not diversified by reason of the instruments of motion but by reason of the figure of the magnitude traversed. For it is in this way that "straight" and "circular" differ. The reason is that motions are not diversified on account of the mobiles but on account of the things in respect to which the mobiles are moved. Now instruments lean more to the mobile, whereas figures are on the part of that in which the motion occurs.

946, Then at (727) he concludes his proposition. Concerning this he does three things:

> First he concludes to the main proposition;
> Secondly, he draws from the conclusion a fact to be considered, at 947;
> Thirdly, he investigates the problem of diversity of species, at 948.

He concludes therefore first (727) that since motions are not comparable unless they are of the same species, and local motions are not of one species unless they traverse the same specific magnitude, it follows that those are equally swift which traverse the same magnitude in equal time, where "same" refers to what is not different in species. For it is in this way that motions, too, do not differ in

species, And therefore the main thing to be considered in the question of the comparison of motions is their differences. For if they differ either in genus or in species, they cannot be compared. But if they differ in accidentals, they can be.

947. Then at (728) he draws from the foregoing a fact worthy of consideration, namely, that a genus is not something absolutely one, whereas a species is. This is made known first of all from the preceding argument in which it was shown that things not of one genus are not comparable, whereas things of one species are; and secondly, from the preceding lecture, in which it was stated that the nature of comparable things is one. From this it can be gathered that a genus is not one nature, while a species is.

The reason for this is that the species is taken from the ultimate form, which is absolutely one in the universe of things, but the genus is not taken from a form that is one in the universe of things but from one that is so in conception only. For the form on account of which man is animal is not distinct from the one on account of which man is man. Therefore, all men who are of one species agree in the form which constitutes their species, because each has a rational soul. But there is not in man, horse, and ass, some common soul which makes them animal, over and above the soul that makes one a man, or a horse, or an ass. (If there were, then the genus would be one and comparable, just as the species.) But it is only in our mental consideration that a generic form is extracted, namely, it is brought about by the intellect's abstracting from the differences.

Consequently a species is one quiddity deriving from a unity of form existing in the universe of things. The genus, however, is not one, because according to the diverse forms existing in the universe of things, diverse species are capable of receiving a same genus as a predicate. Consequently, a genus is one thing logically but not physically.

Now, because a genus, although not purely one, is still in some sense one, the equivocation of many things is often masked on account of their likeness and their closeness to a unity of genus.

Now certain equivocal things are very unlike and possess in common only a name, as when a heavenly body, and the animal which barks, are called "dogs." Other things, however, have a certain likeness, as when the word "man" is applied to a real man, and to one that is in a painting, on account of the latter's likeness to a real man.

Still other equivocations are very close. This may be on account of agreement in genus. For example, when "body" is said of a heavenly body and of a corruptible body, it is equivocation, because naturally speaking the matter is not one. They agree, however, in logical genus, for which reason they appear not to be equivocal. Or it may be on account of some likeness. For example, one who teaches in the schools is called "master." and so is the head of a house,

equivocally; this is by a close equivocation, however, on account of the likeness, for each is a ruler, one in the schools, the other in the house, Hence, on account of their close resemblance in genus or likeness things do not appear to be equivocal which nevertheless are.

948. Then at (749) because he had said that we must consider the question of the differences of motion, i.e., whether motions differ specifically, he now inquires how specific differences may be taken in motions and in other things as well. And because the definition designates the essence of the species, he poses two questions: one about the species, and one about the definition.

He first of all asks about species: "When is something to be reckoned of a different species from another? Is it only because the same nature is found in different receivers, as Plato held?" According to the foregoing this cannot be the case. For it has been said that a genus is not absolutely one; therefore a difference of species is not reckoned on the basis that some same thing is in one and another, except for the Platonists who posited that a genus is absolutely one. On this account, as though answering the question, Aristotle adds that a species is different, not because the same thing is in a different subject, but because a different nature is in a different subject.

The second question is about definition, and it is this: "What is a term, i.e., what is the definition which declares a species?" And because things that have the same definition are absolutely the same, he then, as if answering the question, adds that the proper definition of a thing is that by which we can discern whether some thing is the same or other, e.g. white or sweet. And "other" may be taken in two ways as before: in one way, as meaning that the white is said to be something other than the sweet, because in the white thing is found a subject nature other than the one in the sweet; in another way, as meaning that they differ not only in subject nature but that they are wholly not the same. These two are the same as the two he mentioned above, when he said: "If the same thing is found in things that are other, or if differing things are found in differing things." For it is clear that there is a same reason of identity and diversity in species and in definition.

949. Then at (730) he discusses the comparison of alterations, About this he does two things:

> First he shows that one alteration is as equally fast as another;
>
> Secondly, he investigates from what aspect equality of quickness in alteration is considered, at 950.

He asks therefore first about alteration, how one alteration is as equally fast as another. And that two alterations are equally fast, he proves. For being healed is to be altered. But one can be healed swiftly and another slowly, and likewise some come to be healed at the same time. Therefore, one alteration is as equally

swift as another, for what is moved in an equal time is said to be moved with equal speed.

950. Then at (731), because equality of speed in local motion requires not only equality of time but also of magnitude traversed, and assuming that in alteration equality of time is required for equality of speed, he asks what else is required. And this is what he says: "What is it that must be reached in equal time in order that an alteration be called equally swift?"

And the reason for this question is that in quality, with which alteration is concerned, equal is not found, so as to enable us to say that when an equal quantity is reached in equal time there is an equally fast alteration, as indeed happens in local motion, as well as in growth and decrease. But as equality is found in quantity, likeness is found in quality.

To this question he responds at (732). And first he answers the question, and says that alterations should be called equally swift if in an equal time it is the same thing which has been changed, i.e., altered.

951, Secondly, he raises a question about this answer. Since it has been said that there is an equally swift alteration, if it is the same thing that has been altered in an equal time, and since in that which has been altered there are two things to consider, namely, the quality with respect to which alteration occurred, and secondly, the subject in which the quality exists, the question arises: "Should a comparison of this sort be regarded from the viewpoint of the identity of the quality or of the identity of the subject in which the quality exists?"

952. Then at (734) he answers one part of the question and says that with respect to the quality received in alteration, two types of identity must be considered in order that alterations be equally swift. First, that the same specific quality be involved, for example, the same health, of the eye or of something similar; secondly, that the quality which is taken be present in the same way, and neither more nor less. But if the qualities in question differ specifically, e.g., if one alteration involves becoming white, and another healthy, in these two cases nothing is the same; they are neither equal nor alike. Hence a diversity of these qualities causes a diversity in species of alteration, so that the alterations are not one, just as it was said above that a straight motion and a circular one are not one local motion. Consequently, whenever you wish to compare either local motions or alterations, you have to consider the species of alterations or of local motion to see whether they are the same or many. And this may be considered from the things in which motions occur, for if the things which are moved, i.e., in which motion occurs *per se*, and not *per accidens*, differ specifically, then the motions differ specifically; if they differ generically, so do the motions differ generically; if they differ numerically, then also the motions differ numerically, as was pointed out in Book V.

953. Thirdly, at (735), having determined one part of the question he raised, he now attacks the other. The question is this: "In order that alterations be adjudged similar or equally swift should regard be paid only to the quality to see if it is the same, or also to the subject which is altered; that is, if a certain portion of this body becomes white in a certain time and an equal part of another becomes white in the same or in equal time, should the alterations be judged equally swift?"

And he answers that attention must be paid to both, i.e., to the quality involved and to the subject, but in different ways. For from the viewpoint of the quality we judge an alteration to be the same or different according to whether the quality is the same or not; but we judge an alteration to be equal or unequal, if the part of the subject altered is equal or unequal: for if a large part of this body becomes white and a small part of another becomes white, the alterations will be specifically the same, but they will not be equal.

954. Then at (736) he shows how comparison should be made with respect to generation and ceasing-to-be.

> First, according to his own opinion;
> Secondly, according to the opinion of Plato, at 955.

He says therefore first (736) that in generation and ceasing-to-be, in order that a generation be called equally swift, we must consider whether in an equal time the same thing is generated and is something indivisible as to species; for example, if a man is begotten in equal time in both generations, they are equally swift. But generations are not equally swift just because an animal is generated in equal time, for some animals on account of their perfection require more time for being generated~ But generation is said to be swifter, if something else is generated in an equal time; for example, if in the time required for the generation of a dog, a horse should be generated, the generation of the horse would be swifter.

And because he had said that, in alteration, from the viewpoint of the quality involved, two things must be considered, namely, whether it is the same health and whether it exists in the same way and not more or less, while here he says that in generation only one thing has to be considered, namely, whether it is the same that is being generated, he now gives the reason for this difference, saying: "For we do not have two things in which there is an otherness called unlikeness." It is as if he said: "The reason why in generation the only thing to be considered is whether it is the same that is being generated, is that in generation we do not have something that could vary with regard to two things, according to which a difference could be discerned, in the way that unlikeness occurs in alteration through the fact that one and the same quality can vary according to more and less. For a substance, which is the proper terminus of generation, is not capable of more and less."

955. Then at (737) he discusses the comparison of generations according to the opinion of Plato, who supposed that number is the substance of a thing. For he thought that the "one" which is the principle of number is the substance of a thing. Now what is "one" is entirely of one nature and species. Therefore, if number, which is nothing more than an aggregate of units, is, according to Plato, the substance of things, it follows that a number will be called larger or smaller according to the species of quantity, but yet as to substance it will be of like species. And hence it is that Plato declared that one is the species, but that the contraries through which things differ are "the large and the small," which are considered from the side of the matter. Accordingly, it will follow that just as one and the same health has two aspects, inasmuch as it receives more and less, so also substance, which is number, since it is of the same species on account of unity, will have two aspects according as the number is larger or smaller. But in substance no general word exists to signify both, i.e., the diversity which arises from the largeness and smallness of number, whereas in qualities, when more of one is in a subject or when it is in any way outstanding, the quality is said to be "more"—for example, "more white" or "more healthy", while in quantity, excellence is described as "greater," as a "greater body" or a "greater surface." But in this sense there is no common word to signify excellence in substance—which is due to the largeness of number, according to the Platonists.

Lecture 9

Rules for the comparison of motions

956. After showing which motions are mutually comparable, the Philosopher now teaches how they are compared:

> First in local motions;
> Secondly, in other motions, at 962.

About the first he does two things:

> > First he mentions the aspects according to which local motions ought to be mutually compared;
> Secondly, he sets forth the rules of comparison in the light of the foregoing, at 957.

He says therefore first (738) that the mover in local motion always moves some mobile, in some definite time, and through some quantity of space. And this is required, because, as was proved in Book VI, something always moves and has moved, simultaneously. For it was proved there that whatever is being moved has already been moved through some part of a distance and through some part of time. Hence it follows that what is being moved is something quantitative and divisible, as are the distance and the time involved. However, not every mover is

quantified, as will be proved in Book VIII; nevertheless, it is clear that some quantitative things are movers and it is in respect to those that he proposes the following rules of comparison,

957. Then at (739) he lays down the rules of comparison.

First according to division of the mobile;
Secondly, when the mover is divided, at 958.

He says therefore first (739): Let A be a mover, and B a mobile, and C the length of space traversed, and D the time in which A moves B through C. If therefore we take another moving power, equal to the power of A, it will follow that it will move half of the mobile B through a distance twice C in the same time; but in half the time D it will move half of mobile B through the entire length C,

From these statements of the Philosopher two general rules may be gathered. The first is that if some power moves a mobile through some certain distance in a given time, then it or an equal power will move half of that mobile through twice the distance in the same time or in an equal time.

The other rule is that an equal power will move half the mobile over the same distance in half the time. The reason behind these rules is that the same proportion is being kept. For it is clear that the swiftness of a motion results from the victory of the mover's power over the mobile, because the weaker the mobile the more the strength of the mover prevails over it and the more swiftly will it move the mobile. The swiftness of a motion cuts down on the time and increases the length traversed, for the swifter is what traverses a greater distance in an equal time or an equal distance in less time, as was proved in Book VI. Therefore, according to the same proportion by which the mobile is diminished, either the time is diminished or the length traversed is increased, provided, of course, that the mover is the same or an equal mover.

958. Then at (740) he teaches how motions are to be compared from the viewpoint of the mover,

First according to a division of the mover;
Secondly, and conversely, according to an assemblage of movers, at 9610

About the first he does three things:

First he sets forth a true comparison;
Secondly, he rejects some false comparisons, at 959;
Thirdly, from this he answers an argument of Zeno, at 960.

He says therefore first (740) that if a power moves the same mobile through a certain distance in a given time, it moves half the mobile the same distance in half the time, or it moves half the mobile through twice the distance in the given original time, as was said of an equal power. Further, if the power be divided,

half the power will move half the mobile through the same distance in the given time. However, this must be understood of a mover that is not destroyed by division, for he has been speaking in a general way without making application to the particular natures involved. And he gives an example: Let E be half of power A and let Z be half of mobile B, then just as A moved B through C in time D, so E will move Z through the same distance in the same amount of time, because the same proportion of motive power to body mass moved is preserved. Hence, it follows that in an equal time the motion will traverse an equal distance, as was said.

959. Then at (741) he rejects two false comparisons. The first consists in adding to the mobile without adding to the motive power. Hence he says that if E, which is half the motive power, moves Z9 which is half the mobile, a distance C in time D, it is not necessarily true that the halved power E will move a mobile twice Z through half the distance in the given time, for it could happen that the halved power cannot move the doubled mobile at all. But if it can move it, the comparison will hold.

The second false comparison occurs when the mover is divided and the mobile is not divided. This he rejects at (742), saying that if the motive power A moves the mobile B through distance C in time D, it does not necessarily follow that half the motive power will move the entire mobile B in time D through a part of distance C such that this part of C is related to the entire distance C as A was related to Z in our other example. For when A was compared with Z, it was a suitable comparison, but in the present case it is not, for it can happen that half the motive power will not move the whole mobile any distance. For if some whole power moves some whole mobile, it does not follow that half of it will move the same mobile any distance, no matter how much time is allowed. Otherwise it would follow that a man by himself could move a whole ship a certain distance, if the combined power of the shiphaulers is divided by the number of haulers and the distance they haul it be so divided.

960. Then at (743) he uses the foregoing to answer an argument of Zeno who wished to prove that each grain of millet falling to the earth makes a sound, because an entire bushel of it, when poured to the earth, makes a sound. But Aritstotle says that this argument of Zeno is not true, i.e., that each grain of millet makes a sound when it falls to the earth. For there is no reason why any such part should in any length of time move the air to produce a sound, as does the whole bushel in falling.

And from this we can conclude that it is not necessary, if a part existing in a whole causes a motion, that this part, now existing in isolation from the whole, can cause a motion. For in the whole the part is not actual but potential, especially in continua. For a thing is a being in the same way that it is one, and "one" is that which is undivided in itself and divided from others. But a part,

precisely as existing in a whole, is not actually divided from it but only potentially; hence it is not actually one but only potentially. For this reason, it is not the part but the whole that acts.

961. Then at (744) he sets forth a comparison based on an aggregate of movers and says that if there are two and each of them causes motion and if each by itself is moving its own mobile a certain distance in a given time, then when the two are united they will move the mobiles—which are now joined together—through an equal distance in the same time, because even in this case the same proportion is maintained.

962. Then at (745) he sets forth the same rules of comparison for other motions. About this he does three things:

First he shows that the things according to which the comparison of motions must be judged are divisible;

Secondly, he sets forth the true comparison, at 963;

Thirdly, he rejects some false comparisons, at 964.

He says therefore first (745), in respect to growth, that there are three things involved, namely, the cause of increase, the thing increased, and the time; and these three have a certain quantity. Also there is a fourth thing to be considered, namely, the quantity of increase produced by the cause and received by the growing thing. And these four things must be considered also in alteration, namely, the cause of alteration, the thing altered, the amount or degree of alteration (which is present according to more and less), and the amount of time. These four, of course, are the same as are involved in local motion.

963. Then at (746) he sets forth the true comparison and says that if a power moves something to a certain amount in a given time according to these motions, then it will move to twice the amount in twice the time; and if it moves to twice the amount, it will be in twice the time. Likewise, the same power will move to half the amount in half the time, or if it moves in half the time, then the motion will be to half the amount, Or if there is twice the power, it will move something to twice the amount in an equal time.

964. Then at (747) he dismisses a false comparison and says that if what causes alteration or increase causes a certain amount of increase or alteration respectively in a certain amount of time, it does not necessarily follow that half the force will alter or increase half the object or some given amount in half the time; for it may happen that there will be no alteration or increase at all, the case being the same as with the locally mobile that has weight.

It should be observed that when Aristotle says "half will be moved in half or double will be moved in an equal," "double" and "half" (in the accusative case) refer, not to the mobile but to the sphere of motion, i.e., the quality or the

quantity, which are related to alteration and growth as length of distance is related to local motion. For in local motion it was said that if a certain power moves a certain mobile, half will move half the mobile, but here it is said that half might not move anything. But it must be understood that we are speaking of an integral mobile whole, which will not be moved by a halved motive power to any amount of quantity or degree of quality, much less to half.

BOOK VIII

Lecture 1

Opinions on the beginning and end of motion

965. After showing in the preceding book that it is necessary to posit a first mobile, and a first motion, and a first mover, the Philosopher intends in this present book to inquire after a description of the first mover, and first motion, and first mobile, The book is divided into two parts:

In the first he premisses something necessary to the following investigation, namely, that motion is sempiternal;
In the second he proceeds to investigate what is proposed, (L. 5).

About the first he does three things:

First he raises a problem;
Secondly, he states the truth according to his own opinion, (L. 2);
Thirdly, he answers possible objections to the contrary, (L. 4)#

In regard to the first he does three things:

First he proposes his problem;
Secondly, he gives opinions for both sides, at 968;
Thirdly, he shows the usefulness of this consideration, at 970.

About the first he does two things:

First he proposes the problem he intends to investigate;
Secondly, he responds to a tacit question, at 967.

966. In regard to the first it should be known that Averroes says that Aristotle in this book does not intend to inquire whether motion is sempiternal universally, but limits his question to the first motion.

But if one considers both the words and procedure of the Philosopher, this is entirely false. For the words of the Philosopher speak of motion in a universal sense. He says in effect: "Was there ever a becoming of motion before which it had no being and is it perishing again so as to leave nothing in motion?" From this it is clear that he is not inquiring about one definite motion but about motion universally, asking whether at any time there was no motion.

The falseness of Averroes' statement appears also from the very procedure of Aristotle. First, it is Aristotle's custom always to argue to his proposition from proper causes. Now, if anyone will consider the arguments he adduces, he will see that in none of them does Aristotle argue from a middle term that refers properly to the first motion, but he argues rather from a middle proper to motion

in general. Hence this alone shows that he intends to inquire here about the sempiternity of motion in general.

Secondly, if he had already proved that there is one or a number of sempiternal motions, he would have been foolish to ask below whether anything is eternally in motion, for that question would have been already answered. It also is ridiculous to say that Aristotle would repeat from the start his consideration of a problem he had already settled, and act as though he had omitted something, as the Commentator pretends. For Aristotle had the opportunity to correct his book and fill in at the proper place any section he had omitted, so as not to proceed in a disorderly way. For if this chapter had been treated in the way charged by the Commentator, everything that follows would be confused and disorderly. This is not strange, for, having supposed an initial impossibility, others then follow.

Furthermore, the correctness of our view is shown by the fact that Aristotle later on uses what he proves here, as a principle to prove the eternity of the first motion. He would never have done this, had he already proved that the first motion is eternal.

The reason which moved Averroes is wholly frivolous. For he says that if Aristotle is here intending to inquire into the eternity of motion in common, it will follow that the consideration of Aristotle has been diminished, because it is not evident from what he proves in this place, how motions could be always continued one to the other.

But this has no weight, because it is enough for Aristotle to prove in this chapter in a general way that motion has always been. But how the eternity of motion is continued—whether it is because all things are always in motion, or because all things are sometimes in motion and sometimes at rest, or because some things are always in motion and others sometimes in motion and sometimes at rest—is a question he raises immediately after the present one.

Thus the present chapter must be explained according to this intention, namely, that he intends to inquire about motion in common. According to this, therefore, he asks: "Did motion in common begin to be at some time, so that previously there had never been any motion, and so that at some time it will perish so as to leave nothing in motion, or, on the other hand, did it never begin and will it never cease, so that it always was and always will be?

And he gives an example taken from animals, for some philosophers have said that the world is a certain large animal. For we see animals as alive so long as motion is apparent in them, but when all motion ceases in them they are said to be dead. Accordingly, motion in the whole universe of natural bodies is taken as a kind of life. If, therefore, motion always was and always will be, then this sort of life of natural bodies will be immortal and never-failing.

967. Then at (749) he answers a tacit question. For in the preceding books Aristotle had discussed motion in common, without applying it to things; but now, inquiring whether motion has always existed, he applies his general doctrine about motion to the existence it has in things. Therefore, someone could say that in this consideration the first question should have been about whether motion has existence in things rather than whether it is eternal, especially since there are some who have denied that motion exists.

To this he responds that all who have spoken about the nature of things admit that motion exists. This is evident from their statements that the world was made, and from their consideration of the generation and ceasing-to-be of things, which cannot occur without motion. It is therefore a common supposition in natural science that motion has existence in things. Hence there is no need to raise this question in natural science any more than in other sciences are raised questions about the suppositions of the science.

968. Then at (750) he presents opinions for both sides of the question he proposed.

> First he gives the opinions which declare that motion is eternal;
> Secondly, those who declare that motion is not eternal, at 969.

In explanation of the first part (750), therefore, it should be known that Democritus supposed that the first principles of things are bodies that are *per se* indivisible and always mobile and that the world came to be by the chance aggregation of these bodies—not only the world in which we exist but an infinitude of other worlds, since these bodies congregated to form worlds in diverse parts of infinite void. Still he did not posit these worlds as fated to endure forever; rather, some came into existence as a result of atoms combining, and others passed out of existence as a result of the same atoms scattering. Therefore all the philosophers who agree with Democritus assert the eternity of motion, because they say that the generation and ceasing-to-be of certain worlds i′s always going on-and that necessarily involves motion.

969. Then at (751) he gives the opinions of the other side. And he says that whoever declare that there is just one world which is not eternal, also declare what reasonably follows with respect to motion, namely, that it is not eternal.

Therefore, if there be supposed a time in which nothing was in motion, this could happen in two ways, just as it is in two ways that this world could be supposed not always to have been: in one way, that this world began in such a way that previously it never existed at all, as Anaxagoras held; in another way, that the world so began to be that it did not exist for some time previously, but that it again had existed before that time, as Empedocles held.

In like manner with respect to motion, Anaxagoras said that at one time all things

were a mixture of one thing with another and nothing was segregated from anything else—in which mixture it was necessary to posit that all things were at rest, for motion does not occur without separation, since whatever is in motion separates from one terminus in order to tend to another. Therefore Anaxagoras posited the pre-existence of this mixture and rest in infinite time, in such a way that at no time before (the present world) had there been any motion at all, and that it was Mind, which alone was unmixed, that caused motion in the first instance and began to separate things one from another.

Empedocles, on the other hand, said that in one period of time some things are in motion, and again in another period all things are at rest. For he posited Friendship and Discord as the first movers of things: Friendship's property was to make a unity of all things, and Discord's to make many things from the one. But because the existence of a mixed body requires a mingling of the elements so as to form one thing, whereas the existence of a world required that the elements be dispersed in orderly fashion, each to its respective place, he posited that Friendship is the cause of the coming-to-be of mixed bodies, and Discord the cause of their ceasing-to-be; but that, contrariwise, in the whole world Friendship was the cause of its ceasing-to-be and Discord the cause of its coming-to-be.

Accordingly, he posited that the whole world is being moved, when either Friendship makes one from the many or when Discord makes many of the one; but during the intermediate times, he supposed there was rest—not in the sense that there was no motion at all, but none with respect to the general change of the world.

Because Aristotle had mentioned the opinion of Empedocles, he also gave the very words, which are difficult to interpret because they are in metre.

Thus, therefore, did Empedocles express his opinion in this arrangement of words : "It has learned to be born," i.e., it is customary for something to be generated, "the one from the manifold"; "and again," i.e., in another way, "from the one commingled," i.e., composed of a mixture, "the manifold arises," i.e., the many come to be through separation—for some things are generated by combining with others, and others by separating.

And according to what we observe in regard to particular instances of coming-to-be, so "thus do things come to be," i.e., the same must be understood in the universal coming-t-o-be of things with respect to the whole world. "Nor is their era one," i.e., there is not just one period of duration of things; but at one time a world is generated, at another it is destroyed, and in between there is rest: for "era" is taken to mean the measure of the duration of a thing..

He expresses the distinction of these eras when he adds, "Thus are they changed," i.e., as though stating that the time in which things pass through the cycle of combining or separating is called one era. And lest anyone suppose that

the generation of a world does not require an era, i.e., a period of time, but that the universe comes to be in an instant, Empedocles adds, "nor are they made perfect all at once," but after a long interval of time.

Then speaking of the other era he adds, "thus are they always immobile," i.e., in the time between the generation and corruption cycle, he supposed that things are at rest.

And lest anyone believe that before there was always change, and that later there will be continual rest, he excludes this by saying "alternately," i.e., as though saying that this happens in cycles, namely, that things change and then rest, and then change again, and so on *ad infinitum*.

Then the words of Aristotle are added to explain the foregoing words of Empedocles, especially the expression, "thus they change." He says therefore that following the words, "thus they change," must be understood the addition, "from then hence", i.e., from a definite beginning up to the present—not in the sense that motion always was, or that after it began it had been interrupted.

970, Then at (752) he shows the usefulness of considering the question he has proposed. And he says that we must consider just what is the truth about this question, for to know the truth about it is most necessary not only for natural science but the science of the first principle as well, since both here and in the *Metaphysics* he uses the eternity of motion to prove the first principle.

This method of proving the existence of a first principle is most efficacious and irresistible. For if on the supposition that both motion and the world existed forever, it is necessary to posit one first principle, then, if the eternity thereof should be rejected, it is all the more necessary, for it is clear that every new thing requires a principle bringing it into being. Now the only reason why it could seem that no first principle would be necessary, would be if things were *ab aeterno*. But if the existence of a first principle follows even on that supposition, i.e., that the world existed *ab aeterno*, it is clear that the existence of a first principle is absolutely necessary.

Lecture 2

Arguments for the eternity of motion

971. After raising the problem of the eternity of motion, the Philosopher now intends to show that motion is eternal. His treatment is divided into two parts:

In the first he explains his proposition;
In the second he solves objections contrary to his proposition, (L.4).

About the first he does two things:

First he presents arguments to show the eternity of motion;
Secondly, he answers opinions to the contrary, (L. 3).

About the first he does two things:

First he shows that motion always has been;
Secondly, that it always will be, at 895.

About the first he does two things:

First he explains his proposition with an argument from motion;
Secondly, with an argument from time, at 979.

About the first he does three things:

First he premisses something needed for his proposition;
Secondly, he presents a proof that manifests his proposition, at 976;
Thirdly, he shows that his argument proceeds necessarily, 977,

972. He says first (753) therefore, that in order to demonstrate the proposition we must begin with things determined at the very beginning of the Physics and use them as principles. By this he gives us to understand that the preceding books, in which he determined about motion in general and which for this reason are given the general title "About Natural Things," are set off from this Book VIII, in which he begins to apply motion to things.

He assumes, therefore, what was said in Physics III, namely, that motion is the act of a mobile precisely as such. From this it appears that in order for motion to exist there must exist things which can be moved with some sort of motion, because an act cannot exist without the thing of which it is the act. Accordingly, from the definition of motion it is evident that there must be a subject of motion, if there is to be motion at all.

But even without the definition of motion that fact is *per se* evident from the general consent of all, for everyone admits as a necessary fact that nothing is moved except what can be moved—and this with reference to any and all motion; for example, nothing can be altered except what is alterable, or be moved with respect to place unless it be changeable with respect to place.

And because the subject is by nature prior to what is in the subject, we can conclude that in individual changes—both from the viewpoint of the mobile and of the mover—the combustible subject is prior to its being set afire, and the subject capable of setting it afire is prior to its setting afire, prior, I say, not always in time but in nature.

973. From this argument of Aristotle, Averroes took occasion to speak against what is held by faith about creation. For if coming-to-be is a kind of change and every change requires a subject, as Aristotle here proves, it is necessary that

whatever comes to be does so from a subject, therefore, it is not possible for something to come to be from nothing.

He confirms this with another argument: When it is said that the black comes to be from the white, this is not to speak *per se*, in the sense that the white itself is converted into the black, but it is to speak *per accidens*, in the sense that upon the departure of the white, the black succeeds it. Now whatever is *per accidens* is reduced to what is *per se*. But that from which something comes to be *per se*, is the subject, which enters into the substance of what comes to be. Therefore, whatever is said to come to be from its opposite comes to be from it *per accidens*, but *per se* it comes to be from the subject. Accordingly, it is not possible for being to come to be from non-being absolutely.

In further support of his position Averroes adduces the common opinion of the early philosophers that nothing comes to be from nothing.

He also gives two reasons from which he considers that the position arose that something should come to be from nothing. The first is that ordinary people do not consider as existing anything but what is comprehensible by sight; therefore, because they see something visible come to be which previously was not visible, they think that it is possible for something to come to be from nothing.

The second reason is that among the common people it could be thought to be a weakening of the virtue of the agent that it should need matter in order to act, which condition, however, does not derive from the impotency of the agent, but from the very nature of motion. Therefore, because the first agent does not have a power which is in any way deficient, it follows that it should act without a subject.

974, But if one considers rightly, he was deceived by a cause similar to the cause by which he claimed we are deceived, namely, by considering particular things. For it is clear that a particular active power presupposes the matter which a more universal agent produces, just as an artisan uses the matter which nature makes. From the fact therefore, that every particular agent presupposes matter which it does not produce, one should not suppose that the first universal agent—which is active with respect to all being—should presuppose something not caused by it.

Nor, moreover, is this in keeping with the intention of Aristotle who in Metaphysics II proves that the supremely true and the supreme being is the cause of being for all existents. Hence the being which prime matter has—i.e., a being in potency—is derived from the first principle of being which is in a supreme way a being. Therefore, it is not necessary to presuppose for its action anything not produced by it.

And because every motion needs a subject—as Aristotle proves here, and as is the truth of the matter—it follows that the universal production of being by God is

neither motion nor change, but a certain simple coming forth. Consequently, "to be made" and "to make" are used in an equivocal sense when applied to this universal production of being and to other productions.

Therefore, just as, if we should understand the production of things to be from God *ab aeterno*—as Aristotle supposed, and a number of the Platonists—it is not necessary, indeed, it is impossible, that there have been a pre-existing but unproduced subject of this universal production, so also, in accord with the tenets of our faith, if we posit that he did not produce things *ab aeterno* but produced them after they had not existed, it is not necessary to posit a subject for this universal production. It is evident, therefore, that what Aristotle proves here, namely, that every motion requires a mobile subject, is not against a tenet of our faith—for it has already been said that the universal production of things, whether *ab aeterno* or not, is neither a motion nor a change. For in order that there be motion or change, it is required that something be other now than previously, and thus there would be something previously existing, and consequently this would not be the universal production of things about which we are now speaking.

975. Similarly, Averroes' statement that something is said to come to be from its opposite *per accidens* and from a subject *per se* is true in particular productions according to which this or that being comes to be, e.g., a man or a dog, but is not true in the universal production of being.

This is clear from what the Philosopher said in *Physics* I. For he said there that if this animal comes to be inasmuch as it is this animal, it ought not come to be from "non-animal" but from "non-this-animal"—for example, if a man comes to be from non-man or a horse from non-horse. But if animal is produced precisely as animal, it must come to be from non-animal. Accordingly, if some particular being comes to be, it does not come to be from absolute non-being; but if the whole being comes to be, i.e., if being precisely as being comes to be, it must be made from absolute non-being—if, indeed, this process should be called "being made," for it is an equivocal way of speaking, as has been said.

What Averroes introduces about the early philosophers has no value, for they were unable to arrive at the first cause of all being but considered the causes of particular changes.

The first of these philosophers considered the causes solely of accidental changes, and posited all "being made" to be alteration. Those who succeeded them arrived at a knowledge of substantial changes, but those who came still later, such as Plato and Aristotle, arrived at a knowledge of the principle of all existence.

Consequently, it is clear that we are not moved to assert that something comes to be from nothing because we suppose only visible things to be beings; rather it

is because we do not content ourselves with considering merely the particular productions of particular causes, but go on to consider the universal production of all being from the first principle of being. Nor do we assert that to need matter in order to act is due to a diminished power, in the sense of such a power's lacking its natural energy, rather, what we say is that this is proper to a particular power, which does not extend to all being but makes a particular being.

Hence one can say that it is characteristic of a "diminished power" to make something from something in the sense that we would say that a particular power is less than the universal power.

976. Then at (754), assuming that a mobile and a mover are required in order that there be motion, Aristotle argues in the following manner: If motion has not always existed, it is necessary to say either that mobiles and movers were at some time made, having previously not existed, or are eternal. If, therefore, it is held that each mobile has been made, it is necessary to say that previous to the change which is taken as the first, there was another change and motion according to which was made the very mobile which is able to be moved and to have been moved. This inference, indeed, depends on the preceding. For if it is granted that motion has not always been but that there is some first change before which there was none, it will follow that that first change involved a mobile, and that that mobile was made, for previously it did not exist—since it is being supposed that all mobiles have been made. Now, whatever comes to be after having previously not existed, comes to be through a motion or a change. But the motion or change through which a mobile comes to be, is prior to the change by which the mobile is moved. Therefore, prior to the change which was presumed to be first is another change and so on ad infinitum.

But if it is held that things which are mobile always pre-existed even when no motion existed, this seems to be unreasonable and a sign of ignorance. For it immediately appears that if mobiles exist, motion ought to exist, for natural mobiles are at once also movers, as is clear from Book III. But if natural mobiles and movers are existing, there must be motion.

But to enter more deeply into our search for the truth, it is necessary that this same thing happen—if mobiles and movers are assumed to be eternally existing prior to motion—that followed from the assumption that they were made, namely, that prior to the change supposed to be the first, there is other change *ad infinitum*. This is evident in the following way: If it be supposed that certain mobiles and certain movers exist, and yet the first mover begins at some time or other to cause motion and something is moved by it, and before this nothing is being moved but is at rest, it will be necessary to say that there was another change in the mover or mobile made prior to that which was assumed to be the first one produced by the mover beginning to cause motion, The truth of this is clear from the following:

Rest is the privation of motion. Privation, however, is not present in a thing capable of habit and form except on account of some cause. Therefore there was a cause—either on the part of the mover or on the part of the mobile—why there was rest. Therefore, as long as that cause prevailed, there was always rest. If, then, a mover begins at some time to cause motion, the cause of rest must be removed. But it cannot be removed except by a motion or change. Therefore, it follows that before that change which was said to be first, there is a prior change by which the cause of rest is removed.

977. Then at (755) he proves the necessity of the foregoing argument. For someone could say that it happens that things are at rest at some time and in motion at some time, without any pre-existing cause of rest to be removed. Hence he wishes to refute this. And about this he does two things:

First he premisses something needed for his proof;
Secondly, he presents the proposed proof, at 978.

He says therefore first that among movers, some move "singularly," i.e., in just one way, while others move with respect to motions that are contrary. Things that cause motion in just one way are natural things, as fire always heats and never cools. But beings that act through intellect are causes of motions that are contrary, for one and the same knowledge seems to deal with things and their contraries, as medicine is the science of health and of sickness. Hence one sees that a doctor by means of his science can cause motions that are mutually contrary.

Now Aristotle mentioned this distinction among movers, because in things that act through intellect it does not appear that what he had said is true, namely, that if something is moved when previously it had been at rest, the cause of the rest ought first be removed. For things that act according to intellect seem to be ready to move to opposites without any change of themselves being involved; hence it seems that they can cause motion and not cause it, without any change.

Therefore, lest his argument be forestalled by this objection, he adds that his reason holds both for things that act according to intellect and that act by nature. For things that act by nature do always *per se* move to one, but *per accidens* they sometimes move to the contrary, and in order that such an accident occur, some change is necessary; thus cold always *per se* causes coldness, but *per accidens* it produces warmth.

But that cold should *per accidens* cause warmth is due to some change affecting the cold object, either inasmuch as it is moved to another location, thus making it differently related to the object which is now made warm by it than it was when it was making it cold, or inasmuch as it completely departs.

For we say that cold is the cause of warmth by departing in the way that a

captain is by his absence the cause of the sinking of a ship; again, cold becomes *per accidens* the cause of warmth either by moving farther away or by approaching closer, as in the winter the interior of animals is warmer, because their heat retreats inward on account of the surrounding cold.

The same applies to things that act by intellect, For knowledge, although it is one thing dealing with contraries, does not deal equally with them both but with one principally, as medicine is *per se* ordained to causing health. Therefore, if it happens that a doctor uses his knowledge for the contrary purpose of causing sickness, this will not be *per se* from this science but *per accidens*, on account of something else. And in order that that something else occur when previously it did not exist, some change is required.

978. Then at (756) he sets forth the proof which manifests his proposition. He says therefore that from the fact that things are such, i.e., that a similar situation prevails with respect to things that act by nature and things that act by intellect, then, speaking universally of all, we can say that whatever things are possible to make, or to be acted upon, or to cause motion, or to be moved, cannot cause motion or be moved in just any disposition in which they find themselves, but according as they are in some definite state and nearness with respect to each other.

And this he concludes from the premisses, because it has already been said that both in things that act according to nature and in things that act according to will, none is the cause of diverse things except as it is a different state. Accordingly, it is necessary that when the mover and the moved approach one another according to a suitable distance and likewise when they are in whatever disposition is required for one to cause motion and for the other to be moved, then the one must be moved and the other must cause motion.

If, therefore, there was not always motion, it is clear that existing things were not in that state that allowed for one to cause motion and another to be moved; rather, they were in the state of not being able to cause motion and of being moved at that time. But later they reached that state in which one moves and the other is moved. Therefore, one or the other of them changed.

For we see that in all things which are said to be "to something" it does not happen that a new relation arises except through a change affecting one or other or both, as, for example, if something which previously was not "double" has now become double, even though not both of the extremes were changed, yet at least one of them was. Accordingly, if there newly arises a relationship by which something causes motion and something is moved, then one or other or both had to be previously moved. Hence, it follows that there is a change prior to the one assumed to be the first.

979. Then at (757) he explains his proposition with an argument from time.

First he premisses two things necessary for his proposition. The first of these is that "prior" and "subsequent" cannot occur unless there is time, since time is nothing else than prior and subsequent precisely as numbered. The second is that time cannot be, unless there is motion. This, too, is clear from the definition —given in Book IV—describing time as the number of motion with respect to prior and subsequent.

980. Secondly, at (758) he concludes to a conditional proposition from statements made in Book IV, For there, according to his doctrine, he stated time to be the number of motion; according to the doctrine of the other philosophers time is a motion, as he there stated. But whichever of these is true, it follows that this conditional is true: If time always exists, it is necessary that motion be perpetual.

981. Thirdly, at (759) he proves in two ways the antecedent of this conditional. First, from the opinions of others. And he says that all the philosophers but one, namely, Plato, seem to be in accord with regard to the opinion that time is not begotten, i.e., that it did not begin to exist after previously not existing. Whence, Democritus also proved that it is impossible that all things should have been made in the sense of newly beginning to be, because it is impossible that time have been so made that it begin newly to be.

Only Plato generates time, i.e., says that time was newly made. For he says that time was made at the same time as the heavenst and he supposed that the heavens were made, i.e., that they have a beginning of their duration, as Aristotle here claims, and as Plato's words seem at first glance to indicate— although Platonists say that Plato asserted that the heavens were made in the sense that they have an active principle of their existence but not as having a principle of their duration. Thus, therefore, does Plato alone seem to have conceived that time cannot be without motion, for he did not suppose that time existed before the motion of the heavens.

982. Secondly, at (760) he proves the same point by an argument, namely, from the fact that it is impossible to say or to understand time to exist without the "now," just as it is impossible that there be a line without a point, The "now," however, is something intermediate, having as part of its nature that it be at once a beginning and an end, i.e,, the beginning of a future time, but the end of a past. From this it appears that it is necessary for time always to be. For whatever time is taken, its boundary is a "now" in both senses. And this is clear from the fact that nothing is actual in time but the Itnow," because what is past has gone by, and what is future does not yet exist. But the "now" which is taken as the boundary of time, is both a beginning and an end, as has been said. Therefore it is necessary that from both aspects of whatever time is taken, time always be; otherwise the first "now" would not be an end, and the last not a beginning.

But from the fact that time is eternal, he concludes that motion too must be eternal; the reason for this conclusion being that time is a property of motion, for it is its number, as was said.

983- But the argument of Aristotle does not appear efficacious. For the "now" is to time as the point is to the line, as was explained in Book VI. But it is not necessary that a point be an intermediate, for some points are merely the beginnings of lines and others the ends, although every point would be both a beginning and an end if the line were infinite. One could not, therefore, prove that a line is infinite from the fact that every point is a beginning and an end; rather it is the other way around: from the fact of a line's being infinite, one would go on to prove that every point would be both a beginning and an end. Accordingly, it also appears that the claim that every "now" is a beginning and an end is not true, unless time is assumed to be eternal. Therefore in assuming this as a middle term, i.e., that every "now" is a beginning and an end, Aristotle seems to suppose the eternity of time—the very thing he ought to prove.

Now Averroes, in trying to save Aristotle's argument, says that the attribute of always being both a beginning and an end belongs to the "now" inasmuch as time is not stationary like a line but flowing. But this does not pertain to the proposition. For from the fact that time is flowing and not stationary, it follows that one "now" cannot be taken twice in the way that one point is taken twice, but the flow of time has nothing to do with the "now" being at once a beginning and an end. For the notion of begining and end is the same in all continua whether they be permanent or flowing, as is clear from Book VI.

984. And therefore another explanation must be furnished in accord with the intention of Aristotle, which is that he wishes to derive the fact that every "now" is a beginning and an end from what he had first supposed, namely, that "prior" and "subsequent" would not be, if time did not exist. For he uses this principle which he supposes for no other purpose, but deduces from it that every "now" is a beginning and an end. For let us suppose that some "now" is the beginning of a time; but it is clear from the definition of a beginning, that the beginning of a time is that before which nothing of the time existed. Therefore, there must be taken something "before" or "prior" to the "now" which is assumed as the beginning of the time. "Prior," however, does not exist without time. Therefore, the "now" which is taken as the beginning of a time is also the end of a time. In the same way, if a "now" be taken as the end of a time, it too will be a beginning, because an end is by definition that "after which" nothing of a thing exists; but "after" cannot be without time. Therefore, it follows that the "now" which is the end of a time is also a beginning.

985. Then at (761) he shows that motion will always be. And he shows this on the part of motion, because the argument from motion given above concluded

only that motion never began, whereas the argument from time concluded both, i. e., that it never began and that it never ceases. He says therefore that the very argument by which it was proved that motion never began can prove that motion is indestructible, i.e., that it will never end. For just as from the assumption that motion began it followed that there was a change prior to the change assumed to be first, so too, if it be supposed that motion at some time ceases, it follows that a change will occur after the one assumed to be the last,

How this follows he explains by abbreviating the more diffuse explanation he gave with regard to the beginning of motion. For he had supposed that if motion began, the mobiles and movers either began or always were. The same alternatives can be taken here, namely, that if motion should cease, the mobiles and movers will remain or they will not. But because he had previously shown that the same conclusion follows from either alternative, here therefore he uses only the one alternative, i.e., the supposition that motion ceases in such a way that the mobiles and movers also pass away.

Therefore, beginning with the assumption mentioned, he says that both the actual motion and the mobile do not pass away simultaneously, but just as the generation of a mobile is prior to its motion, so the ceasing-to-be of a mobile is subsequent to the passing away of its motion. This is so because something combustible can remain after combustion ceases.

And what was said of the mobile must also be said of the mover, because a mover in act does not in ceasing to be cease at the same time to be a mover in potency. Accordingly, it is evident that if even the mobile cease to be after the destruction of its motion, then there has to be a process by which the mobile passes out of existence.

And again, because we are supposing that all mobiles and motions are ceasing to be, it will be necessary later that even the cause of their ceasing-to-be cease to be. But because ceasing-to-be is a type of motion, it will follow that after the final change, other changes occur. But since this is impossible, it follows that motion endures forever.

986. These, therefore, are the arguments by which Aristotle intends to prove that motion always has been and will never cease, The first part of which, i.e., that motion always existed, conflicts with our faith, For our faith admits nothing as eternally existing but God alone, Who is utterly immobile—unless, of courset you wish to refer to the act of the divine intellect as a motion, but that would be an equivocal sense, and Aristotle is not here speaking of motion in that sense but of motion properly so called.

The other part of the conclusion is not entirely contrary to the faith, because, as was said above, Aristotle is not treating of the motion of the heavens in particular but of motion universally. Now we believe according to our faith that the

substance of the world indeed began, yet so as never to cease. For we posit that some motions will always exist, especially in men who will always remaing living an unceasing life either of happiness or misery.

But some, vainly trying to show that Aristotle concluded nothing contrary to the faith, have said that Aristotle does not intend here to prove as a truth that motion is eternal but to allege reason for both sides of a question that is doubtful. Rut this is a foolish statement to anyone who investigates Aristotle's procedure here. Moreover, he uses the eternity of time and of motion as a principle to prove the existence of a first principle both here in *Physics* VIII and in *Metaphysics* XII. That shows he considered it proved.

987. But if one rightly considers the arguments here given, the truth of the faith is not assailed by them, For they prove that motion did not begin through the way of nature, as some taught it did, but that it did not begin by things being created by a first principle of things, as our faith holds, cannot be proved by these arguments. And that will be evident to anyone who considers each of the inferences here drawn by Aristotle.

For when he asks whether, if motion did not always exist, the movers and mobiles always existed or not, the reply must be that the first mover always existed; other things—movers or mobiles—did not always exist, but began to exist from the universal cause of all existence. But it has been pointed out above that the production of all being by the first cause of being is not a motion, whether this coming-forth be taken to be *ab aeterno* or not. Accordingly, it does not follow that before the first change there was a previous change. But this would follow if the movers and mobiles were newly brought into existence by some particular agent acting upon some presupposed subject that would be changed from non-being to being, or from privation to form—and Aristotle's argument concerns this way of coming into existence.

988. But because we posit that at least a first mover always existed, we need to give an answer to his subsequent deduction that, if movers and mobiles pre-exist, and motion begins newly to be in them, then the movers or mobiles could not have been previously in that disposition in which they are while there is motion, and therefore, some change must have preceded the first change.

Now, if we are speaking of the motion itself, the answer is easy: the mobiles were not previously in that disposition in which they now are, because previously they did not exist; hence they could not be moved. But, as it has been said, they received their existence not through a change or motion but through coming forth from the first principle of things; accordingly, it does not follow that before the first change there was a change. But there still remains the question about the first production of things. For if the first principle, which is God, is no different now than before, then neither does he produce things now any more than

before; but if he is different, at least the change affecting him will be prior to the change which is supposed to be the first.

And indeed, if he were a cause that acts only through nature and not through intellect and will, this reason would conclude necessarily. But because he acts through will, he can through an eternal will produce an effect which is non-eternal, just as by his eternal intellect he can understand a thing that is non-eternal—the thing understood being in a certain way the principle of action in causes that act by intellect, as a natural form is in causes that act by nature.

989. But a further point must be pursued. For we do not say that a will postpones doing what it wants, unless something is expected in the future that does not yet exist in the present, as for example, when I will to make a fire not now but later, because in the future it is expected to be cold, on account of which I make the fire; or at least a presence of time is awaited. But that time succeeds time does not occur without motion. Therefore, it cannot be that a will, even if it be immutable, postpones doing what it wills, without some motion being involved, Accordingly, the new production of things cannot come forth from the eternal will except by means of motions succeeding one another *ad infinitum*.

Now those who raise this objection fail to see that it assumes a thing acting in time, i.e., something that acts on the assumption that time exists; for in this kind of action which occurs in time, one must consider some determinate relationship to this time or to things that exist in this time to explain why it be performed in this time rather than in some other time. But this reasoning has no place in the universal agent, which produces time itself at the same time that it produces other things.

For when we say that things have not always been produced by God, we do not understand that an infinite time preceded, in which God refrained from acting and that later, at a definite time, He began to act; rather, we understand that God produced at once both time and things after they did not exist. Accordingly, we must not consider in the divine will that it willed to make things not then but later, as though time were already existing; rather, we must solely consider the fact that he willed that things and the time of their duration should begin to be after they had no existed at all.

If it be asked why he willed this, it must be said without a doubt that it was for his own sake. For just as he made things because of himself, in order that in them the likeness of his goodness be manifested, so he willed that they not always be, in order to show his self-sufficiency, from the fact that, although nothing else existed, he in himself had all sufficiency of happiness and of power to produce things.

And this can indeed be said as far as human reason can grasp divine things, saving, of course, the secret of divine wisdom which cannot be comprehended by

us.

990. Because the solution of this argument proceeded on the supposition that time did not always exist, there remains the problem of solving the argument which seems to prove that time always existed. And perhaps Aristotle, after the argument from motion, gave one from time, because he thought that the one from motion would be inefficacious, unless time was assumed to be eternal. His statement, therefore, that whenever there is time there must be a "now" existing, must be granted without demur. But the statement that every "now" is both a beginning and an end should not be conceded, unless it be also granted that motion always existed, so that every indivisible of motion (which is called a "moment") should be both a beginning and an end of motion—for the "now" is to the moment as time is to motion. If, therefore, we suppose that motion has not always existed, but that we can take some first indivisible in motion before which nothing of motion existed, we can also take some "now" in time before which there was no time.

Now we have already shown, in explaining the text, that what Averroes says to bolster this argument is inefficacious. But neither is there any efficacy in what Aristotle cites to bolster his own position, namely, that "before" and "after" do not exist without time.

For when we say that a time's beginning is "that before which nothing of the time existed," we are not thereby compelled to say that the "now" which is the beginning of the time, is preceded by a time signified by the word "before," any more than in magnitudes, if I say that the beginning of a magnitude is "that beyond which nothing exists of that magnitude," it is necessary to say that the phrase, "beyond which beginning," signifies some real place existing in nature—for it signifies an imaginary one only. Otherwise, it would be necessary to posit a place beyond the universe, whose magnitude is finite and has a beginning and an end.

Similarly, the first "now" which is the beginning of time is not preceded by a time existing in reality but only in our imagination. And this is the time that is described when one says that the first "now" is the beginning of time, "before which" nothing of time exists.

Or it may be said that in the expression, "the beginning of time is that before which nothing of time exists," the word, "before," is not affirmed but denied—and so it is not necessary to posit a time before the beginning of time. For in things which exist in time, it happens that some certain time precedes their beginning, as, when it is said that the beginning of youth is that before which there was nothing of youth, the word "before" can be taken in an affirmative sense, because youth is measured by time. But time is not measured by time; hence no time preceded its beginning; hence the word "before" in the definition of time is

not taken affirmatively but negatively.

But before time there does exist a duration, namely, the eternity of God. But this eternity has no extension or any before or after as time does; rather, it is all at once—and is not of the same nature as time any more than the divine magnitude is of the same nature as a bodily magnitude.

Therefore, just as when we say that "outside" the universe there is nothing but God, we are not positing some dimension outside the world, so too, when we say that "before" the universe nothing existed, we are not positing any sort of successive duration before the universe.

Lecture 3

Arguments against Anaxagoras and Empedocles

991. After presenting the reasons showing that motion always existed, the Phillosopher here gives arguments against Anaxagoras and Empedocles who posited the contrary. About this he does two things:

First he gives an argument against their position;
Secondly, against the argument they presupposed, at 992.

He says therefore first that since it has been shown that motion always exists, it is wrong to say, as Empedocles and Anaxagoras did, that at some time motion exists and at another time it does not; for to make such a claim is a figment, because it has no basis. Something stated without a reason or the support of divine authority seems, indeed, to be a fiction. However, divine authority has more value than human reason, much more indeed than the authority of a philosopher is more valuable than the weak argument some child might give. Therefore, what is held by faith, even though it be believed without an argument is not a figment of the mind, because we believe on the divine authority approved by miracles —works that God alone can produce.

992. Then at (763) he objects against the argument on which they rested. About this he does three things:

First he suggests that their argument is unsuitable;
Secondly, that it was more unsuitable to Anaxagoras' position than to that of Empedocles, at 993;
Thirdly, he shows that even according to Empedocles' opiniont it is unsuitable, at 994.

He says therefore first (763) that it also seems a fiction that anyone, positing that motion at one time exists and at another time does not, should give as his reason that this is so because it is natural for it to be that way, and then adds that this

statement must be accepted as a principle. Now that is what Empedocles seems to say, namely, that the situation whereby during one period of time things maintain friendship, and during another are ruled by discord that sets things in motion, but in the interim are at rest, is due to a sort of necessity in things. That is like saying that the reason why heat warms is that it has to be that way, and that heat warms should then be accepted as a principle. This is exactly what Empedocles does, when he takes as a principle that it is due to an ordinance of nature that things are at one time being moved by friendship, and at another time by discord, and at another time are at rest.

Perhaps Anaxagoras, too, and others who posit one active principle would speak in a similar vein, namely, that we must accept as a principle that moti6n began to exist after not existing for an infinite period of time.

993. Then at (764) he shows that Anaxagoras used this argument in a more unsuitable way than did Empedocles. For it is clear that when something is laid down as a principle, it should be accepted as being according to the nature of a thing, i.e., that the nature of a thing is such that such a thing belongs to it. Thus we accept the principle that the whole is greater than its part, because it is the very reason and nature of a whole that it exceed the quantity of a part. Hence, when Empedocles says, "It is natural that it be that way," he gives us to understand that it should be accepted as a principle. Anaxagoras would have said the same, although he did not express it.

But it is clear that no natural thing nor anything that belongs to things naturally, can exist without ordert because nature is a cause of order. For we see that nature in its works proceeds in an orderly fashion from one thing to another. Therefore, whatever does not possess order is not according to nature and cannot be called a principle.

But two infinites have no order, one to the other, because there is no ratio between one infinite and another, whereas every order is a kind of ratio. Accordingly, it is evidently not a work of nature that things rest for an infinite time and later begin to be moved for an infinite time without there being, between this time and that, any difference to explain why motion comes to be now rather than before; any more than it is a work of nature not to assign some other order between the two thingst so that when one fails the other begins and motion comes to be, as Anaxagoras posited. These are not works of nature, because whatever is in nature either is always the same and not sometimes this way and then that way—as fire always moves upwards—or there is some reason why it is not always the same, as for example, animals do not always continue growing but reach a point when they start to decrease—and for this there is a reason.

Accordingly, it does not seem to be according to nature that for an infinite time

things be at rest and later begin to be moved, as Anaxagoras assumed.

Hence it is better to say, as Empedocles said—and those who believed as he—that the whole universe is at rest at one time and in motion at another, because at least in this case there would be order, for there can be a ratio between one finite and another.

It should, however, be considered that the tenet of our faith is not akin to Anaxagoras' position, for we do not assume before the world any infinite reaches of time that have to be related to a later time; rather, before the world began, only the simple eternity of God existed, and that is outside the genus of time.

994. Then at (765) he shows that the above-mentioned argument is not appropriate in Empedocles' situation either.

First he explains the proposition;
Secondly, he rejects a false interpretation, at 995.

He says therefore first (765) that even the holder of Empedocles' theory ought not to assert the fact only but also should explain the cause of his statement and not go beyond what is required by the cause he assigns. Nor should he accept anything as an axiom, i.e., as a principle without reason; rather, whatever is accepted as a principle should be explained either by induction, as is done in the case of natural principles based on sense experience, or by demonstration, as in the case of those principles which are proved by prior principles. But Empedocles does not do that. Granted that he posits friendship and discord as causes, yet it is not the property of friendship or hostility that one should cause motion after the other. For it is not the nature of friendship to be changed into hostility, or vice versa; though it is of the nature of friendship to gather and of hostility to scatter.

But if it is further determined that at one time the one gathers and that at another time the other scatters, it must be further made clear by definite instances in which this occurs. For example, that friendship gathers and discord scatters is manifested among men, because by the former men are united but by the latter they fly from one another. So Empedocles supposed that this is what happens in the whole universe, because it seems to happen in certain cases. But that according to equal periods friendship should move at one time and discord at another, needs to be supported by argument, since that is not seen to happen among men.

995. Then at (766) he rejects a false assumption. For someone could believe that whatever is eternal has no cause, since whatever we observe as being caused among us is something that begins newly to be. Consequently, it seemed to some that when a discussion reached something that always existed, there was no need to inquire any further for a cause or a reasons In this vein Empedocles could say that friendship and discord had always caused motion according to

equal times and therefore no reason for it need be sought. But Aristotle disqualifies this by saying that it is a wrong assumption to suppose that we have an adequate first principle in virtue of the fact that something always is so or always happens so. In this way Democritus reduced all the causes that explain nature to something existing always: he assigned a principle for things that begin newly to be, but would not look for a principle of what has always been, Now this is true in some things and not in others. For it is clear that a triangle always has three angles equal to two right angles, but even of this eternal property there is a cause other than the fact. But some things are indeed eternal, such as principles, that do not have a cause.

996. Very special attention should be paid to what is here said, because, as is mentioned in *Metaphysics* II, the arrangement of things in existence and in truth is the same. Therefore, just as some things are always true and yet have a cause of their truth, so Aristotle understood that there are some eternal beings, namely, the heavenly bodies and separated substances, which nevertheless have a cause of existence.

From this it is evident that although Aristotle posited a world that was eternal, he did not believe that God is not the world's cause of existence but of its motion only, as some maintained. Finally, he concludes his main proposition with a summary. And he says: "Let this conclude what we have to say in support of our claim that there never was a time when there was not motion and there will never be a time when there will not be motion."

Lecture 4

Solution of arguments concluding motion was not always

997. After giving arguments proving that motion always exists, the Philo*per accidens*sopher now intends to answer objections to the contrary. About this he does two things:

First he gives the arguments;
Secondly, he answers them, at 1000.

In regard to the first he gives three arguments, after first stating that it is not difficult to solve the objections contrary to his position. And he says that there are three main arguments from which it seems to follow that motion began to be at some time after previously not existing at all.

The first of these is that whereby he proved in Book VI that no change is infinite, because by the same argument it can be proved that no change is eternal. For no terminated change is eternal any more than it is infinite. But every change is terminated. For every motion is naturally from something to something, and

these two are contraries; hence, of necessity, the termini of any change are the contraries within the sphere of that change. But because contrariety of termini is not evident in all cases of local motion, Aristotle adds something common to every motion, namely, that nothing is moved to infinity, because nothing is moved to what it cannot reach, as has been said in Book VI, Accordingly, it is clear that no motion is perpetual, just as it is not infinite. If, therefore, no motion is perpetual, it also seems possible to posit a time in which there is no change. This first argument is taken from motion.

998. The second argument is based on the mobile, at (768). It is this: If motion cannot newly come to be when previously it was not, it seems fitting to say of anything that either it is always in motion or never in notion; because if motion can sometimes be and sometimes not be in one particular mobile, why not for the whole universe? But we see that it is possible for something to be moved that previously was not moved as a whole, and that had no motion in itself with respect to any of its parts, as is apparent in non-living things, among which some mobile begins at one time to be moved when previously no part had been moved, nor the whole itself, but it was completely at rest. It remains, therefore, that in the whole universe there can be motion where previously there was none.

999. But because in non-living things, even though motion is seen to begin anew in something when previously there was none at all, yet motion appears to have been pre-existing in something external by which it is moved, he accordingly gives a third argument from animals, which are moved not from without but by themselves.

This argument is at (769). and it says that it is more evident in animals than in the non-living that motion begins after previously having not existed. For when we have rested for a time so that ho motion exists in us, we begin at a certain time to be moved and the principle of our motion is from our very selves even if nothing external moves us. This, however, does not happen in non-living things, because they are moved always by something external, such as the cause that generates them, or a cause that removes an obstacle, or a cause that subjects them to force. From this it follows, if an animal is at one time entirely at rest, that motion begins to exist in an immobile being after previously not existing in it, which motion does not originate from an external mover but from the very thing that is moved. And if this can occur in an animal, there is nothing to prevent its occuring in the universe. For an animal and especially man possesses a likeness to the world; wherefore it is said that man is a small world. Accordingly, if in this small world, motion can begin after previously not existing in it, it seems that the same can happen in the large world. And if this happens in the world, it can happen in the infinite whole, which some assumed exists beyond the world—provided, of course, that there is something infinite that can rest and be moved.

1000. Then at (770) he answers these arguments in order.

In answer, therefore, to the first he says that it is correct to say that motion which occurs between contraries cannot always endure as one and the same numerical motion, because perhaps this is necessary, as will be proved later—and he leaves this in doubt, because it has not yet been proved. But because someone could say that even motion which is between contraries can be always numerically the same on account of maintaining the same mobile which is repeatedly moved from one contrary to another—for example, if it is first moved from white to black, and then from black to white, and so on throughout time—he then adds that it is not possible that a motion which is always in one and the same mobile be kept one and the same by repetition. And he explains this by an example: Let the same chord be continually struck on a lyre and let the striker be unvarying in his striking; one may ask whether the motion and sound of the one chord struck twice is one and the same or continually other and other.

Yet whatever be the case with other mobiles, there is nothing to prevent a motion which is not between contraries, such as a circular motion, from being the same continual and perpetual motion. This will be made clearer from later development. Therefore, although every motion is finite with respect to its termini, yet by repetition some motion can be continuous and perpetual.

1001. Then at (771) he answers the second argument. And he says that it is nothing unusual for a non-living thing to begin to be moved when previously it was not being moved, provided that this occurs because an external mover is present at one time and not at another. For it is clear that motion must pre-exist on the part of a mover which at some time becomes near but previously was not so. However, this seems to be a point to be looked into as a problem, namely, whether, if a mover exists, the same object can be at one time moved by this mover and at another not—for he had previously said that such a thing cannot happen unless there intervenes some change affecting either the mover or the mobile. Accordingly, motion always pre-exists, whether or not a mover pre-exists. Now this point seems to need investigation, because whoever proposed this argument seems to be certain about everything but one factor, namely, whr it is that things at rest do not always rest, and mobiles are not always in motion.

1002. Then at (772) he answers the third argument, And he says that the third objection causes the greatest problem about whether motion can exist after previously not existing, based on what is seen to happen in living things. For it seems that an animal which previously was at rest, later begins to move about without any external cause of motion; accordingly, it seems that that motion of the animal was not preceded by any motion, either in the animal or in anything else, as happens in non-living things.

But it is false that the motion of the animal does not come to be from something external. For we always observe in animals something naturally moved, whicht namely, is not moved through will. And the cause of its be,ing moved naturally is

not the animal through its appetite, but perhaps the cause of this natural change is its surroundings, i.e., the air, and beyond that the heavens, as is plainly the case when the body of an animal is altered by heat or coldness of air.

And he says, "perhaps," because in an animal something is also moved naturally by an internal principle, as is evident in those changes which occur in the vegetal soul, such as are the digestion of food and the subsequent transmutations, which are called "natural" because they do not follow upon apprehension and appetite. And because this seems to be contrary to what is proper to an animal, which is to move itself, he adds that when we say that an animal "moves itself," we do not understand this of any and every motion, but of local motion, according to which an animal moves itself through apprehension and appetite.

Accordingly, there is nothing to prevent—indeed, it is necessary—many changes from taking place in the body of au animal on account of its surroundings, i.e., the air and the heavens, some of which changes move the understanding or the appetite, by which in turn the whole animal is moved.

1003. It should be noted that Aristotle here declares the way in which heavenly bodies act upon us. For they do not act directly on our souls but on our bodies; but when our bodies are moved, then *per accidens* a change occurs in the powers of the soul, which are acts of bodily organs, but not necessarily in the intellect and the intellective appetite, which do not use bodily organs. Yet the intellect and will sometimes follow upon some of these changes, as when a person through his reason chooses either to pursue or to reject or to do something on account of a passion which began in the body or in the sensitive part. And therefore Aristotle does not say that all motions caused by the surroundings move the intellect or appetitet but that some of them do. In this way he excludes necessity from the intellective powers.

Of the things he said he gives an example from sleeping things, in which there seems to be maximum rest with respect to animal motions. But even though during sleep there be no motion that is sensible, i.e., proceeding from sense apprehensiong animals rise awakened by some motion existing within, due either to the work of the nutritive soul, as when, as a result of the food's being digested, the vapors which caused sleep vanish and the animal is aroused, or when the body is altered by its surroundings, from heat or cold.

Thus it is clear to anyone who considers the matter diligently that no motion ever newly appears in us unless some other motion preceded. And he promises to give a fuller explanation of this later.

Lecture 5

Five ways in which things may be disposed with respect to motion or

rest.
Two first excluded.

1004. Having shown in Book VII that there is not an infinite process in movers and in mobiles but that a first must be reached, and having now shown that motion has always been and always will be, the Philosopher goes on further to consider the condition of the first motion and of the first mover. And his treatment is divided into two parts.

> In the first he shows that the first motion is eternal and that the first mover is entirely immobile;
> Secondly, from this he proceeds to show the condition of the first motion and of the first mover, (L. 14).

The first is divided into three parts:

> In the first he gives a division having five members;
> In the second he excludes three members of this division, at 1006;
> > Thirdly, he investigates the two remaining members to see which of them is truer, because the truth of what he intends to settle depends on it, (L. 6).

1005. He says therefore first (773) that the reason for the following consideration, in which we intend to investigate about the first motion and the first mover, is that it pertains to a question he raised in answering the second argument (given in the preceding lecture), namely, that of whence it happens that certain things are at one time in motion and at another time at rest, and are not either always in motion or always at rest since motion in common is considered perpetual.

And he says that the ways in which things are disposed with respect to motion or rest are necessarily limited to three. The first of which is that all things be always at rest and nothing ever in motion; the second is that all things be always in motion and nothing at rest; the third way is that some things are in motion and others at rest.

But the third way is again divided into three ways. The first of these is that some things are in motion and some at rest in the sense that the ones in motion are always in motion and those at rest always at rest, and nothing is at one time in motion and at another time at rest.

The second way is the converse, ioeol that all things are apt to be in motion and to rest and that nothing is either always in motion or always at rest.

The third way is that certain things are always immobile and never in motion; others are always mobile and never at rest; still others may be taken with both, i. e., with motion and rest, so as to be in motion at one time and at rest at another.

This last member must be determined by us to be the truth, because in it are contained the solutions of all objections. And when we shall have shown this, we shall possess the end which we intend in this work, namely, to arrive at a first eternal motion and a first immobile mover.

Therefore, it is in the above manner that the third member of the first division is divided into three members, thus making a general division consisting of five members.

Now, it should be noticed that in three of these members all things are respectively put in one definite disposition; for example, in the first member all things are taken to be always at rest; in the second all things are always in motion; and in the fourth all things alternate between motion and rest. But in one member, namely, the third, beings are divided according to two dispositions, so that some are always in motion and others always at rest. Finally, in one member, the fifth, beings are divided according to three dispositions; namely, some are never in motion, others are never at rest, while the others are sometimes in motion and sometimes not. Notice, too, in this last member that it is not rest but immobility that is posited; because the first mover, who is never moved, can not strictly be said to be at rest, for, as was said in Book V, only what is apt to be moved, and is not being moved, is properly said to be at rest.

1006, Then at (774) he excludes three members of the division.

> First he posits that not all things are always at rest;
> Secondly, that not all things are always in motion, at 1007;
> > Thirdly, he excludes the third member, in which it was said that the things in motion are always in motion and those at rest are always at rest, (L. 6).

In regard to the first he posits three statements. The first of these is that it is due to a weakness of understanding that some affirm rest of all things and in support of their stand search for a sophistic reason without referring to sense. For it proceeds on the fact that the intellect is not capable of destroying sophistical arguments which conflict with things evident to sense. But it has been said in *Topics* I that there is no need to dispute against positions or problems that are in a mind which needs sense or punishment. Hence it is not necessary to dispute this position, due to its stupidity.

The second thing he says is that this problem does not concern a particular being but being in general. Nor does it affect natural science alone, but in a way all demonstrative sciences and all opinions, i.e., all the arts which use opinions, as do rhetoric and dialectics, for all the arts and sciences make use of motion. For the practical arts in a way direct certain motions, and natural philosophy speculates about the nature of motion and about mobile beings. Mathematicians, too, make use of motion, i.ee, of an imagined one, saying that a point in motion

makes a line. The metaphysician, however, considers first principles. Accordingly, it is plain that to destroy motion conflicts with all sciences.

Now an error that affects all beings and all sciences is not to be reproved by the philosopher of nature but by the metaphysician. Thereforet it is not the business of natural philosophy to dispute this error.

The third thing he says is that unreasonable and inappropriate problems about the principles of mathematical sciences do not pertain to mathematics to be answered. The same is true in the other sciences. In like manner, it is not the business of the physicist to destroy an affirmation that is contrary to its principles. For in each science the definition of the subject is assumed as a principle; hence in the science which deals with nature, it is assumed as a principle that nature is a principle of motion. Accordingly, in the light of these three statements, it is apparent that it does not belong to natural philosophy to dispute this position.

1007. Then at (775) he excludes the second member, in which Heraclitus posited that all things are always being moved. And first he compares this opinion with the previous one which posited that all things are always at rest; and he says that to say that all things are always in motion, as Heraclitus said, is both false and contrary to the principles of natural science. Yet this position is not in as great conflict with the art as the first one is.

But that it does conflict with the art is clear, because it takes away the assumption of natural science that nature is principle not only of motien but also of rest, which supposition makes it clear that rest is something natural just as motion is. Hence, just as the first opinions which destroyed motion, was against natural science, so too is this one that destroys rest.

The reason why he says that this opinion is less against art is that rest is nothing more than the privation of motion. But it is less evident that there is no motion than that there is no privation of motion. For there are some motions so weak and insignificant that they can be scarcely noticed; for that reason it is easy to suppose that something is at rest when it really is not. But great and strong motions cannot be concealed; hence it cannot be said that the senses are deceived in perceiving motion as they are in perceiving rest.

Therefore, secondly, at (776) he shows how some posited this second opinion. And he says that some, such as Heraclitus and his supporters, have said that all things which exist are always in motion, and not some things only or just at some time, but this motion eludes our senses. Now, if they say this of some motions, they are correct; for some motions do elude us. But because they do not qualify their statement but speak of all motions, it is not hard to find arguments against them, for there are many motions which evidently could not have existed always.

1008. Thirdly, at (777) he forms the arguments against this position.

First with respect to the motion of growth;
Secondly, with respect to the motion of alteration, at 1009;
Thirdly, with respect to local motion, at 1012.

The reason he begins with growth is that Heraclitus was led to his doctrine as a result of considering growth. For he observed that a person grows a small amount in one year and, supposing that growth is continuous, he believed that in each part of that year he was increased with respect to part of that quantity; and yet that increase is not sensed, because it comes in a small portion of time, He reasoned, therefore, that the same thing happens in other things which seem to be at rest.

Against this Aristotle says that it is not possible for a thing to be continually increased or diminished so that the increased quantity can be divided according to time in such a way that in each part of time there is a corresponding increase. Rather, there is, after the increase of one part, a time in which there is no increase but a disposition is produced for the increase of the next part.

And this he explains with kindred examples. The first of these is that we see that the multiplication of drops of rain breaks a stone. The second example is that we see that things being born, i.e., that plants born in stones divide the stones. Now, we cannot say that, if the repeated drops dig out or remove a certain quantity of the stone in a given time, half of this number of drops in half the time would previously remove half of that quantity. But what happens here is what happens with regard to shiphaulars. For it does not follow, if 100 men pull a ship a certain distance in a given time, that fifty of them will move it half the distance in the same time or the full distance in twice the time—this was said in Book VII. So also it does not follow, if many drops cave in a stone, that some part of those drops had previously removed the half in some certain time.

The reason for this is that what is removed from the stone by many drops is indeed divisible into many parts, but none of them is removed separately from the stone, for all the parts are removed at once, in the sense that they are in the totality removed in potency.

And he is speaking here of the first total quantity that is removed, for there is nothing to prevent that, over a long period of time, such a large quantity, be removed from the stone by these drops that a certain part may have been removed previously by a part of these drops. But we must come to a removed quantity which is removed all together and not part after part. Therefore, in the removing of that whole, none of the preceding drops removed anything, but merely disposed for its removal. However, the last acts in virtue of all and removes what the others had disposed to be removed.

The same is true in the motion called decrease. For it is not necessary, if something decreases a certain amount in a given time (even though the quantity be divided *ad infinitum*), that in every part of that time a corresponding part of the removed quantity should depart; rather, at some time a given amount will depart all together. The same holds in increase. Consequently, it is not required that something be continuously increased or decreased.

1009. Then at (778) he contradicts the above-mentioned position of continuous motion with respect to alteration, and this with three arguments. First, he says that what was said about increase, applies also to alteration. For although a body that is being altered is infinitely divisible, that is no reason for supposing that alteration is divided *ad infinitum*, so that for each period of time a part of the alteration should occur. Rather, alteration very often takes place swiftly, i.e., many parts of the altered body are altered all at once, as happens when water is condensed or congealed. For a whole mass of water is congealed all at once and not part after part (although if it be a large mass of water, there is nothing to prevent part congealing after part).

It should be noticed that what Aristotle says here about alteration growth seems contrary to what was said in Book VI, where it was shown that motion is divided according to the division of the time, and of the mobile, and of the sphere of motion.

But it should be recognized that in Book VI Aristotle was talking about motion in common, without application to definite mobiles. Therefore, what he discussed there must be taken according to the requirements of motion's continuity; but at present he is speaking of motion with application to definite mobiles, in which a motion can be interrupted and not be continuous, which, when viewed under the common aspect, could be continuous.

1010. He gives the second argument at (779), and he says that if a sick person is to get well, he has to become healed in a period of time and not in a terminus (an instant?) of the time. And it is further necessary that the very change, which is healing, tend to a definite terminus, ie., to health and not to anything else. Accordingly, every alteration requires a definite time and a definite terminus, because every alteration tends to a contrary, as was said in Book V. But no such change is always continuous. Therefore, to say that something is being always and continuously altered, is to speak against the facts.

1011. The third argument he gives at (780) and he says that a stone does not become harder or softer, even after a very great period of time; thus it is foolish to say that all things are always being altered.

1012. Then at (781) he contradicts the opinion at issue with respect to local motion, on two counts. First, indeed, because some local motions and rests are so evident that they cannot be hidden. For it would be strange if it were hidden

from us when a stone is carried downwards or when it is at rest on the earth. Consequently, it cannot be said that, because of the concealment of local motions, all things should be supposed to be always being moved locally.

Tnl3. Secondly, at (782) he argues thus: Earth and any other natural body, when they are in their due placest rest from a necessity of nature and are not removed except by force. But it is evident that certain natural bodies are in their due place. Therefore, it is necessary to say that some things are at rest with respect to place and that not all things are being moved locally.

Finally, he concludes in summary that, from the foregoing and other things similar to the foregoing, anyone can know that it is impossible for all things always to be in motion, as Heraclitus said, or for all things always to be at rest, as Zeno and Parmenides and Melissus said,

Lecture 6

A third member of the division is rejected

1014. Having disposed of two members of the foregoing division, the Philosopher now rejects a third, in which it was posited that things are divided into two dispositions only, in such a way, namely, that some things are always at rest and others always in motion, and there is not a third class of things that are sometimes in motion and sometimes at rest. He rejects this in two ways.

He does this first (783) in the same way that he rejected the two previous positions, namely, on the ground that they are contrary to sense observation. For we see by the senses not only that some things are in motion (which destroys the first position, namelyt of those who posit all things to be always at rest), and that some are at rest (by which is destroyed the second position, of those who maintain that all things are always in motion); but we also see that the aforementioned changes or variations from motion to rest, and from rest to motion, occur in the same things. This shows that there are some things which are sometimes moved and sometimes at rest.

1015. In a second way at (784) he rejects the same opinion on the ground that the one who would engender this doubt would be contrary to what is evident in nature. In the first place it would deny the motion of growth, for we see that growth takes place in things that are not always growing, because, were they always growing, they would be tending not to a definite quantity but to the infinite.

In the second place it would deny compulsory local motion, for a motion is not compulsory, unless something is moved not in keeping with its nature when previously it was naturally at rest; for a forced motion is nothing more than a

departure from natural rest. If therefore nothing at rest can be moved, it will follow that what is naturally at rest cannot later be moved by compulsion.

In the third place generation and ceasing-to-be would be excluded by this opinion. For the former is a change from non-being to being, and the latter from being to non-being. Therefore, in order that a thing cease to be, it ought previously to have been existing for a time, and in order that a thing be generated, it ought previously not to have been existing for a time. But whatever is a being or a non-being for some time is at rest (where rest is taken in a very general sense), If, therefore, nothing at rest can be moved, it follows that nothing which is for some time a non-existent can be generated, and that nothing which exists for a time can cease to be.

In the fourth place this position destroys all motion universally, because every motion involves generation and ceasing-to-be either absolutely or in a qualified sense. For what is being moved toward something as toward a terminus is being made such-and-such, so far as alteration and growth are concerned, or being made to be in such-and-such, so far as local motion is concerned; for example, what is being changed from black to white, or from small to large, becomes white or large, but whatever is being moved to a place comes to exist in that place. But from the fact that something is changed from its *terminus a quo*, a "such and such" ceased to be, when it is a case of alteration and growth, and a "there" ceased to be, if it is a case of local motion. Therefore, because in every motion there is generation and ceasing-to-be, it consequently rejects all motion.

Because such things are impossible, it becomes clear that some things are being moved, but not always; and that some things are at rest, not always, but sometimes.

1016. Then at (785) he studies the other two members of his division.

> First he reveals his intention;
> Secondly, he pursues it, (L. 7).

About the first he does three things:

> First he shows to which opinion the fourth member pertains;
> Secondly, he summarizes what has been said in this chaptert at 1017;
> Thirdly, he states what remains to be said, at 1020.

He says therefore first (785) that to posit that all things are sometimes at rest and sometimes in motion pertains to the ancient arguments which we touched upon in discussing the eternity of motion. For Empedocles seems to be the chief protagonist of this opinion that all things are at some time moved by friendship and by discord and in the meantime are at rest.

1017. Then at (786) he sums up what has been said in this chapter.

First he recalls the divisions previously made;

Secondly, he recalls the rejection of the first member which posited all things at rest, at 1018;

Thirdly, the rejection of the other two members, at 1019.

He says therefore first (786) that in order to make clearer the intention of what follows, we must begin with what has just been determined and use the same principle as before, namely, that beings must maintain themselves in one of three dispositions, i.e., either that all are at rest or all in motion or some at rest and some in motion. And this third is again divided into three members, for if all things are such that some are at rest and others in motion, then necessarily all must be at one time at rest and at another in motion, or some are always at rest and others always in motion, or to these two a third member may be added, namely, that there are others of which some are at rest not always but sometimes, while the others are in motion sometimes but not always.

l018. Then at (787) he rejects the first member and says that it was said above that it is not possible for all things to be always at rest; but something else must now be added. And he says two things against this position.

First, some motion must be posited at least in the soul. For should anyone want to say that according to truth it is a fact that nothing is being moved (as the followers of Melissus did, who posited that being is infinite and immobile), yet it is also a fact that this does not appear to be so according to sense, for many things appear to the senses to be moving.

If, therefore, anyone declares as false the opinion by which we believe that some things are in motion, it still follows that motion exists. For if there is false opinion, there is motion; and universally if there is opinion, there is motion and, likewise, if there is imagining, there is motion. The reason is that imagining is a motion of the sensitive part and is produced by the sense in act. Opinion also is a certain motion of the reason and proceeds from several acts of reasoning. But it follows even more strongly that there is motion in opinion and imagining, if things appear to be this at one time and that at another. This happens when things at one time seem to us to be at rest and at another time not to rest. Thus, it entirely follows that motion exists.

He says, secondly, against the opinion at issue, that to have the intention of destroying this opiniong and to look for an argument to prove those things that we ought to hold in a respect surpassing the need for proof, since they are accepted as self-evident. To do this, I say, is no different from judging poorly between what is better and what is worse in morals, and between what is credible and incredible in logical matters, and between a principle and a non-principle in matters of demonstration.

For whoever looks for arguments to prove things which are self-evident and,

consequently, held as principles, does not recognize them for principles so long as he intends to prove them through other principles. Likewise, it seems that he does not recognize what is credible and what is incredible, because he is trying to prove what is *per se* credible through something else, as though it were not *per se* credible. Nor does he seem capable of distinguishing between the better and the worse who tries to prove the more evident by means of the less evident. But it is self-evident that some things are in motion. Therefore, we should not address ourselves to trying to prove this by arguments.

1019. Then at (788) he rejects two more members of his original division. And he says that just as it is impossible for all things to be always at rest, so too is it impossible that all things be always in motion, or that some things are always in motion and some always at rest, so as to leave nothing which is sometimes in motion and sometimes at rest. Against all this, sufficient credence arises from one medium, namely, the fact that we see that some things are sometimes in motion and sometimes at rest. Hence, it is clear that it is impossible to say that all things are continually at rest—which was the first member—and that all things are continually in motion—which was the second member—or that some are always in motion and the remainder always at rest without any mediate possibility.

1020. Then at (789) he shows what is left to be said, and he concludes from the foregoing that since three members of the division cannot stand, what remains is to consider which of the other two is the truer, whether, namely, all things are capable of both motion and rest, or whether some are capable of both motion and rest while still others are always at rest and others always in motion. This last is what we intend to demonstrate. In this way it will be shown that the first motion is eternal, and the first mover immobile.

Lecture 7

Universally, whatever is moved is moved by another

1021. After revealing his aim, the Philosopher now begins to execute it, namely, to establish that not all things are sometimes in motion and sometimes at rest, but that something is entirely immobile, and something always in motion. The treatment is divided into two parts.

> In the first he shows that the first mover is immobile;
> In the second that the first mobile is always being moved, (L. 13).

The first part is divided into two sections:

> > In the first he shows the immobility of the first mover from the order of movers and mobiles;

In the second, from the eternity of motion, (L. 13).

The first is divided into two parts:

In the first he shows that the first mover is immobile;
In the second that the first mover is eternal, (L. 12).

About the first he does two things:

First he shows that to prove what follows depends on showing that whatever is moved is moved by another;
Secondly, he shows the proposition, (L. 9).

He had indeed showed above, in the beginning of Book VII, that whatever is moved is moved by another, by a generic argument based on motion itself, but because he has now begun to apply motion to mobile things, he here shows that what was previously proved in a universal way is verified universally in all mobiles and movers. Hence the first part is divided into two parts:

In the first he gives a division of movers and mobiles;
In the second he explains his proposition in individual cases, at 1024.

About the first he does two things:

First he divides movers and mobiles;
Secondly, he explains the division, at 1023.

1022. He gives therefore first (790) three divisions of movers and mobiles. The first of these is that among movers and mobiles some move or are moved *per accidens*, and some *per se*. And he takes "*per accidens*" in a wide sense include what moves or is moved with respect to a part. Hence in explaining what he means by "*per accidens*, he adds that things cause motion or are moved *per accidens* in two ways. (1) Whatever things are said to cause motion by virtue of being present in things which move are said to cause it *per accidens*, as when it is said that a musician causes health, because a knowledge of music is present in the one who heals; and likewise things are said to be moved *per accidens* either on account of existing in what is being moved in the way that an object in place exists in a place, e.g., when we say that a man is being moved, because the ship on which he is is being moved, or on account of being an accident in a subjects as when we say that the white is being moved, because a body is being moved. (2) In another way, things are said to move or to be moved *per accidens*, because they move or are moved with respect to a part, as a man is said to strike or be struck, because his hand strikes or is struck.

But when these two *per accidens* ways of causing motion or being moved are eliminated, things are said to move or to be moved *per se*, i.e., when they are not said to cause motion or be moved by virtue of being in the cause of motion or in what is being moved, or because some part of them causes motion or is

moved.

Therefore, leaving out what causes motion or is moved *per accidens*, he subdivides things that are moved *per se* into those which are moved by themselves, as are animals, and those moved by others, as are the non-living.

He gives a third division, namely, that some things are moved according to nature and some not according to nature.

1023. Then at (791) he explains how to discern what is according to nature and what is not according to nature, both in things that are moved by themselves and in things that are moved by something else.

First, with respect to things that are moved by themselves—such as are animals, which move themselves—he says that they are moved according to nature. And he proves this on the ground that they are moved by an intrinsic principle, and since things whose principle of motion is within are said to be moved by nature, it follows that an animal's motion, by which it moves itself, if it is compared to the whole animal, is natural, because that motion proceeds from the soul which is the nature and form of the animal. But if it be compared to the body, an animal's motion may be both natural and not according to nature. The difference depends on the type of motion and on the element of which the animal is composed. For if an animal consists of a predominant heavy element, as does the human body, and it is moved upwards, such a movement would be compulsory with respect to the body; but if it is moved downward, it will be a movement that is natural to the body. However, if there were animals whose bodies were composed of air, as Platonists held, then the contrary would be true.

Secondly, he explains how to discern compulsory and natural motions in things that are moved by another. Of these, some, he says, are moved according to nature, as fire upward and earth downward; others are moved outside their nature, as earth upward and fire downward, which is a compulsory motion.

Thirdly, he mentions another type of unnatural motion in animals, namelyt those in which the parts of animals are moved in an unnatural way, their positions and the character of the motion being abnormal. For example, a man's arms bend (at the elbow) facing forward, while his legs bend (at the knee) facing backward; but dogs and horses and the like, bend the forelegs facing backward and the hind legs facing forward. If motions contrary to these are made, they will be compulsory and not according to nature.

1024. Then at (792) he proves that everything that is moved is moved by another.

> First he manifests it in cases that are evident;
> Secondly, in cases about which there is doubt, at 1025.

Leaving aside things that are moved *per accidens*, because such things are not

moved but are merely said to be moved when other things are moved, and confining ourselves to those which are moved *per se*, it is clear, especially in things moved by compulsion and outside their nature, that what is moved is moved by another.

For in the case of things moved by compulsion, it is clear from the very definition of compulsion that they are moved by another. For compulsion, as is said in *Ethics* III, is that whose principle is from without, with the thing suffering it contributing nothing.

After things that are moved by compulsion, it is clear that what is moved is moved by another if we consider things moved by themselves according to nature, as animals are said to move themselves. For in animals it is clear that something is being moved by something else—but there might yet be a question as to how to distinguish in them the mover and what is being moved. For at first glance it appears to many that what is true with respect to ships and other artifacts which do not exist according to nature, namely, that the part which causes motion is diverse from the part which is moved, applies to animals, for it seems that the soul which causes motion is related to its body which is moved, as the mariner is related to the ship, as is said in *On the Soul* II. In this way it seems that the whole animal moves itself insofar as one part moves another. But whether the soul is related to the body as a mariner to a ship he leaves to be investigated in his treatise *On the Soul*. However, the fact that a thing is said to move itself, insofar as one part thereof moves and another is moved, will be shown later.

1025. Then at (793) he explains his proposition in regard to things in which it is more doubtful. About this he does three things.

> First he sets down those things in which it is more doubtful that whatever is moved is moved by another, namely, in the heavy and the light, when they are moved according to nature.
>
> Secondly, he shows that they do not move themselves, at 1026;
>
> Thirdly, he shows by what they are moved, (L. 8).

He says therefore first (793) that, since it is in things moved by compulsion, and after them in things which move themselves, that it is especially evident that whatever is being moved is moved by another, the greatest doubt appears to be in the remaining member of the last division, namely, in things that do not move themselves, but yet are moved naturally.

The "last" division to which he refers is that in which he divided things that are moved not by themselves but by another into those that are moved contrary to nature, and those that are moved according to nature. In these latter there is doubt as to what moves them: for example, heavy and light objects are moved to their proper places according to nature—i.e., the light upwards and the heavy

downwards—and into contrary places by compulsion; but the source of their motion when they are moved according to nature is not clear, as it is when they are moved contrary to nature.

1026. Then at (794) he proves with four arguments that these things do not move themselves. The first of which is that to move itself pertains to the notion of life and is peculiar to living things; for it is through motions and sensations that we distinguish the animate from the inanimate, as is said in *On the Soul* I. But it is manifest that the heavy and light as such are not alive, or animate. Therefore, they do not move themselves.

1027. The second argument is given at (795); Things that move themselves can cause themselves to stop, as we see that animals are moved and stop by reason of their appetite, Therefore, if heavy and light things moved themselves with a natural motion, they could cause themselves to stop, in the way that a person who is the cause of his walking is so also of his ceasing to walk. But we see that this is false, because the heavy and the light do not stop outside their proper places, unless some external cause intervenes to halt their motion. Therefore, they do not move themselves.

But because someone could say that although such things are not the cause of their own stopping outside their proper places, yet they are the cause of stopping in their proper places, he adds a third argument at (796): it is unreasonable to say that things which move themselves are so moved according to one motion alone and not by many, because what moves itself does not have its motion determined by another but determines its own motion for itself, so that at one time it determines this motion and at another time that one. Hence it is in the power of what moves itself to determine for itself this or that motion. Therefore, if heavy and light things moved themselves, it would follow that if it were in the power of fire to be moved upward, it would also be in its power to be moved downward, which is something we never see occurring, unless from an extrinsic cause. Therefore, they do not move themselves.

It should be recognized that these two arguments are probable in respect to what appears in things among us that move themselves, which are found at one time to be moved with this motion and at another time with that motion, and at another time to be at rest. Hence he does not say, "It is impossible," but "It is unreasonable," which is his manner of speaking when he talks of what is probable. For he will show later that if something is moving itself and it is an entirely immobile mover, that it is always being moved and with one motion. Yet that could not be said in regard to heavy and light things, in which there is nothing that is not moved either *per se* or *per accidens*, and they are also generated and cease to be.

1028. He gives the fourth argument at (797): No continuum moves itself. But

heavy and light bodies are continua. Therefore neither of these moves itself.

That no continuum moves itself he proves in the following manner: The mover is related to the moved as agent to patient. But since the agent is contrary to the patient, that which is apt to act must be divided from what is apt to be acted upon, Now, to the extent that things are not in mutual contact but are completely one and continuous in quantity and form, to that extent they can not be acted upon by one another, In this way, therefore, it follows that no continuum moves itself, but the mover must be divided from what is moved, as is evident when non-living things are moved by living things, as is a stone by the hand, Hence, too, in animals that move themselves, there is rather a connection of parts than a perfect continuity (for which reason one part can be moved by another), a situation that is not verified in the light and the heavy.

Lecture 8

What moves the heavy and light. Everything moved, moved by another.

1029. After showing that the heavy and the light do not move themselves, he shows.by what they are moved.

> First he shows by what they are moved;
> Secondly, he concludes to his main intention, at 1036.

About the first he does two things:

> First he shows that they are naturally moved by something;
> Secondly, he investigates by what they are moved, at 1030.

He says therefore first (798) that although the heavy and the light do not move themselves, they are nevertheless moved by something. And this can be made clear if we distinguish moving causes. For just as in things that are moved, we must take it that (1) some things are moved according to nature and some not, so also in movers, some move not according to nature, e.g., a stick, which is not naturally capable of moving a heavy body such as a stone; and that (2) some things move according to nature, as what is actually hot naturally moves what is according to its nature potentially hot, and similarly in other cases. And just as what is in act causes motion naturally, so what is in potency is naturally moved, with respect either to quantity or quality or where.

And because in Book II he had said that those things are moved naturally whose principle of motion exists in them *per se* and not by virtue of some concomitant attribute, which might lead one to suppose that what is only potentially hot is, when it becomes hot, not moved naturally in that it is being moved by an external active principle of its motion, he now adds, as though to preclude this objection, "since it has a principle of this kind in itself and not accidentally," as if

to say that in order that a motion be natural, it is enough that a principle of this kind, i.e., the potency, about which he made mention, exist in that which is moved *per se* and not *per accidens*, as a bench is potentially combustible, not precisely as bench but as wood.

Hence in explaining the expression "*per accidens*," he adds that the same subject can be quantified and qualified, but one of these is related to the other *per accidens*; what is potentially of such and such a quality is also potentially quantified, but *per accidens*.

Therefore, because what is in potency is naturally moved by something else in act, and nothing is in potency and in act with respect to the same, it follows that neither fire nor earth nor anything else is moved by itself but by another. Fire and water are moved by another, but by compulsion, when their motion is outside their natural potency; but they are moved naturally when they are moved to their proper acts, to which they are in potency according to their nature.

1030. Then at (799) he shows by what they are moved. And because what is in potency is moved by something in act,

First he distinguishes potency;
Secondly, from this he shows by what such things are moved, at 1035.

About the first he does three things:

First he shows that it is necessary to know the ways in which something is said to be in potency;
Secondly, he explains this at 1031;
Thirdly, with this he solves a question, at 1033.

He says therefore that the reason why it is not evident by what heavy and light things are moved with respect to their natural motion (as fire upward and earth downward) is that the expression "being in potency" has many senses.

1031. Then at (800) he distinguishes "being in potency":

First in the understanding;
Secondly, in quality, at 1032;
Thirdly, in local motion, at 1033.

He says therefore first that one who is learning and does not yet have the habit of science is not in potency to science in the same way as one who already has the science but is not using it by considering.

But something is reduced from the first potency to the second, when the active principle is united with the patient; and then the patient through the presence of the active principle comes to be with respect to such an act, but after that the patient is yet in potency: for example, a learner is through the action of the

teacher reduced from potency to act, but when he is in this state of act, there is yet another potency present. Consequently, the thing existing in first potency comes to be in another state of potency; because one having science, and not considering, is in a sense in potency to an act of science, but not in the same way as he was before he learned. Therefore, from first potency he is reduced to an act to which is united a second potency, by some agent, namely, the teacher.

But when he is in the state of possessing the habit of science, it is not necessary that he be reduced to second act by some agent; rather he operates immediately by himself, just by considering, i.e., unless he is prevented by other occupations or by sickness or by his will. On the other hand, if he were not impeded and still could not consider, then he would not be in the habit of science but in its contrary, namely, ignorance.

1032. Then at (801) he manifests the same thing in qualities. And he says that what was said with respect to the potency of anything in the mind applies also to natural bodies. For when a body is actually cold, it is potentially hot, just as an ignorant person is potentially a knower. But when this body has been so modified that it has the form of fire, then it is now actually fire and has the power to burn; and it acts at once and burns, unless it is prevented by something acting to the contrary or somehow preventing its acting, as by removing the combustible material. This is similar to what was said above, that when someone after learning becomes a knower, he at once considers, unless prevented by something.

1033. Then at (802) he manifests the same thing in the local motion of the heavy and the light. And he says that a light thing comes to be from a heavy, as a hot thing comes to be from the cold, as, for example, when air which is light comes to be from water which is heavy. Therefore, this water is first potentially light and later becomes actually light, and then it has its own activity at once, unless something prevents. But now being light, it is related to a place as potency to act —for the act of the light as light is to be in some definite place, namely, above; but it is prevented from being up by the fact of being in a contrary place, namely, down, because it cannot be in two places at the same time. Hence, that which keeps a light thing down prevents it from being up. And what has been said of local motion is true also of motion with respect to quantity or quality.

1034. Then at (803) he uses the foregoing to answer a question. For although the act of the light is to be above, yet some ask why the heavy and the light are moved to their appropriate places. But the cause of this is that they have a natural aptitude for such places. For to be light is to have an aptitude for being above, and the nature of the heavy is to have an aptitude to be down. Hence, to ask why a heavy thing is moved downward is exactly the same as to ask why it is heavy. Accordingly, the very same thing that makes it heavy makes it be moved downward.

1035. Then at (804) he uses the foregoing to show what moves the heavy and the light. And he says that since what is in potency is moved by what is in act (as has been said), it must be considered that something is said in many senses to be potentially light or heavy.

For in one way, when something is yet water, it is in potency to lightness; in another way, when from the water air has now been made, it is still in potency to the act of what is light, which is to be above in the same way that one having the habit of science and not considering is said still to be in potency—for what is light can possibly be prevented from being up.

If, therefore, that obstacle be removed, it immediately acts for the purpose of being up by ascending, as it was said with respect to quality that when a thing is actually of such and such a quality, it immediately tends to its act, as a knower immediately considers, unless he be prevented. And the same is true with respect to the motion to quantity, for from the fact that an addition of quantity has been made to a quantitative thing, extension immediately follows in an increasable body, unless something prevents.

Accordingly, it is clear that what moves, i.e., what removes the obstacle preventing and sustaining does in some sense cause motion and in other senses does not; for example, if a pillar supports something heavy and thus keeps it from descending, the one who casts down the pillar is said somehow to move the heavy object that was supported by the pillar. In like manner, one who removes a stopper that was preventing water from flowing out of a container is said in some sense to move the water; for he is said to move *per accidens* and not *per se*. Also when a ball rebounds from a wall, it is moved *per accidens* by the wall but *per se* by the one who first threw it. For it was not the wall but the thrower that gave it the impetus for motion; but it was *per accidens* that, being prevented by the wall from continuing according to its impetus, it rebounded into a contrary motion, the original impetus remaining. In like manner, the one who casts down the pillar did not give the heavy object resting upon it the impetus or inclination to be downward, for it had that from the first generator, which gave it the form upon which that inclination follows. Consequently, the generator is the *per se* mover of the light and the heavy, whereas the remover of obstacles is a *per accidens* mover.

He concludes, thereforel that it is clear from the foregoing that none of these, i. e., of the heavy and the light, moves itself; yet their motion is natural, because they have in themselves the principle of their motion, not indeed a moving or active principle but a passive one, which is a potency to such-and-such an act.

From this it is evidently contrary to the intention of the Philosopher that in matter there be an active principle, which some declare is necessary for a natural motion; for a passive principle is sufficient, since it is a natural potency for act.

1036. Then at (805) he concludes to the conclusion chiefly intended in the whole chapter. And he says that if it is true that all things which are *per se* moved are moved either according to nature, or outside their nature and by compulsion, and if of those which are moved by compulsion it is true that all are moved not only by a mover but even by an external mover that is other; and, again, if among things that are moved according to nature, some are moved by themselves—in which things it is clear that they are moved by something not extrinsic but intrinsic—while others, such as heavy and light things are moved according to nature not by themselves but by some mover) as has been explained—for they are moved either *per se* by the generator which makes them be heavy and light, or they are moved *per accidens* by whatever removes what impedes or removes their natural motion—it is accordingly clear that all things which are moved are moved by something, i.e., either by an intrinsic or an extrinsic mover; which is to be moved by something other.

Lecture 9

No process to infinity in movers. Not every mover need be moved.

1037. After showing that whatever is moved is moved by another, the Philosopher now begins to show that it is necessary to reach a first immobile mover. And his treatment is divided into two parts.

> In the first he shows that it is necessary to reach a first that is either immobile or moves itself;
> In the second he shows that even if a first that moves itself is reached, it is further necessary to reach a first mover that is immobile, (L.10).

About the first he does two things:

> First he shows that it is not possible that things be moved by another *ad infinitum*;
> Secondly, he shows that not every mover need be moved, at 1042.

About the first he does two things:

> First he explains the proposition by ascending in the order of mobiles and movers;
> Secondly, by descending, at 1041.

About the first he does two things:

> First he premisses things needed for manifesting his proposition;
> Secondly, he gives an argument that shows the proposition, 1040.

1038. Now he premisses two things, of which the first (806) is a division of movers. For since it has been said that whatever is moved is moved by something, a thing might be a mover in two senses. In one sense, when it moves not on its own account, i.e., not by its own power, but because it has been moved by some other mover. This is a second mover. In another sense, something moves on its own account, i.e., by its own power and not because it has been moved by another. Now, such a mover can cause motion in two ways: First, in such a way that the first mover moves the one next to the last, i.e., the one which is nearest to it after the second mover; this happens when the first mover moves a mobile through just one intermediate. Secondly, in such a way that the mover moves a mobile through a number of intermediates, as when a stick moves a stone and the stick is moved by a hand, which is moved by a man who does not move as being moved by something else. In this way the man is a first mover on his own account and he moves the stone through a number of intermediates; however, if he moved the stone with his hand, he would be moving the tone through one intermediate only.

1039. Secondly, at (807) he compares the first mover with the second. For since both the first mover and the ultimate are said to cause motion, we say that the first mover is more a mover than the ultimate mover. This is clear for two reasons: first, because the first mover moves the second

mover but not vice versa; secondly, because the second mover cannot cause motion independently of the first, but the first can cause it independently of the second. For example, the stick cannot move the stone unless it is moved by the man, but the man can move the stone without using the stick.

1040. Then at (808) he proves his proposition in the light of the foregoing. For it has been shown that whatever is being moved is being moved by another. But that by which it is moved is itself either moved or not moved; and if it is moved, it is either moved by another or not. Now these two, namely, being moved by another or not being moved by another, are such that if one is posited the other must be and not vice versa: that is, if there is something which is moved by another, it is necessary to come to a first that is not moved by another; but if such a first is posited, namely, a first that is not moved by another, it is not necessary further to posit another, namely, one that is moved by another.

This, indeed, is self-evidentt but there could be some doubt about the first one, namely, that if there be found something moved by another, there be found a first that is not moved by another. For this reason, he proves this in the following manner.

If something is moved by another and this in turn by another, and if something not moved by another is never reached, it follows that there is a process to infinity in movers and moved things. But this is impossible, as was proved in Book

VII. However, he here proves it in a more certain way, from the fact that there is no first in an infinite series. Therefore, if movers and moved things go on *ad infinitum*, there will be no first mover. But it has already been said that if the first mover does not act, the last mover does not act and, consequently, there will be no mover, which is evidently false. Therefore, the process of something being moved by another cannot go on *ad infinitum*. If, therefore, it be conceded that whatever is being moved is being moved by another, as has been proved, and again, if it be supposed that the first mover is itself being moved but not by something else, it is necessarily being moved by itself.

It should be noted that this argument is not proving that the first mover is being moved, but he is supposing this according to the common opinion of the Platonists. As to the force of the argument, it does not conclude more that the first mover moves itself than that it is immobile. Hence he later presents this same conclusion under a disjunction, as will be clear below.

1041. Then at (809) he proves his proposition by descending. And it is the same argument as the preceding so far as its illative value is concerned, but differs with respect to the order of the process; he repeats it, however, for the sake of greater clarity.

He says therefore that the previous argument might be presented in another way. And he premisses propositions that have the same truth value as the previous ones, but in a different order. For above he had premissed that whatever is being moved is being moved by another and that that by which it is moved acts either on its own account or on account of something else previously moving it; and this was an ascending process.

But now he uses a descending process, saying that every mover moves something and moves by means of something, i.e., either by itself or by means of some lesser mover, as a man moves a stone either by himself or by means of a stick and the wind casts something to the earth either by its own impulse or by means of a stone which it moves.

Again, he had premised above that the last mover does not cause motion independently of the first mover, but vice versa. In place of that he here says that what a mover uses as an instrument in causing motion cannot itself cause motion without a principal mover moving it, as a stick cannot cause motion independently of the hand; but if something moves by itself as a principal mover, the addition of an instrument is not required. And this is more evident in instruments than in an ordered array of mobiles, although the same truth is present in both cases, because not every one would consider the second mover an instrument of the first. But as he deduced above that, if there is something that is being moved by another, there must be something that is not being moved, but not vice versa, so here in a descending process he says that if that by

which the mover causes motion is another thing, as an instrument, there has to be something which causes motion not by an instrument but by itself. Otherwise, there is an infinite process with respect to instruments, which is the same as proceeding to infinity with respect to movers, and that is impossible, as has been proved above.

If, therefore, there exists a mover of that which is being moved, a halt must be made and the process cannot go to infinity. For if the stick causes motion because it is moved by the hand, it follows that the hand moves the stick; if, however, something else is moving the hand, it also follows conversely that a mover is moving the hand. Consequently, the same process that was valid with respect to moved instruments is valid for movers of instruments. But with respect to movers, as was shown, an infinite process must be avoided; therefore, it must be avoided with respect to instruments. Thereforet since it is always so that a thing being moved is moved by another which moves, and an infinite process must be avoided, it is necessary that there be a first mover that moves by itself and not through an instrument.

If, therefore, it be granted that this first which moves itself is indeed moved but there is no other moving it (because then it would be an instrument), it follows of necessity that it is moving itself—following the supposition of the Platonists that every mover is moved.

Hence also according to this argument, either what is being moved will be immediately moved by a mover that moves itself, or at some time such a mover that moves itself must be reached.

1042. Then at (810) he shows that not every mover is being moved, as was supposed in the preceding arguments. About this he does two things:

First he proves that not every mover is being moved;

Secondly, from this and from the previous arguments he concludes to his main proposition, at 1049.

He says therefore first that to the above-mentioned things may be added the following in order to show our proposition. About this he does three things:

First he premises a division;

Secondly, he rejects one member$ at 1043;

Thirdly, he rejects another, at 1046.

He says therefore first (830) that if whatever is being moved is being moved by another, which is tantamount to saying that every mover is moved, this can be in two ways: in one way, that it is *per accidens* in things that a mover is moved, i. e., the mover does not act in virtue of being moved (as if we should say that a musician is a builder not because he is a musician, but this is *per accidens*); or in a second way, that it is not *per accidens* but *per se* that a mover is moved.

1043. Then at (811) he rejects the first member in three ways. First, with this argument: Nothing *per accidens* is necessary, for what is in a thing *per accidens* is not present of necessity, but may happen not to be present, as musician in a builder. If, therefore, it is *per accidens* that movers are moved, it follows that it can happen that they not be moved. But once you posit that every mover is moved, it is a consequence, if movers are not moved, that they do not cause motion. It follows, therefore, that at some time, nothing is being moved. But this is impossible, for it has been proved above that it is necessary that motion always exist. This impossibility, however, does not follow from the supposition that movers are not moved; because if it is *per accidens* that a mover is moved, it will be possible for movers not to be moved, and if a possibility is posited, no impossibility follows. It remains, therefore, that the other statement from which it (the cessation of motion) followed is impossible, namely, the statement that every mover is moved.

1044. Secondly, at (812) he proves the same with another probable argument, which is this: Three things are found in motion: one is the mobile that is being moved; another is the mover, and the third is the instrument by which the mover causes motion. Now among these three, it is clear that the thing which is moved has to be moved, but it does not have to cause motion. The instrument, however, by which the mover causes motiont must both move and be moved—it is moved by the principal mover and it moves the last thing moved. For this reason, whatever "moves and is moved" has the character of an instrument.

Now, the reason why the instrument by which the mover causes motion both is moved and moves is that it partakes of both and exists in a sort of identity to what is moved. This is especially evident in local motion, for it is necessary that from the first mover to the last thing moved, all must touch one another. Accordingly, it is evident that an intermediate instrument is through contact the same as the mobile and is moved at once with it, insofar as it is in union with it. But it is also in union with the mover, because it is a mover—although under its aspect as the instrument by which the mover causes motion, it is not immobile.

Accordingly, thereforeo it appears from the premisses that the last thing moved is, indeed, being moved but it does not have in itself a principle for moving either itself or anything else, and it is moved indeed by something else and not by itself. Hence, it seems to be reasonable, i.e., probable (and in the present case we do not care to say that it is necessary) that there be a third thing which causes motion but is immobile.

For it is probable that if two things are joined *per accidens*, and one is found without the other, then the other might be found without it (but that it may be found without the other is necessary, because things joined *per accidens* may happen to be not joined); for example, if white and sweet are joined *per accidens*

in sugar, and if white is found without sweet, as in snow, it is probable that sweet be found in some thing without white, as in cheese. If, therefore, it is *per accidens* that a mover be moved and something is found to be moved without moving something else, as happens in the last thing moved, it is probable that one may find moving without being moved, so that there would be a mover that is not moved.

From this it is evident that this argument does not have force in substance and accident, and in matter and form, and in like things, of which one is found without the other but not vice versa; for accident *per se* exists in a substance, and to matter it belongs *per se* to have existence through form.

1045, Thirdly, at (813) he proves the same point on the testimony of Anaxagoras. For since it may be that a mover be found that is not moved, Anaxagoras spoke aright when he said that Mind is impassible and unmingled. He said this because he posited Mind as the first principle of motion, and the only way it could cause motion and command, without itself being moved, was that it be unmingled—for what is mingled with something else is in a certain way moved when that something else is moved.

1046. Then at (814) he concentrates on the other part of the division, namely, that whatever is moved, is being moved by another which is moved *per se* and not according to an accident.

And he disproves this with two arguments, the first of which is: If it is not according to an accident but of necessity that a mover be moved and if it can never cause motion unless it is movedt this must happen in two ways: one of which is that the mover is moved according to the same species of motion as that which it causes; the other is that the mover moves according to one species of motion, and is moved according to another. He subsequently explains the first way at (815): We say that a mover is being moved according to the same species of motion if, for example, the thing that causes heating is heated, and the healer is healed, and something carrying locally is itself being carried locally.

He explains the second way when he says: "Or else the healer is carried along, or the thing carrying along is growing." These are examples of "moving and being moved" according to different species of motion.

Then he shows the impossibility of the first way, at (816). For it is clearly impossible that a mover be moved according to the same species of motion. For it is not sufficient to stop at some subalternate species, but one Must divide until he reaches the "individuals," i.e., the most special species. For example, if someone is teaching, it is not enough for him simply to be taught at the same time, but he must be teaching and being taught the same; e.g., if he is teaching geometry he must be at the same time being taught it; or if he is the cause of a local motion called throwing, he must himself be moved according to the same

motion of throwing. This is clearly false.

Then he dismisses the second ways namely, that the mover not be moved according to the same species of motion, but that it move according to one species and be moved according to another; for example, if it moves with a local motion, and is being moved with respect to growth; and if what causes the growth is being moved by some thing else according to alteration; and if this mover in turn is being moved with respect to some other motion.

Now it is clear that motions are not infinite either in genus or species. For it was held in Book V that motions differ in genus and species according to the differences of the species in which motion occurs. But the genera and species of things are not infinite, as we proved elsewhere; accordingly, neither are the genera and species of motion. If, therefore, a mover is necessarily being moved according to some other genus or species of motion, one will not be able to proceed to infinity and there will be some first immobile mover.

1047. But because someone could say that when all the species of motion are exhausted, a return will be made to the first species, in such a way that if the first thing taken as moved was moved locally, and we distributed all the genera and species of motion to different movers until these genera and species were exhausted, the remaining mover will then be moved according to local motion, in order to exclude this he subsequently says that such a return is tantamount to saying that the cause of alteration is being moved locally (he uses this explanation because above in his example he mentioned local motion first and alteration last), the same, I say, as supposing from the very beginning that the mover according to local motion is being moved, and that the teacher is being taught not only generically but in the specific sense.

And that this means nothing more, he proves consequently. For whatever is being moved is moved more by the higher mover than by the lower one, and, consequently, much more so by the first mover. If, therefore, the thing posited as being moved locally is being moved by a neighboring mover that is being increased, and it by a mover that is being altered, and it further by one that is being moved according to place, what is being moved according to place will be more moved by the first one moved according to place than by the second one which is being altered or by the third one which is being increased.

Therefore it will be true to say that the mover according to place is being moved according to place, and the same for every sphere of motion. Now this is not only false, because it is seen to be belied in many cases, but it is also impossible. For it would follow that the teacher is learning while he is teaching—which is impossible. For this involves a contradiction, since it is the property of a teacher that he have science, and of a learner that he not have it. Accordingly, it is clear that it is not necessary for a mover to be moved.

1048. He gives a second argument at (817) which does not differ from the preceding one except in that the first leads to certain particular inconsistencies, for example, that a thrower would be thrown or that a teacher would be being taught. But this one leads to inconsistencies in general.

Hence he says that although it is inconsistent that a teacher be learning, there is something still more unreasonable, for it turns out that every mover is mobile, if nothing is moved except by what is being moved. For it will thus follow that every mover is mobile, if, for example, one says that whatever has thepower to heal, or is actually causing health, is healable, and that whatever has the power to build is buildable—which is more unreasonable than that a teacher be learning, for a teacher could have been learning before, but a builder was never built.

Now this follows in two ways. For if it be conceded that every mover is being moved with respect to the same species of motion, it follows that a builder is being built immediately (i.e., without intermediary) and that a healer is being healed immediately. But if it be conceded that the mover is not being moved according to the same species of motion, it follows that we shall finally come to this after passing through a number of intermediates. And he explains this: If every mover is being moved by another but not being moved immediately with respect to the same species in which he is causing motion but according to some other species—for example, if a healer is not at once being healed but is being moved according to the motion of discipline by learning—yet, since the species of motion are not infinite, by thus ascending from mobile to mover one will at length reach the same species of motion, as was explained above.

Therefore, of these two, one appears plainly impossible, e.g., that the builder be immediately being built, while the other is seen as a fancy, namely, that one come to the same thing through a number of intermediates. For it is unacceptable that what is apt to cause alteration is of necessity apt to be increased in size.

1049. Accordingly, (818) having considered the foregoing arguments, the first of which concluded that this process—that whatever is being moved is being moved by another—must not go on *ad infinitum*, and the second of which concluded that not every mover is being moved, we can conclude from all the foregoing arguments that it is not necessary *ad infinitum* that what is being moved be moved by another in such a way that it is always being moved by a mover that is being moved. Therefore, it is necessary to stop at some first. However, this first must either be immobile or be moving itself.

But if we are considering which is the first cause of motion in the genus of mobiles, whether it is something that moves itself or a mobile that is moved by another, it is held as probable among all that the first mover moves itself. For a *per se* cause is always prior to what is a cause through another. For this reason,

the Platonists held that prior to things that are moved by another there is something that moves itself.

And therefore we must consider this thing that moves itself and make of this another beginning of our consideration, namely, that we consider that if something moves itself, how is this possible.

Lecture 10

In that which moves itself, one part moves and the other is moved.

1050. After showing that in mobiles and movers there is no going on to infinity, but that a first is reached with is either immobile or selfmoving, the Philosopher now shows that even if a first that moves itself is reached, it is nevertheless necessary to come to a first which is immobile. This treatment is divided into three parts.

> In the first he shows that what moves itself is divided into two parts, one of which is mover and the other moved;
> In the second how these parts are mutually related, (L. 11);
> In the third that it is necessary to come to a first which is immobile, (end of L, 11).

About the first he does two things:

> First he shows that in a thing that moves itself, one part is mover and the other is moved, because a whole cannot move its whole self;
> Secondly, he rejects other ways in which a thing that moves itself might be thought to do so, at 1054.

About the first he does three things:

> First he proposes that what moves itself does not totally move itself as a whole;
> Secondly, he proves the proposition, at 1052;
> Thirdly, he concludes to the main conclusion intended—end of 1053.

1051. Because whole and part have no place except in things that are divisible, Aristotle, therefore, from what he had proved in Book VI, concludes first that whatever is moved is necessarily divisible into parts that are always further divisible—for this pertains to the very notion of a continuum. Now, whatever is being moved is a continuum, if it is being moved *per se* (for it is not impossible for an indivisible, for example, a point or whiteness, to be moved *per accidens*). And this was shown previously in Book VI: for all the statements made prior to Book VIII he calls universals of nature, because in Book VIII he begins to apply to things the statements he previously made about motion in common.

Accordingly, since what is moved is divisible, a whole and a part can be found in everything that is being moved. If, therefore, there is anything that moves itself, we shall be able to take a whole and a part in it; but a whole cannot move its whole self, i.e., in its entirety move itself.

1052. Then at (820) he proves his proposition with two arguments, the first of which is this: The motion of a thing that moves itself at one time and in one motion is numerically one; if, therefore, a thing should move itself in such a way that the whole moves the whole, it will follow that one and the same will be mover and moved with respect to one and the same motion, whether it bel local motion or alteration. But this is seen to be impossible: for mover and moved are mutually opposite, and opposites cannot exist in the same thing with respect to the same. It is therefore not possible that some same thing be mover and moved with respect to the same motion.

For when something is at once moving and being moved, the motion according to which it moves is different from the one according to which it is being moved, as when a stick, moved by the hand, moves a stone, the motion of the stick is numerically different from the motion of the stone. Accordingly, it will follow further that someone will be both teaching and be taught at the same time with respect to one and the same knowable thing, and, similarly, that someone will heal and be healed with respect to one and the same numerical health.

1053. He gives the second argument at (821) which is this: It has been determined in Book III that what is being moved is a mobile, i.e., something existing in a state of potency, since what is being moved is being moved precisely because it is in potency and not in act, for a thing is considered to be in motion when, being in potency, it is tending toward act. Howeverf that which is being moved is not in potency in such a way that it is in no wise in act, because the very motion is a kind of act of the mobile precisely as being moved; but it is an imperfect act, being the act of the mobile inasmuch as it is still in potency.

But what causes motion is already in act, for what is in potency is not reduced to act except by something in act, namely, the mover; for example, the hot causes heat and that generates which has the form to be generated, as one who has the human form generates a man, and so on for other things. If, thereforet the whole moves its whole self, it follows that the same thing is, with respect to the same, at once hot and not hot, because, insofar as it moves, it will be hot in act; insofar as it is moved, it will be hot in potency.

The same is true in all other cases in which the mover is univocal, i.e., agreeing in name and species with the thing moved, as when the hot makes the hot and a man generates a man.

And he says this because there are some agents which are not univocal and which do not agree in name and notion with their effects, as the sun generates a

man. In such agents, nevertheless, even though they do not possess the form of the effect according to the same notion, they do so in a higher and more universal sense. Consequently, it is universally true that the mover is somehow actually what the mobile is potentially. If, therefore, the whole moves its whole self, it follows that the same thing is at once in potency and in act—which is impossible.

From this he concludes (822) the main proposition that, with respect to a thing that moves itself, one part is mover and the other part moved.

1054. Then at (823) he rejects certain ways that someone might suppose to take place in the motion of a thing that moves itself.

> First he shows that with respect to a thing that moves itself, both parts are not moved by each other;
> Secondly, that with respect to a thing which moves itselfg one part does not move itself, at 1059.

About the first he does two things:

> First he proposes what he intends;
> Secondly, he proves his proposition, at 1055..

He says therefore first (823) that it is clear from what follows that a thing can not move itself in such a way that each part is moved by the other; for example, if AB moves itself, that A move B, and B move A.

1055. Then at (824) he proves the proposition with four arguments. And it should be noted that for this conclusion he re-uses the reasons previously used to show that not every mover is being moved by another. Hence from the foregoing he here collects four abridged arguments.

The first of these he takes from the first argument presented above in a double (i. e., ascending and descending) order to show that the process of something else being moved by another does not go on always, *ad infinitum*, because then there would be no first mover—from whose non-existence would follow the non-existence of all coming after it. Hence in this place too, the Philosopher premises the same unacceptable outcome.

For he says that if, in the first thing moved which is supposed as moving itself, both parts are reciprocally being moved by each other, it will follow that there is no first mover. This follows because, as was said above, the prior mover is more the cause of motion, and moves more, than the subsequent mover. And this was proved above on the ground that something causes motion in two ways. In one wayf something moves by being moved by another, as a stick moves a stone, because it is being moved by the hand, and this is a second mover. In another way, something moves by being moved of itself, as a man moves, and this is a

condition of a first mover. Now what causes motion independently of being moved by another is farther removed from the last thing moved, and nearer to the first mover, than an intermediate which causes motion as being moved by another.

This argument should be formulated in the following way: If both parts of a thing that moves itself move each other reciprocally, one is no more the cause of motion than the other. But the first mover is more a cause of motion than a second mover; therefore, neither of the parts will be a first mover. Now this is unacceptable, since it would then follow that what is moved of itself would be no nearer to the first principle of motion (whose existence would thereby be rejected) than what is moved by another, whereas it was proved above that a mover that moves itself is first in the genus of mobiles. Therefore, it is not true that both parts of a thing that moves itself are moved by each other.

1056. Then at (825) he presents two arguments for the same taken from one he used above when he showed that not every mover is being moved, in the sense that being moved is found *per accidens* in the mover. In this argument he drew two conclusions above, namely, first, that a mover can happen not to be moved, and secondly, that motion is not eternal. In the light of these two conclusions he now forms two arguments.

For he says first of all "it is not necessary for a mover to be moved except by itself according to accident," the sense of this being that unless the first mover be taken as being moved by itself, it will not also be necessary that the first mover be moved according to an accidents as some posited that every mover is being moved but that its being moved is in it ptr accidens.

When therefore it is supposed that of a thing which moves itself, the part causing motion is equally being moved by the other, this will be only *per accidens*. But as we conceded above, whatever is *per accidens* is able not to be; therefore, it is possible for the part which causes motion, not to be moved. Thus, therefore, it remains that of a thing that moves itself one part is moved, and the other causes motion and is not moved.

1057. Then at (826) he gives another argument corresponding to the second conclusion that he inferred above, namely, that it follows that motion does not always exist, Here, however, he argues in reverse order. If it is necessary that motion always exist, it is not necessary that a mover, when it causes motion, be moved, but it is necessary that the mover be either immobile or that it be moved by itself.

The reason for this conditional is apparent from an argument given above. For if a mover does not cause motion unless it is being moved, and if being moved is only in it *per accidens*, it follows that it can happen not to be moved. Consequently, it can happen also not to cause motion, and as a result, there will

be no motion. But motion was proved to be eternal. Therefore, it is not necessary for a mover to be moved, when it is causing motion, Consequently, it is not true that each part of a thing that moves itself is moved by the other.

1058. Then at (827) he presents the fourth argument, which is taken from the argument previously given to prove that it is not essential to a mover that it be moved, because it would follow that we must come to this, that a mover would be being moved by the same motion which it is causing, as explained above.

And now abridging this argument he says that, if each part is being moved by the other, it will follow that it causes motion and is being moved with respect to the same motion. Hence, it follows that the heater is heated—which is impossible.

Now, the reason why it follows that the same thing is causing motion and being moved with respect to the same motion, when it is posited that each part of a thing which moves itself is moved by the other is that there is in the thing that moves itself just one motion, and it is according to that motion that the part causing motion will itself have to be moved.

1059. Then at (828) he excludes another way, namely, the supposition that the part of a thing which moves itself does not move itself.

> First he proposes what he intends;
> Secondly, he proves his proposition, at 1060.

He says therefore first that if something that is first moving itself be assumed, it cannot be said either that one part of it moves itself or that a number of parts do so, in such a way that each of them moves itself.

1060. Then at (829) he proves this with two arguments, the first of which is that if the whole is being moved by itself, this belongs to it either by reason of a part that isbeing moved by itself or by reason of the whole.

If it belongs to it by reason of its part, then that part will be a first mover that moves itself, because that part separated from the whole will move itself, but then the whole will no longer be a first mover of itself, as was supposed.

But if it be said that the whole moves itself by reason of the whole, then it will be only *per accidens* that some parts move themselves. But what is *per accidens* is not necessary. Therefore in the mover that first moves itself, it is most important to presume that the parts are not moved by themselves, Therefore, one part of the first mover that moves itself will cause motion, since it is immobile, and the other will be moved. For those are the only two ways in which it is possible that a part which causes motion could be moved, namely, either because that part would be moved by another part which it moves, or because that part would move itself.

Hence it should be noticed that Aristotle in excluding these two ways intends to

conclude that in a thing which moves itself, the part which causes motion is immobile, but not that what moves itself is divided into two parts, one of which causes motion and the other is moved; for this had been sufficiently concluded, when he first proved that the whole does not move itself as a whole.

Accordingly, it is clear that it was not necessary that Aristotle introduce a division of five members, as some claimed: one member of which is that the whole moves the whole; the second that the whole moves a part; the third that a part moves the whole; the fourth that two parts mutually move one another; the fifth that one part is a mover and the other moved. For if the whole does not move the whole, it follows for the same reason that the whole does not move the part, nor the part the.whole; because in either case it would follows that a moved part would be moving itself. Hence the fact that the whole does not move the whole suffices for concluding that one part is a mover and the other is moved. But in order to conclude that the part which causes motion is not moved, he proves two other things, namely, that the part causing motion is not moved by a moved part, and that it is not moved by itself.

1061. And to prove this last point he presents a second argument (830): If it be granted that the motion-causing part of a thing that moves itself moves itself as a whole, it follows through what was proved above that a part of that part causes motion and the other part is moved. For it has been already proved above that a whole does not move itself in any other way than by one of its parts causing motion and the other being moved, So, let AB be the motion-causing part of a thing that moves itself; then by the previous argument it follows that one part of it is a mover, namely A, and the other part, namely B, is moved. Therefore, if AB as a whole moves itself as a whole, as you say, it follows that the same thing would be moved by two movers, namely, by the whole AB and by the part A—which is impossible. It remains, therefore, that the motion-causing part of a thing which moves itself is entirely immobile,

Lecture 11

How the parts of something moving itself are related.

1062. After showing that a thing which moves itself is divided into two parts, one of which causes motion and is not moved, and the other of which is moved, the Philosopher now shows how such parts are mutually related. About this he does three things:

First he proposes what he intends;
Secondly, he shows his proposition, at 1063;
Thirdly, he reaches the conclusion chiefly intended by all the foregoing, at 1068.

He says therefore first (831) that since a mover is divided into two elements, one of which is also moved by something else, and the other of which is immobile, and again, since a mobile is divided into two, there being a mobile which also causes motion, and another which does not move anything, one must say that what moves itself is composed of two parts, one of which is such a mover as to be immobile, and the other of which is so moved as not to move anything else.

And when he says that the latter does not move anything "of necessity," it can mean two things: If it is understood as though the moved part of a self-mover does not move anything that is part of the self-mover, the word "necessity" should be interpreted in an affirmative sense, referring to his calling it "non-moving," as meaning that of necessity it does not move anything else. For he at once proves that it is impossible for a thing that moves itself to have a third part which is moved by the moved part. But if the words are interpreted as meaning that the moved part does not move anything extrinsic, then the phrase, "of necessity," must be given a negative meaning; for it is not necessary in a thing which moves itself that its moved part move something extrinsicq but neither is it impossible.

1063. How this happens he shows at (832). About this he does two things:

First he explains his proposition;
Secondly, he solves a doubt, at 1066.

About the first he does two things:

First he shows how the parts of a thing that moves itself are related;
Secondly, how with respect to them a whole is said to move itself,1065.

About the first he does two things:

First he shows that in a thing which moves itself there are just two parts, one of which causes motion and is not moved, and the other of which is moved and does not cause any motion;
Secondly, how these two parts are joined to one another, at 1064.

He explains the first part in this way (832): If it be said that the moved part of a thing that moves itself does in turn move something else which is part of the very thing that moves itself, then let A be the first immobile part of this self-moving thing. Let B be the second part and let it be both the one moved by A and the mover of a third part C. which is so moved by B as to move nothing else that is a part of this self-moving thing. For it cannot be said that there is an infinite descent in the parts of a thing which moves itself, such that a moved part in turn moves anothert for then it would be moving itself *ad infinitum*, which is impossible, as was shown above. There will be, therefore, in that self-moving thing a part which is moved but is not a mover, i.e., the part C. And although it might be that it is through many intermediate moved movers that the last moved

part C is reached, we can accept B as the one intermediate taken in place of all these intermediates. Thus, therefore, does this whole, which is ABC, move itself. If from this whole there be taken away the part C, AB will still move itself, because one of its parts is a mover, namely A, and the other moved, namely B, which was required for a thing to be able to move itself, as was shown above. But C will not move itself, or move any other part, as we have assumed.

Likewise, even BC does not move itself without A, because B does not cause motion except inasmuch as it is moved by something else, which is A, which is not a part of BC. It remains, therefore, that only AB moves itself first and *per se*. Hence a thing which moves itself must have two parts, one of which is an immobile mover, and the other of which is moved and necessarily does not move anything that is part of the whole thing that moves itself, for this was concluded by the foregoing argument.

Or else it "moves nothing of necessity"—since it is not a necessity of a self-mover that the moved part move anything else, even anything extrinsic.

1064. Then at (833) he shows how these two parts are mutually related.

Here it must be considered that Aristotle has not yet proved that the first mover has no magnitude, as will be proved later. But some of the earlier philosophers posited that no substance can exist without magnitude. Hence Aristotle is keeping with his custom when he leaves this matter doubtful until it is proved; and he says that the two parts of a self-mover, of which one is a mover and the other moved, must be somehow conjoined if they are to be parts of one whole. But not by continuation, because above he has said that a self-mover and a moved thing cannot form a continuum but are necessarily divided. Hence it remains that these two parts must be joined by contact: either by both parts touching one another, if they have magnitude; or by just one of the parts touching the other and not vice versa, which will be the case if the mover has no magnitude. For what is incorporeal can indeed touch a body by means of its power and so move it, but it is not touched in turn by the body; two bodies, however, touch each other.

1065. Then at (834) he shows by what reason a whole is said to move itself with one part causing motion and the other part being moved.

And let us suppose at first that each part is continuous, i.e., having a magnitude, because in Book VI it has been proved of anything that is moved that it is a continuum, and let the same thing be supposed at the present time for the mover, before the truth is proved.

Therefore, using this supposition, three things are attributed to this whole composed of two parts: it is moved, it causes motion, and it moves itself. But self-movement is attributed to it not because a part moves itself but because the entire whole move itself, while to cause motion, and to be moved, are attributed

to the whole by reason of the part. For the whole neither moves nor is moved, but one part A moves, and the other part B is moved only; and it has already been shown that there is no third part C which is moved by B. For this is impossible, if we are dealing with a thing that moves itself primarily, as has been shown above.

1066. Then at (835) he raises a doubt about the foregoing.

First he raises it;
Secondly, he solves it, at 1067.

This doubt springs from what he had previously proved, namely, that in a thing that moves itself in a primary sense, there are but two partat of which one moves and the other is moved, on the ground that, if there were a third, even if this third were removed, the composite of the first two would still move itself, and thus the latter is the primary self-mover.

From this, therefore, the following doubt follows (835). Let us suppose that the immobile but motion-causing part A of a self-moving whole is a continuum. Now it is clear that its part B, which is the moved part, is a continuum, according to what has been previously proved. But every continuum is divisible. Therefore the doubt is this: If through division a part be removed from A or R, would the remaining part be a mover or a moved part? Because if it is either, the part of AB that remains will move itself andq accordingly, AB will not be some-thing that moves itself in a primary sense. Thus it further follows that nothing will be a self-mover in a primary sense.

1067. Then at (836) he resolves this doubt.

Now it should be remembered here that in Book VI Aristotle has proved that there is no first in motion, either on the part of the mobile, or of the time or of the sphere of motion, and that this is especially true in growth and local motion: the reason being that he was then speaking of motion in common and of the mobile as it is a certain continuum, without yet making application to particular natures. And according to this, it would follow that there would not be anything that is first moved and, consequently, no first mover, if the mover were a continuum. Likewise, there would also not be anything that is a first mover.

But now Aristotle is speaking of motion and applying his doctrine to definite natures and for that reason he posits that there is a first mover of self.

And he resolves the doubt in the following manner, stating, namely, that there is nothing to prevent the mover and moved from being divisible in potency, due to the fact that they are continua, i.e., if both are continua, or at least one of them, namely, the one that is moved, which necessarily is a continuum. But yet it is possible that some continuum, whether it be a mover or something moved, have such a nature that it cannot be actually divided, as is evident of the body of the

Sun. And if it happens that some continuum is divided, it will not retain the same potency for causing motion or being moved as it had before—because such a potency follows upon the form, and a natural form requires a determinate quantity. Hence, if it is an incorruptible body, it cannot be actually divided. But if it is a corruptible one, then if it be divided, it will not retain the same potency, as is evident with respect to the heart. Hence, there is nothing to prevent, in things potentially divisible, there being one first.

1068, Then at (837) he infers the conclusion mainly intended from all this. And he says that from the foregoing it is clear that it is necessary to posit a first mover that is immobile. For since there is not an infinite process in movers and moved things, but a halt must be made at a first which is immobile or self-moving, then, whether the movers and moved stop at some first immobile or at some first that moves itself, in either case it turns out that the first mover is immobile, because one part even of a thing that moves itself is an immobile mover, as has just been proved.

Lecture 12

The first mover is not moved, but is one and perpetual.

1069. Having shown that in things moved by another there is not a process to infinity but a first must be reached which is either immobile or a mover of self, and having shown that, of a thing that moves itself, one part is an immobile mover, and that, consequently, in either case there is a first mover that is immobile, now, because among self-movers which exist among us, namely, perishable animals, it happens that the motion-causing part in the thing which moves itself is perishable and moved *per accidens*, namely, the soul, the Philosopher wishes to show here that the first mover is imperishable and is not moved either per ae or *per accidens*. About this he does two things:

First he proposes what he intends;
Secondly, he proves it, at 1072.

About the first he does three things:

First he reviews what has been previously manifested;
Secondly, he omits something that seemed useful for his proposition, at 1070;
Thirdly, he explains his proposition, at 1071,

He says therefore first (838) that it was shown above that motion always exists and never fails. And since all motion is from a mover, and in movers there is not a process to infinity, it is necessary that there be a first mover. And since it has not yet been proved that the first mover is one, he accordingly lets it remain

doubtful whether it is one or many. Further, it has been shown that the first mover is immobile, whether by ascending from moved to movers one imediately reaches a first immobile mover, or whether what is reached is a first mover that moves itself, one part of which is an immobile mover.

1070. Some have opined that all moving principles in things that move themselves are imperishable, for Plato posited all the souls of animals to be perpetual. And if this opinion were true, Aristotle would have his proposition clinched at once, so far as the first mover's being eternal is concerned. But the opinion of Aristotle is that among the parts of the soul, only the intellect is imperishable, even though other parts of the soul are movers.

Consequently he omits this at (839) where he says that as far as the present argument is concerned it is of no moment whether each of the principles that move themselves and are immobile is imperishable, even though some have posited this by positing that all souls are imperishable. And he says that this does not affect the present argument, because he will prove his proposition without using this supposition.

1071. Then at (840) he explains what he intends to prove. And he says that by considering the thitgs that follow, it can be plain that even though not every immobile mover is imperishable, there must,be something immobile in such a way that it is no way moved from without, either absolutely or *per accidens*, and yet is a mover of something else.

When he says "immobile with respect to any change from without," he does not mean to exclude a motion, i.e., an operation, which is in the one operating in the sense that to understand is called a "motion," and in the sense that the appetite is moved by the desirable object. A motion of this sort is not excluded from the first mover which Aristotle is discussing.

1072. Then at (841) he proves what he had said, namely, that there exists a first mover that is eternal and entirely immobile.

> First he proves this through self-movers that at one time exist and at another time do not;
>
> > Secondly, through moving principles which sometimes are causing motion and sometimes not, (L. 13).

About the first he does three things:

> First he shows that there must be a first mover that is eternal;
> Secondly, that such a mover should be one rather than many, at 1075;
>
> > Thirdly, he shows both at once, i.e., that there is one first mover and that it is eternal, at 1076.

About the first he does two things:

First he rejects an argument by which some could try to prove this proposition;
Secondly, he goes on to explain his proposition, at 1074.

1073. Now, someone could proceed as follows (841): Whatever cannot at one time be and at another not be is eternal; but the first mover, since it is immobile, as has been shown above, cannot be at one time and not be at another time, for whatever is such is generated and ceases to be, which involves its being moved. Therefore, the first mover is eternal.

But Aristotle does not have any use for this argument, because someone could say, if he wants, that in some things it happens that at one time they exist and at another time they do not, without their being generated or ceasing to be, speaking *per se*, and consequently without their being moved *per se*. For if something not divisible into parts, which is, namely, not composed of matter and form, is at one time in a certain way, and at another time is not, then necessarily every such thing—without any self-change—does at one time exist and at another time not exist, as may be said of a point, and of whiteness, and of anything of this sort, for it has been shown in Book VI that whatever is moved can be divided into parts, and in *Metaphysics* VII that whatever is generated is composed of matter and form. Such non-divisible things, therefore, are neither generated nor changed *per se*, but *per accidens*, when other things are generated or changed.

From this it is also plain that if something is moved neither *per se* nor ar accidens, it is eternal; and that if it is eternal, it is moved neither *per se* nor *per accidens*, insofar as it is eternal. If, therefore, it is conceded to be contingent for something to exist at one time and not at another without its being generated or ceasing to be, then let it also be conceded to be contingent that certain immobile moving principles, which are yet mobile *per accidens*, exist at one time and do not exist at another. Nevertheless it is not at all possible that all such principles which are movers and immobile be such that they exist at one time and not exist at another.

1074. Then at (842) he proves his proposition. And he says that if some things which move themselves exist at one time and not at another, then there must be a cause of their generation and ceasing-to-be, by virtue of which they exist at one time and do not exist at another, because whatever is moved has a cause of its motion. But what exists at one time and not at another, if it is a composite, is generated and ceases-to-be. Now, a thing that moves itself must possess magnitude, since it is moved, and it has been shown in Book VI that nothing indivisible into parts is moved.

But from the foregoing it cannot be held that it is necessary for the mover to have magnitude, and thus it is not moved *per se*, if it exists at one time and does

not exist at another. But if there is a cause of the generation and perishing of things that move themselves, then there must also be a cause to account for their generation and perishing being continued forever.

But it cannot be said that the cause of this continuity is one of those immobiles that do not always exist, nor can it be said that the cause of the eternal generation and perishing of some things that move themselves are certain immobile movers which do not always exist, and of that of others, certain others. And he explains this when he says that not one, nor all of them, can be the cause of this continuous and eternal generation.

That one of them cannot be the cause he thus proves: What does not exist forever cannot be the cause of what is forever perpetual and necessary. That all cannot be the cause he proves for the reason that all such perishable principles, if generation is perpetual, are infinite and do not all exist at once. But it is impossible for one effect to depend on an infinitude of causess

And again, things that do not exist at once cannot be the cause of one thing, although it could be said that when things do not exist all at once, some dispose and some cause, as is plain with respect to drops that fall successively and wear away a stone. But if a number of things are a direct cause of anything, they must exist all together.

Accordingly, therefore, it is manifest that if there are a million principles that are movers and immobile, and if there are many things that move themselves, of which some perish and others come to be, and among these, some are mobile and some movers, nevertheless there must be something above all of them that by its power contains all the things which are generated and perish in the above-mentioned way and which would be the cause of the continual change affecting them by which they sometimes are and sometimes are not and through which these latter are the cause of coming-to-be and of motion for others, and these for yet others. For every generator is a cause of generation to the thing generated, but it is from some imperishable first principle that perishable generators possess the characteristic of being causes of generation. If, therefore, the motion through which some things at one time exist and at another do not is perpetual, as has been shown above, and a perpetual effect cannot exist except from a perpetual cause, then, necessarily, the first mover is perpetual, if it is one; and if there are more than one first mover, they too are perpetual.

1075. Then at (843) he shows that one perpetual principle ought to be posited rather than many. And he says that just as finite principles ought to be preferred to infinite, so one first principle rather than many. For if the same effects happen or follow from positing finite principles as from positing infinite principles, one should assume that the principles are finite rather than infinite, because in things that are according to nature, the preference must be given to what is better, if it

is possible, because things that are according to nature are disposed the best. Now, a finite principle is better than an infinite one, and one better than many. But one first immobile principle, if it is perpetual, is sufficient for causing the perpetuity of motion. Therefore, many first principles should not be posited.

1076. Then at (844) he concludes from the foregoing that it is necessary that there be one first mover which is imperishable.

And although this seems to be sufficiently proved from the foregoing, yet someone could cavil that the cause of the continuity of generation is a perpetual first mover of self, but the mover of that is not perpetual and one but moved by diverse movers, of which some cease to be and some come to be.

But this he intends to dismiss, because if motion is perpetual, as he had proved above, then necessarily the motion of the first mover of self, which is posited as the cause of the entire perpetuity of motion, is eternal and continuousq for if it were not continuous, it would not be eternal. However, what is successive is not continuous, whereas in order that a motion be continuous it must be one; and in order to be one, it must be from one mover and in one mobile. But if the mover is other and other, the motion will not be a whole continuous motion, but a successive one.

Therefore, it is absolutely necessary that the first mover be one and perpetual. But an immobile mover that is moved pjr accidens is not perpetual, as has been said above. It remains, therefore, that the first mover is utterly immobile, both *per se* and *per accidens*.

13

Lecture 13

The first mover perpetual and wholly unmoved, as shown from moving principles

1077. After showing that the first mover is perpetual and utterly immobile on account of the perpetuity of the generation and perishing of animals, which move themselvesl.the Philosopher now intends to prove the same with an argument based on the moving principles. About this he does three things:

> First he reviews things said from the beginning of this treatise;
> Secondly, from these he forms an argument for his proposition, at 1081;
> Thirdly, he finishes the solution of a doubt mentioned above, at 1085.

1078. About the first he reviews three things: First (845), the destruction of certain improbable positions. And he says that anyone can know that there is a first immobile. mover not only from the foregoing, but also by considering the principles of motion. And as was said above, it is evident to sense that among

natural things are found some that are at one time being moved and at another time at rest.

From this it was explained above that none of these three positions is true: the position that all things are always being moved; the position that all things are always at rest; and the position that all things which rest, always rest, and those being moved, are always being moved. The truth of this matter is demonstrated by the very things found under botht namely, under motion and under rest, since they have the potency to be moved at one time, and to be at rest at another.

1079, Secondly, he recalls the process he went through when investigating the first immobile mover. And he says that because things which at one time are being moved and at another time are at rest are plain to all, lest anyone follow a fourth position that all beings are such that they are at one time being moved and at another time at rest, we want to demonstrate two differing natures by showing, namely, that there are certain things that are always immobile, and certain things again that are always being moved.

And in dealing with this matter we proposed first that whatever is being moved is being moved by something and that this thing by which something is being moved is either immobile or is itself being moved, and if it is being movedt then either by itself or by another. And since one cannot proceed to infinity in the series of "being moved by another," we must come to this that there is some first principle of motion, such that in the genus of things that are moved there is a first principle which moves itself, and beyond that, absolutely among all, there is a first principle which is immobile. Nor ought it to be thought strange that something move itself, because we plainly see many such in the genus of living things and animals.

1080. Thirdly, at (847) he recalls an objection mentioned and solved above. For since he had proved the eternity of motiont he cited to the contrary an objection based on living things which after having been at rest begin at a certain time to be moved. And what he says here is that those living things which move themselves seem to foster the opinion that in the entire universe motion begins after previously not having been, on the ground that we see this happen in things, namely, that they at one time begin to be moved, when previously they were not being moved.

To solve this it is necessary to accept that animals move themselves with respect to one motion, namely, local motion; for only this motion, based on appetite, is found in animals. And yet animals do not properly move themselves even with respect to this motion as though another cause of this motion does not pre-exist. For no animal is of itself the first cause of being moved locally, but other motions precede—not voluntary but natural—either from within or from without, according to which the animals do not move themselves, as is plain in the

motions of growth and decrease, and respiration, according to which animals are movedt although they rest with respect to local motion by which they are moved by themselves

The cause of these local motions is either an extrinsic container—namely, the heavens and air—by which the bodies of animals are changed externally, or something enters the bodies of animals, as air enters through breathing and as food enters through eating and drinking. And from such transmutations, caused either from within or from without, it happens that animals at a certain time begin to be moved, when previously they were not being moved, as is plain from the change which arises from food: for while the food is undergoing heat the animals sleep on account of the vapors being broken down, but when the food is now digested and dissolved, and the vapors are left, the animals awaken and get up and move themselves from place to place. In all this, nevertheless, the first principle of motion is something extrinsic to the nature of the animal that moves itself.

That is the reason why animals are not always moved by themselves, because with respect to any animal moving itself there is found some previous mover, which is being moved and causes motion. For if it were entirely immobile, it would always maintain itself in the same way in causing motion and, consequently, the motion also of the animal would be perpetual. But because this extrinsic mover that moves animals is itself moved, it does not always move in the same way.

Hence, neither do animals always move themselves in the same way, because in all these things the first mover which is the cause of the animal's moving itself, such as the soul, causes motion in such a way that it is itself being moved not *per se* but *per accidens*, for the body is changed with respect to place, and when the body has been changed, that which exists in the body, namely, the soul, is also changed *per accidens*, And thus the whole that moves itself is changed of necessity, so that it does not maintain itself in the same disposition for causing motion.

1081. Then at (848) from the foregoing he proves his proposition.

> First that the first mover is immobile;
> Secondly, that the first motion is perpetual, at 1083.

About the first he does two things:

> First he proves the proposition;
> Secondly, he dismisses an objection, at 1082.

He says therefore first (848) that from the foregoing we can know that if some principle is an:bmobile mover nevertheless moved *per accidens*, it cannot cause a continuous and perpetual motion. For the reason assigned for saying that animals

do not always move is that they are moved *per accidens*. But it has been shown above that the motion of the universe must be continuous and perpetual. Therefore, it is necessary that the first moving cause in the whole universe be immobile, in such a way as not to be moved even *per accidens*.

But, as was said above, in natural things a motion that is immortal and unceasing ought to be found, and the disposition of this universe should be maintained in its disposition and in the same state. For from the immobility of the principle that is set down as remaining immobile, it follows that the entire universe has an eternal permanence, insofar as it is joined to the first immobile principle and receives an influence from it.

1082. Then at (849) he excludes an objection. For he had said that if a mover is moved *per accidens*, it does not move with an undying motion. Now this seems to give rise to an objection, because, according to his positiont the motions of the inferior orbs, such as the sun and moon and other planets are eternal, and yet their movers seem to be moved *per accidens*, if we follow what he had just said. For he said that the reason why the soul of an animal is moved *per accidens* is that the animalts body is moved by an external principle, which is not from the soul; in like manner, it appears that the orb of the sun is moved by some other motion as though carried along by the motion of the first orb, insofar as it revolves from east to west; this is not the way it is moved by its proper movert but contrariwise, from west to east.

He dismisses this objection, saying that "being moved *per accidens*" can be attributed to something either with respect to itself or with respect to something else, and this is not the same. Now "being moved *per accidens*" can be attributed to the movers of the orbs of the planets, not in the sense that these movers are moved *per accidens*, but that the orbs moved by them are moved *per accidens* in being influenced by the motion of the superior orb. And this is what he says, that "to be moved *per accidens* from another," i.e., by reason of another, is attributed to certain principles of heavenly motions, in the case of the movers of the orbs which are moved by more than one motion, namely, by their own and by that of the superior orb. But the other case, that a thing be moved *per accidens* with respect to itself is found only in perishable things, as in the souls of animals. The reason for this diversity is that the movers of the superior orbs are not constituted existents through being united to bodies, and their connection with the latter is unvarying; and therefore, although the bodies of the orbs are moved, the motors are not moved *per accidens*. But the souls which move animals depend for their existence on being united to their bodies, and they are connected in a way subject to variation, and accordingly, as the bodies are affected by change, the souls themselves are said to be changed *per accidens*.

1083. Then at (850) he proves that the first motion is perpetual. And he does this with two arguments, the first of which depends on the foregoing and is this: A

motion which is not perpetual is found to be from a mover that is moved *per se* or *per accidens*, as is evident from above. Since, therefore, the first mover is immobile and perpetual, and is moved neither *per se* nor *per accidens*, then, necessarily, the first mobile, which is moved by this utterly immobile mover is moved with a perpetual motion.

Now, it should be noted that above he proved the immobility of the first mover by means of the perpetuity of motion, shown above. Here, on the contrary, through the immobility of the first mover he proves the perpetuity of motion, But this would be arguing in a circle, if the same motion were meant in both arguments.

Hence it must be said that above he proves the immobility of the first mover from the perpetuity of motion in general; that is why he said that among the things that exist, there is an unceasing and immortal motion. But here through the immobility of the first mover he proves the perpetuity of the first motion. From which it is plain that what the Commentator says is false, namely, that in the beginning of this Book VIII Aristotle proved that the first motion is perpetual.

1084. The second argument is given at (851) and is taken from the perpetuity of generation. And he says that the first motion is perpetual for another reason, namely, that the only way temporal generation and ceasing-tobe, and changes of this sort, can exist is that something move and be moved, for it has been proved above that every change is caused by some mover. Therefore, coming-to-be and ceasing-to-be and change of this kind ought to be from a mover, But they cannot be immediately from the immobile mover, because the immobile will always cause the same motion and in the same way, for its relation to the mobile is not variable; and, given a relation between mover and moved that remains the same, the motion remains always the same, However, coming-to-be and ceasing-to-be are not always in the same state, but at one time something is generated and at another it ceases to be. Therefore, these changes are not immediately from the immobile mover but from a mobile mover. Now, whatever is moved by a moved mover which in turn is moved by the immobile mover can retain perpetuity in spite of the alternation of diverse motions, because, since the mobile mover stands in varying relation to the things moved, it will not always cause the same motion. Rather, since it occupies differing positions (if moved with local motion), or assumes differing forms (if moved with a motion of alteration), it will produce a contrary motion in other things and will cause them to be at one time at rest and at another time in motion. He says "in contrary positions or forms," because it has not yet been proved by what form of motion the first mobile is moved; but he will inquire into this later.

Thus, therefore, insofar as it is moved, it is a cause of the diversity of motions; but insofar as it is moved by the immobile mover, it is the cause of the perpetuity in this diversity of changes. Therefore, the very perpetuity of generation shows that the first motion is perpetual and brought about by the immobile mover.

But it should be understood that these arguments by which Aristotle tries to prove that the first motion is perpetual do not conclude of necessity, for it can happen without any change in the first mover that it not always cause motion, as was shown above in the beginning of this Book VIII.

1085. Then at (852) he draws a conclusion which he left unsettled above, namely, why some things are always in motion and some not always.

And he says that the cause of this is now plain from what has gone before: Things which are moved by an immobile and eternal mover are always in motion; things which are moved by a changed mover are not always in motion—for the immobile, as previously stated, since it remains absolutely alike and in the same state, will cause a motion that is one and simple.

Lecture 14

Many reasons why local motion is the first motion

1086. After showing that the first mover is immobile, and the first motion perpetual, the Philosopher here begins to show which motion is the first and what kind of being the first mover is. And it is divided into two parts:

In the first he shows which is the first motion;
In the second, what kind of being the first mover is, (L. 21).

About the first he does two things:

First he states his intention;
Secondly, he carries out his proposal, at l087.

He says therefore first that in order that the consideration of the foregoing be more certain, we must begin from another starting-point and consider whether there is any motion which may be infinitely continuous and, if so, which it is, and which is the first of all motions,

And lest anyone should think that the one which may be continuous and the one which is first are two different motions, in order to exclude this he adds that it is plain that since it is necessary for motion always to exist, and the first is forever continuous, for it is caused by the first immobile mover, then necessarily it is one and the same motion which is eternally continuous and which is first.

1087. Then at (854) he proves the proposition.

First with arguments;
Secondly, by referring to the sayings of the ancients, (L. 20).

About the first he does two things:

First he shows that local motion is the first;
Secondly, which local motion, (L. 15).

The first he proves in three ways:

First through the properties of motions;
Secondly, through the difference between rior and subsequent, 1090;
Thirdly, by reason of the order of mobiles, at 1096.

1088. With respect to the first he gives two arguments, in regard to the first of which he proceeds thus:

First he proposes what he intends, and says that since there are three species of motiong one with respect to quantity and called "growth and decrease," another with respect to passible quality and called "alteration," and a third with respect to place and called "local motion," the last one must be the first of all.

Secondly, he proves this on the ground that it is impossible for growth to be the first motion, For growth cannot take place unless an alteration precedes it, because that by which something is increased is somehow unlike and somehow like, That it is unlike is plain, because that by which something is increased is food, which in the beginning4s contrary to what is nourished, on account of the diversity of disposition. But when it is added and causes increaset it is necessarily like. Now the transition from unlike to like does not take place except through alteration. Therefore, it is necessary that before growth, there must occur alteration through which food is changed from one contrary disposition to the other.

Thirdly, he shows that before every alteration there is a previous local motion, for if something is altered, it is necessary that there be something causing alteration, that makes the potentially hot come to be actually hot. But if this cause of alteration were always in the same way near at an equal distance to the thing altered, then it would not make it any hotter now than previously. Therefore, it is plain that the mover in alteration does not remain the same distance from what is altered, but is at one time closer and at another time farther away—and this cannot happen without a change of place. If, therefore, motion must always exist, then local motion must always exist, since it is the first of all motions. And if one local motion is prior to all other local motions, then, necessarily, if the foregoing is true, this first motion must be eternal,

1089. The second argument he gives at (855) and it is this: Alteration, as was proved in Book VII, occurs with respect to passions and passible qualities, among which, according to the opinions of the ancients, density and rarity seem to be a principle, because the heavy and the light, the soft and the hard, and the hot and the cold, seem both to result from, and to be distinguished by reason of, the dense and the rare (for among the elements the dense are found to be the heavy

and the cold, and the rare the hot and the light). Now this opinion is true to a certain extent, if the passible qualities be ranged according to their proximity to the material principle, for the rare and the dense seem especially to pertain to matter, as is clear from what was said in Book IV. But density and rarity seem to be instances of commingling and separation, according to which the ancient philosophers explained the generation and ceasing-to-be of substances. This opinion Aristotle uses as probable before manifesting the truth about generation and ceasing-to-be in his book *On Generation*. But things commingled and separated seem by that very fact to be changed with respect to place. Hence, change of place is a principle of alteration.

It should be noted, however, that although the commingling and separation that affect bodies actually existing pertain to local motion, yet the commingling and separation according to which the same matter is contained under larger or smaller dimensions do not pertain to local motion but to the motion of alteration, And it is was in this sense that in Book IV Aristotle explained the nature of the dense and of the rare. But here he is speaking according to what is probable according to the opinion of other philosophers.

Yet, just as local motion is required for alteration, so also for growth. For it is necessary that the magnitude of what is increased or decreased be moved with respect to place, because what is increased expands into a larger place, and what decreases shrinks into a lesser place. Therefore, in this way it is plain that local motion is naturally prior to both alteration and growth.

Ane he says that from this consideration it will be clear that change of place is the first of motions, for, just as in other things, so too in motion, one thing is said to be "prior" to another in various ways. For in one way something is said to be "prior" in the sense that, if it does not exist, neither do the other thingst while it itself can exist without the others, as "one" is prior to "two," because "two" cannot exist unless there is "one", but "one" can exist, even if there are not two. In a second way, something is said to be "prior" in times namely, in the past, when something is more distant from the present "now," or in the future, when something is closer to the present, as was said in Book IV. Thirdly, something is said to be "prior" according to substance, i.e., with respect to what completes a substance, as act is prior to potency, and the perfect to the imperfect.

1091. Secondly, at (857) he proves that local motion is the first among the three above-mentioned kinds of motion:

> First, as to the first;
> Secondly, as to the second, at 1092;
> Thirdly, as to the third, at 1094.

He says therefore first (857) that since it is necessary for motion always to exist, as was proved previously, this can be understood in two ways: first, as meaning

that there exists a continuous motion; secondly, as meaning that there are motions which exist one after the other, and nothing exists between them. Now, the perpetuity of motion is better saved if motion is continuous; moreover, it is a greater thing, if it be continuous rather than successive, because the former possesses more unity and perpetuity, and in nature we ought always to take what is more noble, if possible. But it is possible that there be a motion that is infinitely continuous, provided it be a local motion. (This is assumed for the presentg but later it will be proved.) From this it is plain that local motion must be taken to be the first motion.

For other motions are not required for the existence of local motion. For in order that a thing be moved with respect to place it need be neither increased nor altered, because a body that is in local motion does not have to be subject to generation and corruption, and we know that growth and alteration affect only things that are generated and cease to be. However, none of these motions can occur unless there is that eternal motion, caused by the first mover, the motion, namely, that is none other than local motion. Consequently, local motion can exist without the others but not they without it. Therefore, it is first according to the first way of being "prior."

1092. Then at (858) he proves that it is prior in time, About this he does two things. First he shows that, absolutely speaking, it is prior in time, because what is perpetual is, absolutely speaking, prior in time to what is not perpetual. But only local motion can be perpetual, as has been said, therefore, absolutely speaking, it is first in time.

1093. Secondly, at (859) he dismisses an objection through which this seems to be made invalid. Because if we consider some one body that is newly generated, local motion seems to be the last change to affect it. For first it is generated, then it is altered and increased, and finally it undergoes local motion, when it is now perfect, as is clear in man and in many animals.

But this does not disprove the statement that, absolutely speaking, local motion is first in point of time, because before all those motions which are found in this generated thing, a local motion had to exist in some prior mobile, which is the cause of the generation for those that are generated, as the generator is the cause of what comes to be in such a way as not to be itself generated.

That the motion which precedes generation is a local motion and that, absolutely speaking, it is the first of motions, he proves on the ground that generation is seen to be the first of motions in things that are generated, because a thing must first be made before it is moved—and this is true in everything generated. But there must be something moved prior to what is generated and which is itself not generated, or if it is generated, then there was something prior to it. In this way we must go on *ad infinitum*, which is impossible, as was proved above, or come

to some first.

But that first cannot be generation, for then it would follow that all changeable things are perishable, because everything that can be generated is able to perish. Therefore, if the first mobile is something generated, it follows that it is perishableg and as a consequence, all the subsequent mobiles. But if generation is not absolutely first, it is clear that none of the motions that follow it is absolutely first. And I say motions that follow, meaning growth, alteration, decrease and ceasing-to-be, all of which follow generation in time. If, therefore, generation is not prior to local change, it follows that none of the other changes can be absolutely prior to local change, And so, since some change must be absolutely first, it follows that local change is first.

1094. Then at (860) he proves that local motion is first in the order of perfection, And this he proves in two ways. First, in this way: Everything that is coming to be is, while it is coming to beg imperfect and tending to its principle, i.e., to a likeness to the principle that made it, and which is naturally first. From this it is clear that what is subsequent in the order of generation is prior in the order of nature. But in the process of generation, in all things generable, local change is found to be last, not only in one and the same thing, but also in the total progress of the nature of things that can be generated. Among theset some living things are completely immobile with respect to place on account of a lack of organ, as are plants, which do not have the organs required for progressive motion, and also many types of animals. But in the perfect animals local motion is found. If, therefore, local motion is present in things which comprehend nature in a higher degree, i.e., which attain to a greater perfection of nature, it follows that local motion is among all motions the first with respect to the perfection of substance.

1095. Secondly, at (861) he proves the same thing in this way; The less a motion takes away from the mobile, the more perfect is its subjeott and in this regard, a motion is somehow more perfect. But it is only according to local motion that nothing in the mobile subject is taken away: for in alteration, a transmutation with respect to a quality in the subject takes place, and in growth and decrease, a change with respect to the quantity of the subject takes place; moreover, the change involved in generation and ceasing-to-be affects the very form which constitutes the substance of the subject. But local motion is only with respect to place, which contains the subject externally. It remains, therefore, that local motion is the most perfect.

1096. Then at (862) from the side of the mobile he shows that local motion is first. For it is plain that what moves itself, most properly moves itself according to local motion. Since, therefore, it is something which moves itself that is the principle of other movers and mobiles and is consequently the first among all things that are moved, it follows that local motion, which is proper to it, is first

among all motions.

In this way, therefore, he concludes from the foregoing that change of place is the first of all motions.

Lecture 15

Local motion alone can be continuous and perpetual.

1097. After proving that local motion is the first of all motions, the Philosopher now shows which local motion is the first. And becauset as he said above, the motion must be the same which is continuous and first, this treatment is divided into two parts:

> First he shows which motion can be always continuous;
> Secondly, he shows that such a motion is the first, (L. 19).

The first part is divided into three sections:

> In the first he shows that no motion but local can be continuous;
> In the second that no local motion but a circular one can be continuous, (L. 16);
> In the third that a circular motion can be continuous, (L. 19).

About the first he does two things;

> First he proposes what he intends;
> Secondly, he proves his propositiont at 1098.

He says therefore first that since it has been shown that change of place is the first among all types of motion, we must now show which change of place is first, because there are many types of it, as was proved in Book VII,

And at the same time, according to the same method, i.e., art, i.e., according to the same technical consideration, there will be plain what we have just said and what was also previously assumed at the beginning of Book VIIII namely, that there exists a motion which is continuous and perpetual. Now the first and the continuous must be the same, as was proved above. For that reason both of them fall under the same consideration.

That no other type of motion, however, but local motion can be continuous and perpetual will be clear from what will be said.

1098. Then at (864) he proves the proposition. And about this he does two things:

> First he shows that no other species of change but local can be continuous and perpetual, remaining one and the same;

Secondly, that two changes which are opposite cannot suceed one another without an interval of rest, at 1103.

About the first he does two things:

First he proves the proposition;
Secondly, he excludes some objections, at 1100.

About the first he does two things:

First he proves the proposition in motions;
Secondly, in changes, at 1099.

He proposes therefore first (864) one proposition which is true in common both for changes and motions, namely, that all changes and motions are from opposites to opposites. But local motion is in alsense excluded from this generality, as was said at the end of Book VI. For generation and ceasing-to-be, which are changes, have, for their termini, existence and non-existence; the opposite termini of alteration are contrary passions, i.e., passible qualities, such as hot and cold, black and white; and the opposite termini of growth and decrease are large and small, or perfect and imperfect in magnitude, or quantity.

But it is plain from what was said in Book V that motions toward contrary termini are contrary. Therefore, a motion to white is contrary to a motion to black. But contraries cannot be together; therefore, while something is being moved to white, it cannot at the same time be undergoing a motion to back, Hence what begins to be moved from white to black by the motion of blackening, even though it should be moved by the motion of whitening while beeoming white, it could not simultaneously be moved by the motion of blackening, But what was existing previously, if it was not always being moved by some definite motion, must be considered as having been previously resting with a rest opposite to this motion, for whatever is apt to be moved is either at rest or being moved.

Therefore, it is plain that what is being moved to a contrary was at one time resting with a rest opposite to that motion. Hence no motion to a oontrary can be continuous and perpetual.

If, therefore, to this conclusion be added what was first assumed, namely, that every motion of alteration, or growth or decrease is to a contrary, it follows that none of these motions can be continuous and perpetual.

1099. Then at (865) he proves the same thing for changes, i.e., for generation and ceasing-to-be: these, indeed, are opposed universally according to the common opposition of being and non-being, and also in the singular thing, as the generation of fire is opposed to the ceasing-to-be of fire, according to the opposition of its existence and its non-existence.

Hence, if opposite changes cannot co-exist, it will follow that no change is

continuous and perpetual in the same way that it followed previously for motions, and that between two generations of the same thing, there must intervene a time in which ceasing-to-be occurred. In like manner, a time of generation interrupts instances of ceasing-to-be.

1100. Then at (866) he dismisses three objections. First of all, someone could say that since changes are opposed according to the opposition of their termini, whereas the termini of generation and ceasing-to-be are not contrary but contradictory, it seems to follow that generation and ceasing-to-be are not contrary; consequently, the same argument will not apply to them and to motions that are contrary.

To this objection he replies that it makes no difference whether changes which differ according to contradictory termini are contrary or not contrary, as long as this alone is true, that it is impossible for both to be in the same thing at the same time, For to be contrary or not contrary has no bearing on the argument given.

1101. The second objection he dismisses at (867). For someone could say that it is necessary for what is not always being moved to be previously at rest, because motion is the opposite of rest. But this does not occur in generation and ceasing-to-be, to which, properly speaking, rest is not opposed, as was said in Book V.

To this objection he responds that it makes no difference to the argument given whether there is rest in either of the contradictory termini or not, or whether change is not contrary to rest (because perhaps what does not exist cannot rest, and ceasing-to-be tends to non-existence, whence it seems that rest cannot occur in the terminus of a ceasing-io-be): but the proposition is sufficiently proved if an intermediate time exists between two generations or two instances of ceasing-to-be. For the consequence will be that neither of these changes is continuous.

After this he returns once more to the first objection and says that the reason why it makes no difference whether the changes between contradictory termini are contrary or not is that in the earlier discussions about motions likewise, it was not the question of contrariety that played a part in the proofs but the fact that the two changes could not occur at one and the same time. And this is not a peculiarity of contraries, but is common to all opposites.

1102. The-third objection he dismisses at (868). For he had said previously that motions which tend to contraries are contrary. Therefore, since motion is contrary to rest, it seems to follow that one thing has two contraries—which is impossible, as is proved in *Metaphysics* X.

In order to exclude this he says that there is no need to be disturbed about the fact that one thing seems to be contrary to two things, i.e., a motion contrary to

rest and to the motion which is to a contrary. Rather, the only thing we ought to take is that one contrary motion is in some manner opposed both to another contrary motion and to restt to another contrary motion according to direct contrariety; but to restt more according to privative opposition. Yet this latter opposition has some contrariety, inasmuch as an opposite rest is the end and complement of a contrary motion, just as "equal and commensurable" is opposed in a way to two things, namely, to the excelling and to what is excelled, i.e., to the large and the small, to which two it is opposed rather according to privation, as is plain in *Metaphysics* X. And once more, what is important to grasp is that opposite motions or opposite changes do not occur at one and the same time.

1103. Then at (869) he shows that there must not only be a time between two motions or changes of the same species, and that no single change which tends to one of two opposites can be perpetual and continual, but also that it is impossible for opposite motions or changes so to follow one upon the other that there is no time between them. For it seems to be utterly at odds with generation and ceasing-to-be that when something has come to be and its generation is complete, that immediately it begin to cease to be, so that there would be no period of time in which the generated thing would be permanent. For a thing would be generated in vain, if the generated thing were not to remain in existence.

Hence from these changes of generation and ceasing-to-be, we can understand the others. For the natural is what occurs in a like way in all things, since nature always acts in the same way. Therefore, just as it seems unacceptable for something to cease to be as soon as it is generated, so, toot it seems unacceptable that a thing should start becoming black as soon as it became white, and..that a thing should begin to shrink as soon as it is grown. For in all these cases, the intention of nature would be frustrated.

Lecture 16

No change of place can be continuous and perpetual except the circular

1104. After showing that no change but local can be continuous and perpetual, the Philosopher now shows that no local change can be continuous and perpetual, unless it be a circular one. About this he does two things:

First he proves his proposition by a demonstration;
Secondly, dialectically, (L. 18).

About the first he does two things:

First he proves his proposition;
Secondly, from the proven truth he solves some doubts, (L. 17).

About the first he does three things:

First he mentions what he chiefly intends. For he intends to prove that it is possible that there be a motion which, being one, might be continued *ad infinitum*, and that such a motion can be none but a circular one. This is the first thing he proves.

1105. Secondly, at (871) he shows how to proceed. And he says that whatever is moved locally is moved with either a circular motion or a straight one or in a motion that combines these two, e.g., a motion through a chord and an arc. Hence it is clear that if either of the two simple motions, namely, the circular or the rectilinear, cannot be infinitely continuous, much less their combination. Therefore one must omit the latter and attend to the simple ones.

1106. Thirdly, at (872) he shows that a rectilinear motion upon a straight and finite magnitude cannot be infinitely continuous and that consequently no rectilinear motion can be infinitely continuous unless an actually infinite magnitude is assumed—and this was proved impossible in *Physics* III above.

He proves his point with two arguments,, of which the following is the firstt If anything be moved *ad infinitum* upon a finite magnitude, it has to be done by reflexion. For it has been proved in Book VI that something will traverse a finite magnitude in finite time. When, therefore, the boundary of the finite magnitude is reached, the motion will cease, unless the mobile is returned by reflexion to the beginning of the magnitude whence the motion began. But what is reflected in a rectilinear motion is being moved with contrary motions. And this he now proves;

Contrary motions are ones whose terminal points are contrary, as was proved in Book V. But the contrarieties of place are up and down, ahead and behind, right and left. Now, whatever is reflected must be reflected according to one or other of these contrarieties. Therefore, whatever is reflected is moved with contrary motions.

But it was shown in Book V which motion is one and continuous: the one, namely, which is of one subject, in one time, and in the same category that does not differ specifically. For these three elements are considered in every motion: first, there is the time; secondly, the subject being moved, such as a man or a god, according to those who call the heavenly bodies "gods"; thirdly, there is that in which the motion occurs: in local motion it is a place; in alteration it is a passion, i.e., a passible quality; in generation and ceasing-to-be it is a form; in growth and decrease it is a magnitude.

Now it is clear that contraries differ with respect to species; hence contrary motions cannot be one and continuous, But the six things listed above are differences of place and, consequently, they must be contrary, because the differences of any genus are contrary. It remains, therefore, that it is impossible

for that which moves by a reflected motion to be moved by one continuous motion.

1107. And because someone could doubt whether what is reflected is being moved with contrary motions, on the ground that there does not appear a manifest and determinate contrariety in place, such as does appear in the other genera in which motion occurs, as was said in Book V, he therefore, in order to show the same point, adds a certain sign over and above the argument above, which was based on the contrariety of termini.

And he says that the sign of this is that a motion from A to B is contrary to one from B to A, as happens in a reflex motiong because such motionst if they take place simultaneously, "arrest and stop each other," i.e., are such that one impedes the other and stops it.

And this happens not only in reflex straight motion but in reflex circular motions. For let three points A, B and C be designated on a circle. It is evident that if something begins to be moved from A to B and later is moved from A to C, there was reflexion and those two motions block one another and one arrests the other, i.e., causes the other to stop. But if something is moved without interruption from A to B and again from B to C, there is no reflexiono But the reason why reflex motions impede one anothert both in straight and in circular motions, is that it is the nature of contraries to impede and destroy one another.

Motions, however, that are diverse but not contraryt do not impede one another, as, for example, an upward motion and a motion to the side, i.e., to the right or left, do not obstruct one another; rather something can at the same time be moved upwards and to the right.

1108. Then at (873) he gives a second argument to show that reflex motions cannot be continuous *ad infinitum*, and it is an argument based on the pause that must intervene. He says, therefore, that it is above all the fact that what is reflected must rest between two motions which makes it clear that it is impossible for a rectilinear motion to be infinitely continuous. And this is true not only if something is moved through a straight line but also if it is carried along according to a circle.

And lest anyone suppose that being carried along "according to a circle" is the same as being carried along "circularly," to exclude this he adds that it is not the same to be carried along circularly according to the characteristics of a circle and to be carried along a circle, i.e., to traverse a circle. For sometimes it occurs that the motion of what is moved is according to a certain continuity, as, namely, it traverses part after part according to the order of parts of the circle, and this is "to be carried along circularly." But sometimes it occurs that what traverses a circle has not, when it returns to the point whence the motion began, travelled in an onward direction according to the order of the parts of the circle, but has

returned backwards—and this is "to be reflected." Whether, therefore, the reflexion occurs in a straight line or a circular line, a pause must intervene.

1109. Belief in this can be based not only on sense, for it is sensibly evident, but also on an argument.

The principle of this argument is that, since three things are involved in a magnitude that is traversed, namely, a beginning, a middle, and an end, the middle is both, when compared to both. For in respect to the end, the middle is a beginning, and in respect to the beginning, it is an end. Consequently, while it is one as to subject, it is two in conception. Another principle to be taken is that what is in potency is other than what is in act.

Keeping these things in mind, it should be considered, from what has been said, that each sign, i.e., each designated point between termini of a line ever which something is being moved, is potentially a middle, but it is not one unless a division with respect to the motion takes place in such a way that at a given point the thing in motion stops and then resumes its motion at that point. Now, in this way that middle will become an actual beginning and an actual end, i.e., the beginning of the subsequent (inasmuch as the mobile resumes its motion from it) and an end of the first motion (inasmuch as the first motion was terminated there by reason of rest).

For let there be a line at whose beginning is A, at whose middle is B, and at whose end is C. Then let something be moved from A to B and stop there; then let it begin to be moved from B and be carried along to C. In this example, it is plain that B is actually the end of the prior motion and the beginning of the subsequent one.

But if something be moved continuously from A to C without any interval of rest, it is not possible to say that the mobile has "come to be," i.e., has arrived at, or has "ceased to be," i.e., has left, either the point A or the point B. Only this can be said, namely, that it is in A or in B at a certain "now." (But not at a certain time, unless we should perchance say that a thing is somewhere in time because it is there in some "now" of time. And so what is being moved continuously from A to C in some time will be in B at an instant which is a divider of time. In this way, it will be said to be in B in that entire time, in the sense that we speak of something being moved in a day because it is in motion in a part of that day.)

And because it seemed doubtful that what is in motion does not arrive at and leave each determinate point of a magnitude which is traversed by a continuous motion, he shows this. He says, then, that if someone grants that the mobile arrives at and then leaves some assigned point in the magnitude, it follows that it is at rest there. For it is impossible that in the same instant a mobile arrive at and leave this point B, because to arrive somewhere and to leave there are contraries, which cannot exist in the same instant.

Therefore, it must be at other and other "now's" that the mobile arrives at and leaves a given point of the magnitude. But between any two "now's" is an intermediate time. Therefore, it will follow that the mobile, A, rests in B. For anything that is somewhere for a time is there before and after. And the same must be said for all the other "signs" or points, because the same reasoning applies to all.

Hence it is plain that what is being carried along continuously over a magnitude is at no time arriving at, or departing from, any intermediate point. For when it is said that the mobile is "at" this point, or is "coming to be" in it or is "approaching" it, all these expressions imply that that point is a terminus of the motion. And when it is said that it "leaves" or "departs," a beginning of motion is implied. But a designated point of a magnitude is not actually a middle or a beginning or an end, because the motion neither begins nor ends there; rather, it is these potentially only, because the motion could begin or end there. Hence the mobile neither arrives at nor leaves an intermediate point, but it is said to be there absolutely in a "now." For the existence of a mobile at some point of the magnitude is compared to the whole motion as the "now" is compared to time.

1110. But when the mobile A uses B as an actual middle, beginning and end, then it must be at a stop there, because by moving and stopping it makes that one point to be two, namely, a beginning and an end, as happens also in understanding. For we can simultaneously understand one point as it is one in subject, but if we consider it separately as a beginning and separately as an end, this will not take place simultaneously. So too, when that which is being moved uses a point as one, it will be there only in the one "now." But if it uses it as two, namely, as a beginning and end in act, it will be there for two "now's," and, consequently, for a middle time between them. And so it will be at rest. Therefore, it is plain that what is being moved continuously from A to C was neither present nor away from the intermediate B, i.e., it neither arrived at it nor departed from it; but it was away from and left, the first point A, as the actual beginning; and it was present in, or arrived at, the final point C, because there the motion is finished, and the mobile rests.

It should be remarked that in the foregoing, "A" was sometimes taken as the mobile, and sometimes as the beginning of the magnitude.

1111. From all these things it is clear that a reflected motion, whether it occurs along a circular or a straight magnitude, cannot be continuous, but a rest intervenes, because the same point is actually the end of the first motion and beginning of the reflexed one. But in a circular motion the mobile does not use any point as an actual beginning and end, but each point is used as an intermediate. Therefore, a circular motion can be continuous, but a reflexed one cannot.

Lecture 17

Certain doubts resolved.

1112. After showing that a reflex motion is neither continuous nor one, the Philosopher now settles some doubts on the basis of what has gone before. And it is divided into three parts according to the three doubts he resolves from the foregoing.

The second part begins at 1115;
The third, at 1119.

About the first he does two things:

First he sets forth the doubt;
Secondly, he solves it, at 1114.

1113. He says therefore first (874) that what was said in order to prove that a reflex motion is not continuous may be applied to solving a certain doubt, which is this: Assume two equal magnitudes, one called E, and the other Z. Let A and D be two equally swift mobiles, such that A is continuously moved from the beginning of the magnitude (E) to C, and D (along Z) to I, And let us assume that in the magnitude E there is an intermediate point B, which is as far from C as a like point Z on Z is distant from I. Let us further assume that at the same time that A in its continuous motion is approaching B, D in its continuous motion is receding from Z and going to I. Now, since these motions are regular and equally swift, it will follow that D will arrive at I before A arrives at C, because the one which starts first will first arrive to the end of an equal distance. But D left Z before A left B, because D left Z when A was arriving at B. Therefore, according to this, A did not simultaneously arrive at B and leave B, and it consequently follows that it departed after it arrived, because if it arrives and departs at the same time, it will not have begun to move later. And so it is necessary that A, while being carried along, rest in B. Therefore a continuous motion will be composed of periods of rest, as Zeno claimed in Book VI.

1114. Then at (875) he resolves this doubt in the light of the foregoing. For the objection supposed that A in its continuous motion arrives at a point B in the magnitude and that at the same time that A arrived at B, D left the point Z—which is against what was had above. For it was said above that when something is being moved continuously, it can neither arrive at, nor depart from, any intermediate point. Therefore, what the objection assumes must not be assumed, i.e., that when A was at, i.e., approached B, D was departing from Z, because if it be granted that A arrived at B, then for the same reason it should be granted that it left B, and that this did not occur simultaneously, but in two instants, so that in the intermediate time between the two instants it was at rest.

But as was said previously, when something was being continuously moved, it was neither departing fromt nor approaching, a given point, but was simply there —and this not for a time, because then it would have been resting, but in a division of time, i.e., in some "now," which divides time.

Therefore, what the objection assumed, namely, that A arrived at and that D left some intermediate point is impossible to state in a continuous motion. But in a reflex motion this must be stated. For if a mobile I is moved to the point D and is then rebounded, it is plain that the mobile uses the ultimate, which is D, as a beginning and as an end, i.e., the point is used for two things, hence it had to be at rest there.

Nor can it be said that it simultaneously arrived at and left D, because then it would have been, and not have been, there in the same instant. For whatever has been moved exists in the terminus to which it was being moved, and whatever begins to be moved is not in the terminus from which it begins to be moved. But when we use the expression "to be at" or "to approach," we mean that a motion is being terminated at that point, and when we say "to be away from" or "to depart," we mean that the motion is beginning. Hence, it is necessary that whatever arrives at, or is at, a point, be in it, while what is leaving it or is departing from it, be not in it. Since, therefore, it is impossible to be and not to be in a given point at the same time, it is consequently impossible to be at once at and away from the same, as the objection more than once assumed.

It should be noted that here he uses different letters from those used above. Here I is the mobile and D the terminus; above, it was the opposite.

But the solution given for continuous motion is not to be used with respect to a reflex motion. For it cannot be said that the mobile I is in the terminus D, from which it began to be reflected, only in the division of time, i.e., only during the "now," and that the mobile neither arrived at, nor departed from, the same, as was said with respect to a continuous motion. For in a reflex motion an end must be reached that is an actual end, and not merely a potential one, as the intermediate point in a continuous motion was only potentially a beginning and an end. Therefore, that which is an intermediate point of a continuous motion is only potentially a beginning and an end; but the point from which a reflex motion begins is actually a beginning and end. For example, it is the end of the downward motion of a stone, and the beginning of its upward motion, in the case of a stone falling to earth and bouncing upward.

Therefore, just as in the magnitude in which a motion is occuring, a point from which the motion is reflexed is both an actual beginning and end, so also in the motions themselves, there is actually an end of one and a beginning of the other. And this would not be so, unless an interval ofrest occurred. Therefore, it is necessary that what is reflected in a straight line be at rest. And so it follows that

on a straight magnitude there cannot be a continuous and perpetual motion, because no straight magnitude is infinite. And so there could not be perpetual continuous rectilinear motion, unless reflexion is involved.

1115. Then at (876) he presents the second doubt. About this he does three things:

First he mentions the doubt;
Secondly, he rejects a solution given in Book VI, at 1116;
Thirdly, he gives the true solution, at 1118.

He says therefore first (876) that by the same method, using the things shown above, one can block those who give the objection of Zeno and wish to argue in the following manner: Whatever is being moved must first cross what is intermediate before arriving at the end; but between any two termini there are infinite intermediates on account of a magnitude's infinite divisibility; and so it is impossible to traverse the intermediates, because infinites cannot be traversed. Therefore, nothing can by motion arrive at any terminus.

Again, the same difficulty can be presented under another form, as some do in fact propose it: Whatever traverses a whole must previously traverse the half; and since the half is again divided in half, half of the half must be first traversed. And thus, whatever is being moved counts off every half as it reaches it. But such halves can be multiplied *ad infinitum*. Therefore, it follows that if anything traverses an entire magnitude, it has counted off an infinite number, which is plainly impossible.

1116. Then at (877) he rejects the solution he had presented above in Book VI.

First he cites it;
Secondly, he sets it aside, at 1117.

He says therefore first that the foregoing objection was answered in Book VI, when motion in general was being discussed, on the ground that just as a magnitude is divided infinitely, so also is time. Consequently, time possesses infinities in itself in the same way as a magnitude. And so it is not unfitting if the infinites in a magnitude be traversed in the infinites which are in time. For it is not inconsistent for an infinite magnitude to be traversed in an infinite time. But, as shown in Book VI, the infinite is found in magnitude and in time in the same way.

1117. Then at (878) he sets aside this solution, And he says that this solution is sufficient to answer the questioner who asked whether it was possible in a finite time to traverse and count off infinites. This question was retorted by saying that a finite time possesses infinities in which the magnitudinal infinites can be traversed. But that solution does not reach the truth of the matter, because if someone should omit to ask about the magnitude and whether it is possible to

traverse infinities in finite time, but asked rather this same question about time, namely, whether the infinites which are in time can be traversed—since time is divided *ad infinitum*—then the previous solution would not answer this question. Consequently, another solution must be sought.

1118. Then at (879) he gives the true solution in the light of his premises above. And he says that the true solution of the present doubt requires us to repeat what was premised in the immediately foregoing arguments, namely, that if someone divides a continuum into two halves, he then uses the one point at which the continuum is divided as two, because.he is making it serve both as the beginning of one part and as the end of the other. He does this by numbering, and by dividing into two halves.

But when a continuum has been divided in this manner, it is no longer a continuum, whether it be a magnitude, such as a line, that is divided, or a motion, for a motion cannot be continuous unless it is the motion of something continuous, namely, as to subjects and time and magnitude traversed. Therefore, the divided in effect counts and by counting breaks the continuity.

But so long as continuity endures in a continuum, there is an infinity of intermediates not in act but in potency, for if someone should make some middle actual, it will be due to division, as has been said, insofar as it is taken as the beginning of one and the end of the other. In that case, the continuum will not remain but will "stop," i.e., the intermediates that,are now in act will not be infinite but one will come to a stop in them. This shows up especially in the case of one who wishes to count the intermediates, because he will have to count one as two, inasmuch as it is the end of one half and the beginning of the other. And this, I say, takes place when the whole continuum is not counted as one, but two halves are counted in it, For if the whole continuum is taken as one, it has already been stated that then an intermediate point will not be taken as an actual end and beginning but potentially only.

With these facts in mind, the answer to be given to one who asks whether infinites in time or in a magnitude may be traversed is that in one sense it does happen, and in another it does not happen. For when one has infinites in act, it is impossible that they be traversed, but when they are potentially infinite, they can be traversed. And so, since the intermediates in a continuum are infinite only in potency, it does happen that infinites are traversed, because what is in continuous motion traverses *per accidens* what is infinite, namely, what is infinite in potency, But *per se* it has traversed a finite line which happens to have an infinitude of intermediates in potency. The line itself, however, in its nature and definition, is distinct from those infinite intermediates. For a line is not a composite of points, but points may be designated in a line insofar as it is divided.

1119. Then at (880) he resolves the third doubt. About this he does three things:

First he mentions the doubt and its solution;
Secondly, he explains each with an example, at 1120;
Thirdly, he draws a corollary from the foregoing, at 1122.

First therefore (880) he states the doubt that is wont to arise with respect to generation and ceasing-to-be. For what is generated ceases not to be, and begins to be. But the time assigned for the existence of a thing that is generated or has ceased to be, must be different from the one assigned to its non-existence. For example, if from air fire is generated, then in the whole time AB there was not fire but air, but in the entire time BC there is fire. Since, therefore, sign B of the whole time ABC is common to both times, it seems that in that common instant the fire both exists and does not exist.

The Philosopher therefore solves this doubtj saying that it is plain that, unless someone holds that the point of time which divides a prior time from a later one, "always belongs to the later," i,e., that in that instant the thing is in the state which it subsequently has, it follows that the same is simultaneously being and non-beingt and that when something has been produced, it is non-being. For it is then produced when generation terminates, namely, in that "now" which divides the prior time and the later. If, therefore, in the entire prior time it was non-being, in that "now" also when it has already been generated, it is also non-being, since this "now" is the end of the prior time.

How these impossibilities do not follow he explains by adding that one and the came sign as to number, i.e., the "now" is common to both times, namely, to the prior and to the subsequent. But although it be one as to subject, it is not one in conception but two, for it is the end of the prior time and beginning of the subsequent. But if we take the "now" as it is a thing, i.e., if it be taken as it is one in reality, it always belongs with the subsequent state (passion).

Or in other words: Although the "now" is the end of the prior time and the beginning of the subsequent, and is thus common to both, yet accordingly as it belongs to the thing, i.e., insofar as it is compared to the thing which is being moved, it always belongs to the subsequent passion, because the thing being moved is in that instant being subject to the passion of the subsequent time.

1120. Having given the objection and its solution, he explains both with examples. And first the objection, at (881). He says therefore: Let ACB be the time, and D the thing that is being moved, so that, in time A, D is white, and in B it is non-white. It seems therefore to follow that in C it is white and non-white. How this follows he now explains: If it is white in the entire time A, then at any time taken in A it is white; and likewise, if it is non-white in the entire time B, it follows that at any time taken in B it is non-white. Since, therefore, C is taken in both—being both the end of the former and the beginning of the latter—it seems to follow that in C it is white and non-white.

1121. Secondly, at (882) he illustrates the solution given above. And he says that we must not concede that it is white at any point of time in A, for the ultimate "now," which is C, must be excepted, for it is already "later," i.e., it is the ultimate terminus of the change. For example, if the white was coming to be or ceasing to be in the entire time A, in C it is not ceasing to be or becoming white, but already become or ceased to be. But what has already been made, exists, and what has already ceased to be, does not exist. Hence it is clear that in C it is first true to say this is white, if the generation of white has terminated there, or this is not white, if the ceasing-to-be of white has terminated there. Or, if that is not stated, the above-mentioned incompatibilities follow, namely, that when something has been already generated, it is still non-existent, and when it has ceased to be it is still a being. Or, it also follows that something is at once white and non-white, and, universally, being and non-being.

1122. Then at (883) he draws a certain corollary from the foregoing, namely, that time is not divided into indivisible times, because, should one suppose this, it would be impossible to solve the doubt previously mentioned.

He says therefore that it is necessary that whatever is first a non-being, and later is a being, come to be at some time; and again, it is necessary that when something is coming to be, it is not existing. Now, if these two aeoumptions are true, it is impossible for time to be divided into times that are indivisible. For let a time be divided into indivisible times. Then let A be the first indivisible time, and B the second and subsequent time. Now D, which was previously not white and later is white, was becoming white in time A, and at that time was not white. But one must suppose that it has been made white in some indivisible time which is "had,", i.e., subsequent, to A, namely, in time B in which it is now white. Now, if it was becoming white in A, it follows that in A it was not white; in B, however, it is white. Since, therefore, between non-existence and existence an instance of generation occurs, because nothing passes from non-existence to existence but by generation, it follows that an act of generation occurs between time A and time B. Therefore, there will be between A and B an intermediate time in which it was becoming white (since in time B, D is already generated).

And similarly, since in that intermediate indivisible time it is becoming white, it is not white: hence for the same reason it will be necessary to posit still another intermediate time and so on *ad infinitum*, because we cannot assume that it is becoming white and is white in the same period of time.

But the argument is not the same, if one states that the times are not divided into indivisible times. For according to this, we will say that it is one and the same time in which it was coming to be, and was produced. But it was coming to be, and was non-being, in the entire preceding time, and it was produced and a being in the final "now" of the time, which instant is not related to the preceding time as being "had" or subsequent, but as its terminus. But if one assumes

indivisible times, they are necessarily (discrete and) consecutive.

But it is plain according to the foregoing that, if we do not assume indivisible times, then if something comes to be white in the entire time A, the time in which it was coming to be and was completely made, is no greater than the time in which it was coming to be alone. For it is coming to be in the entire time, but in the ultimate terminus of that time it was completely made. But time plus its terminus is not something greater than the time by itself, any more than a point adds any magnitude to a line. But if indivisible times are assumed, it is clear from the foregoing that there must be more time in coming to be and completely being, than in coming to be alone.

Finally, in summary, he concludes to his main intention, saying that the foregoing arguments, and ones like them, are the appropriate ones to convince us that a reflex motion is not continuous.

Lecture 18

Dialectical reasons to show reflex motion is not continuous

1123. After proving with proper reasons that reflex motion is not continuous, the Philosopher now proves the same with common and logical reasons. About this he does two things:

First he expresses his intention;
Secondly, he proves his proposition, at 1124.

He says therefore first that if someone wishes to prove "reasonably," i.e., logically, the proposition in question, it will be seen from the reasons to be given that the same thing follows, namely, that reflex motion is not continuous.

1124. Then at (885) he proves the proposition.

First, for reflex local motion only;
Secondly, in common for all motions, at 1126.

The first argument is this: Everything in continuous motion has been, from the very beginning of its motion, in the process of being carried, as toward an end, to that at which it arrives according to change of place, unless there is some obstacle (because an obstacle could deflect it in another direction). He exemplifies this by saying that if something in local motion has arrived at B, it was being moved toward B not only when it was near B but at soon as it began to be moved. For there is no reason why it should be tending more toward B now than before. And the same is true in other motions.

But if a reflex motion should be continuous, it will be true to say that what is in motion from A to C, and is then reflected back to A, is in a continuous motion.

Therefore, in the very first part of the motion from A to C it was being moved to its final terminus in the part A; in this way, while it is being moved from A, it is being moved toward A. It follows, therefore, that it is being simultaneously moved with contrary motions, because in the sphere of rectilinear motions, to be moved from a thing and to be moved toward the same are contrary. But in circular motions this is not contrary. Now it is impossible for something to be moved simultaneously with contrary motions. Therefore, it is impossible for a reflex motion to be continuous.

1125. Then at (886) from the same middle he leads to another impossibility. For if something, while it is being moved from A, is being moved toward A, it cannot be moved toward A except from a counter-point C, in which the mobile was not yet present when it began to be moved from A. It follows, then, that something is being moved from a terminus at which it is not present—which is impossible. For it cannot leave a place in which it is not. Thus, it is impossible for a reflex motion to be continuous. And if this is impossible, then it is necessary that at the point of reflexion the mobile be at rest, i.e., in C. From which it is plain that it is not one motion, because a motion interrupted by rest is not one.

1126. Then at (887) he proves the same thing in a more universal way for every genus of motion, with three arguments. The first of them is this: Whatever is in motion is being moved with respect to one of the species of motion listed previously. In like manner, whatever is at. rest is so with respect to a rest that is opposite to one of the aforesaid species of motion. For it was shown above in Book V that no motions other than the ones listed are possible.

Let us, therefore, take a motion that is distinct from other motions, in the sense of being specifically distinct from others, as whitening is distinct from blackening—but not distinct in the way that one part of a motion is distinct from other parts of the same motion, as one part of the motion of whitening is distinct from other parts of the same whitening. Taking, therefore, one motion in the way described, it is true to say that whatever is not forever being moved with this motion, was before of necessity at rest with an opposite rest, as whatever is not being forever whitened was at some time at rest with a rest opposite to whitening. But this proposition would not be true if some definite part of the motion should be taken, for it is not necessary that what was not forever being moved in this part of the whitening was previously at rest with an opposite rest, because before the thing was becoming white in some other part of the whitening. And because of this he states significantly: "...not some particular part of the whole."

This proposition he now proves: When one of two things that are in privative opposition is not in its recipient, the other must be. But rest is opposed to motion privatively. Therefore, if a mobile was existing at a time when motion was not in it, it follows of necessity that rest would then have been in it.

Accordingly, since this proposition has been provedg he takes the minor from the argument already presented above and says that, if rectilinear motions from A to C and from C to A are contrary, and contrary motions cannot coexist, it is plain that when something was being moved from A to C, it was not at the same time being moved from C to A. Consequently, it was not forever being moved with respect to the motion from C to A.

Hence, according to the previous proposition, it is necessary that the mobile first rest with an opposite rest. For it has been shown in Book V that to a motion from C is opposed rest in C. Therefore, it was at rest in C, Therefore the reflex motion was not one and continuous, since it was interrupted by the interposition of rest.

1127. He presents the second argument at (888), and it is this: Non-white ceases to be and white comes to be simultaneously; similarly, white ceases to be and non-white comes to be simultaneously. But if reflex motion in every genus is continuoust it will follow that an alteration is terminated at whiteness, and begins to depart from whiteness, in such a way as to form a continuous motion, and that it does not rest there for any time; for if rest should intervene, the alteration would not be continuous. But, as has been said, when the white comes to be, the non-white ceases to be, and when departure from white occurs, non-white comes to be. Therefore, it will follow that non-white is ceasing to be and coming to be at the same timeg for these three things are present at the same time, namely, the coming-to-be of white, the ceasing-to-be of non-white and the coming-to-be of non-white—that is, if the reflex motion is continuous without any interval of rest. This, however, is plainly impossible, namely, that non-white should be coming to be, and ceasing to be, at the same time. Therefore, a reflex motion cannot be continuous.

Now, this argument is seen to refer to generation and ceasing-to-be. For this reason he says that this argument is more proper than the previous ones, because it is more apparent in contradictories that they cannot be true at the same time. And yet, what is said in generation and ceasing-to-be applies to all motions, since in every motion there is a kind of generation and ceasing-to-be. For just as in the case of alteration, white is generated, and non-white ceases to be, so too in every other motion.

1128. At (889) he gives the third argument, which is this: As was had in Book V, it is not necessary, if the time is continuous, that a motion be on that account continuous. For motions of diverse kinds, even though they succeed one another in continuous time, are not on that account continuous, but are, rather, consequent upon one another, for continua must have one common terminus. But there cannot be one common terminus in things that are contrary and specifically different, such as whiteness and blackness. Since, therefore, a motion from A to C is contrary to one from C to A in any genus of motion, as was shown in Book Vt it is impossible that those two motions be continuous one to the other

—even though the time be continuous—with no intervening rest. It remains, therefore, that a reflex motion can in no way be continuous.

It should be noted that the foregoing arguments are called "logical" because they proceed from certain common things, namely, from the property of contraries.

Lecture 19

Proper reasons why circular motion can be continuous, and why it is the first

1129. After showing that no local motion but a circular one can be continuous, the Philosopher now shows that a circular motion can be continuous and first.

First of all he shows this with proper arguments;
Secondly, with logical and common arguments, (L. 20).

About the first he does two things:

First he shows that a circular motion is continuous;
Secondly, that it is the first, at 1134.

About the first he does two things:

First he gives two arguments to prove that circular motion can be continuous;
Secondly, from the same arguments he concludes that no other motion can be continuous, at 1132.

1130. But that a circular motion can be one continuous motion he proves at (890) with his first argument: That from which nothing impossible follows is said to be possible. But nothing impossible follows from the statement that a circular motion is forever continuous.

This is plain from the fact that, in a circular motion, that which is being moved from somewhere, e.g., from A, is at the same time being moved to the same point "according to the same position," i.e., according to the same progress of the mobile, the same order of parts having been maintained. This, however, does not happen in a reflex motion, because when something turns back, it is disposed according to a contrary order of parts in its motion. For either that part of the mobile to the fore in the first motion must be at the rear in the reflexion, or that part which was facing one difference of place, for example, the right or above, in reflexion must face a contrary direction. But in a circular motion the same position is maintained, while a thing is being moved toward the point from which it departed. Consequentlyt it could be said that even from the very beginning of its motion, while it was departing from A, it was being moved toward that which it would finally reach, namely, the very same A.

Nor does this lead to the impossibility of being moved with contrary or opposite motions at one and the same time, as followed in rectilinear motion. For not every motion to some terminal is contrary or opposite to one from the same terminal, but such contrariety is present in the straight line, according to which, contrariety in place is gauged. For contrariety between two termini is not forthcoming according to a circular line, whatever part of the circumference be taken, but according to the diameter. Contraries, indeed, are things most far apart; but the greatest distance between two termini is not measured according to a circular line, but according to a straight line. For between two points an infinit,e number of curves can be described but only one straight line, But the measure in any genus is that which is one.

Consequently, it is plain that if one takes a circle, and it be divided in half, and AB be its diameter, a motion through the diameter from A to B is contrary to a motion over the same diameter from B to A. But a motion over the semicircle from A to B is not contrary to a motion from B to A over the other semicircle. But it was contrariety that prevented a reflex motion from being continuous, as appears from the reasons given above. Nothing, therefore, once contrariety has been removed, prevents a circular motion from being continuous and also not failing at any time.

And the reason for this is that a circular motion is completed by the fact that it is from the same to the same, and thus its continuity is not impaired by this. But a rectilinear motion is completed by its being from one thing to another; hence, if it returns from that other to the same from which it began, it will be not one continuous motion, but two.

1131. Then at (891) he gives the second argument, saying that a circular motion does not exist in identical things, but a rectilinear motion is very often in identical things.

Now what this means is that, if something is moved from A to B across a diameter, and again from B to A across the same diameter, it has to return across the same middles through which it previously travelled, Consequently, it is being carried over the same middle a number of times. But if something is moved through a semicircle from A to B, and again from B to A through the other semicircle—and this is motion in the circular manner—it is clear that it does not return to the same point over the same middles.

Now, it is of the nature of opposites that they be considered with relation to the same thing. And thus it is clear that to be moved from the same to the same with a circular motion is without opposition, but to be moved from the same to the same with a reflex motion is with opposition.

In this way it is plain that a circular motion which does not return to the same

over the same middles, but always goes over something other, can be one and continuous, because it does not have opposition. But that motion, namely, the reflex motion, which, in returning to the same, traverses more than once the same middles, cannot be forever continuous, because that would require something being moved with contrary motions at one and the same time, as was proved above.

And from the same argument it can be concluded that a motion confined to a semicircle, or to any portion of a circle, cannot be continuous in perpetuity, because such motions require repeated traversing of the same middles and involve being moved with contrary motions, as though a return to the beginning should be made. The reason is because the end is not joined to the beginning when you are dealing with a straight line, or a semicircle, or an arc of a circle; rather the beginning and end are apart. It is only in a circle that the end is joined to the beginning.

And for this reason only a circular motion is a perfect motion, since a thing is perfect from attaining its principle.

1132. Then at (892) he proves from the same argument that in no other genus of motion can there be continuous motion.

First he proves the proposition;
Secondly, he draws a corollary from what was said, at 1133.

He says therefore first (892) that also from this distinction between circular motion and other local motions, it is plain that neither in the other genera of motion can there be any infinitely continuous motions, because in all the other genera of motion if anything is to be moved from the same to the same, it follows that the same will be repeatedly traversed. For example, in alteration the intermediate qualities must be passed through—for the passage from hot to cold is through tepid, and if a return is to be made from cold to hot, tepid must be traversed again. The same is apparent in a motion according to quantity—for if that which is moved from large to small, should return again to large, the intermediate quantity must be traversed twice. Generation and corruption present a similar situation—for if air comes to be from fire, and then again fire from air, the intermediate dispositions must be traversed twice (for a middle may be placed in generation and ceasing-to-be, insofar as taken along with the dispositional changes).

And because the intermediates are traversed in different ways in changes that are diverse, he adds that it makes no difference whether many or few intermediates are introduced through which something is moved from one extreme to the other, or whether the intermediate is taken in a positive sense, as pallid between white and black, or in a remotive sense, as, between good and evil, that which is neither good nor evil-for, be they what they may, it always

happens that the same are traversed a number of times.

1133. Then at (893) he concludes from the foregoing that the early natural philosophers did not phrase the matter well when they said that all sensible things are forever in motion, because that would necessitate their being moved with respect to one of the aforesaid motions, concerning which we have shown that they cannot be forever continuous; and especially because they said that the ever-continuous motion is alteration.

For they assert that all things are always perishing and ceasing to be, and yet they say that generation and ceasing-to-be are nothing more than alteration, and so in saying that all things are forever ceasing to be, they are saying that all things are forever being altered.

But it was proved in the argument given above that nothing can be moved forever except by a circular motion. Thus it remains that neither according to alteration, nor growth, can all things be forever in motion, as they said.

Finally, he concludes by way of summary to the chief proposition, namely, that no change can be infinite and continuous except a circular one.

1134. Then at (894) he proves with two arguments that circular motion is the first of motions. The first argument is this: Every local motion, as stated above, is either circular, or straight, or a combination of the two. But circular and straight are prior to the combination. which is composed of them. But between these two, the circular isprior to the straight, for the circular is simpler and more perfect than the straight. And this he proves as follows: Straight motion cannot go on infinitely. For this would occur in two ways: First in such a way that the magnitude traversed by the straight motion would be infinite—which is impossible. But even if there were some infinite magnitude, nothing would be moved to infinity. For what is impossible to be, never comes to be or is generated; but it is impossible to traverse the infinite; therefore, nothing is moved toward the end of traversing the infinite. Therefore, there cannot be an infinite straight motion over an infinite magnitude. In a second way, an infinite straight motion can be understood as being a reflex motion over a finite magnitude. But a reflex motion is not one, as was proved above, but is a composition of two motions.

But if a reflexion does not occur upon a finite straight line, the motion will be imperfect and destroyed: imperfect, because further addition can be made to it; destroyed, because when the terminus of the magnitude is reached, the motion will cease.

From all this it is clear that a circular motion which is not composed of two, and which is not destroyed when it comes to a terminus (for its beginning and terminus are identical), is simpler and more perfect than a straight motion. Now

the perfect is prior to the imperfect, and likewise the imperishable is prior to the perishable, in nature and notion and time, as was shown above when it was proved that local change is prior to other motions. Therefore, it is necessary that circular motion be prior to straight.

1135. Then at (895) he gives the second argumentt which is this; A motion which can be perpetual is prior to one that cannot be perpetual, because the perpetual is prior to the non-perpetual, both in time and in nature. But a circular motion and no other can be perpetual, for the others must be followed by rest, and where rest intervenes, motion is destroyed. What is left, therefore, is that circular motion is prior to all the other motions. (The premisses of this argument are plain from what has been said previously.)

Lecture 20

Dialectical reasons why circular motion is continuous and first. Confirmation from the ancients

1136. After proving with proper reasons that a circular motion is continuous and first, the Philosopher now proves the same with certain logical and common reasons. And he gives three arguments.

With respect to the first (896) he says that it is reasonable that a circular motion but not a straight one be one and forever continuous. For in a straight motion there are determined a beginning, middle, and end, and all three of these can be designated in a straight line, Therefore in a straight line there exist that whence the motion begins, and where it ends, since all motion rests at its termini, namely, the terminus from which or to which (he having distinguished these two states of rest in Book V). But in a circular line the termini are not distinct, for there is no reason why in a circle some designated point should be a terminus more than another, since each and every one alike is a beginning and an intermediate and an end. Consequently, the things which are moved circularly are in a sense always in the beginning and in the endt insofar, namely, as any point at all in a circle may be taken as a beginning or end, while in another sense, they are never in the beginning or end, inasmuch as no point in the circle is a beginning or end in act.

Hence it follows that a sphere is in one sense in motion and in another sense at rest, because, as was said in Book VI, while the sphere is being moved it always keeps the same place as to subject, and in this respect it is at rest; but yet the place is always other and other in conception, and in this respect it is being moved.

Now, the reason why a beginning, intermediate and end are not distinguished in a circular line is that these three belong to the center, from which, as from a

beginning, lines proceed to the circumference and at which lines drawn from the circumference end. Moreover, it is the middle of the entire magnitude by virtue of its equidistance to all the points of the circumference.

And therefore, since the beginning and end of a circular magnitude are outside its circularity—for they are in the center which is never reached by a thing moving circularly—no place can be assigned at which a thing in circular motion should be at rest, because anything in circular motion is always carried about the middle but not to what is ultimate, because it is not carried to the middle, which is the beginning and the ultimate.

On this account, a whole that is being moved in a spherical manner is in one sense always at rest and in another in continuous motion, as has been said.

From all this the following argument may be extracted: Every motion that is never in its beginning and end is continuous. But a circular motion is of this kind. Therefore, etc, And with this same middle term, it is proved that a straight motion cannot be continuous.

1137. Then at (897) he gives the second argument, saying that these two follow one another conversely, namely, that a circular motion is the measure of all motions and that it is the first of all motions—for all things are measured by what is first in their genus, as is proved in *Metaphysics* X. Accordingly, this is a convertible proposition: Whatever is a measure is the first in its genus; whatever is first is a measure. But circular motion is the measure of all other motions, as is clear from what was said at the end of Book IV. Therefore, circular motion is the first of motions. On the other hand, if one suppose that a circular motion is the first of motions on account of the arguments given above, it will be concluded that it is the measure of the other motions.

1138. The third argument he gives at (898), saying that only a circular motion can be regular, since things in motion in a straight line are being carried along in an irregular manner from beginning to end.

For, as was said in Book V, a motion is irregular which is not equally swift throughout, and this must occur in every straight motion, since in natural motions the further things in motion are distant from the first rest, from which the motion started, the swifter they are moved; and in a violent motion, the farther they are distant from the ultimate rest, at which the motion terminates, the swifter they travel. For every natural motion is more intense near the end, but a violent motion at the beginning.

But this has no place in a circular motion in place, because in a circle the beginning and end do not exist somewhere in the circling which occurs along the circumference, but outside it, i,e., in the center, as was explained. Hence, there is no reason why a circular motion should be intensified or weakened on account of

a nearness to its beginning or end, since it is always equally approaching the center, which is the beginning and ends

Now, it is plain from what was said in Book V that a regular motion is more one motion than an irregular one. Consequently, a circular motion is naturally prior to a straight motion. For the more a thing is one, the more it is by nature prior.

1139. Then at (899) he shows through the opinions of the early philosophers that local motion is the first of motions. And he says that the statements of all the ancient philosophers who discussed motion attest to this truth, for they declare that the principles of things move with local motion.

He refers first to the opinion of Empedocles, who posited friendship and strife as the first moving principles, the former gathering and the latter separating—and gathering and separating are local motions.

Secondly, he shows the same thing through the opinion of Anaxagoras, who posited Intellect as the first moving cause, whose work, according to him, is to separate what is commingled.

Thirdly, he shows the same thing through the opinion of Democritus, who did not posit a moving cause but said that all things are moved on account of the nature of the void. But a motion that is due to the void is a local motion or one similar to local motion, for void and place differ only in conception, as was said in Book IV. And so, by posi ting that things are first moved on account of the void, they posit local motion as naturally first and none of the other motions, but they believe that the other motions follow upon local motion. For those who follow Democritus declare that being increased and corrupted and altered occur by a certain assembling and separating of indivisible bodies.

Fourthly, he shows the same thing through the opinions of the ancient philosophers of nature who posited only one cause, a material cause, namely, water, or air, or fire, or some intermediate. For from that one material cause they explain the generation and ceasing-to-be of things through condensation and rarefaction, which are completed by a kind of assembling and separation.

Fifthly, he shows the same through the opinion of Plato who posited soul as the first cause of motion. For Plato posited that that which moves itself, which is the soul, is the principle of all things that are moved. But self-movement belongs to animals and all animate things, according to *autokinesis* with respect to place, i. e., *per se* local transmutation.

Sixthly, he shows the same thing through what is commonly and popularly held, For we only say that to be moved in the proper sense which is moved with respect to place. Whereas, if something is at rest in place, but is moved with the motion of growth or decrease or alteration, it is said to be moved in a certain sense but not absolutely.

1140. Then at (900) he summarizes what he had said, namely, that motion always has been and always will be, and that there is some first principle of perpetual motions and what the first motion is, and which motion happens to be perpetual, and that the first mover is immobile. For all these things have been set forth in what has preceded.

Lecture 21

Limitations of a finite mover

114l. After describing the condition of the first motion, the Philosopher here describes the condition of the first mover. And it is divided into two parts:

First he mentions his intention;
Secondly, he carries out his proposal, at 1142.

He says first (901), then, that since it was said above that the first mover is immobile, now we must assert that the first mover is indivisible and has no magnitude, as being wholly incorporeal. But before we show this, certain things necessary for this proof must be settled in advance.

1142. Then at (902) he carries out his proposal:

First he premises things required for proving the main proposition; Secondly, he proves the main proposition, at the end of L. 23.

About the first he does three things:

First he shows that an infinite motion supposes an infinite power;
Secondly, that an infinite power cannot exist in a magnitude, at 1146;
Thirdly, that the first mover must be one which causes a continuous and undying motion, (L. 22).

He says therefore first (902) that among the things to be established before the main proposition, one is that it is impossible for anything of finite power to cause motion for an infinite time. This he now proves.

There are three things in every motion: one of which is what is moved, another is the mover, and the third is the time in which the motion occurs.

But all three must be infinite, or all three finite, or some finite and some infinite, i. e., either two only or one.

Suppose, therefore, that A is the mover, B the mobile, and C the infinite time. Then let D, a part of At move E, a part of B. Under these conditions, it could be concluded that D moves E in a time not equal to time C (in which A moved B) but in less time.

For it has been proved in Book VI that the entire mobile requires more time to pass a certain point than it takes for a part of it. Therefore, since the time C is infinite, it follows that the time in which D meves E will not be infinite but finite. So let that time be Z, so that just as A moves B in the infinite time C, D moves E in the finite time Z. But since D is part of A, then if we add to D by subtracting from A, the A will eventually be entirely taken away or used up, since it is finite, and every finite is used up by subtraction, if the same quantity is continually taken away, as said in Book III.

And likewise, B will be used up, if continual subtractions are made from it and added to E, because B is also finite. But no matter how much is taken from the time C—even if the same amount is continually taken away—all of C will not be used up, because it is infinite.

From this he concludes that the entire A moves the entire B in a finite time, which is part of C. And this does indeed follow from the premisses, because additions are made to the time of the motion in the same ratio as they are made to the mobile and to the mover, Since, therefore, by subtracting from the entire mobile and mover and by adding to their parts, the whole mobile the whole mover are at length used up, so that all that was in the whole is added to the part, it will follow that by proportional additions being made to the time, there will result a finite time in which the whole mover will move the whole mobile. Thus, if the mover is finite and the mobile also finite, the time too must be finite.

According to this, therefore, it is not possible that by a finite mover anything be moved with an infinite motion, namely, according to an infinite time. And so what was first proposed is now plain, namely, that it does not happen that a finite mover should cause motion for an infinite time.

1143. But Avicenna raises a difficulty about this demonstration of Aristotle. For it seems not to be universal, since there exists a finite mover and mobile from which nothing can be subtracted or taken away, such as a heavenly body, which nevertheless was not excluded from Aristotle's proof. Hence it seems that the proof is either particular, or it proceeds from a false assumption.

To this objection Averroes in his Commentary answers that although nothing can be subtracted from the heavenly body, yet the conditional is true, that if a part be taken away from the body, that part will move or be moved in less time than the whole body. For there is nothing to prevent a conditional from being true, even if its antecedent be impossible, as is patent from this conditional: If a man flies, he has wings. But whatever takes away the truth of a true conditional is false, even though the antecedent of the conditional be false. Now the truth of the above conditional cannot stand with the statement that the finite moves for an infinite time, as is evident through Aristotle's deduction, Thus, therefore, from the truth of the foregoing conditional Aristotle concludes that it is impossible for a finite

thing to cause motion for an infinite time.

However, it may be said more briefly that when Aristotle in his demonstrations speaks of removing or subtracting, it does not always have to be understood in the sense of destroying a thing's continuity, which is impossible in a heavenly body; rather, substraction can be understood in the sense of designating. For example, I can without disturbing the continuity of a piece of wood designate by touch or thought a certain point as though dividing the whole, and in this way I can remove a part from the whole and say that there is less whiteness in that part than in the whole. In like.manner, it can be said that there is less power to move in a part of a heavenly body— a part removed by designating it—than in the whole.

1144. But there is another and greater difficulty. For it does not seem to be against the prerogatives of a finite mover to cause motion for an infinite time, because if that finite thing is imperishable or impassible in its nature, and never loses its nature, it will maintain itself always in the same way with respect to causing motiong for a same thing, remaining in the same state, will always do the same. Hence, there would be no reason for its not being able to get later as it did before. This is evident to sense, for we observe that the sun can in an infinite time move lower bodies.

To settle this difficulty, we must investigate the sequence of demonstration set forth by Aristotle. For it should be certain that the conclusion is to be interpreted in the sense in which it follows from the premisses.

We should consider, therefore, that the time of a motion may be taken in two senses, especially in local motion: in one sense, according to the parts of the mobile; in another sense, according to the parts of the magnitude along which the motion passes. For it is plain that one part of the mobile passes a designated point of the magnitude, before the whole does, and that the whole traverses part of the magnitude before it traverses all of it. Now, it is plainly clear from the procedure of Aristotle's demonstration, that he is speaking of time of motion according to the parts of the mobile and not according to the parts of the magnitude. For in his demonstrations he assumes that part of the mover moves part of the mobile in less time than the whole moves the whole. But this could not be true, if we took time of motion according to the parts of the magnitude traversed by the motion; for the ratio of the part of the mover to the part of the mobile is the same as that of the whole mover to the whole mobile. Hence, a part will always move part with the same velocity as the whole moves the whole. Thus in an equal time part of the mobile moved by part of the mover will traverse some magnitude and the whole mobile moved by the whole mover will also.

Or perhaps the whole will be moved in less time than the part, because a united force is greater than a divided force, and the greater the force of the mover, the

swifter the motion and the less the time. Therefore, this must be understood in the sense that the time of motion is taken according to parts of the mobile, because one part of the mobile will pass a definite point in less time than the whole will. In this sense, it is impossible for anything but an infinite mobile to be moved for an infinite time. But an infinite mobile cannot be moved by a finite mover, since the power of the mover is always greater than the power of the mobile. Hence an infinite mobile must be moved by an infinite power. Consequently, just as an impossibility follows from the assumption that a finite mover moves a finite mobile with an infinite motion according to the parts of the mobile, so, this incompatibility once removed, one must further conclude that an infinite motion belongs to an infinite mobile from an infinite mover.

1145. But against this, someone could object that Aristotle did not prove above that motion is infinite according to the parts of the mobile in the way that the motion of an infinite body is said to be infinite, for the entire corporeal universe is finite, as was proved in Book III and will be proved in *On the Heavens* I. Hence the demonstration of Aristotle does not seem to be verified as concluding to his proposition, namely, that the first mover, which causes an infinite motion, is infinite.

But it should be said that what is first cause of an infinite motion must be the *per se* cause of the infinity of the motion, because the cause which is *per se* is always prior to that which is so by virtue of something else, as has been said above. Now, the power of a *per se* cause is determined to a *per se* effect and not to a *per accidens* effect, for that is the way Aristotle taught causes are to be compared to their effects in Book II. But, because motion can be infinite in two ways, as has been said, namely, according to the parts of the mobile and according to the parts of the length along which the motion takes place, *per se* the infinite is in motion from the parts of the mobile, but *per accidens* according to the parts of the length—for the quantity of motion based on the parts of the mobile belongs to it by reason of its proper subject and so is present in it *per se*, whereas the quantity of motion based on the parts of the length is based on constant repetition of the mobile's motion, in the sense that a whole mobile, having completed its entire motion upon one part of the length, now successively traverses another. The first cause, therefore, of the infinity of motion has power over the infinity of motion which is *per se*, in such a way, namely, as to enable it to move an infinite mobile, should there be such. Hence, it must be infinite. And even though the first mobile be finite, it has, nevertheless, a certain likeness to the infinite, as was said in Book III. But in order that something be the cause of a motion that is infinite through repetition (which is *per accidens*) infinite power is not required, but an immobile finite power is enough, because, so long as the power remains the same, it will be able to repeat the same effect, as the sun has a finite energy yet can move the lower elements in an infinite time, should motion be, as Aristotle posits, eternal. For it is not the first cause of the infinity of motion

but is something as though moved by another to move in an infinite time, according to the position stated above.

1146. Then at (903) he shows that the power in a magnitude must be proportional to the magnitude in which it exists.

> First he shows that in a finite magnitude there cannot be an infinite power—and this is what he chiefly intends;
> Secondly, that on the other hand, in an infinite magnitude there cannot be a finite power, at 1156.

That an infinite power cannot exist in a finite magnitude he proves at (903), but first he mentions two assumptions. The first is that a greater power produces an equal effect in less time than a lesser power, as a greater heating force raises a thing on which it acts to an equal temperature in less time, and the same is true of a sweetener, or a hurler, or any cause of motion.

And from this assumption he concludes that since an infinite power is greater than a finite power, then, necessarily, if there is a finite magnitude possessing an infinite power, one or a number of things will in the same time undergo from such an agent a greater change than from another having finite power, or, conversely, that which undergoes an equal change will do so from it in less time. Either interpretation suits what Aristotle says here, namely, "...to a greater extent than by anything else."

The second assumption is that, since whatever is being moved is being moved in time, as was proved in Book VI, it cannot be that something undergoing is changed in no time by an agent of infinite power. Therefore, it is changed in time.

From this he proceeds in the following manner: Let A be the time in which an infinite power causes change by heating or throwing, and let the time in which a finite power is causing change be AB, which is longer than A. Now, no matter what a finite power may be, a still greater may be taken. If, therefore, we take another finite power greater than the first and which caused change in time AB, it will act in a shorter time. Again, a third and greater power will cause the change in still less time, And thus by always taking a finite power I will at length come to a finite power that will produce the change in time A, for when an addition is continually made to a finite power, any predetermined ratio will be exceeded. But as the power is increased, the time is decreased, because a greater power can cause a change in less time.

In this way, therefore, it will follow that a finite power will produce a change in a time equal to that used by the infinite power, which was assumed as acting in time A. But this is impossible. Therefore, no finite magnitude has an infinite power.

1147. Now, there are many doubts about this argument. First, it seems not to

conclude in any way. For what belongs *per se* to a thing cannot be taken from it by any power however great, for it is not due to any lack of power, nor does it conflict with infinity of power, if it be said that it is impossible for man not to be an animal. But to exist in time belongs *per se* to motion, for motion is found in the definition of time, as was had above in Book IV. Therefore, if an infinite moving power is conceded to exist, it does not follow that motion exists in non-time as Aristotle here concludes.

Likewise, if the sequence of the argument of the Philosopher is considered, it will be seen that his conclusion that motion exists in non-time is inferred from the fact that the moving power is infinite; but an infinite moving power can also not be in a body. Therefore, for the same reason, it follows that such a power, if it is infinite, will move in non-time. Hence, from the impossibility of being moved in non-time it cannot be inferred that no infinite power exists in a magnitude, but absolutely that no moving power at all is infinite.

Again, two things seem to pertain to the magnitude of a power, namely, the swiftness of motion and its diuturnity; and any superabundance in the power causes a corresponding superabundance in each of these two things. But with respect to the superabundance of an infinite power, he showed above that a perpetual motion depends on an infinite power, but not that an infinite power does not exist in a magnitude. Therefore, here too, with respect to excess of swiftness, he ought not to conclude that no infinite power exists in a magnitude, but that the power which moves in an infinite time would, on account of its infinity, also move in non-time.

Again, the conclusion seems to be false. For the greater the power of a body, the longer it can endure. If, therefore, the power of no body were infinite, no body could endure *ad infinitum*. Now this is plainly false, both according to his own opinion and according to the tenets of the Christian faith, which posits that the substance of the world will endure *ad infinitum*.

It could also be objected that the division and addition which he uses have no correspondence in reality, but since this was sufficiently discussed previously, it can be passed over at the present time.

1148. Answering, therefore, these doubts in order, it must be said with respect to the first one, that the Philosopher in this place does not intend an ostensive demonstration but one that leads to an impossibility, in which, since from something given an impossibility follows, that which was given is concluded to be impossible. For it is not true that the first supposition can possibly co-exist with the conclusion. Thus the supposition that there was some power which could remove the genus from a species, would allow us to conclude that that power could make man not be animal; but because this is impossible, the supposition too is impossible. From this, then, it cannot be concluded that it is possible for a

power to exist that could make man not be animal. So, too, from the fact that an infinite power exists in a magnitude, it follows of necessity that motion exists in non-time; but since this is impossible, it is impossible for an infinite power to exist in a magnitude; nor can it be concluded from this that it is possible for an infinite power to move in non-time.

1149. To the second doubt Averroes responds in his Commentary at this place that the argument of Aristotle here proceeds from power under the aspect of its infinity. But "finite" and "infinite" belong to quantity, as was proved in Book I. Hence, finite and infinite do not properly belong to a power that is not in a magnitude.

But this answer is contrary both to the intention of Aristotle, and to the truth. It is contrary to Aristotle's intention, because in the preceding demonstration Aristotle proved that a power which causes motion for an infinite time is infinite, and from this he later concludes that the power moving the heavens is not a power existing in a magnitude.

It is also against the truth: for since every active power is according to some form, magnitude, and consequently its finiteness and infinity, belong to a power in the way it belongs to form. But magnitude belongs to form both *per se* and *per accidens*: it belongs *per se*, according to the perfection of the form, as a whiteness is called "great" even in a small amount of snow, according to the perfection of its proper notion; it belongs *per accidens*, according to the extension that a form has in a subject, as a whiteness can be called "great" on account of the size of its surface.

Now, this second magnitude cannot belong to a power not in a magnitude, but the first magnitude most truly does, because non-material powers, the less they are restricted through union with matter, the more perfect and more universal they are.

But swiftness of motion does not follow upon a magnitude of power which is *per accidens*, by extension with the magnitude of the subject; rather, it follows one that is *per se*, according to its proper perfection, because the more perfect a thing is in act, the more vehemently is it active. Hence it cannot be said that a power which does not exist in a magnitude, because it is not infinite with the infinity of magnitude which depends on the magnitude of the subject, therefore cannot cause an increase of swiftness *ad infinitum*, i.e., move in non-time.

Hence the same Commentator solves this same difficulty in another way in *Metaphysics* XI, where he says that a heavenly body is moved by a two-fold mover, i.e., by a conjoined mover, which is the soul of the heavens, and by a separated mover, which is not moved either *per se* or *per accidens*. And because that separated mover has infinite power, the movement of the heaven acquires from it a perpetual duration; but because the conjoined mover has finite power,

the movement of the heaven acquires from it a determinate swiftness.

But even this answer is not sufficient. For since both seem to follow upon an infinite power, namely, that it act for an infinite time, as the preceding demonstration concluded, and that it act in non-time, as this demonstration seems to conclude, the doubt still remains why the soul of the heaven which acts in virtue of an infinite separated mover obtains from it the ability to act for an infinite time rather than the ability to act with infinite swiftness, i.e., in non-time.

1150, In answer to this doubt it must be said that every power not in a magnitude acts through intellect, for so the Philosopher proves in *Metaphysics* XI that the heaven is moved by its mover. But no power in a magnitude acts as though through intellect, for it was proved in *On the Soul* III that the intellect is not a power of any body.

Now this is the difference between an agent that acts through intellect and a material agent: the action of the material agent is proportioned to the nature of the agent, for a heating process proceeds in proportion to the heat, but the action of an intellectual agent is not proportioned to its nature but to the form apprehended, for a builder does not build as much as he can, but as much as the notion of the conceived form requires.

Consequently, if an infinite power existed in a magnitude, it would follow that the motion produced by it would be in proportion, to it, as the present demonstration shows. But if an infinite power is not in a magnitude, a motion does not proceed from that power in proportion to its power but according to the notion of the thing apprehended, i.e., according as it fits the end and nature of the subject.

Another point that should be noted is that, as was proved in Book VII only things having magnitude are moved; wherefore, the swiftness of motion is an effect received from the mover into something having magnitude. But it is plain that nothing having magnitude can receive an effect equal proportionately to the power which is not in a magnitude, because every corporeal nature is related to the incorporeal as a certain particular to what is absolute and universal, Hencet it cannot be concluded, if an infinite power is not in a magnitude, that from it there results in a body an infinite swiftness, which is the effect proportionate to such a power, as has been said.

But there is nothing to prevent a magnitude from receiving the effect of a power existing in a magnitude, because the cause is proportioned to the effect. Hence if it were supposed that an infinite power existed in a magnitude, it would follow that a corresponding effect would exist in a magnitude, namely, an infinite swiftness. But this is impossible; therefore, the first too is impossible.

1151. From this the resolution of the third doubt is clear. For to be moved for an infinite time is not repugnant to the notion of a moved magnitude, for it befits a

circular magnitude, as was shown above. But to be moved with an infinite speed, i.e,, in non-time, is contrary to the notion of a magnitude, as was proved in Book VI. Hence the first mover, possessing infinite power, is, according to Aristotle, the cause of a motion that lasts an infinite time, but not one that has infinite speed.

1152. The fourth doubt is, according to Averroes in his Commentary, answered by Alexander's saying that a heavenly body acquires eternity from a separated mover having infinite power, as well as perpetuity of motion. Hence, just as it is not from the infinity of a heavenly body that it is perpetually moved, so, too, it is not from the infinity of the heavenly body that it endures forever. Both are from the infinity of the separated mover.

Now Averroes tries to refute this answer, both in his Commentary on this passage and in *Metaphysics* XI, and says that it is impossible for something to acquire perpetuity of existence from another, because it would follow that something *in se* perishable could be eternal. Yet something can acquire perpetuity of motion from another, for motion is an act existing in a mobile but caused by a mover. He says therefore that in a heavenly body considered in itself there is no potency to non-existence, because its substance has no contrary, but there is a potency to rest, because rest is contrary to its motion. And that is why it does not have to acquire perpetuity of existence from another, but must acquire perpetuity of motion from another.

That a heavenly body has no potency to non-existence happens, he says, because a heavenly body is not composed of matter and form as though of potency and act. Rather, says he, such a body is matter existing in act, while its form is its soul, in such a way that it is not constituted in being through the form, but only in motion. Consequently, says he, there is present in it not a potency to existence, but solely a potency to "where" (place), as the Philosopher says in *Metaphysics* XI.

1153. But this solution conforms neither to the truth nor to the intention of Aristotle. It is not in conformity with truth on a number of counts: First, because he says that a heavenly body is not composed of matter and form—which is utterly impossible. For it is plain that a heavenly body is something actual, otherwise it would not be in motion—something that is in potency only is not a subject of motion, as was proved in Book VI. But, whatever is actual is either a subsisting form, as are the separated substances, or has form in something else, which is related to the form as matter, and as potency to act. Now, it cannot be said that a heavenly body is a subsistent form, because then it would be understood in act and neither sensible nor existing under quantity. Therefore, it must be a composite of matter and form, and of potency and act. Consequently, there is in it in some sense a potency to non-existence.

But even if a heavenly body were not a composite of matter and form, it would

still be necessary to place in it, in some sense, a potency in respect of existence. For every simple self-subsisting substance is necessarily either its own existence or it shares in existence. But a simple substance which is self-subsistent existence itself cannot be but one, just as whiteness, if whiteness were a subsistent being, could be but one. Consequently, every substance after the first simple substance participates existence. But every participant is composed of the participant and what it participates, and the participant is in potency to what it participates. Therefore, in every substance, however simple, other than the first simple substance, there is a potency to existence.

Now he was deceived by the equivocation in "potency." For potency sometimes refers to what is open to opposites. In this sense, potency is excluded from a heavenly body and from separated simple substances, because, in Aristotle's opinion, they have no potency to non-existence, for simple substances are forms only, and it belongs *per se* to a form that it exist, while the matter of a heavenly body is not in potency to another form. For just as a heavenly body is related to its figure, of which it is the subject, as potency to act, and yet cannot not have such a figure, so the matter of the heavenly body is related to its form as potency to act, and yet it is not in potency to being deprived of this form or to non-being. For not every potency is open to opposites; otherwise possibility would not follow upon necessity, as is said in *Perihermeneias* II.

His position is also contrary to the intention of Aristotle, who in *On the Heavens* I, in a certain demonstration, uses the fact that a heavenly body has the potency or the virtue to exist always. Therefore, he cannot avoid the incompatibility by saying that in a heavenly body there is no potency to existing: for this is evidently false and contrary to the intention of Aristotle.

1154. Therefore, let us see whether he adequately refuted the solution of Alexander who says that a heavenly body acquires its perpetuity from something else. His refutation would indeed be good, if Alexander had posited that a heavenly body had of itself a potency to existence and non-existence, and that it acquired from something else its perpetual existence. This I say while keeping in mind his intention, and not excluding the omnipotence of God, by which "this corruptible can put on incorruptibility"—to discuss which now does not pertain to the present question. Still Averroes, even supposing his intention, cannot conclude against Alexander, who did not posit that the heavenly body acquires its perpetuity from something else, as though it had a potency to existence and non-existenoe, but as though not having its existence from itself. For whatever is not its own existence participates existence from the first cause that is its own existence. Hence, he himself professes in his book, *On the Substance of the Orb*, that God is the cause of the heavens not only with respect to its motion, but with respect to its substance as well, which would not be true unless it has its existence from something else. But the only existence it has from another is a perpetual one; consequently, its perpetuity is from another.

And this is in agreement with the teachings of Aristotle who, in *Metaphysics* V and in the beginning of this Book VIII of the *Physics*, says that there a some necessary things that have a cause of their necessity. In the light of this, the solution according to the intention of Alexander is plain, namely, that just as a heavenly body derives its motion elsewhere, so too its existence. Hence, just as a perpetual motion demonstrates the infinite power of the mover but not of the mobile, so too its perpetual duration demonstrates the infinite power of the cause from which it derives its existence.

1155. But the potency of a heavenly body to existence is not exactly the same as its potency to perpetual motiono However, the difference is not the one he assigns, namely, that in a heavenly body there is with respect to motion a potency to opposites, these being rest and motion; rather it is to opposites which are different "where's" (places).

But they differ in respect of something else. For motion according to itself falls under time, whereas existence according to itself does not fall under time, but only according as it is subject to motion, Therefore, if there is an existence not subject to motion, it in no wise falls under time. Hence, the potency to be moved for an infinite time regards the infinity of time directly and *per se*. But a potency to exist for an infinite time, if that existence is transmutable, regards a quantity of time and, therefore, a greater power is required for something to endure in transmutable existence for a longer time, But a potency in respect to intransmutable existence has no relationship to a quantity of time. Hence the magnitude or infinity of time has nothing to do with the magnitude or infinity of the power in respect to such existence. Therefore, granting the impossible assumption that a heavenly body did not derive its existence elsewhere, its perpetuity would not be grounds for concluding that an infinite power exists in it.

1156. Then at (904) he proves that in an infinite magnitude there cannot exist a finite power, And this he does with two arguments, with respect to the first of which he does three things:

First he mentions the conclusion intended, namely, that just as there cannot be an infinite power in a finite magnitude, so neither can there be a finite power in an infinite quantity taken as a whole (for if a finite part of the infinite be taken, it will have a finite power). He mentions this conclusion not as though it were needed for proving his principal conclusion but as cohering with, and akin to, the conclusion previously demonstrated.

1157. Secondly, at (905) he mentions something that could lead someone to suppose that there is a finite power in an infinite magnitude. For we see some lesser magnitude that has greater energy than a larger magnitude, as a small amount of fire has more active power than a large amount of air. But that does not permit us to conclude that an infinite quantity has a finite power, because if a

still greater magnitude is taken, it will have greater power; for example, even though a greater quantity of air has less power than a small fire, yet if the quantity of air be much increased, it will have more power than the small fire.

1158. Thirdly, at (906) he presents his intended demonstration: Let AB be an infinite quantity, and BC a finite magnitude of another kind, having a finite power; let D be a mobile that is being moved by the magnitude BC in time EZ. But because BC is a finite magnitude, it is possible to take a larger magnitude; let us therefore take one which is in double proportion.

Now, the greater the power of a moving cause, the more it moves in less time, as was proved in Book VII. Therefore, the double of BC will move the same mobile, namely, D in one-half the time, namely, ZT, so that the time EZ is bisected by the point T. By continually adding to BC, the time of the motion will be decreased, yet no matter how much is added to BC, it can never traverse AB, which exceeds BC beyond any proportion, as the infinite exceeds the finite. And since AB has finite power, it moves D in a finite time. Consequently, by continually lessening the time BC consumes in moving, we shall reach a time less than the time consumed by AB in its action of moving, because every finite is surpassed by dividing. It will follow, therefore, that the lesser power will move in less time, and this is impossible. What remains, therefore, is that there was an infinite power in the infinite magnitude, for the power of the infinite magnitude exceeded every finite power.

This has been proved by subtracting time, because every finite power must have some determinate time in which it causes motion. This is clear from the following consideration: If so much power acts in so much time, a greater power will move in a time smaller but yet definite, i.e., finite, according to an inverse proportion, such that, by as much as is added to the power, by so much is the time decreased. Consequently, no matter how much is added to a finite power, so long as the power remains finite, so will the time always remain finite, for a time will be reached that will be as much less than a previously given time as the power growing by addition is greater than a power previously given.

But an infinite power in causing motion surpasses every determinate time, just as happens in all other cases involving the infinite—for every infinite, such as that of number and magnitude, exceeds everything determinate in its genus. Thus it is plain that an infinite power exceeds every finite power, because the excess of power over power corresponds to the decrease of time from time, as has been said. Hence, it is evident that the above-stated conclusion, namely, that the power of an infinite magnitude is infinite, follows of necessity from the premisses.

1159. Then at (907) he cites for the same another proof, which differs from the first merely in this, that the first proceeds on the assumption of a finite power existing in a finite magnitude of another kind; but this second proof proceeds on

the assumption of a certain other finite power, in another finite magnitude of the same genus as the infinite magnitude. For example, if air is the infinite magnitude having a finite power, we will assume a finite power existing in some finite magnitude of anothef specimen of air. On these grounds, it is clear that the finite power of the finite magnitude will, if sufficiently multiplied, measure the finite power in the infinite magnitude, because a finite thing is measured or even exceeded by a smaller finite thing taken a certain number of times. Since, therefore, in a magnitude of the same kind, the greater must have more power, as a greater amount of air has more power than a smaller amount, it will be necessary that that finite magnitude which will have the same proportion to the finite magnitude previously taken, as the finite power of the infinite magnitude has to the power of the finite magnitude previously taken, have a power equal to the power of the infinite magnitude. For example, if the finite power of an infinite magnitude were to be 100 times the finite power of a given finite magnitude, then the magnitude 100 times the size of that finite magnitude has a power equal to the power of the infinite magnitude, for in a thing of the same genus the magnitude and the power increase in proportion.

However, the conclusion we have reached is impossible, because either the finite magnitude would have to be equal to an infinite ones or a smaller magnitude of the same genus would have a power equal to a larger magnitude of the same genus. Therefore, the assumption from which this conclusion followed is also impossible, namely, that an infinite magnitude may have a finite power.

In summary, therefore, he concludes to two demonstrated conclusions, namely, that in a finite magnitude there cannot be infinite power, and that in an infinite magnitude there cannot be finite power.

Lecture 22

Diversity of movers annuls continuity of motion

1160. After proving two of the things needed for demonstrating his proposition, namely, that a finite power cannot move in an infinite time, and that an infinite power cannot exist in a finite magnitude, the Philosopher now starts to prove the third, namely, the unity of the first mover. About this he does two things:

> First he shows that on account of the diversity of movers, the continuity or unity of motion fails in certain mobiles that seem to be in continuous motion;

Secondly, he shows from this that the first mover is necessarily one, (L. 23).

About the first he does three things:

> First he raises a doubt about projectiles;

Secondly, he resolves the doubt, at 1162;
Thirdly, from this he shows that the motion of a projectile is not continuous, at 1163.

About the first he does two things:

First he states the doubt;
Secondly, he rejects one solution, at 1161.

He proposes therefore first (909) a doubt about projectiles. It is this: It was proved above in the beginning of this Book that whatever is being moved is being moved by another, provided we are not referring to things that move themselves, such as animals, of which a projected stone is not one. Now a bodily thing causes motion through contact. Therefore there is doubt as to how projectiles remain in continuous motion even after contact with the mover ceases. For they seem to be moved without anything moving them.

1161. Then at (909) he rejects a solution attributed to Plato who said that the projector who first moves a stone moves not only the stone but something else, namely, the air, and the moved air moves the stone, even after contact by the projector.

But he rejects this solution, on the ground that it appears equally a′s impossible for the air to be moved when the first mover, namely, the projector, is no longer in contact with it, nor moving it, as it was for the stone. But rather it seems to be necessary that while the first mover is acting, all are being moved, and when the first mover rests,i.e., ceases to act, all rest, although also something moved by the first mover, such as the stone, may cause something to be moved, just as the original mover did.

1162. Then at (910) he gives his own solution. And he says that if the second mover causes motion insofar as it is moved by the first mover, then it is necessary to say that the first mover, namely, the thrower, gives to the second mover, namely, the air or water or any such body apt to move a thrown body, the ability both to cause motion and to be moved; for both of these are received into the air or water from the thrower, namely, to cause motion and to be moved. But since to cause motion, and to be moved, are not of necessity in the same thing—since there is found a mover that is not itself moved —the mover and moved do not pause simultaneously, i.e., the air moved by the thrower does not simultaneously cease causing motion and cease being moved, but as soon as the thrower ceases acting, the air ceases to be moved, but still moves.

And this is evident to the senses. For when a mobile has now arrived at the terminus of its motion, it is able to cause motion in the ultimate moment of its arrival, at which time it is no longer being moved but is in the state of having been moved. Now while the second mover moves, that which is ″had,″ i.e., which

is next to it, is being moved. And the same applies to this third, for it remains a mover even when it is not being moved. And because a second mover has less power for acting than did the first, and the third less than the second, the motion called "projection" must cease, on account of the fact, namely, that the power for moving is less in the "had," i.e., the subsequent, mover than in that in which it was first.

Thus at length, on account of the diminution of the power to move, a state is reached where that which was prior with respect to the one following will not confer upon the one following the power to cause motion but will solely cause it to be moved. And at that time it is necessary that when this last mover ceases to act upon the one following it, simultaneously that moved by it will cease being moved, Consequently, the entire motion will cease, because the last moved object is unable to cause motion in any other.

1163. Then at (911) he concludes from the foregoing that a motion of projection is not continuous.

He sayst therefore, that this motion, namely, that of projection, comes to be in bodies that are capable of being moved at one time and of resting at another time —if indeed there are bodies to which such a motion belongs. And this is evident from what was said; for the motion called "projection" ceases through a failing of the power to cause motion, as has been said.

It is also evident from the foregoing that this motion is not continuous, although it appears to be continuous. For it seems to be continuous, because there is one mobile involved; yet it is not continuous, because there are diverse movers, as has been said. For either that motion results from a series of consecutive movers or from a series of movers that are in contact—(how "consecutive" and "in contact" differ has been explained above in Books V and VI).

And it is plain to sense that in both cases the different movers can move one mobile inasmuch as they are moved by some first mover. For in things that are moved in a way that projectiles are moved, there is not just one mover but many "had" to each other (i.e., following each other), which are consecutive and in contact. And because diversity is not without division, the projection in question comes to be through a medium that is easy to dividet namely, air and water, in which a diversity of movers can function on account of the easy divisibility of the medium.

This motion of projection is by some called *antiperistasistasis*, i.e., contra-resistance, on the ground that the surrounding air being set in motion somehow moves the projectile, as was said in Book IV. However, the problem under discussion can be solved in no other way than the way mentioned. Because, if the contra-resistance of the air is the cause of the projection, it follows that all the elements involved are moving and being moved simultaneously, i.e., that the

entire air is simultaneously acting and being acted upon and, consequently, that all would cease simultaneously. But this is evidently false, For we see some one thing being moved continuously no matter what moves it. And I say this because it does not have one and the same determinate mover, but diverse movers.

Lecture 23

The first mover can have no magnitude

1164. Having resolved the doubt he raised about the motion of projectiles, from the solution of which he concluded that a motion involving a number of movers is not one continuous motion, the Philosopher now turns to his main task, namely, to prove that the first mover is one. About this he does two things:

First he states his proposition;
Secondly, he raises a doubt and solves it, at 1170.

About the first he does three things:

First he proves the unity of the first mover through the continuity of motion;
Secondly, he shows how a continuous motion comes from one mover, 1166;
Thirdly, where the principle of a continuous motion is, at 1168.

1165. That there must be one movers he proves (912) through the continuity of motion, taking what he had previously proved, namely, that some continuous motion must always exist. But a continuous motion is one, as was said in Book V. Therefore, there must always be some motion that is one. But for a motion to be one it must be of one moved magnitude (because something not able to be divided into parts cannot be moved, as was proved in Book VI) and it must be moved by one mover. For if the mobiles are diverse or the movers are diverse, a motion will not be one, and consequently, not continuous; rather, it will be one motion divided from another—on account of the division of the mobile or mover—and one will have consecutive motions. It is necessary therefore that the mover be one and that it be either a moved mover or a mover that is immovable.

1166. Then at (913) he shows how from one mover there can be a continuous motion. About this he does two things:

First he shows how from one mover there can be a motion ever continuous;
Secondly, how it is regular, at 1167.

He says therefore (913) that one motion from one mover is, as has been said, either from a moved mover or a non-moved mover. If it is the former, it follows that it is moved by something, as was proved above. But this cannot go on *ad infinitum*, as was proved above. Therefore, the series of movers and mobiles must stop and a first mobile moved by an immobile mover be reached, which

mover does not move of necessity, because it is not moved by another. For whatever is moved by another, moves of necessity, to the extent that necessity is imposed upon it by its mover. And because it is changed from its disposition, it cannot cause motion which is always uniform, for its disposition varies.

But nothing other imposes necessity on a non-moved mover, nor does its disposition vary. Hence it does not act of necessity," but it can move always, because to move thus, namely, without change of self, is unwearying, For fatigue occurs to some movers in moving, because they are also simultaneously moved themselves, and from fatigue it occurs that they cannot always act as movers. Hence it remains that a non-moved mover can move with a perpetual continuous motion.

1167. And because perfect continuity and unity of motion require that a motion be regular and uniform, as was had in Book V, therefore at (914) he shows that a motion from an immobile mover is regular.

And he says that either solely the motion from an immobile mover is regular, or if any others are regular also, the former is the most regular. Now he uses this disjunction, because the disposition of a moved mover sometimes remains the same for some time, without variation, at least as far as any sensible perception thereof is concerned, and accordingly, such a mover seems for a time to cause a uniform motion. But that which is always such moves above all with a uniform motion, since such a mover is subject to no change whatsoever. He says this in order to show that there are some movers that are not moved with the same kind of motion as they cause, as a heavenly body is not moved by the motion of alteration but by some other, namely, local motion. But the first mover, being utterly immobile, is moved by no change.

In order that a motion be regular and uniform, it is required that the mover be wholly immobile; besides that, in order that the motion be "similar," i.e., uniform, it is required that what is moved not undergo any change other than that which the immobile mover causes in it, as a heavenly body is moved with local motion by an immobile mover and beyond that has no other change. For if it were altered, its disposition to the motion would not remain constant and, consequently, the motion would not be uniform.

1168. Then at (915) he shows where the beginning of the first continuous motion is. And because it was proved that the first motion is circular and belongs to a circular magnitude, the first beginning of this motion must be either in the middle, i.e., the center, or on the circle, because both are principles of a circular magnitude. For in a circular magnitude lines are extended from the center to the circumference. Hence, one of these must be taken as principle, and the other as terminus.

Then he shows, by the following argument, that the principle of the first motion is

on the circle: Every motion, the closer it is to the moving principle, the swifter it is, because it receives a stronger impression from the mover. But we perceive in the motion of the whole firmament, which motion proceeds from the first immobile mover, that the closer some mobile approaches the outermost circumference, so much the swifter is its motion. Therefore, the mover is on the circle and not in the center.

The major of this argument is plain. But in order to make the minor plain, it must be considered that a twofold motion is found in heavenly bodies: one of which is the motion of the entire firmament in its daily revolution from east to west—and this is the first motion; the other is the motion by which the stars are moved contrariwise from west to east.

Now in this second motion the closer a heavenly body is to the center, the swifter its motion, as is evident from the calculations of astronomers, who assign one month for the motion of the Moon, one year for the motions of the Sun, Mercury and Venus, two years to Mars, twelve years to Jupiter, thirty to Saturn, and 36,000 years to the fixed stars [i.e., the. precession of the equinoxes, actually 26,000 years].

But with respect to the motion of the entire firmament it is the opposite. For the farther a heavenly body is from the earth, the swifter is its motion, because it traverses a larger magnitude in the same time. For the circumferences of circles are greater the farther they are from the center, and yet all the heavenly bodies are revolved with the motion of the whole in the same period of time. Consequently, the outermost bodies are swifter. Hence what remains is that the principle of the first motion is not in the center but on the circumference.

1169. But now a difficulty arises about this conclusion. For the first mover, as he will conclude below, is indivisible and has no magnitude, and its power does not exist in a magnitude. But whatever is such does not seem to have a definite position in a body. Hence it does not befit the first mover to be in one part of the first mobile more than in another.

But it should be stated that the first mover is said to be in some part of its mobile not through any determination of its substance but through its efficient causality of motion, because it begins to move at some part of the object it acts upon. And it is for that reason that the first mover is said to be in the heavens rather than in the earth, and rather in the east where the motion begins. And this is not to be understood as though the mover fixes itself to some definite part of the mobile, since there is no definite part of the mobile always in the east, but the part now in the east is later in the west. Thus it is clear that the power of the mover is said to be in the east by virtue of the inflow of motion, and not through any determination of its substance.

It should also be noted, with respect to the motion of a sphere, that

simultaneously with its motion, it has a kind of immobility—for the parts are moved as to change of place both as to subject and as to conception, but the whole is moved as to change of place in conception but not as to subject, as was shown in Book VI. And these two (different) things are attributed to the two principles of the spherical magnitude he mentions here: for the principle of the motion has its seat on the circumference, while the principle of immobility derives from the fixity of the center.

1170. Then at (916) he raises a doubt about the foregoing.

First he raises it;
Secondly, he solves it, at 1171.

For he had said previously that an immobile mover can cause continuous motion and therefore here at (916) he subsequently asks whether a moved mover can cause a continuous motion, in such a way, namely, that it be truly continuous without any interruption, such as the interruption which occurs when someone pushes a body and then pushes it again. For it is clear that this motion, which is in this wise continuous from the standpoint of the mobile, is not truly continuous, because the movings are not continuous, but one follows the other; for the one pushing does not continually push but at intervals, in such a way that one push is consecutive to another.

1171. Then at (917) he resolves this difficulty and shows that no moved mover can cause a continuous motion.

For it is necessary to say that a mobile that is seemingly being moved continuously is being moved either immediately as to the whole motion by a moved mover, or else through many intermediates, one in contact with the other, as was said with respect to projection. And this division is valid whether the moved mover acts by pushing or pulling or both (as in twirling), as was explained in Book VII. Nor does it happen that a thing is moved locally by a moved mover in more than one way per so and not *per accidens* (for something being carried is being moved *per accidens*).

And because he had said that, in things that are projected, the mover is constantly other and other, and this seems to be false because the projected body seems to be continually moved by an air which remains one, he therefore, in order to refute this, adds that it is because air or water are easy to divide that, so to speak, now one, now another, mover acts, but yet it acts as if being continually moved, so long as the motion of the projectile lasts; and although the air seems one, nevertheless it is other and other through division.

But in either case, i.e., whether the moved mover acts by pushing or by pulling, the motion cannot be one but must be "had," i.e., consecutive—for the reason given above, when the motion of projection was discussed, namely, on account

of the diversity of movers.

What remains, therefore is that only the motion from an immobile mover can be forever continuous, because this mover, remains always "similar," according to the same disposition in itself. For that reason it can maintain itself always and continuously in a similar way with respect to the mobile, so as, namely, to move it uniformly.

But it should be noted that the Philosopher here attributes eternity of continuous motion to the immobility of the mover, whereas above he attributed it to its infinite power. For eternity of continuous motion, if regarded with respect to the motion's repetition, looks to the immobility of the mover, since, if it always remains constant with itself, it can always repeat the same motion. But the infinite power of the mover regards the motion's whole perpetuity or infinity *per se*, was said above.

It should be noted, too, that because no moved mover can cause a perpetual continuous motion, he therefore, in *Metaphysics* XI, intends to prove a number of immobile movers according to the number of the heavenly movements, as though that consideration followed upon this.

1172. Then at (918) from the premisses already demonstrated he concludes to the main conclusion. And he says that from the foregoing it is plainly impossible for the first immobile mover to have any magnitude or to be a body or to be a power residing in a body. For if it had any magnitude, it would te either finite or infinite. But it was proved in Book III, when nature in common was discussed, that an infinite magnitude is not possible. What remains, therefore, is that, if it does have magnitude, it will have a finite magnitude. But that such is not so he proves on the ground that it is impossible for a finite magnitude to possess infinite power, such as the first immobile mover must necessarily have. Therefore, it cannot have a finite magnitude.

But that the first immobile mover must have infinite power he proves from something previously demonstrated, namely, that it is impossible for something to be moved for an infinite time by a finite power. Now, the first mover causes a motion that is perpetual and continuous, and is one and the same for infinite time, for otherwise this motion would not be continuous. Therefore, it has infinite power.

Thus it does not have a finite magnitude, and an infinite magnitude is impossible to be. It is plain, therefore, that the first mover is indivisible, both as having no part, as even a point is indivisible, and as wholly without magnitude, as though existing outside the genus of magnitude.

And thus does the Philosopher in his general consideration of natural things terminate at the first principle of the whole of nature, Who is the One above all

things, the ever blessed God. Amen.