1

ARISTOTLE'S CONCEPTION OF MOTION: AN ANALYSIS FROM PHYSICS TO COSMOLOGY

Zubairi b. Nasseem

It is axiomatic that all metaphysical problems, not to mention other philosophical problems, emanate from, and are secondary to, the perennial problem of being. The need to understand the nature of the ultimate reality generated a debate that polarised philosophers into opposing schools. There emerged the antinomy of the one and many, being and becoming, rest and motion, change and constancy, etc.

A number of thinkers participated in this controversy, thereby laying the ground for Aristotle's metaphysical novelty. But the Stagirite's precursors were subsumed in the two major opposing positions of Parmenides and Heraclitus. The former, in the name of unity and immutability of the First Principle, denied change and diversity, motion and plurality. But the latter, discussing change and motion in anti-substantialist tradition, insisted on change as the basic reality. Heraclitus further emphasized on the unity of all things; and he proposed that the opposites were in reality identical.

With Aristotle, the discussion of change or motion assumes a kind of radical novelty. He rejects the atomistic explanation of qualitative change and diversity by the displacement of the homogenous and immutable elements, denies the existence of atoms and the void, and asserts the reality of qualitative change and diversity. According to Aristotle, every change, including positional change or local motion

implies the passage from potentiality to actuality. Hence, there is in every being, in every existent entity, that which changes. But underlying all these changes is that which does not change. Aristotle is thus led to postulate a being characterised by Form-Substance relation. This is his theory of hylomorphism. However, this theory, taken in abstract, may not adequately explain Aristotle's analysis of motion. It should be born in mind that Aristotle's analysis of motion is a significant shift from the purely mechanistic to a position representing a full metaphysical spectrum from physics to cosmology.

The Imaginative Background of Aristotle.[1]

To the early Greeks, attempting to give a scientific account of motion, the purely mechanical view hardly suggests itself except in the case of a few men of genius such as Democritus and Archimedes. Two sets of phenomena seem important: the movements of animals, and the movements of heavenly bodies. To them, the early Greeks, it seems more natural to assimilate apparently lifeless motion to that of animals.

There is a peculiarity, one represented by the fact that live animals unlike other things move. To Aristotle, this peculiarity suggests itself as the basis of a general theory of physics. Here we use the word "physics" in its specific sense as explicated by Aristotle. According to the Peripatetic Master, "physics would be a theoretical science, and theoretical about such being as can be moved, and about substances which according to formula are for the most part non-separable only." Of course here Aristotle means physical substances *qua* in motion; and of 'substance' he refers to the form of such substance and also to the essence of physical attributes.[2]

In the case of heavenly bodies, they differ from animals by the regularity of their movements, but this may be only due to their superior perfection. To the early Greek, if the heavenly bodies are not divine, then they are at least moved by the will of a Divine Being who has a Hellenic love of order and geometrical simplicity. Thus the

ultimate source of all movements is will: on earth the capricious will of human beings and animals, but in heaven the unchanging will of the Supreme Artificer.

Common to both the world of the humans and animals on the one hand and the world of the heavenly bodies on the other is a characteristic "nature" the "isness" or "essence" of these things that explicates their activities, the sum-total of their existence. In this respect, the essence of the things would seem to precede their existence.

Existence and Essence

For Aristotle all existence is "determinate" and "individual", and is (hence) plural: existence forms many of things and processes. This, he takes for granted from common usage: "to be" menas "to be some thing". Hence Aristotle states a general principle: "To be separate and individual belongs above all to any thing. "[3]

All these separate and individual existents have a central reference to one primary being. This being is primary and therefore first in definition, in knowledge and in time. Nevertheless these existent particulars are really individual when it comes to the question:

"what is it to be that thing?" - that is, the Essence.[4]

By proposing plurality in the Essence, Aristotle seems to disagree with Plato over the latter's Universal Idea or Form in which all existents participate in the likeness. For Plato says:

"Plato tell me, Zeno, do you not further think that there is an idea of likeness, detached and existing by itself, and an opposite idea, which is the essence of unlikeness, and that in these two you and I and all other things to which we apply the term may participate....?"[5]

According to Aristotle, the Platonists, following Plato, have fallen into confusion in hypostatizing Forms, objects and mathematics, universals, genera, and such other formulations of logos. After all, the

Forms are not "things"; the universals are not concrete, particular things; they are predicates common to many things.

But the "essence" of a thing, what it is to be that thing, since it is not common to anything else, and since in a sense it is identical with the thing itself, can be said to be the essence of that thing. The essence of an individual thing is peculiar to it and belongs to nothing else.[6]

It is this 'essence' we express ina formula when we state what that thing is. The 'essence' of each thing is that which it is said to be in itself and in accordance with its own nature.[7]

In this specific way, essence is identical with nature. The specific way in which anything operates is identical with what that thing is. This means that essence is one and the same thing with the particular thing. For Aristotle, "it is when we know its essence that we have knowledge of a thing... It follows that each individual thing is one and the same with its essences, and not merely incidentally, because to have knowledge of the individual is to have knowledge of its essence; so that it is evident that both must be identical."[8]

'Essence' is thus defined as what is knowable and stable about a thing or species. it is what the definition of a kind will formulate. It is not the formula or the definition that is identifical with the concrete things; it is what the logos formulates, the intelligible structure or make-up of the thing, what we know and state when we know the thing.

Here is Aristotle we note some equivocation: in one sense the essence is identical with the individual; in another it is obviously not. For Aristotle therefore, the difficulty arises because so far he has been dealing with the question semantically. He has in effect been answering to question: "What is the relation between what language formulates and that of which it is the fomulable aspect?"[9]

Otherwise, viewed ontologicaly rather than semantically, essence is univocal: for example, whereas it is the essence of man to eat rice,

it is not by the essence of rice to be eaten by man. This is therefore Aristotle's immanent teleology.

According to the principle of immanent teleology, it is by the nature of things - hence by their essence - that they participate in existence in the way they do. Therefore things and all their activities are to be understood by their nature.

But What is "Nature"?

When we ask this question - what is 'nature'? we are actually asking "what is the essence of existence?" insofar as 'essence' is identical with 'nature' in Aristotle's sense.

As a generic term, nature in general means for Aristotle the totality or the sum of the determinate powers possessed by things, what everything has the power to do, the concrete order or pattern of the processes that are taking place 'by themselves'. Nature is thus an intelligible, teleological, or functional order of motion, a system of natural laws in terms of which all natural motions or processes are to be understood.

As a specific term, for example the nature of man, 'nature' is a specific passive power of being moved or acted upon, set in operation or actualized by some external motion or agent, or some Unmoved Mover, and then moving in a determinate way. It is in this specific way that nature is identical with 'essence', that is the 'isness' of a thing.

Since nature exudes immanent teleolgy, the most appropriate explanation of any cosmic process, such as motion, is by nature.[10] By this confention motion is a subject of rafure and therefore of entology. This is why Aristotle situates his treatment of motion paradigmatically in the 'First Philosophy'

Motion as a subject of the 'First Philosophy'

In a way, motion is one of the problems of Aristotle's 'First Philosophy'. Therefore to speak of the deficiencies of peripateticism in

our understanding of the whole (the Universe) and the Particular (motion) is really to speak of the deficiencies of the "First Philosphy" as treated by Aristotle.

The question "what is motion" is a problem of this 'First Philosophy' In the case of Plato, to ask of the 'isness' of motion is a general question that is said to have grown out of the problem of non-being raised by Parmenides and his Eleatic followers.[11] To this same question Aristotle nevertheless, provides two possible answers: first the semantic and second, the cosmological.

Semantically, motion is something that can be a subject of discourses. But cosmogonically, motion is a subject of the sublunar world.

The sublunar world is a world of change. Therefore Aristotle believes that in order to understand motion, we must understand how things come into being and change, act and interact, insofar as these things are the existents that participate in motion. By the same token Aristotle should ask "what is involved in being a fuller functioning?" Thus it will be clear from this that Aristotle's pattern of motion and change is a pattern of novelty that emerges in process.

This clarity becomes evident if we realize that in Aristotle's methodology, semantic is inseparable from logic; logic is again inseparable from physics. Hence starting with things that are said, through what things can be said to be, we are led to things themselves. Ultimately proceeding from the essence to the existence, Artistotle gives motion his formal definition.

Aristotle's Formal Definition of Motion:

Aristotle's formal definition of motion runs as follows:

"Motion is a process in which something which has the power to become a definite something else, becomes something else ... it is thus the continuous actualization of what is potential, taken as being potential."[12]

Motion is thus an incomplete operation, a process going on, pertaining of the charater of both a power and an operation. It is a continuous process by which a thing actualizes itself. This means that the end achieved is not a new thing. Rather it is the potential that exists in the subject of motion. For no thing has the power of becoming another thing outside of its own potency. In other words, the line of immanent teleology cannot be side-tracked. Aristotle insists that "we must admit that of all beings there is none whose nature permits it to act on another or be acted on by another in any chance way whatsoever, nor is there any coming-into-being of any kind of being from any other kind."[13]

In a way Aristotle is proposing to defend motion and change against the denial of the intelligibility of all change and motion. He is proposing to defend 'nature' and 'natural motion' against the denial of the same by Empedocles and Atomists (Democritus and Leucippus). Aristotle expresses his position in the following words:

"... natural things, either in whole or in part, are in motion. This is clear from induction."[14]

Aristotle directs these words at especially the Eleatics---Parmenides and his followers---because they deny the intelligibility of any kind of change and motion. He answers Empedocles and the Atomistic critics of 'coming-into-being' and 'nature' by admitting that they are right in holding the opinion there can be no coming-into-being from 'non-being' as such. Nevertheless there can be genesis from not-being such. Therefore the motions of natural bodies or natural motions are to be understood in terms of a tendency implanted in them, a tendency to change in a specific way, a way according to their nature. This means, according to Aristotle, motion or natural motion is to be understood according to immanent teleology.

Contrary to the opinion held by the pre-Socratics, Aristotle identifies 'whatever exists by nature' with any thing that is in motion.

He proceeds to examine previous opinions as to the principle of the intelligibility of movements and of every kind of change, becoming and process. In other words, movement or process is what he is trying to understand in terms of 'nature'. Nature indicates and delimits a certain subject-matter of inquiry. This inquiry is directed into natural bodies or things that exist by nature.[15]

Aristotle tries to reinstate, reconstruct, and defend the ancient Ionian conception of "nature" against Permendies and the Eleatics whose criticism has culminated in the mechanistic views of Empedocles and the Atomists.

Aristotle insists that the world displays real genesis, real coming-into-being, with a fundamental unity and continuity, a basic temporal pattern or structure. Wherever we cut into these processes, we find that in a significant sense, every process is now what it will be. It has genuine temporal parts and relations which are essential to its being that process, or not merely inclined to it. The process cannot be adequately understood apart from this temporal character and pattern.

Every process, and therefore every motion, involves the operation of determinate powers. Hence motion can be undersood only as the operation, the actualization, the functioning of the powers of its subject or bearer.

Aristotle generalizes to the extent that even local motion, motion in place is the operation of a power, a genuine process: it is a passing from one position to another. Such motion in place is not to be understood in the terms in which Eleatics try to understand it---as a succession of successive points occupied at successive instants of time.[16]

It is rather 'the traversing of a distance'. It is not a succession of determinations, but the determining of a succession, a continuous operation or process. This is the view in terms of which Aristotle affirms motion and deals with and solves Zeno's puzzles.

In light of his affirmation of motion. Aristotle defends his conception of the operation of powers and actualization of the potential by a dialectical development of the consequences of denying motion itself. For example refering to the Megarians, Aristotle says that they are among those philosophers who claim that a thing has a power only when it is functioning, and that when it is not functioning it has no powers.

Aristotle retorts that such doctrines take away all possibility of change or coming into being. For what ever has been deprived of power can do nothing. It follows, whatever has not yet come into being cannot possibly come into being. In the words of the Master himself, "...of what cannot possibly come into being it can never be truly said that it is or that it will be, for not having the power means just that." Aristotle then concludes:

"...power and operation are different..."[17]

Here Aristotle implicity affirms the distinctiveness of the principle of the intelligibility of motion *vis a vis* motion itself.

<u>The Principle of the Intelligibility of Motion.</u>

For Aristotle, motion is the agent of all the cosmic processes. Ultimately, it is the eternal motions of the heavens that act on earth. For him, only motion can 'do' anything, or 'make' anything take place.

To say that motion is the agent of all the cosmic processes is the same as saying motion makes every process happen. The only agent, the only 'cause', is motion. How are we to understand this fundamental fact of motion itself? This does not mean that we are asking the question, what is the 'cause' of motion?

Motion has no efficient cause. Nothing 'makes' motion in general take place. Motion in general is uncaused and eternal. But each particular motion is 'caused' by another particular motion. No matter how far back in time we may go, we never find any motion not itself

'caused' by a previous motion. Efficient causes, like material causes, must form an endless chain.

Motion in general has no efficient cause. But if it is to be intelligible, motion must have a 'reason why'. To understand motion in general, we must find and know the 'reason why' there is motion at all. This does not mean what 'caused' motion; for nothing ever 'caused', but rather, what it does the function it performs, its excuse for being.

There was never a time when motion 'began'. Motion, like time itself, never had a beginning. Aristotle specifically denies any creation of motion. How are we to understand the fact that it is motion, and only motion, that 'causes' motion, world without end? The answerr to this question will be a principle of intelligibility. This principle of the intelligibility of motion is the Unmoved Mover.

The Unmoved Mover has nothing to do with any 'creator' of motion, any 'beginner' or 'initiator' of motion. It has nothing to do with any 'first cause' in any temporal sense of 'first'. It is a logical explanation, not a physical cause; it is a natural law, not a force. It renders the great world complex of natural processes intelligible, it does not 'make' those processes occur, any more than a natural law "makes anything happen. It is a principle of intelligibility, a 'reason why'.

For Aristotle, the principle of intelligibility of motion is its final cause or reason why, the factor expressing what it is directed toward, the fullest expression of what it can do. Now since for Aristotle what a thing can do is identical with what it fundamentally is, since its fullest functioning, its culminating activity, its entelechy, is its intelligible structure, the final cause and ther formal cause of motion are in the last analysis identical. The Unmoved Mover is hence both the final and the formal cause of motion.

At this stage of our analysis we make the following two observations:

First, motion fulfills all processes. These processes are all moving toward a completed and perfected functioning. They are aiming at the perfect state in which all possibilities would be realized, and nothing would be left to be achieved, a kind of being and doing in perfection, an eternal activity. That would be the complete working-out of what motion has the power to effect.

Second, motion in general is to be understood as aiming at it, as directed toward that end. That is what motion is "for"---its final cause. it is not, of course, a state ever to be achieved, but rather a continuous achieving.

This second observation elucidates in nut-shell what motion is: it is not a sharp-act but a continuous process. Now what is the nature of this process that unfolds in perpetuity?

The Nature of Motion

What factors are involved in motion? What concepts are needed to understand it adequately?

"It seems that motion belongs to the things that are continuous, and in the continuous the infinite appears in the first place; that is why the definitions given of the continuous often employ the motion of the infinite, the continuous being infinitely divisible. In addition, without place, the void and time motion is impossible." [18]

It is evident that according to Aristotle, motion belongs to the continuous and occurs in place and in time. We are, however, led to ask where is it (motion) located? Anterior or posterior to that in motion?

The Locus :- Aristotle contends that motion is in the thing moved, the action has its locus in the thing acted upon. The motion is the actualization of the thing moved under the influence of the mover. Yet the actualization of the mover's power to move is the same actualization. There are no two operations but only a single operation, with its locus in the thing moved.

This point raises some logical difficulty. Are not the operations of the thing acting and the thing being acted upon different operations? Is not there any difference between acting and being acted upon? Certainly there seems to be a difference of logos, a difference of terms.

'Acting' and 'being acted upon' are one and the same process with its locus in the thing being acted upon. The active power of the mover and the passive power of the object to be moved are two different powers. But there is only one motion, one operation, one actualization of the two powers.

"If we admit that to act and to be acted upon are the same thing, it is not because the two have an identical definition, which formulates what makes them that they are, like dress and clothes, but like the way in which the road from Thebes to Athens is the same road as the road from Athens to Thebes." [19]

Aristotle is here making a fundamental point about the difference between a motion and logos. A motion has an identity that remains compatible with stating the problem in various ways. Like the road from Thebes to Athens, we can look at it from either en'd; and our position or perspective will determine how we shall get it stated in words. It remains nevertheless the same road, no matter how we are looking at it and stating it.

There is also a second fundamental point involved in this discussion. Every operation is really a cooperation of two different powers, a joint operation of the power of acting and the power of being acted upon. It is the peculiarity of Aristotle's usage that he assigns the locus of this cooperation to the thing being acted upon. Hence in the object of motion is the locus of the motion---whether finite or infinite. Why also the infinite? And what does it mean?

The Infinite:- Like magnitudes and time, motion can be either 'limited' or 'unlimited', finite or infinite. As regards what the infinite is, Aristotle says,

"Not that beyong which there is nothing, but that beyond which there is always something more ... The infinite is hence that beyond which one can always go on taking something more, with respect to quantity. What has nothing outside itself is complete and whole, for we define a whole as that from which nothing is left out, like a man or a chest." [20]

Aristotle concludes, there can be no actual infinite : nothing that is actually infinite can exist, nothing that exists can be actually infinite. Rather everybody is some 'where', and has a determinate motion.

Place and Space :- Aristotle specifically denies that there is any such thing as 'space', the space of Plato's Timaeus or the 'void' of Democritus and the Atomists.

As against this motion of a space in itself of existing by itself, on which both the Platonic and the Atomistic traditions were in agreement, Aristotle develops and defends the relativistic conception of 'place' or 'position', the position of body in a system of bodies, which is essential as a point of reference in describing the motion of a body from on position to another.

Aristotle asks, is there such a thing as place? This is an important question for everything that is is somewhere. Moreover the most universal and most controlling form of motion is motion in place. That place exists is clear from the phenomenon of replacement: place or extension clearly differs from the bodies in it, for bodies can be taken out of place, and the place itself stays put.

Still more important the motions of the simple natural bodies (going 'up' or 'down') not only indicate that there is such thing as place, but also that place has a 'certain power'. Such bodies move to their own 'proper places'. These 'proper places' are parts and kinds of a system of places, which is fixed in relation to your system of bodies; not merely in relation to us' but in itself apart from us.

This system of natural places is defined operationally as one of the different 'withers' of the different natural motions. The system of natural places of position differs from the equally objective determinations of mathematical place :

"It is also clear of mathematical objects : they are not in place, but in accordance with their position in relation to us, they have a right and a left, though their position is only thought by us, and they do not have any of these determinations by nature".[21]

Place is neither matter nor form. Had place been either, then it would not be the 'wither' of natural motions; and if place where 'in' things, then place would be 'in' place itself. In this sense of 'in', things cannot be said to be 'in' themselves.

Therefore by analogy, place is to be explained thus :

"Hence when a thing that is inside another thing that is being moved, is moved and changes its place, like a ship on a river, it is in relation to the surrounding body more as if in a pail than in a place. *Place means something unmoved;* hence it is rather the river as a whole that is in the place, *for as a whole it is unmoved.*" [22] (Emphasis added)

Thus Aristotle's formal definition of place is 'the immediate unmoved limit of the surrounding body'.[23]

Place is 'unmoved' because one can take a body out of its place, and the place does not move. Place is therefore relative to a whole system of bodies. As Aristotle himself puts it, "if a body has outside itself a body which contains it, it is in place; if it has not, it has no place." [24] He sums up the argument thus :

"Hence that whole universe is not where ... next to the universe, there is nothing outside the whole, rather everything that is, is in the heavens ... but the heavens are not in anything else."[25]

If the "heavens are not in anything else", what are they in? Are they in void? In fact the concluding sentence of this quotation is of much import in so far as it raises another question, namely, the

question of void. How? This is raised in light of the fact that if 'the havens are not in anything else' then there could be a possibility of non place. Therefore there could be a possibility of 'void'.

Void:- Aristotle accepts that there is void. For without such a void there could be no motion. It is clear that the fact of motion does not necessitate a void, for a plenum can be altered. Motion in a plenum is possible, since one body can take the place of another.

It is clear, says Aristotle, that there can be no separated void, no place of space in which there is absolutely nothing at all, without structure or determination. Such a void, if it ever existed, could not be the cause of the determinate natural motions.

Why should bodies move detrimentally in void one way rather than another? No motion would in fact be possible in a complete void. For natural motion demands a determinate character. Hence where there is a complete void, motion may stop in it. After all motion and violent motion demands a mover.

Here Aristotle cannot escape the notion that a moving body 'is moved' by something. He has, as yet, to explain the dimension of motion---namely, time.

Time :- In Aristotle's treatment of motion, time is understood as a dimension of motion. To understand this proposition, we need to ask the following questions : Does time belong to the things that are or to those that are not? What is the nature of time?

Time is predicated of past, present and future. It seems to imply, by these divisions, instant. But what is the instant?

"The instant is not a part, for the part is a measure of the whole and the whole must be composed of parts. But time, it seems, is not composed of instants. Again, is the instant which seems to mark the past off from the future always one and the same, or is it always a different one? This is not easy to see." [26]

The ancients identified time with the motion of the whole. or even with the sphere itself. But if time be the motion of the whole, if there be many heavens, there will be many times simultaneously. The simple identification of time with the sphere comes from the fact that every thing is both in time and in the sphere.

Time seems above all to be a kind of motion and change. But the motion and change of anything are uniquely in that thing, while time is everywhere and in all things equally. Again motions are faster and slower, but not time; time defines velocity.

Yet if time cannot be motion itself, it is never found without motion. When we are aware of no motion, it seems that no time has elapsed. Hence it is clear that "time is neither itself motion, nor without motion".[27]

Then what aspect of motion is time? We say that time has elapsed when we have a sense of earlier or later in motion. Hence the definition of time will be:

"Time is the number of motion with respect to earlier or later."[28]

Therefore by definition, time is that aspect of motion which permits the enumeration of succession states. It is not the number which is itself a means of numbering, but the number which is itself numbered and enumerated. Aristotle also calls time the 'means' of motion, the measurable aspect of motion, literally a certain 'dimension' of motion, its temporal dimension. That is, time is an aspect of motion itself. It is not something else measured by motion.

Time and motion are measured reciprocally :

"We measure not only motion by time, but also time by motion, because they are determined reciprocally. For time determines the motion of which it is number, and motion, time."[29]

From the relation of motion to time and vice versa, it can be said that rest is 'in time'. Time is thus measure of rest incidentally. Time is

not the efficient cause, but the incidental cause of motion as a qualitative change.

Finally, of what motion is time the measure? Are there different times? And can two equal times exist simultaneously? Aristotle contends that whereas motions are different and separate, time is everywhere the same. It is the measure of the eternal circular motion of the sphere which provides the common frame of reference for all temporal measurement, since its number is best known.

In contrast to the motion of an absolute time and an absolute space that have come down in both the Platonic and the Atomistic traditions Aristotle presents what we should call a relativistic notion of both time and space. They are systems of measurement, way of determining certain dimensions of motion. Time is a temporal dimension of motion; place is relative position within a system of bodies. Both provide an easily measurable system of reference."[30]

The concepts of the locus, the infinite, place and space, the void and time are not really integrally involved in motion. Rather their analysis and understanding help us understand the conception of motion. Theirs is rather an auxiliary epistemological function in relation to the primary ontological status.

The latter status is taken up by such concepts as the unity, continuity and divisibility of motion. These are factors involved integrally and essentially in the analysis of motion.

The Unity, Continuity and Divisibility.

In respect to unity, continuity and divisibility of motion, Aristotle confines himself to three kinds of motion: change of place (local motion), change of quality, and change of quantity.

Unity: How can we determine when a motion is 'one', and what are the limits of any particular motion? A motion can be said to be 'one', Aristotle points out, in many ways. It can be one generically, or specifically, or substantially, or numerically.

A motion can also be said to be 'one' in the simple sense if it is 'one' in substance and in number. That is, it must be the change of a simple thing that remains identical in kind through a continuous interval of time. We know that we are dealing with a simple motion when it has been completed; for anything that can be said to be a unity is always completed and whole. It is this feature of reading a goal or end that makes a process self-delimiting. In one other case we say that a motion is one when it is uniform. (Therefore the 'unity of a uniformly accelerated motion' is, in the Aristotelian philosophy, a 'tautology').

Continuity:- Any single motion is continuous. Those things are said to be 'together' which are in a single place. They are said to be in "contact" when their extremities are together. They are said to be 'consecutive' if in their serial order they are not separated by any intermediary of the same kind. Two thing are 'contiguous' if they are both consecutive and in contact.

"The continuous is one species of contiguity. I say there is continuity when the limits by which the two things are in contact are one and the same, and, as the name suggests, hold together; that cannot happen when there are two different extremities."[31]

In other words, that is continuous which when cut has a common boundary. It is quite interesting to find Aristotle restricting the distinction between motions in accordance with nature and contrary to nature to local motion.

"There is no alteration in accordance with nature, and another contrary to nature ... And this holds also for generation and destruction: for generation is not in accordance with nature, and destruction contrary ..."[32]

Divisibility of motion:- Aristotle makes it clear that lines are not composed of indivisibles or points; nor is an interval of time composed of instants. Both points and instants are limits, and not magnitudes or parts of a line or of time. Magnitudes and time are

always divisible, no matter how far we carry the division, into magnitudes, but not into such limits. Thus there can be no motion in an instant, but neither can there be any rest.[33]

If so, then Zeno's arrow is never at rest; and both magnitudes and time are infinitely divisible. Therefore Zeno is right at least in holding that it is impossible to traverse an infinite distance in a finite time. Nevertheless one can easily traverse an infinitely divisible distance in a finite time, for a finite time is itself infinitely divisible.

First, no change can be infinite, for it is always from one contrary to the other. It involves a limit and a completion. Only local motion is not always carried on between two such limits. Even so, local motion cannot traverse an infinite distance. It can be infinite in time, if it is a circular motion. So the eternity of motion in the cosmos demands an eternal circular motion of the outermost heavens. Such an eternal motion of the outermost heavens demands an eternal mover, hence the First Mover.

Second, with regard to the necessary agent for all cosmic processes, we postulate local motion. The reason being that every other type of change or process always involves motion in place as a necessary agent. Motion in place is thus the primary kind of 'motion'. It alone can be perpetual and continuous, without interruption or break. Now such a perpetual and continuous motion must exist as the efficient cause of the whole cosmic process.

Third, Aristotle's whole conception of motion as 'bing moved' demands that every process must be moved by some cosmic motion. The ultimate cause of all the processes of generation is thus the eternal circular motion of that celestial body to which we attribute the 'light' of the emanationist philosophers and theosophers. Thus motion in place, and not genesis, is the first of all changes. Aristotle sums it up as follows:

We were right in the Physica in calling motion and not genesis the primary form of change. For it is far more reasonable that what is

should cause the coming-to-be of what is not, than that what is not should cause the being of what is. Now that which is being moved is, but that which is coming-to-be is not: hence also motion is prior to coming-to-be."[34]

Then are all things that come to be of this contingent character? Or, on the contrary, it is absolutely necessary for some of them to come to be? Is there, in fact, a distinction in the field of coming-to-be corresponding to the distinction within the field of being between things that cannot-possibly not- be and things that can not-be?

Aristotle's answer is that only cyclical changes, and therefore circular motion, can be necessary with a simple necessity.

"It follows that the coming-to-be of anything, if it is absolutely necessary, must be cyclical ... It is in circular movement therefore and in cyclical coming-to-be that the absolutely necessary is to be found" [35]

Aristotle assigns necessity to those movements that belong to and depend upon the eternal revolution of the heavenly bodies. Accordingly the revolving heavenly bodies are always setting some other things in motion. The latter display such movement as the circular motion.[36] . The circular motion of the celestial sphere is elucidated better by a cosmological rather than a physical investigation.

The Cosmology of Motion.

Cosmologically, Aristotle discriminates between straight motion and circular motion. Corresponding to these two types of motion are two kinds of simple body as determined by their observed natural motions or operations.

Straight motion is typical of the bodies of earthly kinds, which we can see move naturally in straight lines, either down or to the centre, like air and fire, or away from the centre, like the heavier objects, The straight motion is therefore the natural motion of elements. This type

of motion is the observed motion of gravitation and levitation that defines the natural places of the elements in the structure of the sublunar region. The straight motion as motion of a body towards its proper place is motion towards its proper form.

Aristotle explains the nature of the circular motions by a logical procession from the nature of heavenly bodies.The latter is accordingly logically prior. The logic is consistent with the guiding principle of the Aristotelian system, namely, immanent teleology. In his own words,

"If there is simple motion, and if circular motion is simple, and if the motion of a simple body is simple and simple motion is the motion of simple body, then there will necessarily be a kind of simple body so constituted naturally as to move in a circle in accordance with its own nature. [37] .

Aristotle then proceeds to assert the ontological priority of circular motion. It is a 'first' by virtue of its completeness in nature. After all, it is ontologically and logically understood that the complete is prior to the incomplete. Therefore motion in a straight line which has no limit or end, is incomplete.

A body that participates in the circular motion must be complete and 'first'. To this first body, categories like quality and quantity do not apply. The "first" body is above generation and corruption. [38]

The 'first' body or the 'first heaven' move other heavenly bodies by contact. This means that the 'first' heavenly body needs actual bodily spheres to cause the planetary motion. The 'first heaven' carries innumerable celestial bodies, while the systems of epicycles are said to bear only one. In the. word of Aristotle himself as the Peripatetic Master:-

"Here is a second reason why the other motions, carry one body: the motions before the last one, which carries one star, move many bodies, for the last sphere moves round embedded in a number of spheres, and each sphere is corporeal. The work of the last one,

therefore, will be shared by the others. Each one has its own proper and natural motion, and this one is, as it were, added. But every limited body has limited power." [39]

Concluding Criticism.

Carrying his discussion of motion from 'physics' to 'Cosmology' Aristotle takes over the excellent geometrical construction of epicycles of the astronomers. He tries to construe it as a physical fact. In insisting on an explanation through mechanical contact, he is like the later nineteenth century 'pioneer' astronomers, far too much of a mechanist.

For Aristotle, living and knowing are the most complex and developed forms of change and motion. Hence motion must be understood in terms that will make intelligible 'living' and 'knowing' and not merely explain motion in place, the motion of Galileo and Newton. If the more complex forms of change are not understood, motion in general is not understood.

On the whole, the temper of this contention shows Aristotle the biologist more than it does portray Aristotle the cosmologist and the ontologist. Nevertheless neither the biologist Aristotle nor the mechanist Aristotle did appeal much to the later Aristotelian and Muslim peripatetics. It was the rationalist dimension of the ontologist Aristotle that evolved into the philosophically significant peripateticism. Ultimately, the rationalist aspect of peripateticism captured the imagination of such early Muslim thinkers as al-Farabi and Ibn Sina. With the latter's illuminationist animation, the Aristotelian-peripatetic conception of motion assumed a novel importance in Islamic philosophy.

1. This section is adopted partly from Betrand Russell: *A History of Western Philosophy,* Counterpoint, London, 1984 pp. 213-4.
2. Aristotle: *Metaphysics*, Book Epsilon, ch. 1: 1025^{b} 19-29 pp. 102-3.
3. Ibid., Book Zeta, ch.3: 1029^{a} 27-28

4. Ibid., Book Zeta, Ch. 13: 1038^{b} 10-15
5. Plato: *Parmenides*, 671-2: 129^{a}
6. Aristotle: *Metaphysics*, Book Zeta ch. 13: 1038^{b} 10-12
7. Ibid., Book Zeta, ch. 4: 1029^{b} 14-17
8. Ibid., Bood Zeta, ch. 6: 1031^{b} 7, 8, 19-23.
9. ibid., Book Zeta, ch. 4: 1029^{b} 13.
10. Moreover for Aristotle the fact of nature is obvious, it requres no proof. See Aristotle: *Physics*, Bk. II,, ch. 1:123^{a} 4-10.
11. Plato: *The Sophist*, 243^{c}ff.
12. Aristotle: *Physics*, Bk. III, ch. I, 201^{a} 10-11.
13. Ibid., Bk. I, ch. 5: 188^{a} 32-34
14. Ibid., Bk. I, ch. 2: 185^{a} 12-14.
15. Aristotle: *Meteorologia*, Bk I, ch. 1:338^{a} 20.
16. Modern structuralists - Newtonians and Bertrand Russell - share the same view with Eleatics.
17. Aristotle: *Metaphysics*. Bk. Theta ch. 3: 2046^{b} 29; 1047^{a} 21.
18. Aristotle: *Physics*, Bk. III ch. 1: 200^{b} 16-21.
19. Ibid., Bk. III, ch. 3: 202^{b} 12-15.
20. Ibid., Bk. III, ch. 6: 206^{b} 19-25.
20. Ibid., Bk. III, ch. 6: 206^{b} 19-25.
21. Ibid., Bk. IV, ch. 1: 208^{b} 19-25.
22. Ibid., Bk. IV, ch. 4: 212^{a} 16-20.
23. Ibid., Bk. IV, ch. 4: 212^{a} 21-22.