Aristotle on Necessity and Possibility: A Study of Modal System

Mrinmay Dhali

Department of Philosophy, Ramakrishna Mission Vidyamandira, Belur Math, Howrah – 711202

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ABSTRACT

This paper examines Aristotle's (384 – 322 BC) theory of modal logic, with special emphasis on its historical development, conceptual structure, and philosophical implications. While Aristotle is widely celebrated for his theory of categorical syllogism, his modal system—dealing with necessity, possibility, impossibility, and contingency—remains comparatively less understood due to internal inconsistencies and the absence of a universally accepted formal reconstruction. The study traces the evolution of modal logic from Aristotle's works such as *De Interpretatione* and *Prior Analytics* through its reception and reinterpretation by later thinkers including Theophrastus, Avicenna, Averroes, and William of Ockham. It also highlights the medieval distinction between de dicto and de re modalities, which significantly expanded the scope of modal syllogistics. So, the paper analyses the logical structure of modal propositions using symbolic tools such as necessity (L) and possibility (M), and explores their interrelations through fundamental modal principles. Special attention is given to Aristotle's treatment of modal syllogisms, including the validity and invalidity of various moods such as BARBARA LXL and XLL, along with later critiques by scholars like Jan Łukasiewicz and Nicholas Rescher. The study argues that despite historical criticisms, Aristotle's modal logic laid the groundwork for subsequent developments in formal and philosophical logic. Finally, the paper reflects on the broader philosophical implications of modal logic, particularly its relevance to debates on determinism, necessity, and contingency. It concludes that although Aristotle's system is incomplete and sometimes inconsistent, it remains foundational and continues to inspire modern logical inquiry and interpretation.

Keywords: Aristotle; Modal Logic; Necessity; Possibility; Contingency; Modal Syllogism; De Dicto; De Re; Prior Analytics; De Interpretatione; Logical Entailment; Medieval Logic; Determinism

INTRODUCTION

Aristotle's lifelong contribution on logic is enormous. One common popular thing, for what he is known to all of us especially to the student and scholars of logic, is categorical syllogism. This creation of Aristotle is most popular than other fundamental inventions. We have very elaborately discussed it in our previous sections.

Now we discuss in this chapter one another fundamental thing that is modal system. This system was extensively treated by Aristotle and other ancient writers. As Aristotle is the founder of this logic, the basic concepts of this system were originated by him. But according to some critiques modal logic of Aristotle is not very popular or known to the reader due to two reasons. The first is due to the author himself because there are many faults and inconsistencies. And the other reason is that modern logicians have not as yet been able to construct a universally acceptable system of modal logic which would yield a solid basis for the interpretation and appreciation of Aristotle's work. In this paper we try to solve some questions these are – How can modern modal logic (possible world's semantics) reinterpret Aristotle's modal system? What are the limitations of treating modal operators as propositional functors? Is the distinction between logical necessity and metaphysical necessity present in Aristotle? And how does Aristotle's modal logic influence contemporary debates in metaphysics and epistemology?

Historical view of Modal Logic

Modal logic was first described in a systematic way by Aristotle in his book *De Interpretation* but the system of his modal syllogistic is expounded in Book - I, chapters 3 and 8-22 of the *Prior Analytics*. We know from

Alexander of Aphrodisiac that the followers of Theophrastus and Eudemus disagreed with Aristotle's views on which modal syllogistic models were established and which are not valid.

According to some scholars, Alexander's destroyed work, On the Disagreement Concerning Mixed Moods between Aristotle and his friends could be our path-finder in this regard. But as it is not possible, we have to rely on the work of scholars like Father Bochenski, who in a book which reads like a detective story is able to reconstruct a large part of Theophrastus' logic from clues found in other ancient authors.

If we make a scrutiny in this regard, we will find that modal syllogisms would not get any strong footing in the hand of early Christian scholars. So, Arabic philosopher, Al-Farabi said: "And so the teaching of Aristotelian logic... remained in Alexandria, until the Christian emperor concerned himself about if and the bishops met and deliberated as to what part of the teaching should continue and what should be abolish. They decided that there should only be instruction in the Book of Logic up to the end of the figures of the assertoric syllogisms, and not in that which comes after this, for they were of the opinion, that herein lay a danger to Christianity, but that aid towards the victory of their faith resided in that part in which they permitted instruction. The public (exoteric) part of the teaching was therefore confined to that limit, while the study of the rest was carried on in private (esoterically), until the rise of Islam much later."[1]

But it is very much true that not only modal part, but the complete *Prior Analytics* portion of Aristotle's logic was under veil in the western world until the time of Abailard (1079-1142). And from this time a New Logic was introduced in the arena of western world.

From this source we can imagine that there was a basic interest in modal syllogistic among the Arabic Philosophers. One of the famous thinkers of Arab, Avicenna (979-1037) clarified the modal syllogism system of Aristotle's theory very vividly refusing the prevailing thought of Theophrastus' peiorem rule and Galen. Galen maintained the impossibility of there being a scientific treatment of syllogisms with contingent premises.

Averroes (1126-98), another thinker of Arab, wrote three among these three, the commentaries on the Priori Analytics and among medium size writing contains 90 pages. And it is fully devoted to an exposition of modal syllogisms. "Averroes' commentaries were followed by, among others, that of Albert the Great (1193-1280), by a commentary attributed to Duns Scotus but in fact by an unknown Scotist, and by that of William of Occam (1295-1349)."[2]

In this juncture we should keep it in our mind that those who followed Abailard gave a great emphasis on the distinction between modalities de dicto and de re. According to them the propositions, 'It is necessary (possible) that A is B' and 'A is necessarily (possible) B'. And here the difference between the propositions is not only from the form but in meaning also.

According to the mediaeval philosophers, in the first case necessity (or Possibility) is predicated of a dictum, de dicto; in the second case of a thing de re. Or again, in the first case the proposition 'A is B' is said to be affected by the mode in Sensu Composito; in the second case in Sensu diviso. It is very important sphere of modal syllogisms because by using this distinction of premises these philosophers were able to originate many more syllogistic moods and by this invention they have crossed Aristotle in this regard. And according to Bockenshki who had an extensive study in this regard told, "...that the total number of such moods held to be valid by Occam might reach one thousand."[3]

By keeping all these matters in our mind, we can say that Modal syllogistic is a continuing process and it does not get any fixed place in logical text books. More recent manuals such as the Port-Royal Logic (1662), Aldrich's *compendium* (1691), Whately's *Elements of Logic* (1862) and Keyne's *Formal Logic* (1884) do not contain any account of the modal syllogism. In this regard, Thomas Reid reports that Keckermann called the doctrine of the modals the crux Logicorum, and doubted whether the scholastic doctors "tortured most the modal syllogisms, or were most tortured by them." Reid himself decides to let modal syllogistic "rest in peace, without giving the least disturbance to its ashes."[4]

Albrecht Becker's study and interpretation of Aristotle's system clarify the riddle and by this interpretation we can find the real gain in understanding of it. By using the modern symbolism of quantifiers and some modal operators, Becker he himself represents the distinction of modal propositions de dicto and de re in a very precise manner. And in this regard, he also shows that Aristotle he himself was in a position of dilemma in dealing this distinction and to interpret those propositions which serve as the premises of his modal syllogisms.

Modal syllogistic got its new shape as a completely formalized deductive system through the hand of Lukasiewicz. He was the first who attempted it to make it real. In 1939 he had succeeded in axiomatizing the moods of the categorical syllogism on the basis of four basic axioms. He deduced four syllogistic axioms from modal logic of propositions and he published his system of modal moods in 1957. Lukasiewicz was very keen to construct an entirely new system of proposition modal logic in order to do justice to Aristotle's insights. Yet he failed to represent the system exactly.

The most sympathetic treatment of modal syllogisms in recent times is represented by Rescher. The author discusses the attempts of Becker and Lukasiewicz to reconstruct Aristotle's system using the methods of modern symbolic logic, and describes them all as meeting with 'utter failure'. Though himself a symbolic logician, Rescher implies that such future attempts must fail also, and offers his own intuitive and non-formal interpretation of the modal moods. We agree with the Rescher that previous formal treatments of Aristotle's system have failed, but nonetheless feel that a better treatment can be produced. In fact, we present a formalized system which we believe agrees exactly with Aristotle's at all intuitive points. With Rescher's intuitive interpretation we have no quarrel; on the contrary it provides the basis for what we believe to be the only satisfactory explanation of the rationale of modal syllogism so for forthcoming.

Rescher apart, then, overall Judgement of Philosophers to date on Aristotle's system has been not favourable. Thus, Bochenski in his book 'A History of Formal Logic', said – "This abortive proof is moreover not the only inconsistency in the Aristotelian modal logic. There are for instance essential difficulties in connection with the conversion of premises with the functor of necessity, and consequently in the proving of many syllogism which contain in such premise. In general, one gets the impression that this modal logic, by contrast to the assetoric syllogistic, still only in a preliminary and incomplete stage of development."[5] Lukasiewicz said that, it is not impossible to feel that a formal system which follows Aristotle's own logical insights more closely could be constructed.

Modal Functions and their interrelations

Aristotle in his modal system used four modal terms – 'necessary', 'possible', 'impossible' and another is 'contingent'. The last term 'contingent' is not very clear in the system of Aristotle. His book De Interpretation the term 'contingent' means the same as 'possible' but in the book Prior Analytics it is used in a very complicated manner.

Aristotle said that, only propositions are necessary, possible, impossible and contingent. Now we discuss these four terms. A proposition which is bound to be true we call a necessarily true proposition, or a necessary truth, or simple a necessary proposition; one which is bound to be false we call an impossible proposition; and one which is neither necessary nor impossible we call a contingent proposition. Some contingent propositions will of course be true and others false. If a proposition is not impossible, we say it is a possible proposition. Here 'possible' is not used as 'merely possible'. When we use that p is merely possible, we fundamentally mean that it is in fact false though it might have been true. In our sense possible propositions incorporates all true propositions. Basically, it includes all propositions except impossible ones.

In the present context 'necessity' is used as 'logical necessity'. "The sense in which we use the term 'necessary' can perhaps be sufficiently indicated by saying that when we say that a certain proposition is necessary, we do not mean that, things being as they are, or the world being as it is, it cannot fail to be true; but rather that it could not fail to be true no matter how things were, or no matter what the world turned out to be like."[6]

Giving an example on this basis, if we say, "nobody travels faster than light' -in our sense this is necessary proposition. Because, no one can travel faster than light so consist of facts about the physical universe as it is,

and the physical universe might presumably have been other than in fact it is. Now give another example- 'all bachelors are unmarried', 'no round are squares', 'either it is Thursday or it is not Thursday' these kinds of propositions are necessary truths in our sense.

In the same way 'possibility' means logical possibility, 'impossibility' means logical 'impossibility', 'contingency' means logical contingency. It should be sufficiently clearer what we have said in the sense of necessity. These four notions necessity, possibility, impossibility and contingency are called modal notions. They are related to each other. In these four terms necessity and possibility is more important than others two. And we can say another important modal notion is entailment. Give expression to understand the notion of entitlement, if a proposition 'p' entails another proposition 'q' and alternatively saying that 'q' follows 'p' the inference p to q is logically valid.

Previously we said, according to Aristotle only propositions are necessary, possible, impossible and contingent, we can also say that, the proposition 'p' is necessary. Here 'p' is the name of a proposition. We say 'man is an animal'. So, we will say, 'it is necessary that man should be an animal'. According to modal logic there are two modal functions. 'L' and 'M'. 'L' denotes to the words 'it is necessary that' and 'M' denotes to the worlds, 'it is possible that'.

Now we give the symbolic expression of this sentence:

It is necessary that P=LP

It is possible that P=MP

In this perspective 'p' is an argument. If the modal functions are propositions, then we say that, L and M are proposition-forming functors of one propositional argument. If any propositions beginning with 'L' or equivalents are called 'apodictic' and those propositions beginning with 'M' or equivalents are called 'problematic'. "Non-modal propositions are called 'assertoric'. This modern terminology and symbolism help us to give a clear exposition of Aristotle's propositional modal logic."[7]

In the Modal system of Aristotle, these two modal notions necessary and possible and their interrelation play a fundamental role. His book on De Interpretations we find that he mistakenly asserts that possibility implies non-necessity. We can represent it in our terminology -

(a) "If it is possible that p, it is not necessary that p."[8] But in his later time, he realized that it cannot be right for this reason that necessity implies possibility.

(b) "If it is necessary that p, it is possible that p."[9] And taking help of (b) and (a), we would follow by taking the help of hypothetical syllogism as,

(c) "If it is necessary that p, it is not necessary that p, which is absurd."[10] In this regard Aristotle made a very keen scrutiny and specified very aptly that.

(d) "If it is possible that p, it is not necessary that not p."[11] In this regard we should keep in our mind that he does not make any correction of it in his book, De Interpretation, rather the changes occur in his other book Prior Analytics. Where the relation of possibility to necessity has the form of equivalence.

(e) "It is possible that P if and only if it is not necessary that not P."[12]

According to the scholars, the relation of necessity to possibility that we find in the De Interpretatione as in implication, is also regarded as equivalence and it should be represented in the following form:

(f) "It is necessary that p if and only if it is not possible that not p."[13]

Here we can denote the functor 'if and only if by Q, and 'not' for N, 'it is possible that' for M, and 'it is necessary that' for L, we can symbolically express these relations of (e) and (f) in the following manner -

(e) Mp if and only if-NLNp, that is QMpNLNp

(f) Lp- if and only if-NMNp, that is QLpNMNP

In this regard we should keep it in our mind that these above formulae are cardinal or fundamental to any system of modal logic.

Structure of Modal Sentences

The word 'possible' according to his characteristic of Aristotle's modal logic 'possible' has two senses. In one sense possibility means 'in most cases' and another sense of possibility is using no concern of science. Aristotle only gives explicit expression to this view in one place, but it lies at the base of the whole modal syllogistic and exercises a most remarkable influence. "The expression it is possible for this to belong to that may be understood in two senses: either as 'to the thing to which that belongs'; for 'to that of which B (is predicated) A can (belong)' means one of the two: 'to that of which B is Predicated' or 'to that of which (B as) possible (belonging) is predicated."[14]

According to this expression has two points-

Firstly, "a sentence of the form 'A belongs to B' is paraphrased by the formula 'to that to which B belongs (of which B is predicated) A also belongs'; implying a very subtle analysis of the sentence, reminiscent of the modern formal implication, which we find elsewhere is the analytics (CF. 14.24)."[15] and second is, "it can be gathered from this text that the modal functor does not determine the sentence as a whole, but part of it. So that for Aristotle a modal sentence is not to be conceived in such a sense as: 'It is possible that: A belongs to B."[16] Any modal operator cannot deduce the whole sentence but it can one of its arguments. This difference quickly becomes still clearer.

"1. To that to which B belongs, A also can belong.

2. To that to which B can belong A also belong."[17]

Firstly, the modal operator establishes only the consequent, but in the second part it establishes the antecedent too.

This examination does not extend to necessity, but this examination inferred. Otherwise, many syllogisms can be invalid.

Basic Modal Logic

Aristotle in this system had used two scholastic principles, though these were not very overtly expressed by him.

3. "CLpp, i.e. If it is necessary that p, them p."[18] (here 'C' is the sign of functor 'if - then')

4. "CpMp, If P, it is possible that P."[19]

In the book, Prior Analytics a passage is found and according to this passage, we find that it was well known to Aristotle that from the assertoric negative conclusion 'Not p', i.e. NP, there results the problematic consequence, 'It is possible that not p', i.e. MNp. We have therefore CNpMNp. In this juncture, a very important comment of the great logician, Alexander, could be remembered. According to him "existence implies possibility", that is CpMp, but not conversely, i.e. CMpp should be rejected. If we denote rejected expressions by an asterisk, we get the formula:

5. "CMpp, i.e. if it is possible that P, then P – rejected".[20]

The corresponding formulae for necessity are also started by Alexander who says that necessity implies existence, i.e. CLpp, but not conversely, i.e. CpLp should be rejected. In this regard, we get thus another rejected expression;

6. "CpLp, i.e. if P, it is necessary that p- rejected."[21]

These six formulas are accepted by the traditional logic as well as modern logicians. They are, however, insufficient to characterize Mp and Lp as modal functions, because all the above formulas are satisfied if we interpret Mp as always true, i.e. as 'verum of P' and Lp as always false, i.e. as 'falsum of P'. With this interpretation a system built up on the formulas 1 to 6 would cease to be a modal logic. We cannot therefore assert Mp, i.e. accept that all problematic propositions are true, or assert NLp, i.e. accept that all apodictic propositions are false; both expressions should be rejected, for any expression which cannot be asserted should be rejected. We get thus two additional rejected formulas:

7. "Mp, i.e. It is possible that p- rejected, and

8. NLp, i.e. If is necessary that p- rejected."[22]

These two formulas are called Aristotelian, as they are consequences of the presumption admitted by Aristotle that there exist asserted apodeictic propositions. For, if La is asserted, then LNNa must be asserted too, and from the principle of Duns Scotus CpCNpq we get by substitution and detachment the asserted formulas CNLap and CNLNNœp. As P is rejected, NLa and NLNNa are rejected too, and consequently NLp and NLNp, i.e. Mp, must be rejected.

A system of basic modal logic depends on the above all formulas that is 1 to 8. Here we will keep it in our mind that basic modal logic can be axiomatized on the basic of the classical calculus of propositions. The two modal functors M and L, one may be taken as the primitive term and other can be defined. If M is primitive term and formula 2 is taken as the definition of L. We get the following independent set of axioms of the modal logic.

4. CpMp

5. CMpp

7. Mp

9. QMpMNNp

Where 9 is deductively equivalent to formula 1 on the ground of the definition 2 and the calculus of propositions. Taking L as the primitive term and formula 1 as the definition of M, we get a corresponding set of axioms: -

3. CLpp

6. CpLp

8. NLp

10. QLpLNNp

Where 10 is deductively equivalent to formula 2 on the basis of the definition 1 and the calculus of propositions. The derived formula 9 and 10 are indispensable as axioms.

It is very much important to keep in our mind that Basic modal logic is the foundation of any system of modal logic and it must always be incorporated in any such system. Formulas 1 to 8 are so vital that all these formulas agree with the Aristotle's intuitions and its foundation is found at the roots of our concepts of necessity and possibility. But it is also very vital that they do not exhaust the complete stock of accepted modal laws. And the horizon is open because if a conjunction is possible, each of its factors should be possible, i.e. in symbols: -

11. CMKpqMp and 12. CMKpqMq

And if a conjunction is necessary, each of its factors should be necessary, i.e. in symbols:

13. CLKpqLp and 14. CLKpqLq

None of these formulae can be deduced from the land 1 to 8

Modal Syllogism

There are some differences between Aristotle and his latter logicians. And if we want to understand more fully the differences between them, then we should know the previous system of syllogism with its necessary premises. According to Aristotle the assertoric conclusion follows from two assertoric premises. Aristotle says that, "There is hardly any difference between syllogisms from necessary premises and syllogisms from premises which merely assert. When the term is put in the same way, then, whether something belongs or necessarily belongs (or does not belong) to something else, a syllogism will or will not result alike in both cases, the only difference being the addition of the expression 'necessarily to the terms."[23]

Here we shall see an example the first-figure mood with universal affirmative premises that is traditionally known as BARBARA. If we want to distinguish the BARBARA with one necessary conclusion and two necessary premises from the ordinary assertoric BARBARA, we may represent this by calling the former BARBARA LLL, and the letter BARBARA XXX. Aristotelian Scholar, Lukasiewicz, opines that Aristotle always represented his syllogism moods in the form of conditional proposition. And keeping this point in our mind, we may state BARBARA LLL.

If All B is necessarily A

And All C is necessarily B

Then All C is necessarily A.

In the last line the word 'necessarily' is very important to spot as this word indicates that the conclusion is a necessary proposition but at the same time it is a very important point to recognize that here the conclusion does not follow necessarily from the premises. Aristotle was very much aware of these two distinctions of the word 'necessary'. In this context Aristotle says Modal System of Aristotle that, "one might show .....that the conclusion is not necessary without qualification, though it is a necessary conclusion from the premises."[24]

In the above example we find a necessary conclusion, but this thing does not occur in every case. And this point will be clarified by the following two examples - one is BARBARA LXL and another is BARBARA XLL.

For the BARBARA LXL is:

if All B is necessarily A

and All C is B

then All C is necessarily A

for the BARBARA XLL is:

if All B is A

and All C is necessarily B

then All C is necessarily A.

According to Aristotle first one (BARBARA LXL) is valid, but not the second (BARBARA XLL). BARBARA LXL must be taken as valid. But no proof had been given for the validity of the first one by Aristotle himself. And it is assumed by some scholars that Barbara LXL was the perfect syllogism according to Aristotle.

Aristotle says, since if, "A necessarily belongs to every B, and since C is one of the B's, it is clear that for C also the positive...relation to A will hold necessarily."[24] But this argument is not very sound according to some scholars. According to Aristotle, any valid syllogism must be provable by a reduction ad absurdum. If we deny the conclusion of a valid syllogism there must result an impossibility that means a proposition inconsistent with the premises. Now we try to prove Barbara LXL in this manner.

if All B is necessarily A

and All C is B

then All C is Necessarily A.

For suppose some C is not necessarily A

then, since All C is B.

it follows that, some B is not necessarily A, which is absurd.

This proof is appealing from various angels, but some scholars do not think that there is any matter of satisfaction.

Now we can highlight this reduction proof of Barbara LXL that was given by Ross, one of the most famous Aristotelian Scholar. According to him this reductio proof of BARBARA LXL is not very much convincing and he had no belief on it to take it as valid. Here what he is seeking to show is that the premises proved not only that all C is A, but also that it is necessarily A just as all B is necessarily A just as All B is necessarily A, i.e. by a permanent necessity of its own nature; while what they do show is only that so long as all C is B, it is A, not by a permanent necessity of its own nature, but by a temporary necessity arising from its temporarily sharing in the nature of B.

But here we will site another Aristotelian scholar, Lukasewicz who reject the argument of Ross that was against BARBARA LXL. Ross used to discard Aristotle's view on a basic ground that is permanent necessity, but according to Lukasiewicz, if we want to get the permanent necessity of things then it is only found in metaphysics but not in logic. This argument of Ross is a metaphysical one, as the terms 'nature of a thing' a 'permanent necessity its nature' belong to a domain that is of metaphysics. But behind this metaphysical terminology a logical problem is hidden which can be solved by our four valued modal logic.

But according to Ross, 'the possibility of two terms is related by a permanent necessity' implies that the two terms might be in fact so related, even though the word 'necessarily' failed to occur in any proposition relating them and at the same time two terms might in fact fail to so related, even though the word necessarily did occur in a proposition relating them. But in logic we cannot stop to consider such possibilities; we must deal with propositions as they are stated in words. The only way we can determine the logical powers of a word like 'necessarily' is to consider the validity or invalidity of arguments involving its use, such as BARBARA LXL and XLL.

The conclusion of BARBARA XLL does not follow from its premises.

If All B is A

And All C is necessarily B

Then suppose All C is necessarily A.

But some B is necessarily C (by conversion of the minor)

Hence some B is necessarily A (by DARII LLL)

According to Aristotle this last conclusion is false, as the major premise 'All B is A' is quite compatible with its contradictory, namely 'No B is necessarily A'. It is similar to a reductio ad absurdum. In the reductio ad absurdum we assume the falsehood of the conclusion of an inference we wish to prove valid. But here we assume the truth of the conclusion of an inference which we wish to prove invalid. In this case the original major premise 'All B is A' allows us to make no inference to either the truth or the falsehood of the proposition 'No B is necessarily A' (possible no B is A). Nor, presumably, will the addition of the original minor premise make other difference. We are still not entitled to say any more than the premises are consistent with the proposition. But when we want to draw the conclusion of BARBARA XLL, permits the deriving of a consequence of the original premises which is inconsistent with 'No B is necessarily A'. Therefore, we must reject BARBARA XLL.

Now we give concrete examples of BARBARA LXL and BARBARA XLL.

Aristotle give an example with concrete term as he tries to disprove BARBARA XLL and Theophrastus also gives an example with concrete term for to try to disprove BARBARA LXL. At first, we show how Theophrastus give a concrete example for the disprove of BARBARA LXL.

If All then walks in necessarily in movement

And All men are walking

Then, All men are necessarily in movement.

In this example two premises are true, because at the same time all men were walking, but conclusion is not true. So, BARBARA XLX would not be invalid.

Against of this example, Aristotle's scholars are pointed out that Theophrastus concrete examples are unfair. Theophrastus gives a temporal reference, while Aristotle explicitly restricts assertoric premises to starting something permanently true of a class. Aristotle gives a concrete example for disproving BARBARA XLL. Substitutions are 'in movement' for 'A', 'animal' for 'B' and 'man' for 'C'. Thus:

If All animals are in movement

And All men are necessarily animals

Then, All men are necessarily in movement.

There the premises are true but conclusion false. For an animal does not move necessarily, nor does men. For the result is BARBARA XLL is invalid.

Other remaining moods consist of one exception and this investigation is separately done by Aristotle. In any mood is not perfect one then a proof or disproof of validity given. The method is conversion. For example, by the method of converting the major premise of mood CESARE LXL, we are able to reduce it to the perfect mood CELERENT LXL.

If necessarily no A is B

And All C is B

Then, necessarily no C is A

If we convert the major premise we get-

If necessarily no B is A

And All C is B

Then, necessarily no C is A.

This is perfect mood of CELERENT LXL. One further method of proof used only for the moods BARACO LLL and BOCARDO LLL, is the method of 'ecthesis'. Two further methods of disproof, in addition to this used for BARBARA XLL are (i) the reduction by conversion of a mood to another mood already shown to be invalid and (ii) the lack of a method of proving the conclusion by reductio ad absurdum. And it should keep in our mind that it is not necessary to discuss the other apodictic moods individually because Aristotle he himself arrives at concerning each of them by a proper summary of all these apodictic moods.

Philosophical Implications of Modal Logic

It may appear that modal syllogistic of Aristotle has no useful application to philosophical and scientific problem. But in fact, Aristotle's propositional modal logic is historically and systematically massive importance for philosophy. It is very much true that the elements that are required in building a complete system of modal logic and also the theorems of extensionality were there in his system but the combination was not properly done in a right way.

And another point is also found in Aristotle's system that the logic of propositions would not touch his mind, though this system got a new dimension in the sphere of western logic by the hands of Stoics. According to Aristotle, propositions consist of only two values- either it is true or false. And these two valued logical principles restrict him to think the other dimensions of logic. And for this reason, he could not build the system of many valued logics, though the whole possibility was there in his system. According the scholars, when he was discussing the contingency of future sea-fight, he came to the closer to many-valued logic but he did not give more stress on it and as a result for many centuries this new thought remain under an iron-curtain.

What we have discussed till now, we have seen that modal logic is not two valued logic. Some scholars think so that the influence of Plato's theory of ideas helped Aristotle to develop logic of universal terms and the views of necessity. And this standpoint gave him a position that was very much terrible for philosophy.

Propositions which ascribe essential properties to objects are according to him not only factually, but also necessarily true. This erroneous distinction was the beginning of a long evolution which led to the division of sciences into two groups: the a priori sciences consisting of apodictic theorems, such as logic and mathematics, and the a posteriori of empirical sciences consisting chiefly of assertoric statements based on experience. This distinction may false. There are no true apodictic propositions, and from the standpoint of logic there is no difference between a mathematical and an empirical truth.

Modal logic can be described as an extension of the customary logic by the introduction of a 'stronger' and a 'weaker' affirmation. The apodictic affirmation Lp is stronger, and the problematic Mp is weaker than the assertoric affirmation p.

The Aristotelian a priori is analytic, depend on definitions and definitions may occur in any science. Aristotle's example 'man is necessarily an animal' here the basis is on the definition of 'man as a two-footed animal' which belongs to an empirical science or knowledge. The analytic statement 'I am an animal' made by a man. It is analytic because 'animal' belongs to the essence of man. It does not carry any useful information. But when I am uttering, 'I was born the 16th January 1933' means that this is an empirical statement. If we want to know what the 'essence' of man is if there is such a thing as 'essence' at all we cannot rely on the meanings of words but must investigate the whole culture of the man and it is very much tough task to enquire of it.

The same is true as for the deductive sciences. No other deductive system can be based on only definition deduce some primitive terms, by which many other terms may be defined. But the meaning of every primitive term must be explained by any examples, rules or axioms and based on experience. The true a priori is always synthetic. If

we know by observation that a certain ball in the box contains only white balls, we can say a a-priori that only a white ball will be deduce from it. And if the box contains white and black balls and two drawings are mode, we can predict a priori that only four combinations can possibly occur; black-black, white-white, black-white and white-black. On such experiments the axioms of logic and mathematics are based; there is no fundamental difference between a priori and a posteriori science.

It may be that in our observation; Aristotle's treatment of necessity is futile but his concept is contradictory possibility or contingency is very much important and fruitful idea. This idea can help us to refute determinism.

The law of causality, which states that every event has a cause in some earlier event, understood in its full generality should be regarded as merely a hypothesis. It is true of course that astronomer believe on some laws known to govern the universe. Who are able to predict advance for years the positions and motions of heavenly bodies with considerable accuracy. Just at the moment I finished writing the previous sentence a butterfly crosses me touching my ear. And from this event, Can I believe that this event will happen in my future life when I will be in a position to write something? Or Can I assume that some unknown laws governing the universe? It is nothing but to accept such a thing which is a whimsical speculation and we are relying it abandoning the scientifically verifiable assertions.

If we accept the law of causality as generally true, the above argument is not conclusive. We can assume that every event has a cause, and nothing happens by chance, there the chain of causes producing a future event though infinite does not reach the present moment.

We may assume that the Aristotelian sea-fight of tomorrow, though it will have a cause which itself will have cause and so on, does not have a cause today. Similarly, we may predict that nothing exist today which would prevent there being a sea-fight tomorrow. If truth consists in the conformity of thought to reality, we may say that those propositions are today which conform with today's reality or with future reality in so far as that is predetermined by cause existing today. As the sea-fight of tomorrow is not real today, and its future existence or non-existence has no real cause today, the proposition, ‘There will be a sea-fight tomorrow’ is today neither true nor false. We can only say, ‘There may be a sea-fight tomorrow’ and ‘There may not be a sea-fight tomorrow’. Tomorrow’s sea-fight is a contingent event and if there are such events, determinism is refuted.

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