WHAT IS ARISTOTELIAN SYLLOGISM?

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In the Note that is appended to the letter of Invitations for the Seminar on Inference : Indian and Western, the second paragraph opens with the following sentences :

> "From the point of view of Aristotelian logic, one could raise the question of the structure of syllogiam. Why should there be five members of the Nyaya syllogism? Are the three members of the Aristotelian syllogism really sufficient? Another very significant question is that there is hardly any discussion of invariable concomitance (vyāpti) in Aristotelian inferential process. In fact there seems to be no awareness of invariable concomitance in Aristotelian logic."[1]

These lines reveal, as I shall argue in this paper, several misconceptions about Aristotle's own treatment of syllogistic reasoning and further, confusion of certain issues which we should carefully keep apart. Misconceptions and confusions about Aristotle's logic are not peculiar to the writers of these above sentences but they are widely shared by the present philosphical community in India so much so that it is necessary to plead that the earlier we get rid of them, the better will it be for furthering our investigations. The Western world of philosophers was also labouring under misconceptions and confusions about Aristotle's logic until very recently, say about 50s or 60s of the erstwhile centruy bygone. Therefore there is no wonder that most of us still continue to labour under the same misconceptions and confusions. I am not quite sure whether the entire West has got itself rid of them. I am not sure either if I will be able to cure

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the whole of philosophic community in India of those misconceptions and confusions about Aristotle's logic. I must also confess that I also laboured under those misconceptions and confusions until I myself began to study and teach modern Symbolic or mathematical logic and in the course of my own intellectual development gave a course at post-graduate level on Jan Lukasiewicz's *Aristotle's Syllogistic From the Standpoint of Modern Formal Logic.* (II Edn. 1967 Oxford University Press, London, W.I). In the Perface to the First Edition of the Book, Lukasiewicz has said the following :

> "...There does not exist today a trustworthy exposition of the Aristotle's Syllogistic. Until now all expositions have been written not by logicians but by philosophers or philologists who either, like Prantl, could not know or, like Maier, did not know modern formal logic. All these expositions are in my opinion wrong."[2]

Lukasiewiz's work is thus groundbreaking and throws, as will be seen below, a new light on the nature of Aristotle's logic. I may further also point out that the results of Luksiewicz's investigations have been now confirmed and acknowledged by the contemporary scholarship in the field.[3] I shall therefore follow Lukasiewicz as closely as possible in my presentation.

The following argument is usually quoted as an example of Aristotelian syllogism.

(1) All men are mortal,
Socrates is a man,
Therefore,
Socrates is mortal.

The example is to be found in Ernst Kapp's *Greek Foundations of Traditional Logic,* (New York, 1942), Fredrick Copelston's *History of Philosophy,* vol. I (1946), Bertrand Russell's *History of Western Philosophy* (London, 1946) and many other standard textbooks on traditional logic. Sextus Empiricus mentions the same example (with replacement of 'mortal' by 'animal') as a case of Peripatetic syllogism in his *Pyrrhonic Hypotyposes.* Lukasiewicz points out that this example, as a matter of fact, differs from Aristotelian syllogism in two logically important respects.

Firstly, Aristotle does not introduce singular terms or premisses into his system. If we follow Aristotle on this point and frame the following example as Aristotelian syllogism viz.,

(2) All men are mortal,
All Greeks are men,
Therefore
All Greeks are mortal.

This is still not an Aristotelian syllogism. Because, and this is the second point of difference, it is an infersnce. The word 'therefore' used between the premisses and the conclusion is a clear indication of this. It should be noted specifically that no syllogism is formulated by Aristotle's primarily as an inference. Bertrand Russell gives the above second case of inference below the first case above, and adds in brackets the remark that Aristotle does not distinguish between these two forms.[4] This is an obvious mistake for the reason that Aristotle in his *Prior Analytics* states all his syllogisms as implications having the conjunction of the two premisses as antecedent and the conclusion as the consequent. Thus a true example of Aristotelian syllogism would be the follwing example:

(3) If all men are mortal and all Greeks are men, then all Greeks are mortal.

This of course is a modern example of the Aristotelian syllogism and not to be found in the works of Aristotle. It should be further specifically noted that no syllogism with concrete terms like men, mortal or Greeks is to be found in *Prior Analytics*. Aristotle does mention a few examples of syllogisms with cocrete terms in his *Posterior Analytics* but it should be noted that they are stated as implications as mentioned above. e.g.

(4) If all broad-leaved plants are deciduous and all vines are broad-leaved plants, then all vines are deciduous.

Both these syllogisms, i.e. (3) and (4), are only examples of logical forms but they do not belong to logic because they contain terms that do not belong to logic. Logic is not a science about men and plants. In order thus to get a syllogism within the sphere of pure logic, we must remove from the syllogism what is called its matter and preserve only its form. It should

be noted that Aristotle did this by introducing letters in place of conrete subject-terms and predicate terms. Inducting letter A for 'deciduous', letter B for' broan-leaved plants' and letter C for 'vines', we get the pure syllogistic form:

(5) If all B is A and all C is B, then all C is A.

Aristotle's style of presentation is not however so simple as that. Instead, he states this as follows:

(6) If A is predicated of all B and B is predicated of all C, then A is predicated of all C.

or

(6) If A belongs to all B and B belongs to all C, then A belongs to all C.

Thus genuine Aristotelian syllogism is of the implicational form. It is interesting to note that since he does not state syllogisms as inferences, the component propositions of the antecedent and the consequent are all referred to by Aristotle as premisses. The distinction between premisses and conclusion is of later times-most probably of stoic origin. The Greek word used by Aristotle is 'protasiy' and it means a sentence affirming or denying something of something. Every premiss is thus a statement in which something is said about something else either affirmatively or negatively. The two elements thus involved in a premiss are its subject and predicate. Aristotle calls them terms, defining a term as that into which the premiss is resolved. In building up his Syllogistic Aristotle considers premisses using only universal (or general) terms. He does not take notice of singular or of empty terms. Further, premisses to be considered must have a sign of quantity. 'All, no' are the signs of universality and 'some' is the sign of particularity. A premiss with no sign of quantity is indefinite and Aristotle does not ignore it but for the purposes of his Syllogistic treats it as particular premiss. Taking into account the critria of quantity and quality, Aristotle retained only four kinds of premiss: Universal Affirmative, Universal Negative, Particular Affirmative and Particular Negative.

Lukasiewicz also investigates into the reasons as to why singular terms were omitted by Aristotle's. Philosophical explanations are suggested

by various commentators of Aristotle but Lukasiewicz finds no textual basis for them in Aristotle's *Prior Analytics* which is his main logical work having bearing on his theory of syllogisms. About this work, Lukasiewicz says that it is purely logical work and that it "is entirely exempt from any philosophical contamination."[5] Lukasiewicz however draws our attention to the fact that Aristotle emphasizes that a singular term is not suited to be a predicate of a true proposition, as a most universal term is not suited to be a subject of such a proposition. This belief of Aristotle's is certainly questionable but that is not the point at issue. What is important to note is that he concentrated only on such terms as could take the position of subject and predicate in propositions or premisses. Only universal or general terms could satisfy this condition. If that is so, the letters (A,B,C) which he sues for expressing valid syllogisms are to be regarded as termvariables. "The introduction of variables into logic is one of Aristotle's greatest inventions."[6] If the earlier draft of Lukasiewicz's this all important work on Aristotle's Syllogistic were not to get destroyed along with his library in the II World War bombing by Germans in 1939, this finding of Lukasiewicz would be the first of its kind.[7] Sir David Ross thought about this use of letters by Aristotle so greatly that he at once declared Aristotle as 'the founder of formal logic.'[8]

If the goal of knowledge is to construct a deductive system or science which is a systematically organized body of knowledge, then Aristotle's Syllogistic is such a science.[9] Such a science must have all its theses true. Inference cannot be true or false. They can be valid of invalid. One can see why Aristotle stated all the syllogisms as implicative propositions that are necessarily true by the virtue of their form. Lukasiewicz, by providing textual basis, shows and proves conclusively how Aristotle tried to achieve this goal, viz. construction of deductive system of syllotisms in all the four figures. He shows that even those laws of propositional logic which are absolutely necessary for developing such a syllogistic system are stated by Aristotle in his *Prior Analytics.* I shall not go into details of all that[10] but return to the point which I wanted to make regarding misconceptions and confusions which prevail in the academic circles regarding Aristotle's syllogisms. If we bear in mind the true nature of Aristotle's syllogism, that it is implicational thesis which is necessarily

true and that it is not an inference, we can avoid the temptation to have its comparison with Nyāy's *Pancāvayavi* Vākya. The latter is an inference and there is no attempt at building up anything like a science of formal logic. Formal proof of the said argument and justification of the steps involved by citing rules of inference seems to be of no concern to a Naiyāyika. If you consider the example of an argument or inference presented by Naiyāyika from the point of view of modern formal logic, its logical structure and formal proof of validity is as follows:

1. For all values of x, if x is smoky then it is firey.
2. This mountain is smoky / ∴This mountain is firey.
3. If this mountain is smoky then it is firey.....1. U. I.
4. This mountain is firey. ..... 3.2. M.P.

Or to put it more symbolically

1. (x) (Sx ⊃ Fx)
2. Sm /∴ Fm
3. Sm ⊃ Fm..... 1. U. I.
4. Fm ..... 3.2. MP

In fact whether a syllogism or any quantificational argument is three membered or five membered is indeed irrelevant. Consider the following argument :

> If all drugs are contamunated then all negligent technicians are scoundrels. If there are any drugs which are contaminated then all of them are contaminated and unsafe. All germicides are drugs. Only the negligent are absent-minded. Therefore if any technician is absent-minded then if some germicides are contaminated then he is a scoundrel.

This is a perfectly valid argument but I really do not know how a Naiyāyika will be able to handle the argument or how he will be able to construct a proof of validity for this argument.[11] It is a quantificational or syllogistic argument. Is it three membered? or five memberd? or n-membered? All such questions whether we raise them in the context of Aristotelian logic or Naiyāyika's logic have lost their relevance due to extensive developments

in the field of modern formal logic.

I now come to the question of *Vyāptijñāna*. I think here we have a genuine philosophical issue. All of us share philosophical anxieties as to how we come to acquire truth of a universal real proposition. In the case of the example given by Naiyāyika, it is not the validity of the argument that is at stake. We also require that the arguments that we present are sound. A sound argument is one which is not only formally valid but it has also true premisses. There are types of discourses or inquiries in which proof is sought or demanded. Such a demand natrually gives rise to logical investigation. To prove a proposition is to infer it validly from true premisses. The conditions of proof are two: true premisses or starting points and valid arguments. It is necessary to realize that the two conditions are independent. Inquiry into the question regarding truth of premisses belongs to epistemology (*Jñānaśāstra* or *Pramāṇaśāstra*). It is an inquiry that falls within the scope of epistemology and not certainly within the scope of formal logic, which Aristotle was interested in founding. It is however a mistake to suppose that" there is hardly any discussion of invariable concomitance (*vyāpti*) in Aristotelian study of inferential process and that there seems to be no awareness of invariable comcomitance (*vyapti*) in Aristotelian logic." The distinction betwen the two conditions that I have mentioned above, especially their independence was perfectly clear to Aristotle when he drew the distinction between apodeictic reasoning on the one hand and dialectical reasoning on the other, in the *Topica* and again in the *Prior Analytics*. The premiss of an apodeictic or demonstrative reasoning (syllogism) is true and necessary, that of a dialectical reasoning (syllogism) need not be so. He points out that mathematical reasoning is demonstrative and its premiss or premisses are true and necessary. In dialectical reasoning which belongs to other fields, premisses are simply assumed to be true for the sake of the argument and then we look for proofs of contingent propositions. The following passage from Aristotle's *Prior Analytics* speaks for this distinction and Aristotle's view-point clearly:

> "The demonstrative premiss differs from the dialectical because the demonstrative is the asumption of one of a pair of contradictory

> propositions (for the man who demonstrates assumes something and does not ask a question) but dialectical premiss is a question as to which of two contradictories is true. This, of course, makes no defference to the fact that there is a syllogism in each case. Both the man who demonstrates and the man who asks the question do reason assuming that some predicate does belong or does not belong to something.....Syllogistic premiss is demonstrative if it is true and accepted because deduced from basis assmptions, while a dialectical premiss is for enquirer a question as to which of two contradictories is true and for the reasoner the assumption of some plausible or generally held proposition."[12]

In chapter 12 of *Topica,* he draws the distinction between Induction and reasoning, (i.e. deductive reasoning) and of Induction he says: Induction is the passage from particulars to the universal. He also suggests that by induction he does not mean the simple enumeration of actual individual cases but rather the bringing together and comparing of a number of specifically different cases. It is well-known that Aristotle in his *Metaphysics* explained and admired constructive positive elements in Socratic method mostly comprising induction.

NOTES

1. Refer to p.1 of the Note mentioned. The national Seminar was held in Pune University in March 2001.
2. Lukasiewicz, Jan.: *op. cit.* p. viii
3. Refer especially to Kneale W & M. : *The Development of Logic,* 1964, Oxford Uni. Press, London, E.C.4. chap. II, pp. 25-112.
4. Russell, B. : *op. cit.* p. 219
5. Lukasiewicz Jan. : *op.cit.,* p.6
6. *ibid.* p.7
7. Refer to p. vi of Lukasiewicz, *op.cit,* for conditions in which his work saw the light of the day. I have said this because in 1946 Sir David Ross spoke independently of the use of variables by Aristotle.

8. Refer to Note 1 on p. 8 of Lukasiewicz's *op.cit.*
9. Refer to Copi. I.M., *Symbolic Logic,* New York, 1954 (I edn), The MacMillan Co. Chap. Sec. I.I am inclined to believe that since Aristotle lived prior to Euclid by at least 50/60 years, it is Aristotle who should be credited with laying down of Deductive System as a goal of science.
10. Those who are inferested in this should refer to Lukasiewicz's work cited in the beginning of this paper.
11. See page 108 of Copi.: *op. cit.*
12. W. & M. Kneale, *op.cit* , pp. 1-2