LOGIC AND SCIENTIFIC KNOWLEDGE

IN

ARISTOTLE

AN EVALUATION OF THE RELATIONSHIP BETWEEN THE SYLLOGISTIC IMPLICATION AND THE SCIENTIFIC SYLLOGISM OF ARISTOTLE

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SCOPE AND CONTENTS:

In Aristotle's Prior Analytics he develops his doctrine of syllogistic implication. In the Posterior Analytics he presents his doctrine of the scientific syllogism which, for him, is productive of scientific knowledge. My concern in this work is to analyse the relationship between his doctrine of syllogistic implication and his doctrine of scientific syllogism.

It would seem that there is an irreducibly distinctive difference between the roles performed by the syllogistic implicational form and the scientific syllogistic form. Consequently, the syllogistic implicational form cannot be used as the form of the scientific syllogism and, hence, the value of the syllogistic implication does not depend on any relationship it might have to the scientific syllogism. The syllogistic implication is valuable as a body of theoretical knowledge.

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CONTENTS

INTRODUCTION

As its originator and first systematic proponent Aristotle occupies a unique and controversial niche in the chamber of logic. His logical theory has instigated many and varied problems and disputations down through the steps of history. In ancient times it was a matter of argumentation as to what position ought to be assigned to his logic - was it a section of his philosophy or was it propaedeutic to his philosophy? There was the problem as to whether his logical theory, as expounded in the Prior Analytics, preceded or was consequent upon his theory of scientific knowledge, as elaborated in the Posterior Analytics. Was the Posterior Analytics written first and then, stimulated by this work, did Aristotle proceed to elaborate his Prior Analytics? Or was the process the reverse? Ross tells us that Solmsen's view as to the order of the Analytics is that "having formulated the method of dialectic in the topics, Aristotle, next formulated the method of strict science in the Posterior Analytics, and finally reached in the Prior Analytics the general account of the syllogism as being the method lying at the base both of dialectical argument and of scientific reasoning". [1]

1. Ross, W.D., Aristotle's Prior and Posterior Analytics, page 7.

Solmsen attributes this order of the Analytics to the influence of Platonism on Aristotle. He sees the syllogism in the Posterior Analytics as the kind of syllogism that would have been suggested to Aristotle by meditating on Plato's diaeresis, whereas the syllogism in the Prior Analytics indicates that as Aristotle moved away from Platonic influence his ideas widened so that he thought no syllogism unworthy of attention so long as the conclusion follows from the premisses. [1]

Ross says that the value of Solmsen's view depends on whether or not the "detailed contents of the two Analytics tell in favour of or against this view". [2] Ross argues that the Prior Analytics was composed before the Posterior Analytics and used by Aristotle in his composition of the Posterior Analytics. He bases his argument on a comparison of the contents of both books. He says "it may probably be said without fear of contradiction that none of the contents of the Prior Analytics certainly presuppose the Posterior. Let us see whether any of the contents of the Posterior Analytics presuppose the Prior". [3] And from a scrutiny of the contents of both books [4] Ross sums up his findings in the following words: "Taking together the explicit references and the

1. Ross, W.D., Aristotle's Prior and Posterior Analytics, page 8.
2. Ibid. page 8.
3. Ibid. page 11.
4. Ibid. pages 12 and 13.

casual allusions which presuppose the Prior Analytics, we find that at least the present form of the following chapters must be dated after that work: i. 2, 3, 6, 7, 9, 11, 13-17, 19,21, 23-5, 29, 33; ii. 2, 3, 8, 11, 12, 17. Thus of the thirty-four chapters of the first book eighteen explicitly (leaving out doubtful cases) presuppose the doctrine of the syllogism as it is stated at length in the Prior Analytics. If the Posterior Analytics was written before the Prior, we should have to assume a very extensive rewriting of it after the Prior Analytics had been written". [1]

In mediaeval times the true nature of Aristotle's logic seems to have been misunderstood, and what they thought to be the Aristotelian syllogistic implication was something essentially distinct from the Aristotelian syllogistic implication. Lukasiewicz, commenting on this difference, says: "The difference between the Aristotelian and the traditional syllogism is fundamental. The Aristotelian syllogism as an implication is a proposition and as a proposition must be either true or false. The traditional syllogism is not a proposition, but a set of propositions which are not unified so as to form one single proposition. The two premisses written usually in two different lines are stated without a conjunction and the connexion of these loose premisses with the conclusion by means of 'therefore' does

1. Ross, W.D., Aristotle's Prior and Posterior Analytics, page 13.

not give a new compound proposition. ... Not being a proposition the traditional syllogism is neither true nor false; it can be valid or invalid". [1] Exactly why the mediaevals misunderstood the Aristotelian syllogistic implication is not easy to say. Lukasiewicz says that it is probably due to the influence of the Stoics. As we shall see later the doctrine of material implication [2] is absolutely basic to the Aristotelian syllogistic implication. I would suggest that the great error made by the mediaevals in formulating their version of Aristotle's syllogistic was that they failed to take account of this basic and essential doctrine of material implication.

In modern thought there is no great unanimity on the subject of Aristotelian formal logic. For Lukasiewicz the relationship of material implication plays an essential role in Aristotle's syllogistic doctrine and he presents Aristotle's syllogistic as a deductive system. [3] Kneale does not agree that the implicational form is essential to Aristotle's syllogistic as he says that Aristotle regarded this form of the syllogism as no more than one device among others for saying that certain premisses allow inference to certain conclusions. [4] Since Aristotle uses the implicational form

1. Lukasiewicz, J., Aristotle's Syllogistic, page 21.
2. For an explanation of the doctrine of material implication see B. Russell's "The Principles of Mathematics", seventh impression 1956, pages 33-41.
3. Lukasiewicz, J., Aristotle's Syllogistic from the standpoint of modern formal logic 1957.
4. Kneale, W. & M., The Development of Logic, 1962, page 80.

throughout his syllogistic doctrine and, as I will try to show later, the relationship of material implication seems to play a central role in the Aristotelian syllogistic doctrine, I fail to see any evidence to support Kneale's view. Also Kneale regards the presentation of Aristotle's syllogistic in the form of a deductive system by Lukasiewicz as something very interesting, but very different from Aristotle's own idea of his work.[1] By way of comment one might say that Lukasiewicz does not say that this is how Aristotle visualised his work, nor is Lukasiewicz interested in Aristotle's hopes, intentions or aspirations, but is solely concerned with exhibiting the logic of what Aristotle presented as a system of logic.

L. S. Stebbing sees modern mathematical logic as the grandchild of Aristotle. She says: "... the achievement of the ideal of logic makes it indistinguishable from pure mathematics. It might be supposed that the science of logic thus conceived has nothing in common with Aristotle's conception of logic. But that would be a mistake. There are considerable grounds for supposing that, in recognising that the ideal of logic is the exhibition of form, the mathematical logicians are carrying on the work which Aristotle himself initiated".[2] D. J. Allan does not agree with this view of Stebbing. He says that Aristotle ".. did

1. Kneale, W. & M., The Development of Logic, page 80.
2. Stebbing, L. S., A Modern Introduction to Logic, Preface IX.

not approach logic through the study of the methods employed in mathematics or other branches of the sciences, nor was it his chief intention to furnish canons of scientific procedure. This fact ... should be borne in mind in any comparison between Aristotelian and modern logic". [1] And again, referring to Stebbing's opinion as to the relationship of Aristotelian logic to modern logic, he says: "we can hardly admit that Aristotle would acknowledge the logic, which is now declared to be identical with mathematics, as his grand-child". [2]

Allan believes that in developing his logic Aristotle was aiming "to discover the forms of reasoning common to science and rhetorical and popular argument". [3]

In his book 'A History of Western Philosophy', Bertrand Russell devotes a chapter [4] to Aristotelian logic. He refers to Aristotle's logic as "a system which is as definitely antiquated as Ptolemaic astronomy". [5] In the final paragraph of this chapter Russell summarises his view of Aristotelian logic in the following words: "I conclude that the Aristotelian doctrines with which we have been concerned in this chapter are wholly false, with the exception of the formal theory of the syllogism, which is unimportant.

1. Allan, D.J., The Philosophy of Aristotle, page 129.
2. Ibid. page 130.
3. Ibid. page 130.
4. Russell, B., A History of Western Philosophy, New York, 1945, chapter 23.
5. Ibid. page 195.

Any person in the present day who wishes to learn logic will be wasting his time if he reads Aristotle or any of his disciples. ... Throughout modern times practically every advance in science, in logic, or in philosophy has had to be made in the teeth of the opposition from Aristotle's disciples".[1] These remarks leave very little room for doubt as to what Russell thinks of Aristotelian Philosophy and Logic and during the course of this present investigation we may indirectly comment on some of these views of Russell.

In the present work it is my intention to analyse Aristotle's theory of syllogistic implication with a view to assessing its use or value. Does the syllogistic implicational form find its application as the form of a scientific syllogism and so render Aristotle's formal logic useful as providing an instrument of scientific knowledge? Here we are taking scientific knowledge in its Aristotelian sense. Have applicational demands been made on the logic of Aristotle which are quite foreign to the very nature of his logic and, consequently, cannot possibly be satisfied by his logic? If the syllogistic implicational form does not and cannot function as the form of a scientific syllogism then what value can be attributed to the theory of syllogistic implication or Aristotelian formal logic? Is his formal logic merely a useless structure having no value?

1. Russell, B., A History of Western Philosophy, New York, 1945, page 202.

Because of the systematic and technical nature of Aristotle's philosophy it is absolutely necessary that, in a specific area of investigation such as the present, a number of excursions be undertaken into the more general and related areas of Aristotelian Metaphysics, Physics, Philosophical Psychology, Epistemology and Cosmology. There is a unifying thread throughout Aristotle's philosophy which prevents one from taking a specific area and proceeding to investigate this area in isolation from the rest of Aristotelian philosophy.

CHAPTER ONE

ARISTOTLE'S SYLLOGISTIC DOCTRINE.

In the Prior Analytics [1] Aristotle presents, in elaborate detail his syllogistic doctrine or theory of formal logic. This syllogistic doctrine incorporates a large number of forms or, as they are traditionally called, moods. In order to attain a concise accurate understanding of the specific nature or character of the Aristotelian syllogistic doctrine it does not appear necessary to engage in an exhaustive analysis of all the moods or forms involved as this would involve much unnecessary repetition and irrelevant prolixity. Aristotle regarded the four forms which constitute the first figure as self-evident and consequently, asserted them without giving, or feeling the need to give, any proof for them. In contemporary terminology he asserted the first figure forms as axioms. And it was his contention that the truth of all the other forms could be proved by reducing them to these first-figure forms or axioms. Thus, if we can focus our

1. All reference to the Prior Analytics are to the translation contained in 'Aristotle's Prior and Posterior Analytics' by W. D. Ross, Oxford at the Clarendon Press, 1957.

attention on these axioms and attain an understanding of their characterizations, then we have, through them, attained an understanding of the other syllogistic forms since they are structurally similar to these axioms and are reducible to them.

As a starting-point of our investigation into the nature of the Aristotelian syllogistic forms we will take the following first-figure form and analyse its nature or character.

> "If B is predicated of all A
> and C is predicated of all B
> then C is predicated of all A". [1]

What are the characteristics of this syllogistic mood? We notice that it contains variables and consequently is formal. Furthermore, we notice that it is a complex structure or form. Three propositional forms are structured into a single unitary propositional form by the conjunctional and material implicational connectives or operators. I use the term material implication as Russell uses it to denote that relationship of implication which is consequent solely upon the operation of the implicational connective as distinct from formal implication which depends on the existence of a relationship between the constituents of the implication. In other words I am using the phrase 'material implication' to refer strictly to the 'horseshoe' relationship in formal logic. [2]

1. Prior Analytics $25^{b}35$.
2. Russell, B. Principles of Mathematics, pages 33-41.

The three constituent propositions are composed of term-variables and the universal affirmative connective, which unites each of two variables into a propositional form. And from an analysis of the other three moods of the first figure we notice that the conjunctional-implicational structure remains constant and invariable while the constituent propositional variables are structured by the universal affirmative or universal negative operators or by the particular affirmative or particular negative operators. Consequently, the whole doctrine of the Aristotelian syllogistic is the doctrine of all the possible true or valid combinations that can be performed by the universal and particular operators on the term-variables within the conjunctional-implicational framework.

Returning to our syllogistic implication as stated above we are now confronted with the question as to its truth status. When the syllogistic implication is tested for truth or validity by the truth-table method, does it always render 'true' for its truth-value? In other words is the syllogistic implication a logical law? For brevity and convenience in assessing the truth-value of the syllogistic implication it may be symbolised as follows: CKAab Abc Aac [1].

This expression can be further abbreviated by replacing the constituent propositional forms by a single variable and thus it reads: CKxyz.

1. Lukasiewicz, J. Aristotle's Syllogistic from the standpoint of Modern Formal Logic, page 78.

Thus, when we draw up the truth-table for CKxyz it does not seem to be a logical law:

	X	Y	Z	KXY	CKXYZ
1	T	T	F	T	F
2	T	F	F	F	T
3	T	F	T	F	T
4	T	T	T	T	T
5	F	F	F	F	T
6	F	F	T	F	T
7	F	T	T	F	T
8	F	T	F	F	T

In the final right hand column of line one the value 'false' appears and, consequently, it seems that the syllogistic implicational form is not a logical law. But if we take the values of XYZ i.e. Aab Abc Aac we can ask what sort of relationship does the functor A set up between the variables it binds. Have we any justification for giving Aab and Abc a true--value while we give Aac a false-value as in 'one' above? Let us suppose that in these syllogistic forms of the first figure that the functor A always sets up either a true or a false relationship between the variables it binds. But it would appear that this supposition is untenable. By what criterion can we claim that Aab is true and Aac is false or Aab is now true and now false? In contradistinction we can say that Cpq is true or false and Kpq is likewise true or false because of the definition of the functors C and K and because we can substitute either true or false for the

variables they bind. But not so in the case of the functors A, E, I, O. There seems to be no definition governing these functors which indicates under what condition the relationship is true or false. Thus, how do we establish the truth or falsity of an A, E, I, O, expression in Aristotle's syllogistic?

Since the variables are term variables and hence cannot sustain the property of truth or falsity we must look to the operators themselves for the clue. When we consider the functors A, E, I, O, we can immediately suppose that all the possible expressions they set up are true, or all the possible expressions they set up are false or all the possible expressions they set up can be both true and false, or that of all expressions they set up some are true alone and some are false alone.

If we examine the last possibility we find ourselves in difficulties. How can some be true alone and some false alone? Which functors set up the true relationships and which set up the false relationships? The answer must be discovered solely in the realm of the operators as the variables do not enter this particular problem. Let us suppose that every A expression is false and every E, I, O, expression is true. Then everytime we would say Aab we would be in fact saying Oab since the contrary of a false expression is true. Then we could never have a universal affirmative expression. The A functor would be useless.

Clearly this cannot be the case. Or again if we say all E expressions are false and all A, O, I, are true, we are involved in a similar contradiction. E becomes useless being supplanted by I and universal negative expressions would no longer be possible. And if we suppose A, E, are always false and I, O, always true we are involved in an even greater confusion and contradiction. So we must rule out the possibility of some of the operators setting up true relationships while others set up false relationships.

Hence we are left with the conclusion that A, E, I, O, set up relationships which are either all true or all false. Can we now say whether or not these relationships will be all true or all false? It does not seem so. In fact all that is needed to avoid involvement in a contradiction is that there be consistent adherence to either true-values or false values.

Now we find that on the basis of this reasoning we can conclude that Aristotelian syllogistic forms are logical laws.

If we adhere to the fact that the operators set up all true relationships then the expression: CKAab Abc Aac always renders 'true' as its truth-value as we see in this example:

CKttt = Ctt = True.

And if we adhere to the fact that the operators set up all false relationships then the expression: CKAab Abc Aac

also always renders 'true' as its truth-value as we see in this example:

CKfff= Cff = True.

Thus we can conclude that the Aristotelian syllogistic forms are logical laws, that is, they always render 'true' as their truth value no matter what permissible values we substitute. And, as we have shown, the permissible values are either all true values or all false values.

From this fact that the Aristotelian syllogistic implications are logical laws very significant and valuable consequences follow. Within the context of syllogistic implication meaning assumes a definite and distinctive connotation, while factual truth is excluded and logical truth is enthroned. These notions will be the subject of later analysis and discussion.

CHAPTER TWO

SCIENTIFIC KNOWLEDGE AND PRE-EXISTING KNOWLEDGE.

In Greek Philosophy there is a pre-occupation with the notions of change, unity and knowledge. Initially the Greek Philosophers were cosmologists and they "... were profoundly impressed with the fact of change, birth and growth, decay and death". [1] And Copleston goes on to say that "... these wise men saw that, in spite of all the change and transition, there must be something permanent. Why? Because the change is from something into something else. There must be something which is primary, which persists, which takes various forms and undergoes this process of change. Change cannot be merely a conflict of opposites; thoughtful men were convinced that there was something behind these opposites, something that was primary. Ionian philosophy or cosmology is therefore mainly an attempt to decide what this primitive element or Urstoff of all things is, one philosopher deciding for one element, another for another element. What particular element each philosopher decided on as his Urstoff is not so important as the fact that they had in common this idea of Unity. The fact of change, of motion in the Aristotelian

1. Copleston, F. A History of Philosophy, Vol.1, Part 1, Page 33.

sense, suggested to them the notion of unity". [1] Again he says "The fact is, that the early Cosmologists leapt beyond the data to the intuition of universal unity: they possessed what we might call the power of metaphysical intuition, and this constitutes their glory and their claim to a place in the history of philosophy". [2]

Thus the Greek Philosophers were stimulated by the plurality of facts they observed to seek an underlying unity. Thales thought that the underlying unity was water whereas Anaximenes thought it was air and Heraclitus thought it was fire. [3] Anaximander said it was not any of these so-called elements but a nature different from them and infinite, out of which all things come. [4] For Parmenides, Being, the One, is, and becoming or change is illusion. His argument presented by Copleston is "For if anything comes to be, then it comes either out of being or out of not-being. If the former, then it already is-in which case it does not come to be; if the latter, then it is nothing, since out of nothing comes nothing". [5] Thus for Parmenides plurality and change are illusions and Being or reality is one.

This doctrine of Parmenides led to a belief that sense-perception is untrustworthy, and this in turn led to the undermining of the very foundations of cosmology and a

1. Copleston, F. A History of Philosophy, Vol. 1, Part 1, Page 36.
2. Ibid. Page 93.
3. Ibid. Pages 36 and 57-58.
4. Ibid. Pages 41-42.
5. Ibid. Page 65.

distrust in the aims of the Greek Philosophers. [1] Greek Philosophers had as their end the attainment of objective truth about the world but "Their success, however, did not equal their philosophic sincerity, and the successive hypotheses that they advanced easily led to a certain scepticism as to the possibility of attaining any certain knowledge concerning the ultimate nature of the world". [2] This fact coupled with social circumstances is largely responsible for the succeeding sceptical and subjective trend of the Sophists. There was a widespread need throughout Greece for greater education and the Sophists set themselves up as teachers of the people. Their end was to teach men how to control the practical affairs of life and they were not guided by any disinterested desire for the truth about the world. They were governed by the needs of concrete situations and Copleston says "If a man wanted to make money in the Greek democracy, it had to be done mainly by lawsuits, and the Sophists professed to teach the right way of winning these lawsuits. But clearly that might easily mean in practice the art of teaching men how to make the unjust appear the just cause. Such a procedure was obviously very different from the procedure of the old truthseeking attitude of the philosophers, and helps to explain the treatment meted out to the Sophists at the hands of Plato". [3]

1. Copleston, F. A History of Philosophy, Vol. 1, Part 1, Page 101.
2. Ibid. Page 101.
3. Ibid. Page 104.

From this we can see how knowledge became subjective in the hands of the Sophists. For Protagoras man is the measure of all things and this means that what appears to me to be true is true for me and what appears to you to be true is true for you.

Plato rejects this doctrine of Protagoras as forming the solution to the nature of knowledge. Plato was convinced that there can be objective and universally valid knowledge. Such knowledge, he maintained, must be of what is, and must be infallible.[1] But side by side with this idea of knowledge, Plato accepts the doctrine of Heraclitus for the objects of sense-perception. And knowledge of such objects cannot be real knowledge since it is not infallible, and is not knowledge of what is. The objects of sense-perception are always in a state of becoming, they come into being and pass away and, consequently, they cannot be the objects of scientific knowledge. For Plato the objects of scientific knowledge must be fixed and permanent and be capable of being grasped in a scientific definition. In judgments about such fixed and permanent objects we find that they are judgments concerning universals. For example "The Roman Constitution is good". Here the fixed element is the concept of goodness which never changes though the Roman Constitution may change. A scientific knowledge of goodness, then, is enshrined in the

1. Copleston, F., A History of Philosophy, Vol. 1, Part 1, page 173.

definition of goodness: "Goodness is .... ", where the essence of goodness is expressed. Scientific knowledge aims at crystallising and stabilising knowledge in a clear definition. But definition concerns the universal. And Plato concludes that true or scientific knowledge is of universals. Consequently for Plato we have scientific knowledge when we recognise the universal forms and elaborate their essences in clear definitions and give an account of their relationship to the primary forms. The objects of scientific knowledge for Plato are the objective, universal, immutable forms. We have only opinion concerning the world of particulars or the world of sense-perception, whereas we have scientific knowledge of the real world or the world of forms. For Plato sense-perception cannot give us knowledge of the necessary and universal since the objects of sense-perception are always in a state of becoming. But in the Meno [1] Plato argues that the slave-boy who has had no mathematical education, can, by a process of questioning alone be induced to present mathematical truths. Since the slave-boy has not learned these truths from anybody and cannot get them from sense-perception, the implication is that he apprehended them in a state of pre-existence, and that the process of coming to know them in the present existence in union with the body is merely a process of recollection. Thus Plato visualises

1. Meno, 84ff.

man as a substantial duality and for him the soul had a prior existence in separation from the body. In its state of prior existence the soul knew the universal, immutable forms, but when it was united with the body it lost or forgot this knowledge it possessed. Now in its state of existence with the body particular things stimulate the soul to remember or recall knowledge of the universal immutable forms which it clearly possessed prior to its union with the body. Thus for Plato scientific knowledge means recollection of the universal immutable forms which we knew in a prior existence. Thus scientific knowledge is possible for Plato because there has been pre-existing knowledge, that is, knowledge of the universal immutable forms possessed by the soul in that state of existence which it had prior to its union with the body.

Aristotle, on the other hand, has quite a different notion of what scientific knowledge is. For Aristotle "To know what a thing is, is to know the cause of its being: the reason is that there is a cause either identical with the thing or different from it, and if it is different and demonstrable, it must be a middle term and the proof must be in the first figure, since its conclusion is to be universal and affirmative".[1] From this passage we can see that the basic concept in scientific knowledge is that it is knowledge of the cause which explains why the fact exists. In scientific

1. Posterior Analytics, 93^a 1-8.

knowledge we know the fact without qualification in the sense "that we know its cause to be its cause and that the fact could not be otherwise". [1] Thus we do not have scientific knowledge until we know why a thing is, that is, until we know what is the reason which explains its existence. Mere knowledge that a thing exists does not constitute scientific knowledge of that thing. But for Aristotle we cannot have scientific knowledge of everything that exists. Aristotle divides existing entities into essences, essential attributes and accidents. [2] Essences do not depend on any entity beyond themselves for their existence whereas essential attributes and accidents can only exist as existing in subjects. "Essential attributes belong to their subjects by the very nature of their subjects and necessarily. For it is impossible that such an attribute ... should not belong to its subject". [3] And we have scientific knowledge of an attribute when we can show in a syllogism this relationship of necessity that exists between a subject and an essential property or attribute. An accident exists in a subject but there is no necessary relationship between the accident and the subject, that is, the subject can exist with or without a particular accident.

Now Aristotle proceeds to define what he means by genuine predication: "Whenever one thing is genuinely predicated

1. Posterior Analytics, 71^b 9-13.
2. Ibid. 73^a 34ff. Also see Metaphysics Book Epsilon 1026^b 27-34.
3. Ibid. 73^b 16-25.

of another thing, the predicate will always be either included in the essence of the subject, or assign a quality, quantity, relation, action, passivity, place or time to the subject". [1] When a predicate states the essence of the subject then we have a definition of the subject and a definition cannot be demonstrated as we shall see later. Such predicates indicate substances but there are predicates which are not identical with the subject, that is, they do not indicate a substance. Such predicates indicate essential properties and accidents and are predicated of subjects distinct from themselves. For example 'white' indicates an accident and there is nothing which is just simple 'white' without being anything else. [2] Accidents and essential attributes depend for their existence on something other than themselves. But because there is no necessary relation between accidents and their subjects, that is, accidents do not belong to their subjects because of the very nature of their subjects, then accidents cannot be demonstrated. It is because "essential attributes belong to their subjects by the very nature of their subjects and necessarily" [3] that essential attributes can be demonstrated.

Why is it not possible to have scientific knowledge of an essence? We can only have scientific knowledge of an essence if we can demonstrate the essence. Demonstration is

1. Posterior Analytics, 83^a 19-23.
2. Ibid. 83^a 30-36.
3. Ibid. 72^b 16ff.

by syllogism, which proves one term true of another by means of a middle term. And we know an essence when we can state the genus and differentia of the entity in question. Call this knowledge of an essence its definition. If we are to have scientific knowledge of an essence then the conclusion of such demonstrative syllogism must be the definition of the essence. And since a definition is universal and affirmative the proof of it must be in that syllogistic mood which is traditionally called Barbara. But the two terms in a definition must be coextensive, that is, reciprocally predicable of each other, since a definition states what is peculiar and essential to that whose definition it is.[1] And from this it follows that all three terms used in such a syllogism must be coextensive or else the major or minor premiss would be untrue. Take the following syllogism form: if all B is A, and all C is B, then all C is A, and suppose that the middle term symbolised by B is greater than the coextensive extremes symbolised by A and C, then the major premiss is false, and if we suppose it is smaller than the two extremes then the minor premiss is false. But in a syllogism of the mood Barbara we do not know that the three terms are coextensive and unless we assume them to be so from the beginning the conclusion will not follow i.e. the definition will not follow. But if we assume the coextensitivity of the terms in a syllogism then

1. Posterior Analytics, 91^a 14-15.

we beg the question. Aristotle exemplifies this in the Posterior Analytics when he talks about the soul:

> "If soul is that which is the cause of its own life
> And that which is the cause of its own life is a self moving number
> Then soul is a self moving number". [1]

To say that we have demonstrated the definition 'Soul is a self moving number' is begging the question because already this definition has been assumed in the minor premiss because if the conclusion is to follow and be a definition then its terms must be coextensive. Hence in the major premiss it must be assumed that 'soul' and 'that which is the cause of its own life' are coextensive. Then in the minor, 'that which is the cause of its own life' must be coextensive with 'a self-moving number'. But to assume that these two terms in the minor are coextensive is, de facto, to assume that 'soul' and 'a self moving number' are coextensive since 'soul' and 'that which is the cause of its own life' are already assumed to be coextensive. And this is to assume what we aimed at proving and hence a begging of the question. Consequently to demonstrate an essence involves begging the question.

All attributes in categories other than substance are accidents and are genuinely predicable only of substances. And Aristotle concludes that demonstration is of 'per se' attributes of things. [2] This means that in such predications what is predicated belongs to the subject precisely in virtue

1. Posterior Analytics, 91^a 33-39.
2. Ibid. 84^a 7.

of the subject's nature, and nothing else with a different nature can sustain these attributes. What is predicated of the nature in question is not predicable of any other different nature, and it is impossible that such an attribute should not belong to its subject. This follows from the fact that 'per se' attributes are elements in the essence of their subjects.

Now we may be able to see more exactly what Aristotle means when he defines scientific knowledge as knowledge of the cause of a fact to be its cause, and that the fact could not be otherwise.[1] Scientific knowledge is concerned with showing in syllogisms that certain 'per se' attributes exist and why they exist - they exist because their subjects exist and they "belong to their subjects by the very nature of their subjects and necessarily".[2] 'Per se' attributes are accidents and depend upon substances for their existence. Causation for Aristotle means a relationship whereby an entity depends upon another entity for its existence. 'Per se' attributes are exclusively predicable of certain definite natures and of no other natures. And so we have scientific knowledge of these attributes when we can show in syllogisms what are the subjects upon which they depend for their existence - that is, when we can present in syllogisms their causal relationship which necessarily exists because the subjects exist and the "essential attributes belong to their subjects by the very

1. Posterior Analytics, 71^b 11-15.
2. Ibid. 73^b 16ff.

nature of their subjects and necessarily". [1]

This brings us to Aristotle's notion of accidental being. An accidental being is a being which does not have an existence of its own but has 'inesse', meaning it depends for its existence on something else. [2] Accidental being is two-fold. Though it depends for its existence on some other being it may not be part of the essence of that other being and hence from the essence of the other being we can never infer the existence of such an accidental being. Between the subject and the accident there is no necessary relation - the subject can exist with or without the accident. Aristotle says for example that there is no necessary connection between a man and being musical. A man may or may not be musical, he is still a man. When an accident is such that it is an essential part of its subject then such an accident is necessarily related to the subject and exists when the subject exists. It is concerning such essential attributes we can have scientific knowledge because of the necessity they involve - their explanation lies in their subjects. But with non-essential accidents such necessity and consequently such an explanation is not possible and hence we cannot have scientific knowledge of them. [3]

Substances or essences and essential attributes, as oppposed

1. Posterior Analytics, 73^{b} 16ff.
2. Ross, W. D., Aristotle's Prior and Posterior Analytics, Commentary on 83^{a} 30-32, page 577.
3. Posterior Analytics, 75^{a} 18 and Metaphysics 1027^{a} 27-28.

to accidents, are necessary beings. This does not mean that their existence is necessary but that their essence is necessary. There could not be a man who was not an animal whereas there could be a man who was not white. [1] Hence somethings cannot be otherwise, but are always and of necessity what they are.

And we know an attribute scientifically when we can arrange two sentences to form the antecedent of a syllogism such that, in the conclusion inferred from them, they show the reason why the attribute asserted of the subject in the conclusion is asserted of that subject, i.e. they show that the attribute is asserted of the subject in the conclusion because it belongs to the subject by the very nature of the subject and necessarily. This becomes evident in the following example:

> " If all trees in which the sap congeals are deciduous
> And all broad-leaved trees are trees in which the sap congeals,
> Then all broad-leaved trees are deciduous." 2.

Here we see that the two sentences forming the antecedent of the syllogism formally imply the conclusion and consequently this is the reason why the attribute is asserted of the subject in the conclusion.

And similarly when there is a negative demonstration we can see from the premisses that the attribute in the

1. Metaphysics, 1026^b 38-39.
2. Posterior Analytics, 98^b 32ff.

conclusion is not an essential attribute of the subject. If we consider the example:

> "If whatever is near does not twinkle
> And the planets are near
> Then the planets do not twinkle." [1]

We see that twinkling is not an essential attribute of planets and we also see the reason why and hence we have scientific knowledge.

But we must note that in the above examples of scientific syllogisms the sentences forming the antecedents were already known prior to forming the syllogisms. How were they already known? Were they deduced as conclusions of other scientific syllogisms? Even if they were then there must be a stage at which the premisses in a scientific syllogism are not themselves known scientifically [2] or else we would either be begging the question in the case when such premisses are definitions as we have shown on pages 23,24 and 25 or we would be involved in an infinite regress which cannot be as then there would be no certain knowledge since no proposition could be conclusively proved or explained "Where there is no first term, there is no explanation at all".[3] Thus Aristotle says that scientific knowledge proceeds from primary premisses which cannot themselves be known scientifically but must be known already beforehand [4] and that scientific

1. Posterior Analytics, 78^a 28.
2. Metaphysics, Book Gamma, 1011^a 1-20.
3. Metaphysics, Book Alpha the Less, 994^a 17-18, also 993^b 31 - 994^b 31.
4. Posterior Analytics, 99^b20ff.

knowledge presupposes prior knowledge of all the universal terms involved and also it presupposes knowledge of the first principles common to all sciences. [1] Thus for Aristotle scientific knowledge presupposes pre-existing knowledge. [2]

For Plato the pre-existing knowledge upon which scientific knowledge depended was simply that knowledge possessed by the soul in its state of existence prior to its union with the body. But Aristotle rejects Plato's solution as to the nature of the pre-existing knowledge necessary in order to have scientific knowledge. [3] Aristotle's rejection of the Platonic solution to the nature of pre-existing knowledge necessitates him to offer an alternative solution. And, as we shall see later, it is within the framework of a new metaphysical doctrine and a new doctrine of philosophical psychology that Aristotle elaborates his solution to the problem of pre-existing knowledge on which scientific knowledge is based. His solution is that we get the pre-existing knowledge on which scientific knowledge is based by a process which he calls Induction. We shall see exactly what this process means for Aristotle in our next chapter. Briefly we can say that, for Aristotle, we have an innate capacity to know and this capacity he calls sense-perception. [4] Knowledge of the first principles of scientific knowledge

1. Posterior Analytics, 76^{a} 31ff.
2. Ibid. 71^{a} 1ff.
3. Ibid. 71^{a} 24-30.
4. Ibid. 99^{b} 34ff.

begins with sense-perception, which leads on to memory and experience and finally the uncovering by the intellect of the universal implied in the clearly known particular. As we shall see later the universal thus known by the intellect is not the sum-total of all particular instances that we have actually experienced or counted - it is not attained by an enumerative but by a generic process.

For Aristotle his doctrine of Induction explained the nature of the pre-existing knowledge on which his scientific knowledge was based and also explained how we get this pre-existing knowledge. When Aristotle says that we get the pre-existing knowledge by Induction, he uses 'Induction' to refer to the process of sense-perception and abstraction by which the intellect is enabled to know material things.

We must now proceed to analyse more fully this Aristotelian doctrine of Induction which, he believed, yielded knowledge which was indubitably true and which formed the basis of his theory of scientific knowledge.

CHAPTER THREE

KNOWLEDGE, TRUTH AND THE SCIENTIFIC SYLLOGISM:

"The premisses of a scientific syllogism must be true".[1] If one be permitted to make an apparently trivial remark about Philosophy one might say that it lacks any one definite universally acceptable 'way' or doctrine. Entities have been viewed in more than one way, interpreted by more than one set of explanatory concepts and comprehended within more than one theory. And so it has become difficult, if not impossible, to sustain the view that any one specific doctrine or theory of explanation is the right or true one because it conforms to 'reality' or fits 'reality'. Such a view would involve a circular justification since the very notion of 'reality' itself derives its meaning from the particular theory or doctrine that is being expounded. Similarly the notions of knowledge and truth must be understood within the specific framework in which they are being employed. The notions of truth and knowledge within the Empiricist's framework, for example, are quite distinct from the notions of truth and knowledge within the idealist's framework.

We never just know, we always know something. And, consequently, there is always a knower and a known whenever

1. Posterior Analytics, 71^b 19-20.

there is knowledge. And the interpretation that is imposed on each of these two constituents of knowledge will determine what specifically the notions of knowledge and truth are within any particular theory. And so for Aristotle knowledge and truth will derive their meaning within the context of his metaphysical and rational psychology theories.

Plato dichotomised the world into the real world and the apparent world, and man into body and soul and knowledge into Episteme and Doxa. It has been maintained that in the Eudemus (which is no longer extant) that Aristotle argued in favour of the pre-existence of the soul and elaborated on the Platonic view that learning is merely reminiscence from an earlier life. But in his mature psychological work, De Anima,[1] his position concerning the relation of soul to body and knowledge is completely and distinctly different from what he is alleged to have propounded in the Eudemus. The kernel of his doctrine in the De Anima is that soul and body are aspects of a single substance related to one another as form is related to matter.[2] We find the same doctrine expressed in his metaphysics where he says that matter and form are merely two aspects of the same identical reality and to seek a reason for their unity is like explaining how one is one.[3] This matter-form doctrine of the substantial

1. All references to the DE ANIMA of Aristotle are to the version of William of Moerbeke, published by the Yale University Press 1951.
2. De Anima, Book 2, Chapter 1, Sec. 220-226.
3. Metaphysics Book Eta, 1045^{b} 17-20.

unity of man is basic to the Aristotelian theory of knowledge. Because Plato dichotomised knowledge he was logically necessitated to dichotomise man and the world. But for Aristotle there is only the one world and man is a psycho - physical unity, and the soul could not pre-exist the body and, hence, there is no knowledge possessed by the soul in any prior existence as the soul has no existence prior to its union with the body. Thus for Aristotle knowledge cannot be reminiscence.

This doctrine of the substantial unity of man is based on his metaphysical doctrine of matter and form. Every finite being is a being composed of essence and existence. Essence is the source of limitation and multiplicity in beings. Some essences are simply forms whereas other essences are composed of matter and form, hence there are material and immaterial beings. Form is the reason why a thing is what it is; it is the answer to the question of what a thing is. Every entity is determinate in the sense that it is a definite distinguishable something. And what makes an entity to be a definite distinguishable something is what Aristotle means by its form. Form is the principle of determination in things, it is the reason why an entity is what it is and not something else. Aristotle defines matter as that which is not in itself a particular thing or a quantity or anything else by which things are defined. [1] It is what persists

1. Metaphysics, Book Zeta, 1029^{a} 20ff.

in change. [1]

Aristotle arrived at this notion of matter as a principle of physical being from his analysis of substantial change. Where there is change there must be a constant underlying the change. [2] Change means the passing from the state of potentiality to the state of actuality; [3] it means that an entity acquires a perfection which it does not already actually possess but is capable of possessing. A man is capable of talking though he may not be actually talking whereas a stone is neither actually talking nor capable of talking. And this notion of change implies a subject in which the change takes place. In the case of accidental change the substance in which the changing accidents inhere is the subject of the change. In the case of substantial change a substance ceases to be this particular definite kind of entity and becomes a distinct definite other kind of entity - the substantial form changes. The 'whatness' of an entity before that entity undergoes substantial change is distinctly different from the 'whatness' of the entity which results upon the substantial change. What is the subject of substantial change? What is the underlying constant throughout substantial change? If there is no underlying constant throughout substantial change then there is no continuity

1. Metaphysics, Book Alpha, 983^a 29-30.
2. Ibid. Book Gamma, 1010^a 15-22: Book Eta, 1042^a 34-1042^b 4: Book Kappa, 1068^b 10: Physics, 225^a 12-20: On Generation and Corruption, 319^b 5-320^b 15.
3. On Generation and Corruption, 317^b 15-18.

between the entity before and after the change and hence one is reduced to a notion of change as simply annihilation and creation. If there is no continuity between the entity before and after the change then there is no explanation left for the entity after the change other than creation- meaning the production of an entity out of nothing. Thus when our dog Fido dies one can never claim that the dead dog in our kennel is Fido. When our Fido died then a dead dog was created in our kennel and between Fido and the dead dog there is no relationship of continuity. Aristotle rejected any such explanation of substantial change as untenable and maintained that before the occurrence of substantial change the entity possessed a specific substantial form which made it to be that specific definite entity. But also such a definite entity was in potency to other certain substantial forms and at the point of the substantial change the substantial form of the entity was replaced by the actualisation of a new substantial form to which the entity had been in potency. But throughout this change there must remain an underlying constant which provides a link of continuity between the entity before and after the change and this underlying principle of continuity throughout substantial change is what Aristotle terms the primary matter.

Thus by his analysis of substantial change Aristotle establishes primary matter as a transcendental of physical being. Primary matter is not something which exists in its

own right, it is not anything in particular as it is pure potency, meaning that it is capable, as such, of being actualised by any conceivable number of substantial forms.

The form of a living body is, for Aristotle, the soul. "The soul is the primary act of a physical bodily organism." [1] This definition of soul is synoptic of his doctrine of the substantial unity of man. He explicitly tells us that this definition of soul, based on his doctrine of matter and form, renders any further questions as to the substantial unity of man superfluous and unnecessary. [2] Thus, man is a psychosomatic unit, and the soul's natural state is in union with the body, whereas for Plato man is a duality and the soul's natural state is in separation from the body.

It never occurred to Aristotle either to doubt or to prove the existence of an external material world which was independent of himself. He accepted as a self - evident starting point of Philosophy an existing independent external order of being - an external world. Aristotle was what Wilhelmsen calls a 'Metaphysical realist'.[3] At this point one should note that Aristotle did not assume the existence of the external world, he accepted its existence as self-evident. This approach to Philosophy was rejected by Descartes and subsequent critical realists.

1. De Anima, Book 2, Chapter 1, Sec. 233.
2. Ibid. Book 2, Chapter 1, Sec. 234.
3. Wilhelmsen, Fredrick, D., Man's Knowledge of Reality, Englewood Cliffs N. J., Prentice - Hall, Inc.

The object of knowledge for Aristotle is the external material world and the knower is the psycho-physical unit. The question remains as to how knowledge is attained by the psycho-physical unit and what is meant by knowledge and, consequently, truth in this Aristotelian context.

We now find that Aristotle's treatment of knowledge and truth assumes a definite teleological colouring. His definition of soul as the primary act of a physical bodily organism embraces all living things. Then he proceeds to stratify 'soul' in a tripartite manner. This stratification is in terms of end or purpose. Everything that exists by nature, as distinct from what is fabricated by man, exists for an end or purpose, which is the realisation of its nature. And every living thing must have a vegetative soul since every living thing must have nutriment in order to fulfil or realise its natural functions.[1] Animals must have sensation since every body that moves or is capable of moving must have sensation or else it would fail to reach its end and would soon be destroyed. Mobility in animals is for the sake of obtaining the food which sustains them and without mobility they would not be able to obtain their necessary life - sustenance. And movement requires sense - awareness, otherwise animals would not perceive the noxious things to which their movement sometimes brings them, and thus they would die and then the very purpose of their movement would be frustrated.

1. De Anima, Book 3, Chapter 12, Sec. 847-848.

Underlying this whole argument of Aristotle's is the assumption that nature does nothing in a purposeless way - that everything in nature has a purpose. The justifiability of this assumption is contestable. Animals have the power of movement in order that they may attain their life - sustenance and if movement is to fulfil its purpose then this possibility must be present. And this possibility is made present by the presence of sense - awareness. And the essence of sensation is the reception of form without matter.[1] This we shall see later.

Man's specific end is rational activity and, hence, man must have the ability or the capacity to act rationally. Consequently, Aristotle posits the intellect as that part of the soul by which man knows and is wise.[2] Thus, whereas Plato posits three souls, the intellectual, sensitive and vegetative souls in man, Aristotle posits one soul which sustains and guides the complete functions of the human person. The rational soul is virtually (virtus) the vegetative and sensory souls.

Now Aristotle is confronted with the problem of knowledge. The proper object of the intellect or that towards which the intellect is naturally orientated is the essences of particular material things. For Aristotle the intellect was made to know the essences of material things, and the

1. De Anima, Book 3, Chapter 12, Sec. 847-850.
2. Ibid. Book 3, Chapter 4, Sec. 671-674.

essences of material things exist in the particular material things. This raises a difficulty for Aristotle. Plato held that the essences of material things existed apart from matter in a state of actual intelligibility. Aristotle's rejection of this Platonic notion of the existence of essences of material things apart from the material things has placed him in the position where he must conclude that material essences are, as existing in particular material things, only potentially intelligible or knowable. He must solve the problem as to how the potentially knowable is rendered actually knowable.

For Aristotle knowledge is an immaterial act in which the knower becomes identified with the thing known.[1] Thus he states that there is an intellect which is capable of becoming everything.[2] Materiality is the principle of limitation and restriction and if, in an act of knowledge, the knower became the known materially then the knower would be limited to that particular thing and could not become, that is, know any other things. Hence the identity between the knower and the object known cannot be a material identity but must necessarily be an immaterial or formal identity. Also intellect has no bodily organ and is devoid of matter. This follows from the notions that the principle of restriction and limitation in things is matter and that the intellect

1. De Anima, Book 3, Chapter 5, Sec. 724-726.
2. Ibid. Book 3, Chapter 5, Sec. 729-731.

is capable of knowing, not just a particular material essence, but of knowing all material essences without exception. If the intellect contained matter then it would be incapable of becoming (knowing) everything as it would be limited and restricted to be a definite nature and as a limited definite nature it could not become identified with other natures. To be able to become identified with other objects means not to possess these objects but to have a capacity for possessing them and if intellect is to become identified with material essences then it must not itself be a material essence. Hence the intellect "has no nature and is not one, except in being potential ... the 'intellect' of the soul .... is not, before it understands, in act of any reality". [1] Matter, being the principle of limitation and restriction, is in opposition to knowledge, which is an act of union between a knower and a known object, and knowledge necessitates a liberation from the confines of matter. Immateriality is the basis of knowledge. Hence Aristotle has a problem to solve. The essence of material things is the proper object of the intellect and yet material things are not actually knowable, as such, because of their materiality. Thus, the problem is how are material things rendered intelligible? Aristotle's solution is in terms of a dematerialisation of material things. This dematerialisation necessitates an intellectual dichotomy and a process by which the potentially

1. De Anima, Book 3, Chapter 4, Sec. 679-683.

knowable becomes the actually knowable. And, thus for Aristotle, knowledge is an immaterial or formal union between the knower and the known, the knower becomes the known in a formal manner.

This process of dematerialisation or sense-perception and abstraction or induction [1] is presented by Aristotle to replace Plato's theory of reminiscence which he has rejected. For Plato,as we have seen, the pre-existing knowledge upon which science is based is simply that knowledge which the soul possessed in its state of existence prior to its union with the body. And that knowledge was forgotten or lost when the soul was joined with the body and is regained now by the process of reminiscence. Having rejected this Platonic doctrine, and holding that scientific knowledge is based upon pre-existing knowledge, Aristotle was forced to give a different explanation as to what he meant by pre-existing knowledge and also how we get this pre-existing knowledge. In the last chapter we saw what he meant by pre-existing knowledge and now we must examine his theory that we get this pre-existing knowledge by the process of induction or sense-perception and abstraction or dematerialisation.

At the sensory level, as a result of the inter-action of the organism and environment, there is a stimulation of the organism which initiates the process of sense-perception. The end result of this activity is called the Phantasm by

1. Posterior Analytics, 99^b 35-100^b 5.

Aristotle. The Phantasm is the presence, at the sensory level, of the accidental form of the material object. The Phantasm is the presence of the object to the knower at the sensory level. At this stage the substantial form cannot be present - the Phantasm cannot contain the substantial form as the substantial form is not sensible. But the Phantasm operates as a formal determinant of intellect. It is because of the presence of the object at the sensory level (Phantasm) that different acts of knowledge are distinguishable. Each distinct object that is present at the sensory level formally determines the intellect in a distinctive manner and hence there are distinctive acts of knowledge. The Phantasm is the accidental form of the object present to the knowing subject, and does not, as such, contain the substantial form of the object. And so the question still remains as to how the subject becomes the object, how intellect is identified with the essence of the object and consequently there is knowledge.

His Metaphysical doctrine of Potency and Act necessitates that the possible intellect cannot actualise itself but must be actualised by that which is already in act. As a solution Aristotle posits an agent intellect which is distinct from matter, is essentially in act and is such that it cannot be acted upon.[1] And he attributes to this agent intellect, possessed by every rational creature, the role of

1. De Anima, Book 3, Chapter 5, Sec. 732-739.

dematerialising the substantial form of physical things, which is simultaneously the actualisation of the 'Possible Intellect'.

Plato had no need for this principle of agent intellect since the essences of sensible things were actually intelligible in their world apart. But because Aristotle insisted that the essences of sensible things exist in particular sensible things with only potential intelligibility he had to invoke this abstract and elusive principle of mind so that the essences of sensible things would be rendered intelligible.

This active intellect must not be understood as possessing all intelligible forms. The actuality of the active intellect is not similar to the actuality of the possible intellect when it is actualised. The possible intellect is potential with regard to intelligible objects and is actualised by them. But intelligible objects are potential with respect to the agent intellect and are actualised by it. The agent intellect is an active immaterial power which is able to make other potentially immaterial objects actually immaterial.[1] If the actuality of the active intellect towards intelligible objects was similar to the actuality of the possible intellect then all knowledge would be independent of sense-perception. But for Aristotle sense-perception is fundamental to knowledge.

Knowledge results upon sense-perception and the

1. Aquinas's Commentary on Aristotle's 'De Anima', Book 3, Chapter 5, Sec. 738-739.

activity of agent intellect. By sense-perception we get the Phantasm and working on this Phantasm the active intellect strives to reach the underlying form or intelligibility. When confronted with an object which we already know the agent intellect immediately reaches the underlying intelligibility (substantial form) and this intelligibility, concomitant with its being arrived at by agent intellect actualises the possible intellect. The agent intellect does not first acquire the substantial form of the object and then present it to the possible intellect - the agent intellect cannot be acted upon and the substantial form is rendered intelligible for the possible intellect so that the dematerialisation of the substantial form is concomitantly the actualisation of the possible intellect.

When we are confronted with an object which we do not have previous knowledge of, then the active intellect may find that the Phantasm is not sufficient to enable it to produce the substantial form and so if there is to be knowledge then the Phantasm must be perfected through further investigation and the amassing of further evidence, thus enabling the agent intellect to discover the underlying intelligibility.

When the active intellect produces the substantial form, the possible intellect is actualised and so there is knowledge. But what is known is not the form but the essence - for Aristotle the proper object of the intellect is the essences of material things and the essence of a material

thing is a constituent of matter and form. Thus material essences are the final cause of the intellect and when the intellect is actualised it is actualised in accordance with its own nature or mode of action. And so the intellect naturally knows everything under the conditions of materiality. Materiality is a transcendental property of the intellect's knowing activity. When the possible intellect is being actualised by the form presented by active intellect it grasps this form under the conditions of materiality, that is in accordance with its own way of acting which is to grasp form as united with matter and thus as the essence of a material entity.

This actualisation of the intellect in which it becomes the essence of a material being is the act of knowledge for Aristotle. And such knowledge is accorded the properties of universality and necessity. Since knowledge is the identity of the intellect with essences and these two properties of universality and necessity are characteristics of essences then they are characteristic of knowledge. A material essence, as such, is universal for Aristotle but individuation is a necessary property of a material essence. Material essences only exist in individual particular physical things. Material essences have no existence apart for Aristotle, and solely exist as particularised by matter's individuating property of quantity. And in knowledge the intellect is identified with the universal-existing-in-this-particular-

material-being. Thus knowledge for Aristotle is essentially of the universal and accidentally though necessarily of the individual.

Because of form Aristotle attributes the property of necessity to essences and hence to knowledge. An essence is what it is because of its substantial form and cannot be other than what it is without a change of substantial form and hence a substantial change. Thus an essence cannot change without ceasing to be the essence it is. An essence cannot at the same time continue to be what it is and yet have changing phases like a man who can be ill or healthy or angry without ceasing to be a man. An essence cannot be otherwise than it is without ceasing to be what it is and this is what Aristotle means by necessity in this context. Thus knowledge for Aristotle has the dual characteristics of universality and necessity.

For Aristotle there is no doubt that we can and do arrive at true knowledge or certitude since this is the natural function of the intellect and, true to his teleological tendencies, he sees that to violate a natural function is to offend against the order of nature. So Aristotle accepts as self-evident the fact that we can attain true knowledge and the question that then arises is: how can we be certain that we have arrived at true knowledge in any particular situation or concerning any particular matter? For Aristotle intellect is the apex of the created universe and sovereign of the

intelligible world and, consequently, the solution to the problem of the criterion of truth lies within the intellect itself. That there be a criterion of truth distinct from intellect is anathema to his whole doctrine. Everybody naturally desires knowledge [1] and in any particular situation this desire is not fulfilled until there is true knowledge. Consequently, when intellect grasps an intelligible as a result of the dematerialising process a further question arises naturally for the knower. This question is the expression of the intellect's natural desire for truth, for formal unity with the object. Do I indubitably and unconditionally know this object? And to answer this question Aristotle attributes a reflective ability to intellect by which it checks the grounds on which the knowledge is based.

When a mathematical computation has been performed then there succeeds a process of verification. Having completed the computation there arises the question: is this true or correct? And this question is satisfied by rechecking the various steps involved in the computation for the purpose of detecting any mistakes that may have inadvertently presented themselves at any step of the calculation. If we find that the recheck indicates a flawless computation, that is, that all the appropriate mathematical operations have been performed in accordance with their natures or definitions, then we are satisfied that our conclusion is the correct one. Similarly with our knowledge of external

1. Meta., $980^{a}21$.

things. When we have attained knowledge of something we are still confronted with the question: is this true? And our answer to this question is consequent upon our rechecking our procedural steps in order that we be satisfied that they have been performed correctly. When we have completed this recheck, and when we are satisfied that the various steps involved are satisfactory then we are satisfied that we possess true knowledge.

This process of reiteration of the grounds of our knowledge is not any superfluous activity performed by the neurotic or the intellectually scrupulous or the compulsive doubter but is, as Bernard Lonergan says,[1] categorically necessitated by the mind's natural desire for absolute and grounded knowledge; it is demanded naturally by rational consciousness. The procedural steps to be checked are sense-perception and insight or the activity of agent intellect. By sense-perception the accidents of the object are presented to the knower as the evidence or clues by which intellect is to arrive at the essence of the object. This evidence may be incomplete and, consequently, the knowledge resulting upon this evidence may be false or incomplete. Thus upon rechecking we may be necessitated to undertake more extensive analysis and experimentation in order to perfect the evidence and so correct our knowledge. For Aristotle each sense has its

1. Lonergan, Bernard, J. F., INSIGHT, A Study of Human Understanding. Longmans, Green & Co.Ltd. 1957.

particular proper object and with regard to its particular proper object each sense is infallible. But there are sensible forms such as motion and size which are not the proper object of any one sense but are apprehended by what is called the common sense.[1] And the operation of the common sense can be erroneous[2] since its function is to harmonise the data of the external senses into meaningful wholes and comprehend the common sensibles.

Also there can be error at the level of insight into the Phantasm. Our insight may be based on bias or prejudice as in the case of the Aristotelian 'Argumentum ad hominem' and the 'Argumentum ad populum', or it may be influenced by passions such as anger and fear. Here one might make reference to the Aristotelian 'Argumentum ad baculum'. When we have successfully completed this process of critical reflection then, for Aristotle, we are in possession of absolute indubitably true knowledge. And, consequently, for Aristotle natural truth is not any objective form or standard that we either hit or miss in knowledge but rather refers to any activity of intellect that has been properly and satisfactorily executed and intellect itself is the sole and final judge as to when it has properly performed its proper activity. Thus natural truth, for Aristotle, means that in any activity of the intellect there is a relationship of adequate conformity

1. De Anima, Book 3, Chapter 1, Sec. 575-583.
2. Ibid. Book 3, Chapter 3, Sec. 660-667.

between the intellect and the physical thing.

And, as we have seen, true knowledge bears the dual stamp of universality and necessity. Thus knowledge of essences of things, when the steps leading to this knowledge have been properly performed, is universal and necessary and hence true knowledge since such knowledge is an identity between the mind and the essences and the essences have these dual characteristics. In the case of knowledge of accidents there is a duality of knowledge here for Aristotle corresponding to his duality of accidents. Necessary accidents are accidents which are always present when a certain nature is present and the nature cannot be present without the presence of these necessary accidents.[1] There is a relationship of formal causality between necessary accidents and their subjects. Consequently, these necessary accidents share in the universality of their subjects and consequently knowledge of these necessary accidents will have the dual stamp of universality and necessity and hence will be true knowledge. Thus, for Aristotle, the pre-existing knowledge upon which scientific knowledge is based is true knowledge arrived at by the process of induction which we have described.

But there is a second class of accidents which do not have any relationship of necessity to the subject - the subject can be present with or without these accidents. There is no relationship of formal causality between these accidents and any

1. Posterior Analytics, 72^b 16ff.

subject. It follows then that knowledge of these accidents will lack necessity and so for Aristotle, knowledge of such accidents will not be true knowledge but will be opinion. Opinion, for Aristotle, is of the contingent. [1]

And for Aristotle, the true knowledge upon which scientific knowledge is based (pre-existing knowledge) is got by induction and on the basis of this knowledge he elaborates his doctrine of scientific knowledge. Scientific knowledge is true knowledge since it is the elaboration by means of syllogism, of the relationship of causality between necessary properties and essences.

One of the main criticisms launched against the syllogism is that it commits the fallacy of 'begging the question'. Mill writes "it must be granted, that in every syllogism, considered as an argument to prove the conclusion, there is a petitio principii". [2] This criticism claims that what one sets out to prove has already been assumed in one of the premisses.

This criticism seems to stem from attributing a certain meaning to the Aristotelian universal premiss. If we hold that the Aristotelian universal premiss is an enumerative universal, that is, a collective assertion about every one of a number of particulars, or 'a statment of fact about the whole of a number of particulars' [3] then it will follow that what we prove in the

1. Posterior Analytics, 88^b 30ff.
2. Mill, J. S., Philosophy of Scientific Method, page 121.
3. Joseph, H. W. B., An Introduction to Logic, page 302.

conclusion is already known in the major premiss. In an enumerative universal the assertion is made not because of any insight into the nature of a certain kind of entity and its necessary connection with an attribute but because we have examined every instance of a certain kind and found that a certain property is present in all of them. If we take an example of an Aristotelian premiss this will become clearer: "all trees in which the sap congeals are deciduous".[1] Aristotle makes this assertion, not because he has examined all trees in which the sap congeals and found that all these trees also have the property of being deciduous, but because on the evidence of a few instances he was enabled to grasp a relationship of necessity between a tree in which the sap congeals and the property of being deciduous, that is, he saw that being deciduous was an essential property of a tree in which the sap congealed. Having had this insight he did not need to examine any more particular instances in order to assert the universal proposition "all trees in which the sap congeals are deciduous". Being deciduous was not just a characteristic that happened to be present in a number of particular instances but was necessarily related to the nature or essence in question and hence shared in the universality of this essence. Here we are merely applying the Aristotelian notion of induction which we analysed earlier in this chapter.

Now those who claim that the syllogism is a 'petitio

1. Posterior Analytics, 98^b 31-38.

principii' would say that when Aristotle uses this premiss 'all trees in which the sap congeals are deciduous' to prove the conclusion 'all broad-leaved trees are deciduous' that he has already examined and known this fact in the process of arriving at the major premiss 'all trees in which the sap congeals are deciduous' and consequently he assumes in the major premiss what he pretends to prove.

For Aristotle, on the other hand, the universal premiss arrived at by induction is not of an enumerative but of a generic nature. He asserts it, as we have seen, on the basis of an insight into a necessary relation between an essence or nature and a property and not on the basis of having examined all particular instances. Consequently, we know the conclusion only potentially when we know the major premiss in the sense that in the major premiss we know that a certain essence has a certain necessary property but we do not actually know that the conclusion is an instance of such an essence having such a property until we see the major and minor premisses in relationship to each other.[1] Thus for Aristotle to know the universal premisses of a syllogism in no way involves that, in the process of coming to know these premisses, we must know the conclusion. Thus in order to know the premiss 'all trees in which the sap congeals are deciduous' in no way involved knowing that 'all broad-leaved trees are deciduous'. For Aristotle the universal premisses and terms are attained by a generic process of induction

1. Prior Analytics, 67^a 36-37.

and not by any enumerative process. And, for Aristotle, the pre-existing knowledge upon which his scientific knowledge is based is true knowledge arrived at by the process of generic induction. And scientific knowledge is true knowledge since it is the elaboration, by means of the syllogism, of the relationship of causality between necessary properties and essences.

This notion of truth within the context of the scientific syllogism (natural truth) is, as we shall see later, different from the notion of truth within the context of the syllogistic implication.

CHAPTER FOUR

SYLLOGISTIC IMPLICATION AND THE SCIENTIFIC SYLLOGISM:

In the traditional treatment of the Aristotelian syllogism no distinction seems to have been made between Aristotle's scientific syllogism and his syllogistic implication. The following may be taken as a typical example of the traditional syllogism:

> "All men are mortal,
> Socrates is a man,
> Therefore
> Socrates is mortal". [1]

Lukasiewicz quotes Carl Prantl, a historian, as giving similar formulations of the Aristotelian syllogism. [2] To this traditional form of the Aristotelian syllogism Lukasiewicz has two objections. His first objection is that Aristotle never introduced singular terms or premisses into his system.[3] And he says that the reason was that the "syllogistic as conceived by Aristotle requires terms to be homogeneous with respect to their possible positions as subjects and predicates" and Aristotle believed that a singular term was not suited to be a predicate

1. This example appears in practically all text-books and histories of logic. For example Kapp, E., Greek Foundations of Traditional Logic page 11, Russell, B. History of Western Philosophy page 218, Mill, J.S. Philosophy of Scientific Method page 121, Copleston, F. History of Philosophy, Vol 1, part 1, page 21.
2. Lukasiewicz, Aristotle's Syllogistic page 35.
3. Lukasiewicz, Ibid. page 1.

of a true proposition. [1]

Here, it seems to me, Lukasiewicz is comparing the traditional syllogism with Aristotle's scientific syllogism. As we have seen on page twenty six of the present work a scientific syllogism is an expression showing that 'per se' attributes exist and why they exist - they exist because their subjects exist and they "belong to their subjects by the very nature of their subjects and necessarily".[2] And as we have seen in the last chapter the scientific syllogism renders true knowledge, that is, universal and necessary knowledge. And, to me, this seems a reason why Aristotle excludes particular terms and premisses from his scientific syllogism - if he had particular terms or premisses in a scientific syllogism then the knowledge gained by that syllogism would not have the character of universality and, consequently, for Aristotle, it would not be true knowledge.[3]

Lukasiewicz's second objection to the traditional syllogism is that "the Aristotelian syllogism as an implication is a proposition, and as a proposition must be either true or false. The traditional syllogism is not a proposition, but a set of propositions which are not unified so as to form one single proposition. The two premisses written usually in two different lines are stated without a conjunction, and the connection of these loose premisses with the conclusion by means of

1. Lukasiewicz, op. cit., page 7.
2. Posterior Analytics, 73^{b} 16ff.
3. Posterior Analytics, 88^{b} 30ff; 88^{a} 38ff; Metaphysics, 1039^{b} 20ff.

'therefore' does not give a new compound proposition .... not being a proposition the traditional syllogism is neither true nor false". [1]

Thus it would seem that the traditional syllogism is a corrupt presentation of the Aristotelian scientific syllogism. The true Aristotelian scientific syllogism as expressed in Aristotle's Posterior Analytics is an implication in which the terms and premisses are universal.

But my contention is that within Aristotle's Analytics there is a basic irreducible distinction between his scientific syllogism which is to be found in the Posterior Analytics and his syllogistic implication which is to be found in his Prior Analytics.

As we have seen in the first chapter Atistotle's syllogistic implication propounded in the Prior Analytics is a formal structure. Variables are structured by the operators to form a unitary compound structure or expression which is always true in virtue of the structuring aspect of the structure and independently of what permissable truth-values that may be substituted for the structured variables.

When we look at the scientific syllogism it appears that its structure is that of syllogistic implication. Our problem then is to analyse more minutely the structure of the scientific syllogism. Is its structure that of syllogistic implication? If its structure is not that of syllogistic implication then

1. Lukasiewicz, op. cit., page 21.

how pertinent are the factors which differentiate it from syllogistic implication? Are its differentiating characteristics of a sufficient nature to warrant the conclusion that the structure of the scientific syllogism is essentially different in nature from syllogistic implication?

As a starting point of our analysis we will take an example of a scientific syllogism and we will analyse the structure of this syllogism and see how it compares with a syllogistic implication. The following expression suggested by Aristotle in the Posterior Analytics will be our example of a scientific syllogism:

> "If all trees in which the sap congeals are deciduous
> And all broad-leaved trees are trees in which the sap congeals,
> Then all broad-leaved trees are deciduous". [1]

At first sight the form or structure of this syllogism seems to be that of syllogistic implication. If its structure is that of syllogistic implication then the truth of the whole expression will be determined by the structuring aspect of the structure in total independence of any extensional or causal relationship that might exist between the constituents of the structured aspect and what they might signify. But Aristotle explicitly states in the Posterior Analytics [2] that it is a necessary condition of a scientific syllogism that the facts stated in the antecedent must be the cause of the fact stated in the consequent. If this

1. Posterior Analytics, 98^b 31-38.
2. Ibid. 71^b 21-22.

relationship of causality between the facts signified by the antecedent and consequent is not present then there is no scientific syllogism. This knowledge of facts through their cause is the kernel of scientific knowledge for Aristotle, and a scientific syllogism is the linguistic presentation of this causal relationship between facts. Thus there is an essential relationship between the very nature of a scientific syllogism and the facts signified by the antecedent and consequent of the syllogism. If there is not a certain relationship between the facts signified by the scientific syllogism then there is no syllogism at all. What exactly is this relationship of causality between the facts, which acts as an essential determinant as to whether a certain type of expression is a scientific syllogism or not? In a scientific syllogism an essential attribute is asserted to exist in a subject and the reason why it is an essential attribute of this subject is stated in the premisses. A certain state of affairs or set of facts is presented as the explanatory factor or ground for the existence of another fact. And if the explanatory state of affairs asserted in the premisses of a scientific syllogism is not the adequate grounds for the existence of the fact asserted in the conclusion then such an expression is not a scientific syllogism. How does this notion of causality - the relationship of ground to consequent - harmonise with his doctrine of the four causes presented in Book Alpha of his Metaphysics? Three of those causes are repeated in [1] the

1. Posterior Analytics, 94^a 20-23.

Analytica Posteriora. But instead of the material cause stated in the Metaphysics we now find that the fourth cause is stated as "the conditions that necessitate a consequent". That this is not another statement of the material cause becomes evident from a passage in the Physics [1] where Aristotle points out that the relationship of a material cause to that whose cause it is, is the converse of the relation of the premisses to the conclusion in a scientific syllogism. The material cause is necessitated by and does not necessitate that whose cause it is. Marble may be the material cause of a statue but there is nothing in marble which necessitates that there be a marble statue. But a marble statue necessitates that its material cause be marble. On the other hand the premisses necessitate and are not necessitated by the conclusion. Because of a certain set of facts presented in the premisses it is absolutely necessary that consequently there must be another fact and this is what the conclusion states.

Nor can the causation which Aristotle attaches to the scientific syllogism be identified with efficient or final causation. In both efficient and final causation there is a temporal difference between cause and effect as stated by Aristotle. [2] He gives us examples. "Why were the Athenians made war on by the Medes? The efficient cause was that they had raided Sardis". [3] "Why does a man walk? In order to be

1. Physics, 200^a 15-30.
2. Posterior Analytics, 94^b 23-26.
3. Ibid. 94^a 36-37

well ... health is the final cause". [1] But in the kind of causation attributed to the scientific syllogism there is no temporal difference or succession. Ground and consequent in the scientific syllogism are eternal and simultaneous. Essences are eternal for Aristotle and their essential attributes are also eternal. And in the scientific syllogism an eternal attribute is asserted to belong to an eternal subject because another eternal attribute of the same subject is more directly apprehended to be possessed by the subject and acts as the ground for asserting that the attribute in the conclusion is also possessed by the subject as an eternal attribute. This eternal ground of an eternal consequent is thus introduced by Aristotle as distinct from his material cause which he speaks of in his treatment elsewhere of causation. In a scientific syllogism a certain attribute, known to be an essential attribute of a subject is used as the ground for asserting another attribute as an essential attribute of the same subject. And, it seems, this ground or explanatory factor acts as a certain type of formal causality. He identifies the ground with the formal cause - the angle in the semicircle is a right angle because it is equal to half of two right angles - its being equal to half of two right angles.[2] The ground or explanatory factor for the attribute asserted of the subject is an element in the formal cause of the subject.[3]

1. Posterior Analytics, 94^b 8-12.
2. Ibid. 94^a 27-35.
3. Ross, W. D., op. cit., page 640.

We can now notice that the form of a scientific syllogism does not play quite the same role as a syllogistic implication. The connectives play the role of determining the nature of the syllogistic implication and prior to the operation of the connectives there is no syllogistic. It is because of these connectives that there is a syllogistic implication. But the form of the scientific syllogism is not responsible in the same measure for the nature of the scientific syllogism. The form may be present and playing its part and yet there may not be a scientific syllogism. Thus the role of the form of the scientific syllogism is narrower than that of the syllogistic implication, and, as we shall now see, the role of the form of the scientific syllogism is distinctly different from the role of the form of the syllogistic implication.

Aristotle's theory of syllogistic implication is built up from term-variables and six functors or connectives. These are, namely, the universal affirmative and negative functors, the particular affirmative and negative functors, and the conjunctional and material implicational functors. A syllogistic implication is a complex expression built up from simple expressions by the operations of conjunction and material implication. The simple expressions are formed by the operations of the universal and particular functors on the term-variables. Throughout his whole syllogistic implicational doctrine the material implicational and conjunctional structure remains constant and within this stabilised

structure all the possible operations of the universal and particular functors are performed on the term-variables. Aristotle's whole doctrine of syllogistic implication is simply this elaboration of all the possible operations that can be performed on the term-variables by the universal and particular functors within the implicational-conjunctional framework.

There is a true syllogistic implication when a combination of the universal and particular functors operate, in accordance with their definition or nature, on the term-variables in such a way that this operation fits into the implicational-conjunctional framework. Certain operations that are performed on the term-variables by certain combinations of the universal and particular functors will not harmonise within the implicational-conjunctional framework and consequently there is no syllogistic implication. When the operation of a combination of the universal and particular functors on term-variables harmonises within the implicational-conjunctional framework then a true syllogistic results. Truth in this context then means that the functors combining to form the structure of syllogistic implication operate, within this combination, in accordance with their definition or nature. The structured or variables have no truth status independently of their being structured to form part of a syllogistic implication and the truth-value of the syllogistic implication does not depend in any way on any relationship that exists

between the constituents of its structured aspect. This is true for two reasons. Firstly, the constituent parts are variables and variables as such have no meaning. Meaning is determined by use. The constituent parts of the formal implication are used by the universal and particular operators and, consequently, derive their meaning from it. Thus their meaning is totally determined by their governing connective. The governing connective uses its constituents solely in virtue of its own nature, and could not bind them in virtue of any relationship the constituents might bear to one another since they are meaningless prior to their being structured by the connective. Secondly, since they are meaningless prior to being used by the connective, then the truth-value of the resulting expression can in no way be based on any relationship of necessity or causality between facts signified by these constituents since they do not, as such, signify any facts. Consequently, in the syllogistic implication the only meaning and relationship that can conceivably exist between the constituents is due wholly to the governing connective. Thus, in the syllogistic implication, any notion of any type of relationship of extensionality or causality between its constituents is excluded as impossible and totally irrelevant to either its structure or truth-value. The structured or variables form part of a structure which is always true because of the very nature of the structuring aspect of the structure. Independently of what permissable

truth-values one may assign to the constituent variables, the structure of syllogistic implication is always true in virtue of the form of the structure alone. Truth within the context of syllogistic implication, is solely and completely determined by and due to the structuring aspect of the syllogistic implication.

At this point one is confronted with the question as to how a true syllogistic implication is to be distinguished from an apparent one. Aristotle's answer is that we prove that an expression is a true syllogistic implication by one of two methods. He accepts the first-figure moods as perfect or self-evident and so asserts them as the axioms of his system. And if an expression which appears to be a syllogistic implication can be reduced to an axiom then it is a true syllogistic implication. All expressions of syllogistic implication other than the axioms were, for him, imperfect (not self-evident) and their truth needed to be exhibited by the process of reduction to the axioms. This process of exhibiting the truth of an imperfect syllogistic implication by reduction to the axioms 'consists in showing that from premisses either the same as in the original syllogism, or inferred immediately by conversion from these, the original conclusion, or one from which it can be immediately inferred, follows in the first figure'.[1] All the imperfect moods can be proved by conversion of premisses so as to give an axiom except the two moods, Bocardo and Baroco and these are proved by 'reductio ad impossibile' which is also regarded as a method of proof

1. An Introduction to Logic, Joseph, H.W.B., Oxford at the Clarendon Press, second edition revised 1925, p.288.

by means of the axioms.[1] This notion of truth within the context of syllogistic implication is distinctly different from the notion of truth with the context of the scientific syllogism which we considered in the last chapter.

Natural truth or the truth of a scientific syllogism means that there is a relationship of adequate conformity between the mind and essences and necessary properties. We analysed this notion of truth in the last chapter. Natural truth is not determined by the form of a scientific syllogism but by the fact that there is a certain definite relationship of conformity between the mind and essences and necessary properties. Prior to its forming part of a scientific syllogism a premiss must have this property of truth.[2] And it is because of the fact that the two premisses have this property of natural truth that the conclusion of a scientific syllogism also has this property of truth.

Consequently, it is not because of a scientific syllogism's form that a scientfiic syllogism is true but because a scientific syllogism represents a relationship of conformity between the mind and essences and necessary properties.

Within the context of this discussion on truth one can now clearly see a very important and significant role or function being performed by the syllogistic implicational form which is not performed by the scientific syllogistic form.

1. Prior Analytics, 29^{a} 30ff.
2. Posterior Analytics, 71^{b} 19-20.

The syllogistic implicational form confers truth on the syllogistic implication and thus performs a vitally important and singularly distinguishing role. Such a characterising role is lacking to the form of the scientific syllogism.

Thus this singular role performed by the syllogistic implicational form and lacking to the scientific syllogistic form is representative of a very important and significant distinction between the syllogistic implicational form and the scientific syllogistic form.

As we have seen in chapter two true knowledge for Aristotle consists in a relationship of conformity between intellect and essences and necessary properties, and such knowledge is characterised by its universality and necessity. Knowledge is externalised and rendered inter-personally communicable by means of the propositions of language. Thus a proposition has meaning because it is used to signify an essence or property or a relationship between essences and properties that is known by the intellect. The structured in a scientific syllogism consists of propositions and these propositions signify or represent a relationship of conformity between the mind and essences and properties. Consequently, each of these propositions, as such, has a definite meaning, which is determined <u>not</u> by their being used in the scientific syllogism but by their use prior to their forming the structured aspect of the scientific syllogism. Thus each of the structured propositions in a scientific syllogism has its meaning independ-

ently of and prior to its being structured into a scientific syllogism. The scientific syllogistic form does not have the role of conferring meaning on the content which it structures but necessarily presupposes that what it structures has meaning prior to its being structured in a scientific syllogism.[1] This follows from the very nature of scientific knowledge. Scientific knowledge proceeds from pre-existing knowledge and this pre-existing knowledge has meaning independently of its being structured by the scientific syllogistic form.

In the case of syllogistic implication variables are structured by the syllogistic implicational form. Prior to their being structured by the syllogistic implicational form the variables are meaningless - they do not have any role of signifying, they do not refer to anything beyond themselves. They are simply variables, having no meaning, as such, but can have a meaning conferred upon them by being used. And this is precisely what the syllogistic implicational form does. The syllogistic implicational form functions or exercises its structuring operation on these variables using them to form the content of a syllogistic implication. The variables are used by the syllogistic implicational form to build up the syllogistic implicational structure and within the context of this structure, as forming the structured aspect of the structure, they are allotted a meaning by the structuring aspect of the structure, that is, by the syllogistic implicational

1. Posterior Analytics, 76^a 31ff.

form. Their role is to represent or signify any universal term, and, hence, this is their meaning. Thus a syllogistic implication does not refer to anything in the universe and tells us nothing about the universe.

We are now aware that the syllogistic implicational form performs another very important and uniquely characterising role of conferring meaning on the structured. This role is foreign to, and cannot be performed by the scientific syllogistic form. This presents us with a second important and irreducibly distinctive difference between the roles performed by the scientific syllogistic form and the syllogistic implicational form.

CHAPTER FIVE

VALUE ASSESSMENT AND THE ARISTOTELIAN SYLLOGISTIC:

In his book 'The Philosophy of Aristotle' Allan says that "in his subdivision of philosophy, Aristotle does not rank logic as a branch of theoretical science". [1] He sees this as no chance omission but as following from the nature of Aristotle's logic. He believes that Aristotle's logic "is not a true science but is of a practical nature, being undertaken in the hope of learning how to reason efficiently and prevail over opponents in debate ... the purpose of the inquiry is to discover the forms of reasoning which are common to all sciences". [2] Thus Allan attributes an instrumental value to Aristotle's logic - it is valuable as an instrument for learning how to reason efficiently and win debates.

Ross asks the question as to "what Aristotle meant to be doing in his logical inquiries. Did he mean to provide a purely contemplative study of the reasoning process, or to aid men in their reasoning"? [3] Though Ross would seem to think that Aristotle's logic is of instrumental value and that "we must remember that Aristotle undertook the study of

1. Allan, D. J., The Philosophy of Aristotle, page 125.
2. Allan, D. J., Ibid. page 125.
3. Ross, W. D., Aristotle's Prior and Posterior Analytics, page 24.

syllogism as a stage on the way to the study of scientific method", [1] yet his view is not quite clear. He says that Aristotle's practical purpose in writing his logic is indicated clearly by the following passage "our programme was to discover some faculty of reasoning about any theme put before us from the most generally accepted premisses that there are".[2] But since scholars believe that the Sophistici Elenchi was written earlier than the Prior Analytics [3] then the above passage would not seem to refer to Aristotle's doctrine of syllogistic implication. Ross goes on to say that Aristotle's attitude to the study of the syllogism in the Prior Analytics is the same as his attitude to logic in the Sophistici Elenchi - the purpose of his logic in the Prior Analytics is "the acquiring of the faculty of discovering syllogisms".[4] And in his next sentence on the same page Ross indicates that he views Aristotle's logic as ancillary to practice - to right thinking. But then he goes on to say, "but a change seems to come over his attitude to logic. In the second book of the Prior Analytics, which scholars believe to be later than the first, ch. 19 seems to be the only one that is definitely practical."[5] Here Ross would seem to be saying that Aristotle gradually began to regard his syllogistic implication as mainly a theoretical doctrine. Yet he does not seem to believe that

1. Ross, W.D., Op. cit., page 33.
2. Aristotle's Sophistici Elenchi, 183^a 37-38.
3. Ross, W.D., op. cit., page 23.
4. Ross, W.D., ibid. page 25.
5. Ross, W.D., ibid. page 25.

Aristotle's logic has only a purely theoretical value.

Kneale would seem to think that the doctrine of the syllogism in the Prior Analytics had value for Aristotle because of its relationship to his doctrine of demonstrative science in the Posterior Analytics. Kneale writes "his interest in working out the forms of argument that depend on the relations between general terms is due, no doubt, to his interest in demonstrative science". [1]

To me it does not seem that Aristotle's doctrine of syllogistic implication gets its value from its relationship to his doctrine of scientific knowledge nor does it get its value from any application or practical use that may be attributed to it. Rather, it is of value because of what it is in itself.

The Aristotelian syllogistic implicational form is a complex operation or structuring mode. Its uniqueness and distinguishing character consists in its dual role or function of conferring truth and meaning on the syllogistic implication which it structures. If the syllogistic implicational form is to find its application as the form of the scientific syllogism then, as the form of the scientific syllogism, it will cease to perform its own characterising dual role. But the complex operation or structuring role of the syllogistic implicational form consists in this dual role of conferring meaning and truth on the syllogistic implication and if, as it

1. Kneale, W. & M. op. cit. page 67.

must if it is to be used as the form of the scientific syllogism, it ceases to perform its dual role then it ceases to be the complex operation that it is, that is, it ceases to be a syllogistic implicational form. Hence the syllogistic implicational form cannot function as the scientific syllogistic form without ceasing to be itself, as there is an irreducible difference between the syllogistic implicational form and the scientific syllogistic form. To attempt to use the syllogistic implicational form as the form of a scientific syllogism involves transforming the syllogistic implicational form to the extent that, as a result of the transforming process, the syllogistic implicational form has been banished from the arena of existence and replaced by an irreducibly distinctive form, that is, the form of the scientific syllogism. Thus to attempt to use the syllogistic implicational form as the form of the scientific syllogism involves qualifying the syllogistic implicational form out of existence. Consequently, the Aristotelian syllogistic doctrine or theory of formal logic cannot be acclaimed useful or of value as providing an instrument of scientific knowledge.

To the pragmatic-minded investigator, who is procedurally determined to estimate value in terms of results or returns, and to whom theory divorced from application is, as such, valueless, who queries the value of Aristotle's theory of syllogistic implication or formal logic what is one to offer? In the light of the reasons elaborated in the pre-

ceding chapters of this work and briefly synopsised in the preceding paragraph, I would suggest that such an investigator terminate his query as to the value of the Aristotelian formal logic since, within the context of such an investigators intellectual framework, the Aristotelian doctrine must be valueless. Such an investigator is making applicational demands which are foreign to the very nature of Aristotle's formal logic and, since these demands do not meet with fulfilment, then, for such an investigator, the Aristotelian doctrine has no value.

What value does Aristotle's doctrine of syllogistic implication have in the estimations of an Aristotelian-minded value-seeker? Like so many other specific questions about Aristotelian thought, an answer to this question will have to be contextually positioned within the overall structure of his philosophical system.

Aristotle visualised the universe as a complex of organisms, each striving to attain the end or purpose assigned to it by nature. The notion of end or purpose derives from his notion of final causality and means that, because each entity is a specific entity, it has a specific nature or essence which has its own specific function or proper and proportionate activity, and the fulfilment of this specific function or proper activity is what Aristotle means by reaching its end or fulfilling its purpose. Within the context of this teleological vision he defines the notion of value or

good. Every activity may be dichotomised into a content and an act. And anything is good or valuable if it is capable of forming or becoming the object or content of any natural act.

For Aristotle man's specific function or the end appropriate to man's nature is that of rational activity. [1] And he divides reason into speculative reason and practical reason. Practical reason is concerned with the intelligent execution of man's actions and with the intelligent transformation of man's environment, and knowledge is sought by the practical reason as the means towards the intelligent performance of actions and the intelligent transformation of the environment. Speculative reason, on the other hand, has nothing to do with the guidance of activity or environmental transformation, and its sole concern is attaining knowledge for its own sake since this is its natural and appropriate activity. Knowledge is an end in itself and sought for its own sake by speculative intellect, whereas knowledge is merely a means (something useful because of its relationship to something else that is desire in itself) for practical reason enabling it to guide actions and environmental transformations properly, and, for Aristotle, an end is more valuable than a means. Consequently, speculative knowledge, being the product of speculative reason's natural activity is more valuable than practical knowledge, which is the product of practical reason,

1. Aristotle's Ethics, The Penguin Classics, page 38.

since speculative knowledge is valuable in itself whereas practical knowledge is valuable only because of its relationship to activity and environmental tranformativity.

We have established that the syllogistic implication, as such, is devoid of practical application as it does not and cannot function as a scientific syllogistic form - it cannot function as a means to an end. The syllogistic implication or Aristotelian theory of formal logic is classifiable as speculative knowledge and, consequently, as an end in itself. And, as an end it is, proportionately, valuable. It forms a particular content of speculative reasoning, and is an end in itself for speculative reason, and, consequently, is valuable or good as it acts as a partial fulfilment of man's purpose or end - that of rational activity. And it makes its contribution to man's fulfilment on the highest level, that is on the level of speculative reasoning.

Thus, for the Aristotelian-minded value-seeker, as opposed to the pragmatic-minded investigator, one can thus portray the very significant and elevated value of Aristotle's theory of formal logic.

For Aristotle, the single-minded quest for knowledge for its own intrinsic worth was the distinguishing characteristic of the genuine philosopher and the most sublime and specifying function that a man could engage in. Within the context of this Aristotelian Weltanschauung a very definite and significant value is attributable to his theory

of formal logic. To dislodge and alienate Aristotle's theory of formal logic from its native environment and drape it in foreign finery is, to the Aristotelian-minded, to engage in useless caricaturization and intellectual fraudulency. Within its native environment Aristotle's formal logic contributes to the fulfilment of 'the natural impulse all men have for knowledge'. [1] For Aristotle " ... to be learning something is the greatest of pleasures not only to the philosopher but also to the rest of mankind ... " [2] and his theory of formal logic or syllogistic implication is contributary to man's greatest of pleasures and, consequently, is proportionately valuable.

1. Aristotle's Metaphysics, Book Alpha 980^{a} 21.
2. Aristotle's Poetics, 1448^{b} 14.

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