HOKKAIDO UNIVERSITY

Title	Aristotele on Explanation : Demonstrative Science and Scientific Inquiry Part II
Author(s)	Chiba, Kei
Citation	北海道大學文學部紀要, 40(2), 1-95
Issue Date	1992-02-05
Doc URL	https://hdl.handle.net/2115/33589
Type	departmental bulletin paper
File Information	40(2)_PL1-95.pdf

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP

北大文学部紀要 40-2 (1992)

Aristotle on Explanation: Demonstrative Science and Scientific Inquiry

Part II

Kei Chiba

TABLE OF CONTENTS

Part II. Methods of Scientific Inquiry into Essence
Introduction 1
Chapter 4. The Method and Range of Heuristic Inquiry
A. Heuristic Knowledge and Demonstration 3
B. The Indispensability of Demonstration in Grasping Essence 16
Chapter 5. Scientific and Metaphysical Approaches to The Self-Explanatory Entity and Its Derivatives 34
A. The Structural Classifications of The Causal Entity 34
B. The Metaphysical Classifications of The Causal Entity 42
Chapter 6. Induction and *Νοῦς*
A. Inductive Syllogism 52
B. How Primary Principles Come to be Known through Inductive Argument 60
Conclusion 72
Appendix The Non-Demonstrability of Essence 77
BIBLIOGRAPHY 89
ACKNOWLEDGEMENTS 93
ABSTRACT 94

Part II. Methods of Scientific Inquiry into Essence

Introduction

In Part I, I have discussed the theoretical and pragmatic aspects of Aristotle's Demonstrative Theory mainly on the basis of *Posterior Analytics* Book A. In Part II, I will discuss the practical aspect of Demonstrative Theory and issues relating to it which are mainly developed in *Posterior Analytics* Book B. In Book B, Aristotle establishes what I will call the heuristic inquiry theory, which is concerned with how one can know the

existence and the essence of a kind (thing/event) by employing demonstration as a tool of inquiry. And he discusses various problems relating to this issue. What Aristotle tries to do in Book B is to present the methods of scientific inquiry into essence as a lesson in scientific practice, in the context of a concrete investigation, so as to supply the material or the content of a demonstrative science whose general and abstract conditions have been systematically discussed in Book A. In this sense, the theory of Demonstrative Science and the practice of Demonstrative Inquiry have complementary roles with regards to Aristotle's philosophy of science and his epistemology.

In Book B, concepts central to the theoretical aspect of Demonstrative Theory, such as "Demonstrative Science" and "epistēmē *simpliciter*" have retreated from the foreground. Even the word "epistēmē" (signifying the knowledge which can be gained by having a single appropriate demonstration which secures only the hypothetical necessity of its conclusion, and thus is a less strict form of knowledge than epistēmē *simpliciter*) is found far less than in Book A. This is because Aristotle is discussing heuristic knowledge which can be compared to the knowledge conveyed by a single demonstration in terms of its cognitive value within the context of heuristic inquiry, without seeking for any gurantee from the ultimate principle of a science. In Book B, cocepts relating to scientific investigation such as inquiry and heuristic knowledge, become the central topic. Aristotle is focusing on particular phases of a science in this book, rather than on the science as a whole. The involvement of demonstration in scientific investigation reveals the practical aspect of Demonstrative Theory. Aristotle's one major concern in Book B is to establish his view of the relation between scientific investigation and demonstration.

In Chapter 4, I will set out the theory of heuristic inquiry on the basis of B1-2 and B8. I will argue that Aristotle constructs his theory of inquiry in terms of the complexity involved in discovery. And I will argue that the reason Aristotle imposes a demonstrative condition on the process of inquiry is to allow for the transformation of heuristic knowledge into demonstrative knowledge. I will show in what sense demonstration is indispensable in grasping the essence of a thing/event in the context of inquiry. In Chapter 5, I will first discuss what kinds of entity Aristotle has in mind when he distinguishes the type whose essence is grasped through demonstration from the type whose essence is grasped by a method other than

demonstration. I will present the method by which heuristic knowledge of the essence of the first kind of entity is articulated in a demonstration. Given that demonstration is not available as a means of grasping for the ultimate entity of a science, we must make clear the nature and function of induction as the alternative method of inquiry. I would like to show in Chapter 6 that the existence and essence of the primary term or the genus term of a science will come to be known through a process of induction which involves a search for something in common among the ingredients of a science so as to unify its extension. In Part II, I will try to make clear the functions of demonstration, definition and induction in the context of heuristic inquiry into essence. (In the Appendix, I will discuss the non-demonstrability of essence.)

Chapter 4. The Method and Range of Heuristic Inquiry

A. Heuristic Knowledge and Demonstration

In B1-2, Aristotle sets out the general plan of his theory of heuristic inquiry. In B1 he sets out the goals and the procedure of inquiry and then in B2 discusses its method and range. The primary aim of *Posterior Analytics* Book B is to construct a method of inquiry which leads, through demonstration, to scientific knowledge of the being and essence of kinds of events such as eclipse or thunder, and of things such as man or God.

In this Chapter, I shall first trace Aristotle's argument concerning the goals and procedure of inquiry. Aristotle's arguments on this subject will naturally raise some questions and puzzles, which have been discussed by commentators. Having raised these puzzles, I shall sketch my own interpretation of the method and range of Aristotle's theory, issues which, it seems, have not, even now, been correctly understood in their entirety.

At the outset of his discussion in B1, Aristotle mentions four goals of inquiry for one who seeks knowledge and turns to the world to find it; then he presents an argument to determine the procedure and the purpose of that inquiry. The four goals of inquiry are as follows: (1) the fact (*τὸ ὅτι*), (2) the reason why (*τὸ διότι*), (3) the existence (*εἰ ἔστι*) (4) the essence (*τί ἐστί*). The inquiry into the fact takes the form of the question "Whether *S* is *P* or not", e.g. "whether the sun is eclipsed or not" Having found the fact, then the reason why is sought in the form of the question "Why *S* is *P*", e.g. "Why the sun is eclipsed". On the other hand, in some cases, the inquiry relates to the simple existence of some object, by asking the

question "whether *S* exists or not", e.g. "Whether a centaur or a god exists or not". And once the object is known to exist, the essence is sought in the form of "What *S* is", e.g. "what a god or a man is". (89b23-35) With respect to the inquiry concerning (1) the fact and (3) existence, whereas in the case of the fact, it is the relation between two terms, i.e. the subject and the predicate, which is at issue, in the case of existence, it is the existence or non-existence of one term, i.e. the subject term, that is at issue. This distinction, however, is just a matter of the way in which the issue is articulated, in the sense that it is the form of the question which varies. As regards the content of the question, the two kinds of inquiry may be the same. For example, the question concerning the fact "Is the sun eclipsed or not?" is the same as the question concerning existence "Does a solar eclipse exist?" (cf. 89b26, 90a25-26) The important thing is the fact that there are cases in which we can ask the same question both in the simple form and in the composite form. When Aristotle lists the items of inquiry, he pays heed to our actual practices in phrasing such questions. Aristotle's use of the qualification "simpliciter" (ἁπλῶς), in contrast to the question "whether it is white or not" (89b33) should also be understood as indicating the simple form.

In B2 Aristotle identifies the questions: (1), (3) with the question: (*X*) "Is there a middle term?" (*εἰ ἔστι μέσον;*) and identifies the questions: (2), (4) with (*Y*) "What is the middle term?" (*τί ἐστι τὸ μέσον;*) (89b38-90a1, 90a5-8)[1] This claim concerning the goals and the process of inquiry can be set out in the following diagram:

$$\begin{array}{ccc} (1) & \rightarrow & (2) \\ = & & = \\ (3) & \rightarrow & (4) \\ = & & = \\ (X) & \rightarrow & (Y) \end{array}$$

Aristotle's ground for the introduction of a piece of syllogistic terminology "the middle term" in B2 and his ground for the claim that "in all searches we seek either if there is a middle term or what the middle term is" (90a 5-6) is that he treats the middle term as being substitutable for the cause (*τὸ αἴτιον*). (90a6-7) Thus the question "whether there is a middle term" is identical with the question "whether there is some cause (*τι αἴτιον*) or not." (90a7-8) (Unfortunately Aristotle does not give any argument in B2

to explain why the questions (1) and (3) are identical with (X).) Aristotle does give a reason for his other claim that the process of inquiry will be from (X) to (Y). (90a8–9) The reason why, once we know that there is some cause, we seek to discover what the cause is, is that the answers to (2) and (4) are the same as the answer to (Y). This is the case with respect to both substance or simple being (*ἁπλῶς τὴν οὐσίαν*) and the *per se* attributes or necessary properties (*τι τῶν καθ' αὐτὸ*) in the sense that these three answers involve the same explanatory element. (90a9–15) The identity of the following three processes is justified in terms of the identity of these three answers:

$$\begin{array}{ccc} (1) & \rightarrow & (2) \\ = & & = \\ (3) & \rightarrow & (4) \\ = & & = \\ (X) & \rightarrow & (Y) \end{array}$$

In order to support this view, Aristotle gives two examples, one of which is taken from astronomy and the other from music. What is an eclipse? Privation of light from the moon as a result of screening by the earth. Why is there an eclipse? or Why is the moon eclipsed? Because the light leaves it when the earth screens it. What is a harmony? An arithmetical ratio between high and low. Why does the high harmonize with the low? Because an arithmetical ratio holds between the high and the low. (90a15–20) As these examples indicate, some specific cause has explanatory power which is equal with regard to both (2) Why? and (4) What?. Indeed, since the answer to both questions is the same, they are identical questions. Thus Aristotle concludes "Now it is clear that everything we seek is a search for a middle term." (90a35)

This is the outline of the goals and processes of Aristotle's inquiry theory which is given in B1–2. At least two puzzles will arise from this plan. (I) What is Aristotle's aim in introducing a piece of syllogistic terminology "the middle term" when he describes the goals and the processes of inquiry? Are only demonstrable things the objects of inquiry theory? Does Aristotle mean that neither accidental events nor single things such as substances like man, which are expressed by a singular term, fall under the scope of his inquiry theory? (II) In what sense, is the inquiry into (1) the fact and (3) existence identical with the inquiry into (X) whether there

is a middle term? What is the minimal set of information needed in order to know (1), (3) and (*X*)?

The introduction of the middle term in B2 has been a cause of difficulty for commentators up to the present day. Some commentators have tried to solve the first puzzle (I) concerning the relation between inquiry and demonstration, but without success.

Ross suggests that the inquiry into (3) existence and (4) essence can be reduced to the inquity into (1) the fact and (2) the reason why, provided that the inquiry is concerned with a complex of subject and attribute, (e.g. being capable of learning grammar in man) or of subject and event (e.g. lunar eclipse). For an attribute or event can exist only in a subject, so that in such a case one is able to seek for the middle term between two terms. He does not, however, conceal his perplexity about Aristotle's treatment of substance:

> But how can *εἰ ἔστι* or *τί ἐστί* applied to a substance be supposed to be concerned with a middle term? A substance does not inhere in anything; there are no two terms between which a middle term is to be found. (p. 612)

Ross supposes that, since in B2 Aristotle gives no example of what he means by the *μέσον* in the case of a substance, and since the application of the questions *εἰ ἔστι* and *τί ἐστί* to substance is overshadowed by its application to attributes and events, Aristotle does not seem to have thought out how it applies to substances. In order to solve this problem, Ross is compelled to propose the all-out substitution of the cause for the middle term, attaching importance to Aristotle's statement that "The middle term is the cause." (90a6-7). He concludes, "By *μέσον* Aristotle means not any and every term that might serve to establish a conclusion." In this way, Ross fails to see any role for demonstration in Aristotle's theory of inquiry and rules substance out of the range of inquiry, saying "He [Aristotle] never, as far as I know, makes the question whether a certain *substance* exists..."; (p. 76) and, again, "the former reference [to substance] has almost receded from Aristotle's mind..." (p. 612) But it is impossible to accept this negative proposal which leaves substance like god or man out of Aristotle's inquiry theory, and cannot explain his use of "middle term", a standard piece of syllogistic terminology.(2)

Now I would like to show that it is not the case that Aristotle leaves

those two puzzles ((I) and (II)) without answering them or at least without indicating some direction in which to look for a solution. The sentence at the beginning of B2 which sums up the argument about the four goals of inquiry is crucial in that it provides the basis for my overall view of Aristotle's theory of inquiry. Aristotle says:

> Now what we inquire about and what, on finding, we know (εὑρόντες ἴσμεν), are these and thus many. (89b36-37)

Here the method and the range of his inquiry theory are summed up. The notion of "discovery" (εὕρεσις) is applied to each of the four items of inquiry, and inquiry is spoken of as being on a par with heuristic knowledge. Themistios says, correctly, that "Every inquiry is for the sake of finding." (p. 42) It is not by chance that Aristotle often mentions the simultaneous grasp of the fact and the reason why. (90a27, 93a17, 35, 88a16, 89b12) This is a manifestation of his interest in the analysis of "discovery". I would claim, and will later confirm, that Aristotle constructs his theory of inquiry from the perspective of heuristic knowledge. He looks at questions from the point of view, as it were, of their answers.

To begin with, it is an important thing to make clear what sort of cognitive power is contained in heuristic knowledge. I take it that heuristic knowledge possesses a kind of cognitive power which is comparable to that possessed by both perceptual grasp and scientific knowledge. In other words, heuristic knowledge covers any sort of knowledge to which the word "discovery" may be applied. On the one hand, Aristotle thinks that our discovering something depends on our having sensations like sight as starting points. He says "We inquire, because we have not perceived it." (90 a25, cf. 88a13, 89b11, 90a28, 99b35) But strictly speaking, discovery or heuristic knowledge does not seem to be regarded by Aristotle simply as being equivalent to perceptual grasp. Perception is no more than a kind of weak heuristic knowledge or rather, simply a necessary condition for discovery in the context of scientific inquiry which concerns universals Perception is concerned only with particulars located at a particular point in time and space. (87b30, 90a29) When he talks about any particular piece of perceptual grasp, Aristotle takes care to add the restriction "now". (88a1, 90a29, 90a30)

Heuristic knowledge (εὑρόντες ἴσμεν) on the other hand can also cover causes which are expressed in universal form. (87b27ff, 89b36-37, 90a24,

93a35-36) The cognitive faculty of heuristic knowledge works by triggering perception to grasp the universal as something which is able to reveal the cause of some thing/event. (88a5) Aristotle describes the cognitive faculty of discovery as follows: "In some cases if we saw, we would not have sought, not on the ground that we knew by seeing, but that we grasped the universal from seeing." (88a12-14) This kind of discovery works by triggering perception, memory and experience; that is, by a process of induction performed by the faculty of reason (*διάνοια, νοήσις*). (cf. B19, *An. Pri.* A30 46a17-27) Given that perception cannot grasp a cause as a cause, because it is a universal (cf. 85b26), it is a function of reason to discover the cause, set out in universal form, and so furthest removed from sensation, as the true cause of something. (cf. 85b26, 86a29, 88a5) For example, if we were on the moon, we could perceive the earth screening the moon from the sun. This is, however, nothing but a sort of perceptual grasp of a particular fact. Aristotle says; "If we were on the moon and saw the earth screening it, we would not know the cause of the eclipse," (87b39-88a1) In order to grasp it as the reason why of the lunar eclipse, some insight which hits on the cause as a universal is required. If we know the reason why simultaneously with the fact, when we see the earth screening the moon, it is because "from perceiving, it would come about that we knew the universal too." (90a28-29)

The faculty which grasps the universal at once, triggering sensation, is called "acumen" (*ἀγχίνοιά*). (89b10) It is a sort of quick wit, which at once acquires something comparable to scientific knowledge (*ἐπιστήμη*) of the kind which demonstration is supposed to bring, but dispensing with the procedure of demonstration. Acumen works, for example, when someone who sees that the moon always holds its bright side toward the sun, quickly grasps why this is: i.e. because it gets its light from the sun. (89b11-13)[3] Because of this cognitive power, heuristic knowledge may be compared to scientific knowledge. The goals of inquiry are said to be the object of both heuristic knowledge (*εὑρόντες ἴσμεν*) and scientific knowledge (*ἐπιστάμεθα*). (89b23, 36) That is why, Aristotle even says that "Once the phenomena were adequately apprehended, the demonstration of astronomy was discovered (*εὑρέθησαν*)." (*An. Pri.* A30 46a20-21)

The rich range of possibilities covered by the notion of "discovery" gives a solution to a part of the first puzzle (I) raised by Ross, concerning the possibility of inquiring into a substance which is denoted by a singular

term. The variety of cognitive possibilities offered by heuristic knowledge are described as follows; "As to existence, sometimes we grasp this incidentally, and sometimes when grasping something of the thing itself." (93a 21-22) The sentence shows that according to the degree of strictness in the inquirer's attitude, which is revealed in the way he assesses knowledge which he has acquired earlier on, and according to the degree of difficulty involved in the case, there are different grades of understanding which may be manifested by the subject when he discovers the existence of some object. And we can also conclude from this passage that when we discover the existence of something by utilising sensation or some other faculty, we do not find out its existence only. In fact, the discovery of the existence of a thing/event is always accompanied by some concomitant knowledge, such as knowledge of its accidental or essential properties. Or rather, the existence of a thing/event is known by means of its accidental or essential features. This implies that it is not the case that the description of what the inquirer grasps when he grasps the existence of some object, must be couched in the simple form, e.g. "Man exists." That is, there is room for syllogism to play a role in the process of inquiry in that any heuristic understanding can be expressed in predicative terms, e.g. "Man is an animal." This point will be discussed in more detail later on.

Because scholars have failed to recognise the possibility of different degrees of discovery leading up to the grasp of the cause, they have been perplexed by some passages of Aristotle's inquiry theory. Aristotle constructs his inquiry theory, keeping the notion of discovery in mind; or rather he constructs it from the perspective of discovery. In the *Analytics*, Aristotle looks at "the question" from the direction of "the answer." To view things from the perspective of discovery is essential for an understanding of his theory. The process of formulating a demonstration is supposed to be built into the theory of heuristic inquiry. That is, when the inquirer engages in his search for the cause of some thing/event, he is at the same time seeking to formulate a demonstration of it, applying syllogistic terms to the observed items. Aristotle says "For seeing the extreme terms [major and minor terms] he becomes familiar with all the explanatory middle terms." (89b14-15) In other words, an inquiry proceeds in accordance with the way in which the object in question is to be articulated in a syllogism. So, given that the final goal of inquiry is the "search for the middle term" (90 a35) and given that discovery is on a par with inquiry, we are entitled to

say that "we inquire for a demonstration". (cf. 87b37)

However when Aristotle talks about heuristic knowledge, he is careful to avoid the word epistēmē and to use words which signify a less strict form of knowledge than epistēmē such as *γνωρίζω*, *οἶδα* and their cognates, or words which signify grasping, such as *ἔχω*, *λαμβάνω* and their cognates. (89b28, 29, 34, 36, 38, 90a8, 22, 28, 93a17-29, 35-36. 93b33) The fact that we rarely find word "epistēmē" in Book B tells us that Aristotle's investigation of heuristic knowledge has not placed it within the framework provided by the apodeictic structure of explanation which we have looked at in Part I.

If heuristic knowledge and demonstrative knowledge are related to each other in the way as I have described so far, we can understand why Aristotle introduces a piece of syllogistic terminology: "the middle term" in the context of his theory of inquiry. Aristotle does so because he intends to elevate heuristic knowledge, which may vary a great deal in terms of its cognitive power, to the level of scientific knowledge. In other words, Aristotle puts cognitive conditions such as (*X*) and (*Y*) on heuristic knowledge in order to refine it into scientific knowledge. In this sense, demonstration is to be seen as a tool for scientific investigation. This is the practical aspect of Demonstrative Theory.

Thus, the method involved in Aristotle's inquiry is a heuristic one, accompanied by the procedure of demonstration, and the object and range of inquiry are those of discovery. If, contrary to the traditional view, Aristotle treated the notion of discovery as prior to demonstrative theory as providing the perspective from which we can view the theory of inquiry, then the range covered by inquiry would differ from the traditional interpretation. Since there is nothing in the world which is excluded *de jure* from being the object of discovery, the range of Aristotle's inquiry theory is "the whole object" (100b15) i.e. the universe. In other words, the domain of inquiry is the concrete and actual world that we can see in all its variety. Aristotle claims that the identification of the cause with the middle term will hold for all inquiries, given that the cause of (a) a substance, which is a simple being (*ἁπλῶς τὴν οὐσίαν*) or (b) a *per se* [necessary] event/property (*τι τῶν καθ' αὑτό*) or (c) an accidental event/property (*τι τῶν κατὰ συμβεβηκός*), the three of which seem to constitute the whole universe, is the middle term. (90a9-11)[4] Examples of (a) substance, which is here regarded as the "underlying", are moon, earth, sun and triangle. Examples of (b) *per*

se events/properties are an eclipse, being in the middle or not, two right angles or "larger or smaller" and equality or inequality [alternative attributes of a pair of triangles]. (90a12-14, 90a33-34) No example of (c) is given at this point (90a12-14, 90a32-34), but the following cases may be good examples of (c): when someone is talking to a rich man, the explanation may be that he is borrowing money from him; if two men are friends, the explanation may be that they are enmemies of the same man. (89b13-15, cf. 94a36-b8) In these cases, since the explanations are accidental, as well as the events, each of these events may have a dialectical syllogism which has a probable middle term; but they cannot have demonstrations, for demonstration is concerned with necessity. For it is not necessarily the case, for instance, that whenever someone is talking to a rich man, he is borrowing money from him. But this does not mean that accidental properties are not objects of Aristotle's inquiry theory, though they are certainly not candidates for scientific knowledge. They will be dealt with by a variant of his theory of demonstration, as allowing for a less strict kind of knowledge than demonstrative knowledge, so long as the middle term is discovered. In fact in one passage Aristotle says that "Of things which are or come to be by accident, the cause also is accidental." (*Met.* E2 1027a7-9)[5] Therefore, when we engage in inquiry, whether its object is a substance, such as god or man, or an event, such as eclipse or night, or an attribute (either necessary or accidental), such as two right angles, and whether the first step of discovery is sensation, reason or revelation, all will fall within the range of Aristotle's concept of inquiry— the search for being. (cf. 89b26, 32, 35, 90a5, 33)

One reason commentators have been perplexed about the range of Aristotle's inquiry theory is the fact that, since Aristotle develops his inquiry theory in syllogistic terms in the *Analytics*, they were unable to come to a correct view concerning the relation between his heuristic inquiry theory and his theory of demonstration. In other words, scholars seem to have overlooked the fact that the method of inquiry which is developed in B1-2 is that of a heuristic inquiry whose range is the whole universe (*τὸ πᾶν πρᾶγμα*). (100b16) For example, in his commentary on the four questions "a in B1, Barnes construes the passage as referring not to an inquirer but to demonstrator" who asks the questions listed here. He goes on to say, omitting the word "*οὐσία* (substance)" from B2 90a10, "B2 makes it clear that only syllogistic propositions are in question." and "B1-2 are restricted to mediable

propositions." And his understanding of B1 is based on his own particular interpretation of B2: that is, he deals with the inquiry within the framework, or from the perspective, of the demonstrative theory, and in so doing detaches it, by one step, from the actual world. It would seem, therefore, that Barnes sees Aristotle as going in the opposite direction from the one he actually takes in developing his inquiry, and so fails to realize the range of the theory. In contrast, I construe B2 (which is the focus of the controversy) also as being developed, not from the perspective of demonstrative theory, but rather from that of heuristic inquiry. The formation of a demonstration is the epistemological condition to be satisfied by heuristic knowledge if it is to become scientific knowledge.

Now let us look at the second puzzle (II). In what sense is inquiring into or knowing (1) the fact and (3) existence identical to inquiring into or knowing (X) whether there is a middle term? What is the minimal amount of information needed for knowledge of (1), (3) and (X)? The solution to this problem is, in a sense, contained in the solution to the first puzzle (I) which I have been discussing so far. In answering the first puzzle, I argued that knowledge of (X) or (Y) is an epistemological condition for knowledge of (1) and (3) or (2) and (4), if heuristic knowledge is to become scientific knowledge. This epistemological condition ultimately derives from Aristotle's basic strategy in constructing his inquiry theory: approaching the question from the perspective of the answer, or the standpoint of successful inquiry. If this interpretation of the relation between (1), (3) and (X) is right, it is knowing (X) which allows for knowledge of (1) and (3). Hence knowing (X) will be a prerequisite for, rather than a consequence of knowledge of (1) and (3). This view has a good parallel in the case of (2), (4) and (Y). Aristotle argues that, since knowledge of (Y) provides the answers to both (2) and (4), in the sense that it possesses the same explanatory content and value as those answers, it follows that all three questions are the same. (90a14-23, 30-31) Likewise, since knowledge of (X) provides the answers to both (1) and (3), all three questions are the same. In this way, Aristotle looks at the question from the viewpoint of the answer, in the sense that sameness of answer establishes sameness of question.

The fact that knowing (X) is a prerequisite for knowledge of (1) and (3) is concerned with the complexity involved in discovery. The variety of situations in which discovery and heuristic knowledge may come about is the key to a correct understanding of Aristotle's theory of inquiry. If at

the same time as discovering some thing/event we discover a cause or explanation of that thing/event, we are entitled to say that we know (1) the fact or (3) its existence as well as that there is some cause for it. Aristotle leaves out the definite article in describing the question (*X*) in the following sentence "It results, therefore, that in all our searches we seek either if there is a middle term (*εἰ ἔστι μέσον*) or what the middle term is (*τί ἐστι τὸ μέσον*)." (90a5-6) This suggests that the inquirer is not required to know the existence of the cause of the relevant object of inquiry, but to discover some element of the causal chain connecting the effect and the cause which he is supposed to know at the final stage of inquiry.[6] For instance, the fact that the moon is eclipsed will be known, when the inquirer grasps "inability to cast shadow at full moon with nothing obvious in between" as a middle term. (93a36-b3) This is because this discovery gives sufficient information to explain the fact of the eclipse i.e. the total darkness of the surroundings, by at least pointing towards the fact that the moon is responsible for the darkness. But this middle term does not offer necessary and sufficient conditions for the eclipse. For an eclipse can take place even if the moon is not full, or if there are clouds in between. In order to attain demonstrative knowledge in this case, we must discover "the screening of the moon from the sun by the earth" as the middle term. But in this case the inquirer can at least set off in the right direction in investigating the eclipse by finding a middle term which is sufficient to make known the fact of an eclipse. Therefore, when Aristotle says "Is it eclipsed? [i.e.] Is there some cause (*τι αἴτιον*) or not? After these inquiries, knowing that there is some (*τι*), we seek what it is." (90a8-9), I take it that what he means by knowing the existence of some cause is grasping some causal or explanatory element(s) relating to the phenomenon which carries sufficient information to make known the existence of the phenomenon.

This interpretation will be endorsed by a close examination of Aristotle's argument in B8. In B8 Aristotle discusses how we come to know each of the four goals of inquiry, given that the goals and the processes of inquiry are made clear in B1 and that knowledge of (*X*) and (*Y*) is established as a cognitive condition on knowledge of the four items in B2. The resolution of this problem will necessarily reveal the answer to the first (I) and second (II) puzzles.

Notes.

(1). As regards the reading of B2 90a2, I follow MSS's and Bekker's reading *λέγω δὲ τὸ ὅτι ἢ εἰ ἔστιν* for Ross's *λέγω τὸ ὅτι ἐστί*. The passage runs as follows: "Whenever we become aware of either the fact or if it exists, —either partially or *simpliciter*— (*ἢ τὸ ὅτι ἢ εἰ ἔστιν, ἢ τὸ ἐπὶ μέρους ἢ τὸ ἁπλῶς*), and again seek the reason why or the essence, then we seek what the middle term is. (I mean by the fact or if it exists that it is partially and *simpliciter* (*τὸ ὅτι ἢ εἰ ἔστιν ἐπὶ μέρους καὶ ἁπλῶς*)." (89b38–90a3) Waitz reads this sentence as MSS., and Bekker do. But he argues on the basis of this sentence that *τὸ ὅτι ἐστί* is ambiguous (ambiguum est enim *τὸ ὅτι ἐστί*) in that it signifies both the existential use (rem ipsam existere) and the predicative use (alterum de altero praedicari) of *εἶναι*. (p. 394) This is because Waitz takes it that each of *τὸ ὅτι* and *εἰ ἔστιν* can be combined with both "simpliciter" and "partially". But this reading is wrong. For Waitz confuses the expression "*τὸ ὅτι*" which stands for "the fact" with the expression "(*τὸ*) *ὅτι ἐστί*" which stands for "the existence". In the context of the inquiry theory which is developed in Book B, Aristotle restricts the expression *εἰ ἔστι* to the existential use, by saying that "I mean "*εἰ ἔστιν ἢ μὴ*" in the sense of *simpliciter*, and not [partially e.g.] if it is white or not." (89b33, cf. 89b38, 90a9–10) Hence it is not possible to combine *εἰ ἔστιν* and *τὸ ἐπὶ μέρους* in Aristotle's inquiry theory. We can find no place where *τὸ ὅτι ἐστί* is employed to express the predicative use of *εἶναι*. (Concerning the reading of 91a1–2, I follow the codex A and B.) The expression "*τὸ ὅτι ἐστί*" is stated from the perspective of discovery or the answer to the question of existence.

What should also be noted here is that when Aristotle says "what is the middle term?" (*τί ἐστι τὸ μέσον;*) (90a6, cf. 90a1, 9), one should not confuse the wording of this question with that concerning (4) the essence (*τί ἐστί*). In this question, what is at issue is the discovery of some specific instance of some thing/event and this interrogative *τί ἐστί* does not have any technical sense as it does in the case of the essence.

(2). Goméz-Lobo also makes some criticisms of Ross' proposal. ([2] pp. 72 ff) First, Aristotle repeats four times that he is referring to "all" *τὰ ζητούμενα* already mentioned in B1 (90a5, 7, 14, 35). Second, he mentions substance and examples of subtances in line 90a4–5, 10 and 12–13. Third, when he states explicitly the coincidence of the what and why questions, he makes clear that it holds not only for those things addressed by questions (1) and (2), but also for those addressed by (3) and (4). These remarks will be textual evidence for the continuity of B1 and B2, and substance's being an object of inquiry, though I have a different view on the interpretation of "all" in 90a14 mentioned in Goméz-Lobo's first criticism of Ross as I shall

explain later. These criticisms of Goméz-Lobo's, based on the wording of B2, however, do not seem to be fair to Ross, given that Ross himself admits the occurrence of substance in B2, saying "traces of it [substance] still remain." (p. 612)

But Goméz-Lobo's own proposed solution cannot be accepted. He presents the present problem as follows: "How can there be a middle term between a single term and the predicate 'exists'?" (p. 73) Then Lobo proposes a new reading of *εἰ ἔστι* which he regards as the only possibility which remains, if Ross' solution is not accepted. Although traditionally, we have understood the example of *εἰ ἔστι* (89b37) in an existential sence, e.g. "Does a centaur or a god exist or not?", Goméz-Lobo interprets the question *εἰ ἔστι*? in a predicative way, as *identifying* something as such and such, a task which is normally accomplished by predicating a substanital (or quasi-substantial) term of an as yet unidentified subject, e.g. "Whether y is or is not (a) centaur or (a) god " (p. 79) However, since if we read *εἰ ἔστι* as existential, I do not accept that Ross' negative conclusion follows, I will not discuss Goméz-Lobo's opinion in detail here. Many other passages in which the phrase occurs (e.g. 83a33, *Met.* 1025b26) apart from passages admitted as having an existential sense by Goméz-Lobo seem to indicate that the passage under consideration should also be read as existential. Further, the actual situations in which we in fact seek for and ask about the existence of something in the actual world afford a basis for the easiest and most crucial criticism of Goméz-Lobo. When Aristotle, for instance, asks "*εἰ ἔστι ἁπλῶς*" of a god, his concern must be to discover the existence of a god and not to identify something white, say, as a god. (89b32–33, cf. *Soph. El.* 5 167a4–6)

(3). Aristotle, needless to say, regards the repetition of experimental observations in order to reach the universal which makes clear the true cause as a kind/method of discovery, saying "I do not, of course, deny that by watching the frequent recurrence of this event we might, after hunting for a universal, possess a demonstration." (88a3–5) Thus acumen and the repetition of experimental observation should be taken as complementary.

(4). When Barnes omits *οὐσία* from this text, he fails to recognise the range of Aristotle's theory of inquiry. (p. 53) Ross is also mistaken in understanding *οὐσία* as "a thing's substantial nature". (p. 611) Ross does not take into consideration the expressions "*simpliciter*" in 90a10 or "the underlying" in 90a12 and "*simpliciter* and not one of the things that belong to it" in 90a32. These expressions undoubtedly indicate "substance" which is the independent "underlying".

(5). As a contrasted view, see R. Sorabji Chapter 1.

(6). We should not introduce here the actual-potential distinction with regard to the knowledge of the cause, as Zabarella does. Zabarella says;

"When we discover the thing exists, we discover that there is some cause, by means of which thing exists, but in this way the cause is not actually known, but potentially." (p. 1046) Zabarella's reading is misleading, because the distinction between knowledge of the existence of some cause and the knowledge of a specific cause is of a different type from technical concept arising from Aristotle's actual-potential principle. In the former case, to know the existence of some cause, is not yet to identify or specify any particular cause; the content of that knowledge may be just that there is a cause, whatever it is. Whereas potential knowledge in the Aristotelian sense involves the same content as actual knowledge, since potential knowledge is knowledge of something which is supposed to be actually known later on.

B. The Indispensability of Demonstration in Grasping Essence

One of the main concerns of B8 is to clarify the way in which essence, whether it is of a substance like man or soul or of an event like an eclipse or thunder, is set out in the terms of a demonstration. (cf. 93a14-b20[1] 96a20-22) In other words, Aristotle there discusses how a demonstration of the essence is possible. (93a15-16) In this section, I will show that, in B8, Aristotle develops the theory of heuristic inquiry in a way which reflects the kind of complexity involved in discovering the existence of a thing/event, as described in B1-2. To do this is just to show how demonstration is related to definition, or why the forming of a demonstration is indispensable in grasping essence. Then I will establish that the discussion in B8 endorses the views which I have developed in the previous section regarding the solution to the two puzzles: (I) the relation between inquiry and demonstration especially in terms of the knowledge to which they give rise and (II) the identification made between the inquiry into (1) the fact or (3) existence and the inquiry into (X) the existence of a middle term of the fact/existence.

The discussion in B8 presupposes both the general plan of heuristic inquiry set out in B1-2 and the aporetic discussions concerning demonstration and definition in B3-7. In the aporetic chapters B3-7, Aristotle examines the nature and function of definition and demonstration so as to make clear in what way definition and demonstration are related to each other. At the beginning of B3, he states the goal of his inquiry on the basis of his argument in B1-2; "Now it is clear that everything we seek is a search for a middle term". (90a35-36) Then he presents the three

main themes of his theory. The discussions that follow focus on the following issues: (90a36–38)

(A) How does one prove essence?

(B) In what way may one set out the essence of something in demonstration? (cf. B13 96a20)

(C) What, and of what, is definition?

For Aristotle, to construct a theory of inquiry is just to elucidate these three themes in accordance with the heuristic approach. Aristotle begins his discussion in B3 by suggesting some philosophical difficulties (ἀπορίαι) which are inevitably raised by these topics. Aristotle sets out three aporiai in B3 as follows: Can one know the same thing in the same respect by definition and by demonstration? Is there demonstration of everything of which there is definition? If the objects of definition and demonstration are not all the same, are some of them the same? These aporiai are raised in connection with the relation between definition and demonstration. This is because, given that goal of the theory of inquiry is to find out the essence of a thing/event, which is supposed to be made clear by definition, and given that demonstration is indispensable for scientific knowledge, involving, as it does, a grasp of the cause and necessity of what is known, it is the demonstrability of essence which is the main issue raised by questions (A) and (B).

Aristotle's initial answers in B3 are negative in every case: he concludes that the functions and the objects of definition and demonstration are different. (91a7–11) In B4, Aristotle shows why demonstration cannot demonstrate essence and then he presents and examines some methods such as those of induction and division, which might be claimed to be capable of giving proofs of essence, whether or not they are his own creations. His assessment of these theories is again negative.

In B7, Aristotle proposes four arguments to show the split between the functions of definition and demonstration. B7 has both a positive and a negative contribution to make in clarifying the relations between demonstration and definition and between an account of what a name signifies and definition in the context of the inquiry theory. Here Aristotle makes an unnecessary division between demonstration and definition, by limiting their functions with respect to each other too literally. In order to shed light on the contrast between them, Aristotle brings in the three crucial items in his theory of inquiry: non-existence, existence and essence. Each

of the three has its own method by means of which it may be elucidated. At the initial stage of inquiry, an account is given of what is signified by the name of the object of inquiry, regardless of whether it exists or not. At the second stage, the existence of the object is established by demonstration. At the final stage of inquiry, its essence is made clear by definition. In this discussion, Aristotle makes clear that the account of what the object's name signifies can be identical with its definition in terms of its actual description (92b32-33), though since one cannot grasp essence without passing the stage of grasping existence, the ontological status of the content of the account of what the name signifies and the one of definition is different and its difference will never be buried. (92b4-5, 26-34, 93b29-37)(2) By assigning a distinctive method to each of the three items in such a restrictive way, Aristotle draws the paradoxical conclusion that, given that the knowledge of the essence of a thing/event presupposes the knowledge of its existence, and given that to establish its existence is not the job of definition, but of demonstration cannot even make clear its essence. Aristotle's negative conclusion at the end of these aporetic chapters B3-7 is as follows;

> From this, then, it is evident that definition and syllogism are not the same, and that syllogism and definition are not of the same thing; and in addition, that definition neither demonstrates nor proves anything, and that you can become aware of the essence neither by definition nor by demonstration. (92b35-38)

At the beginning of B8, Aristotle summarizes the subjects of his investigation as follows; "We must inquire again:

(D) which of these points [raised in B3-7] is correctly argued and which not correctly.

(E) and what a definition is.

(F) and whether there is in a sense (πως) demonstration and definition of the essence, or in no way at all." (93a1-3)

Question (D) shows that the aporetic chapters B3-7 prepare for B8-10. (E), which is discussed in B10, may suggest that Aristotle thinks that it is necessary to present a systematic account of definition to establish his theory of inquiry. And (F) identifies the central issue of the theory, without an answer to which the theory cannot be complete. In B8 he investigates (F) and the resolution to this issue will give the answer to (D) and to some extent (E).

Aristotle starts his investigation of (F), by presenting what I take to be the logical conditions on being a demonstration and by delimiting the range of essences which are susceptible to demonstration. What Aristotle says in 93a4-9 is as follows;

> [*P*]; *Since,* as we said, to know the essence of *X* is and to know the cause of if *X* exists are the same. ([*Q*])·····[*P′*]; the reason for this is that there is some cause *C*, and this is either (*α*) the same thing [as *X* of which *C* is the cause] or (*β*) something else from *X*, and if the cause *C* is something else, the cause *C* is either demonstrable or non-demonstrable·····[*R*]; if, then, the cause *C* is something else and it is possible to demonstrate the cause *C*, [*S*]; it is necessary for the cause [of *C*] to be a middle term and the cause *C* is proved in the first figure; for what is being proved is both universal and affirmative.

In [*P*] Aristotle recalls the basic standpoint of his theory of inquiry which was stated in B2; "to know the essence of *X* and to know the cause of if it exists are the same" (93a4). (cf. to know the essence is the same as ⟨to know⟩ the reason why." (90a31-2, cf. 90a15) However, in this paragraph, this clause appears as the antecedent of a "because" sentence, introduced by "Since.. ": [*P*]; but there does not seem to be a consequent: [*Q*] to follow. Someone might wish to supplement [*P*] with the following consequent, adopting suggestions made by Philoponos and Barnes in a slightly revised form; [*Q*] "There is in a sense (*πως*) demonstration of the essence (*ἀπόδειξις τοῦ τί ἐστί*)" (cf. 93a2-3, 94a2, 94a14-15) Philoponos supplements [*P*] as follows; "it is possible that demonstration of definition comes about." (p. 365) Barnes makes a similar addition: "You can in a sense demonstrate what *X* is" (p. 207) And an exponent of this view might say that [*P′*] gives the reason for the tacit consequent [*Q*], especially with respect to the restriction "in a sense" (*πως*) which is taken from a3, the idea being that there is some kind of cause such as essence which can be treated somehow [e.g not as a conclusion of a demonstration] in a demonstration. Then the whole sentence will be as follows; "Since, as we said, to know the essence of *X* and to know the cause of if *X* exists are the same, there is in a sense demonstration of the essence." As well as using [*P′*] to delimit the range of demonstration, the exponent of this view may give an argument for this tacit consequent as follows;

(P1). Demonstration actually makes clear "the cause of if *X* (a thing/

event as a kind) exists" (="why X is" (90a15, 31-32)). (93b38-94a2, 85b23-24, 88a2-6)

(P2). Definition actually makes clear the essence of X (=what a X is). (B10, 91a1)

(P3). "Why X is" (the reason why of X) and "what X is" (the essence of X) are the same. (90a14-15, 90a31-32, 93a3-4)

(C). There is in a sense demonstration of the essence of X.

Zabarella, however, objects to understanding any consequent here. He does not think that anything should be added to this passage: "Aristotle's sentence is perfect." (p. 1110) This is because the consequent which corresponds to [P] comprises [R] and [S]. And Zabarella takes it that [P'] gives the reason for [P]. In other words, the exponent of the first view understands Aristotle's argument as:

$$[((P \wedge P') \rightarrow Q) \wedge (R \rightarrow S)],$$

whereas Zabarella understands it as:

$$[(P' \rightarrow P) \wedge ((P \wedge R) \rightarrow S))].$$

I agree with Zabarella for a number of reasons. One is the neatness of the argument. If we insert [Q], the argument will not flow smoothly as it does on Zabarella's version. Secondly, to think that "*this*" in "the reason for *this*" in [P'] refers to the tacit consequent [Q] is unnatural, provided one can explain in what sense [P'] gives the reason for [P] i.e. the identity of the essence and the cause of existence. Thirdly, what Aristotle aims to do in this quoted paragraph in which he starts to discuss the possibility of the demonstration of essence is to present the conditions on being a demonstration from the causal perspective. That is, the consequence of this paragraph [S] contains two logical conditions on demonstration: Firstly, the cause must occupy the position of the middle term and secondly the proof must be carried out in the first figure *Barbara*. If so, it is wrong to deduce [Q], which is the conclusion of the whole discussion, i.e. that "there is in a sense demonstration of the essence", before Aristotle has set out the logical conditions which make it possible.

Concerning the question how [P'] explains [P], my reading is a little wider than Zabarella's. The phrase "the reason for this" explains not simply the identity between (2) the reason why (or the cause of the existence) and (4) the essence, but also why Aristotle mentions this identity in the

context of discussion about the possibility of demonstrating essence. This identity is mentioned here in order to show that Aristotle is investigating this possibility from the causal perspective, given that demonstration, no matter what its object is, has the role of causal explanation in the apodeictic structure of Demonstrative Science. Hence Aristotle, by quoting the passage from B2, confirms that essence can be treated within the causal framework. Since the issue here is the possibility of demonstrating essence, it is necessary to classify different types of cause, in order to explain where each type of cause fits into the system of causal explanation, and to clarify which kind of cause, as essence, is capable of being demonstrated. Causes are classified into three groups (α) the cause which is identical with its effect and (β) the cause which is something other than its effect; the second category is subdivided into two groups: ($\beta 1$) demonstrable causes and ($\beta 2$) non-demonstrable causes.

A point to be made here is that Aristotle does not classify causes according to metaphysical principles such as form and matter, actuality and potentiality, but in accordance with the structure of Demonstrative Science, that is, the system of causal explanation. (cf. B9) Therefore, I would conclude that in giving "the reason for this" in [P'], Aristotle is offering the reason for his appeal to the identity between the essence and the causes of existence in investigating the possibility of demonstrating essence. That is, Aristotle puts the discussion in a causal context in the sense that he indicates how the essence can be treated within the causal structure of Demonstrative Science. This implicitly suggests that as far as an existing thing has a cause, the cause offers the same answer to both the questions (2) Why? and (4) What?. This also allows the inclusion of another premise [R] which tells us which cause, as essence, can be the object of demonstration. How the three groups of causes are divided up will be discussed in the next chapter. For present purposes, it is sufficient to confirm that in this paragraph Aristotle has set out the logical conditions for being a demonstration and fixed the range of the cause which is proved by the demonstration within the causal explanatory system of Demonstrative Science. That is, when the inquirer tries to demonstrate the essence of some thing/event, the cause must be put in the position of the middle term and the proof must be carried out in the syllogistic form of the first figure *Barbara*; demonstration of essence will be given in the case of causal entities of type ($\beta 1$).

Aristotle presents two ways of proving essence which satisfy the above conditions in B8. He rejects the first method, which he calls "formal syllogism", on the ground that it commits *petitio principii.* (93a8-15) (cf. the Appendix) In this section, I will examine Aristotle's second account of how there can be a demonstration of essence, which he describes in B8 93a15-b20. Although demonstration and definition have been treated as being in sharp contrast in the aporematic chapters B3-7, I take it that Aristotle himself is not committed to the view suggested by these alleged difficulties, which is summarised at the end of the aporetic chapters: "one can become aware of the essence neither by definition nor demonstration." (92b38) This is because the difficulties and puzzles concerning the relation between demonstration and definition in B3-7 arise from a simplified interpretation of their functions. That is, while the function of demonstration is confined to establishing the existence of a thing/event and thus has nothing to do with essence, the function of definition is to reveal the essence of a thing/kind and thus nothing to do with existence. But since one cannot know the essence of a thing/event without knowing whether it exists, definition cannot reveal the essence either. (92b4-34) Therefore, in order to overcome this difficulty, it is essential to make clear how knowledge of the existence of a thing/event and knowledge of its essence are related. Aristotle attempts to do this by appealing to the function of the theory of heuristic inquiry which is developed in B1-2, and he tries to show why and how a normal demonstration can be employed to prove essence.

His second method falls into two parts which are set out in 93a16-29 and 93a29-b14. In the first part, Aristotle develops the theory of heuristic inquiry so as to set out the process involved in grasping the existence and the essence of a thing/event in a continuous fashion. In the second part, Aristotle actually presents some demonstrations which might be formulated in a process of inquiry so that he can show how demonstration is employed to prove essence. Then he concludes that in the case of a thing whose cause is different from itself, i.e. an entity of type (β), one cannot reveal its essence without employing a demonstration. I take it that the demonstration which is employed to establish the essence of something here reveals the practical aspect of Demonstrative Theory.

Aristotle starts by reminding us of the four items of inquiry and the process of inquiry as it is set out in B1-2. (93a16ff) He makes a fresh start. with the following words: "Let us say in what way demonstration

of essence is possible, speaking again from the beginning." (93a15-16) Here he gets back to the context of heuristic inquiry as it is discussed in B1-2. Unlike B1-2, Aristotle describes the two processes in a negative way by saying that unless we already know (1) the fact, we cannot know (2) the reason why; and again, without knowing (3) existence, we cannot know (4) the essence. (93a19-20) This is because he wants to show that the possession of a demonstration, whose role is officially supposed to be to demonstrate (1) the fact and (2) existence, is indispensable for attaining knowledge of the essence. As a first step towards achieving this task, Aristotle unifies the two processes into a single process which concerns both the existence (*ὅτι ἐστί, εἰ ἔστι*) and the essence (*τί ἐστί, τὸ τί ἦν εἶναι*). Two considerations make this unification of inquiry possible for Aristotle. Firstly, he identifies *τί ἐστί* with *διὰ τί ἔστιν* (90a15) as well as identifying *τί ἐστί* with *τὸ τί ἦν εἶναι*. (cf. Chapter 2 Section D p. 94 n. 2) Secondly, (1) the fact and (2) the reason why, both of which are of composite, i.e. subject-predicate, form (*S-P*) can be expressed using the singular form i.e. the subject only (*P* in *S*); hence, although the expression *ὅτι ἐστί* must be understood in the existential sense of *εἶναι*/the verb "to be", when it is used to give a reply to the questions "*εἰ ἔστι*;" and "*ἆρα ἔστι*;" (e.g. 89b32, 33, 90a6, 90a8, 93a32), Aristotle does not see any problem in expressing (1) the fact in existential terms. (90a26, 93b2-3)[3] This is a reason why, when he affirms again the identity of the essence and the reason why in B8, he characterises the reason why as "the cause of whether it exists" (*τὸ αἴτιον τοῦ εἰ ἔστι*) (93a4) instead of "the reason why" (*διὰ τί ἔστιν*) it exists. (90a15, a32)

Aristotle then embarks on a discussion of how, from the perspective of heuristic inquiry, demonstration can be the means of grasping essence. In order to establish this, Aristotle appeals to the complexity involved in discovering the existence of a thing/event. As I have suggested to a certain extent in the previous Section, when we discover the existence of something by sensation or some other faculty, we must not forget that in fact we do not only find out its existence. The discovery of the existence of something is always accompained by some concomitant knowledge, just as God, whom Pascal encountered at his conversion, is not merely a god that exists but the God *of Abraham*. Rather, the existence of something is established by discovering its properties. According to the degree of precision in the inquirer's approach, as it is revealed in his expectations or his

existing knowledge e.g. concerning the meaning of the terms under discussion, and according to the degree of difficulty involved in the case, there are different grades of understanding which can be attained when an object is discovered to exist. Aristotle says "As to if it exists, sometimes we grasp this incidentally, and sometimes when grasping something of the thing itself". (93a21-22) The discovery of the existence of, for instance, thunder, eclipse, man and soul is sometimes accompanied by the knowledge of "a sort of noise in the clouds", or "a sort of deprivation of light", or "a sort of animal" or "something moving itself". (93a23-24) The reason why Aristotle puts the indefinite pronoun "a sort of" (τις) with these properties except the one of soul is that the indefinite pronoun has the role of a placeholder, so that any property which belongs to the thing/event, ranging up to the essence itself, can be substituted, according to the degree of discovery achieved by the inquirer. In the case of the soul, since soul is a form whose cause is identical with itself, the discovery of its existence is necessarily accompanied by a grasp of its essence. As to incomposite substances i.e. entities of type (α), Aristotle characterises them as follows: "If the object exists, it exists in a particular way and if it does not exist in this way, it does not exist at all." (*Met.* Θ10 1051b35-1052a1) Hence Aristotle omits the indefinite pronoun in describing this example.

Establishing the existence of something by grasping "something of the thing itself" is contrasted with grasping it incidentally by grasping its accidental property. As an example of the incidental grasp of existence, E. Rolfes gives the following case: "Dass man das schnelle Laufen sieht und auf einen Hasen schließt." (p. 145) Since such a grasp of the existence of something is so uncertain, Aristotle says "Now in cases in which we know incidentally that something exists, necessarily we have no hold on its essence. For we do not even know that it exists." (93a24-26) On the other hand, if we grasp "something of the thing itself" which is also described as "something of the essence", it is said to be "easier" to inquire into the essence. (93a28, 29) Given that this degree of having a grasp of a thing is contrasted with having an incidental grasp of it, by means of which the inquirer is not entitled to claim that he knows (1) and (3), it is natural to take it that the inquirer who grasps a thing/event by discovering something of the thing itself is entitled to claim that he knows (1) and (3). In some cases, the discovery that something exists accompanies the discovery of its essence, just as while standing on the moon and seeking

to know whether or not there is an eclipse, we may find our surroundings becoming dark and simultaneously discover the obstruction of the light by the earth as the cause of the darkness. (cf. 90a25) "Hence, according to the way in which we grasp that something exists (*ὅτι ἔστι*), to that extent we are also in a position to grasp the essence (*τὸ τί ἐστίν*)". (93a28-29)

Because of the complexity of the situation at the time of discovery, the discovery of the essence can somehow be built into the process of establishing the existence of a thing/event. Or rather, because of the complexity involved in discovery, demonstration can establish the existence of a thing/event. The different grades of grasping the existence of something make it possible to express the discovery of the existence of that thing in subject-predicate form. And this means that the more we appoximate to a grasp of the essence of a thing, the greater the possibility of constructing a demonstration or syllogism corresponding to it. (cf. 93a28)

In setting out the second part of the second method (93a29-b14), Aristotle argues that according to the variation in the degree of heuristic knowledge acquired through discovery, there will be a corresponding variation in the explanatory powers of demonstrations which are based on those pieces of heuristic knowledge. Aristotle makes this point in the context of an actual inquiry by using three examples, one of which is a strict demonstration, the others being less strict cases. In other words, by describing three cognitive values which may be involved in discovering the middle term, Aristotle explains what he says in the abstract 93a28-29: "Hence according to the way in which we grasp that something exists, to that extent we are also in a position to grasp the essence." To show this is to sketch how heuristic knowledge is connected to demonstration and how demonstration is connected to definition.

(I). When we discover the *B* term through immediate propositions which express the proximate cause or the primary cause, we simultaneously know the fact and the reason why. (93a30-36, cf. Chapter 2 Section C)

Aristotle gives the example of an eclipse, taking the middle term as "the screening of the earth" which is *the* explanation of an eclipse. To ask "whether the moon is eclipsed or not" is to ask "whether an explanation of the eclipse (*λόγος αὐτοῦ*) exists or not." Then Aristotle says "If this [the *B* term = "screening of the earth"] exists, we claim that the event [eclipse]

exists as well." (93a33) Bolton comments on this passage as follows; "The key to understanding these initially puzzling remarks [Aristotle's claim that there is an "equivalence" between seeking or finding the fact and seeking or finding its explanation] comes with Aristotle's indication (at a33-36) that he has in mind a case where we learn *that* the eclipse occurs and *why* it occurs simultaneously." (p. 134) This reading is wrong. In this passage, what Aristotle does is just to repeat the general claim established in B2, concerning the grasp of the fact or the existence of something without recourse to any special case, such as the simultaneous discovery of the fact and the reason why, as Bolton suggests. That is, he makes the following general claim: If we find out that there is an explanation for a thing/event, we are entitled to claim that it exists. There are no "puzzling remarks" here. The absence of a definite article in the previous sentence "if there is an explanation of the eclipse (*λόγος αὐτοῦ*)" (93a33) plays the same role as the indefinite pronoun (*τι αἴτιον*) in B2 90a8. And in this case, since the existence of the eclipse is established by discovering its primary cause or *the* explanation; i.e. "screening of the earth", which is expressed by the immediate proposition: "Screening of the earth belongs to the eclipse", the inquirer knows both the fact and the reason why simultaneously.

(II). If we discover the *B* term, but not through immediate propositions, we know the fact, but not the reason why. (93a36-93b7)

Aristotle takes up the eclipse again, together with the middle term "inability to cast shadow at full moon with nothing obvious in between" as an example of this sort of less strict demonstration. This middle term does not offer a necessary condition for the eclipse, since the eclipse can take place, if the moon is not full, or if there are clouds in between. Since this middle term does not offer a necessary and sufficient explanation for the eclipse, it cannot make clear the reason why the eclipse occurs. But it has enough explanatory power to establish the fact in the sense that it explains the deprivation of light which is "something of the thing itself" with respect to the eclipse. Aristotle says, "When it is clear (*δῆλον*) that *A* belongs to *C*, then to seek why it belongs is to seek what *B* is — whether the screening or the rotation of the moon or extinction. This [screening] is the explanation (*ὁ λόγος*) of one extreme term [*A*]. For the eclipse is the screening of the earth." (93b3-7) Although Ackrill remarks in relation to

the word "clear" in this passage that "this must be taken loosely" (p. 372), insofar as the inquirer grasps that there is an explanation for this phenomenon, no matter what it is, say, the screening of the earth or the rotation of the moon, he is entitled to say that he knows the fact that the luner eclipse occurs as something which is clear (δῆλον). And it is noticeable that Aristotle here employs the definite article to show that the screening of the earth is *the* explanation of the eclipse.

> (III). If the *B* term is *an* explanation (λόγος) of the *A* term, i.e. if there is an another middle term, it will be one of the remaining explanations. (93b7-14)

Aristotle gives the following as an example of this way of grasping the fact.

> Thunder/noise φα extinction of fire.
> Extinction of fire φα cloud.
> Thunder/noise φα cloud.

It is unclear in this case whether the heuristic knowledge which results meets the immediacy condition on demonstration. Aristotle cautiously leaves open the possibility that another middle term may be the explanation of thunder, by omitting the definite article: "The *B* term is *an* explanation of the primary extreme *A*." (93b12) If there is no relation of immediacy between the *A* term and the *B* term, we have to look for another middle term among "the remaining explanations" (ἐκ τῶν παραλοίπων λόγων) which are limited by the primary term of the science of astronomy. This phrase suggests that the inquiry presupposes the framework of the apodeictic structure of the relevant science, even though the materials of heuristic knowledge have yet to be provided to fit into the structure.

One thing to notice is that Aristotle treats the terms "thunder" and "noise" as being substitutable. (93b9, 11) This is because when heuristic knowledge is analysed in syllogistic terminology, the discovery made in the context of the actual inquiry already ensures that the syllogistic terms have a unique reference to the phenomenon in question. There is no room to understand something other than "thunder" by the term "noise". In fact, there is a conspicuous difference between the way in which Aristotle describes the essence or definition and the way in which he describes the reason why or "continuous demonstration". (94a6-7) In the latter case

Aristotle prefixes the definite pronoun to the components of continuous demonstration in order to show that the components are picked up as referring to something concrete in the world. (93b8–9, 90a17–18, 20–21, 94a 4) In the definition, however, Aristotle omits the definite pronoun in order to show that a definition is composed of general terms at the abstract level. (93b7, 90a16, 19, 94a5) For instance, Aristotle says "What is thunder? Extinction of fire in a cloud (*πυρὸς ἀπόσβεσις ἐν νέφει*). Why does it thunder? Because *the* fire in *the* cloud is extinguished (*διὰ τὸ ἀποσβέννυσθαι τὸ πῦρ ἐν τῷ νέφει*)." (93b7–9) Hence it is not the case, as Dancy claims, that "this [substitution] is pretty loose." (p. 133) This fact tells us that demonstration or continuous demonstration, which is based on heuristic knowledge, is constructed in the context of actual inquiry, and definition, which is based on demonstration, is constructed at the abstract level. (I will return to the issue on the relation between demonstration and definition at the end of the Section.)

We have seen how syllogism or demonstration is developed on the basis of various degrees of heuristic knowledge. Why does Aristotle not give an account of definition directly in terms of heuristic knowledge? This is because one cannot know the essence without knowing the existence and "Existence (*ὅτι ἔστι*) is the matter for demonstration." (92b13–14) But then what is the difference in cognitive value between grasping the existence by discovery and grasping the existence by demonstration? Does quick wit not grasp the reason why as the reason why of something, even though heuristic knowledge has yet to be added to the apodeictic structure? If both kinds of knowledge have the same cognitive value, one could omit the formation of a demonstration in grasping the essence of something. I take it that the immediacy condition (*δι' ἀμέσων*) is the key to the difference between the two types of knowledge. As we have seen, if we grasp the explanation through an immediate proposition, we grasp both the fact and the reason why, whether simultaneously or not. Otherwise, we know the fact, but not the reason why. An immediate proposition is composed of two terms, in which there is no mediable term, though as we have made clear before, there is nothing to prevent us from having an explanation (a middle term) of the existence of each component of the immediate proposition. (cf. Chapter 2 Section C) In other words, as we have already made clear, an immediate proposition constitutes a *per se* predication which consists of a definitory relation between two terms. (cf. Chapter 2 Section D)

Aristotle describes this immediacy condition as concerned with whether the middle term is the explanation (ὁ λόγος) of the major term or not. (93a 33, b6, b12) That is, the concern of the immediacy condition is whether the major premise in *Barbara* can guarantee the necessity of the conclusion. If the major premise meets the immediacy condition, it can impart its own necessity to the conclusion, even if it is a case of hypothetical necessity. The fact that the necessity of the conclusion is guaranteed means that the thing/event which is expressed by the conclusion can be distinguished from all other similar things. In other words, the unity of a thing/event is guaranteed when the major premise meets the immediacy condition.

Now I will argue for the view that demonstration establishes the existence (ὅτι ἔστι) of a thing/event as being unitary and necessary, by examining some other passages. A thing/event is articulated into three terms, each of which has its own function, in a demonstration: *A*: the effect, or thing/event (οὗ αἴτιον), *B*: the cause (τὸ αἴτιον) and *C*: the underlying (ᾧ αἴτιον). (cf. 99a16-18) For instance, harmony, eclipse and thunder are articulated into these three terms as follows: the effect: harmony, eclipse, thunder/noise; the cause: an arithmetical ratio, screening by the earth, extinction of fire; and the underlying: the high and the low tones, the moon, the cloud. (90a19-22, 93a30-31, 93b9-10) Hence, by constructing a demonstration, one establishes the existence of a thing/event in such a way as to show that the effect belongs to the underlying through its cause. Aristotle allows for various degrees in demonstrative power among demonstrations. The most successful demonstration is one which meets the immediacy condition so that it establishes that the effect *P* and thae cause *Q* are necessary and sufficient for each other. In a successful case like this, a thing/event *P* can be differentiated from all other things/events, in terms of a single, exhaustive relation. Aristotle characterises the various degrees of power possessed by demonstrations in terms of the relation among the constitutive terms: "Is it possible for there not to be the same cause [*B*] of the same thing/event [*A*] in all the underlyings [*C*], but a different one? or not? If it has been demonstrated *per se* and not in virtue of a sign or incidentally it is not possible. For the middle term [*B*] is the explanation (ὁ λόγος) of the extreme [major] term [*A*]." (99a1-4) Here Aristotle raises immediacy condition as giving the ground of the unity of a thing/event.

Furthermore, by supposing that the explanation (ὁ λόγος) holds of a member of the contradictory pair (ποτέρας τῆς ἀντιφάσεώς), Aristotle makes

it clear that the explanation is something which distinguishes the single thing: *P* from all other things (non-*P*) in terms of its existence. (93a34–35) Hence, in the case in which the middle term is the definitory explanation of the major term, a strict demonstration results, and the identity of the thing/event is fixed. For instance, given that thunder and extinction of fire are related by definition, one can distinguish thunder from any other similar phenomenon such as an eruption of a volcano in a cloud. In this way, through the formation of a demonstration, the existence (ὅτι ἔστι) of a thing/event is established. Therefore, the difference between demonstrative knowledge and heuristic knowledge consists in whether the inquirer grasps the necessity of the thing/event in the sense of whether he can establish the unity of that thing/event in terms of its existence so that he can distinguish it from all other things/events. Hence the unity of a definition is based on the formation of a demonstration.

Now we can correctly understand Aristotle's conclusion at the end of his discussion of how demonstration proves essence in B8. Heuristic knowledge of a thing/event which grasps its existence by grasping its essential properties must be built into the demonstration so as to establish that the cause and its effect are necessary and sufficient for each other. Hence, a successful demonstration must include those properties which are necessary and sufficient for the essence of the relevant thing/event. But since demonstration is "a syllogism through the reason why", which works by placing the cause as the middle term in two premises in the syllogistic mood *Barbara*, one cannot prove the essence as the conclusion of a demonstration. Only the existence of a thing/event is established as being unitary and necessary in the conclusion of a demonstration. "Hence no syllogism and no demonstration of essence comes about — yet it is clear through syllogism and through demonstration. Hence without a demonstration one cannot become aware of essence in cases where the cause is something else." (93b18–19) Here Aristotle concludes that demonstration is an indispensable tool in proving the essence in cases where the cause is something other than the thing/event. This reveals the practical aspect of Demonstrative Theory.

If this is the practical function of demonstration, the difficulties which are raised in the aporetic chapters B3–7 will be resolved. The functions of both demonstration and definition are unnecessarily simplified by separating the two functions, in stressing the verbal difference between existence which is allegedly the subject matter of demonstration and essence which

is allegedly the concern of definition. What really happens in discovery is that the existence of a thing/event cannot be grasped without the involvement of at least some information about its essence. Now the relation between demonstration and definition seems to be pretty clear. It is not difficult to obtain one type of definition out of a successful demonstration of this kind. Aristotle says

> Another definition is an account which makes clear why a thing/event is. ... This will be a sort of demonstration of essence, differing in position from the demonstration. For there is a difference between saying why it thunders and what thunder is; for in the one case one will say: Because the fire is extinguished in the clouds. What is thunder? — A noise of fire being extinguished in the clouds. Hence the same explanation is said in a different fashion, and in this way it is a continuous demonstration, in this way a definition. (93b38-94a7)

Finally I will demonstrate how the argument in B8 endorses the view I developed in the previous section concerning the puzzles which are raised in B1-2: (I) why does Aristotle use a piece of syllogistic machinery, i.e. the middle term, in explicating the process of inquiry? (II) In what sence can inquiring into (1) the fact and (3) existence be identical with inquiring the existence of a middle term? Here too the complexity involved in discovery is the key to the resolutions of these puzzles. Concerning (I), Aristotle puts this condition on the process of inquiry so that heuristic knowledge can be turned into demonstrative knowledge which grasps the unitary and nacessary being of a thing/event as well as its cause. The same answer can be made to (II). I take it that a grasp of something of the thing itself (e.g. a sort of deprivation of light in the case of eclipse) offers the inquirer, the knowledge, or at least a good reason for believing, that there is some cause of the eclipse, given that the indefinite pronoun can be replaced by some property more or less equivalent to "inability to cast shadow at full moon with nothing obvious in between."(4) The process of inquiry can be depicted by the following schema, taking the example of the eclipse.

Grasping (2), (4)

$*$ = the middle term (the cause) = "the screening of the earth..."

↑

Grasping (1), (3)

∗ =a middle term (some cause) = "inability to cast shadow. ."
=
∗ =something of the thing itself = something of the essence = "a
↑ sort of deprivation of light"
↑
∗ =accidental property = "entering under a cave"
↑
/ \
eclipse φ the moon

In this way, heuristic inquiry and demonstration correspond to each other in the way in which they reflect the complexity involved in discovery. Because of this feature of discovery, a demonstration which is formulated entirely on the basis of discovery, can contain, if it is successful, the definitory explanation of the thing/event and "something of the thing itself", so that it can be transformed into a definition.

Notes.

(1). These four examples are found in 93a22–24.

(2). In B10 Aristotle explains the ontological difference between an account of what a name signifies and a definition by saying that *some* account (*τις*), but not all accounts, of what a name signifies will be its definition, given that "[the account] of what e.g. "triangle" signifies is [the account] of its essence, *insofar as* (*ἧ*) it is [in fact the account of] the triangle." (93b31–32) [I follow MSS. reading of this sentence: *οἷον τί σημαίνει τί ἐστιν ἧ τρίγωνον*, rather than Ross' reading: *οἷον τί σημαίνει τρίγωνον*.] Here the indefinite article *τις* and the adverbial use of the relative pronoun *ἧ* convey the ontological difference. (cf. *Topics*, A5 103a1–3, *Met*, Z4 1030b7–8) Bolton, for instance, failed to see the significance of these words. ([1] p. 522–524).

(3). The difference between *εἰ ἔστι* and *ὅτι ἐστί* just consists in a difference in perspective. While *εἰ ἔστι* is expressed from the perspective of the question of inquiry, *ὅτι ἐστί* is stated from the perspective of the answer or discovery. (cf Chapter 4 Section A n.1)

(4). Ackrill asks "How can anyone be justified in making the move from [the fact] *P* to explicably-*P* before finding out the explanation?" and complains "He does not say what leads us to suppose or recognise that there is a middle term". (p. 378) We may understand Ackrill's question and complaint as follows; "It would be a natural shift at the stage at which we do not yet know the existence of the middle term, if, finding out the fact, we quickly move to ask the reason why". But if so, it is not the case that

Aristotle fails to answer this question. "It is impossible to know the essence, if we are ignorant of the existence". (93a20) "Now in cases in which we know incidentally that a thing is, necessarily we have no hold on the essence." (93a25-26) These sentences contain Aristotle's answer. It does not matter, whether we ask "Why?" or "What?" at any stage of inquiry. In a sense our scientific research is directed to converge on these two questions from the beginning. But we must not forget that Aristotle considers the process of inquiring from the viewpoint of the heuristic knowledge gained at the final stage of inquiry. The reason why this kind of question and complaint arises is that Ackrill fails to understand that the inquirer has ample opportunity for access to the essence and the reason why at the time he discovers the fact *P*, so that he cannot see any justifiable move from knowing the fact *P* to knowing the explicability of *P*. Aristotle claims that by grasping some essential part of the fact *P*, the inquirer knows or at least has a good reason to believe that there is some cause of the fact *P*, or that *P* is explicable.

J. Hintikka also fails to understand the actual situation involved in discovery in the context of inquiry. ([2] pp. 87ff) Hintikka's solution which is, according to him, "embarrassingly obvious" is to build the εἰ ἔστι question into the following "abbreviated syllogisms" of the form:

(*) Every *B* is *simpliciter*.
Every *C* is *B*.
Hence: Every *C* is *simpliciter*.

This syllogism is the abbreviation of the following regular *Barbara* syllogism, obtained by omitting the major term.

(**) Every *B* is an *A* (and hence exists).
Every *C* is a *B* (no existential force).
Hence: Every *C* is an *A* (and hence exists).

This abbreviation is based on his assumption that the existence of the *B* is always a consequence of the existence of a wider term, say *A*. Hintikka claims that "Aristotle accomplishes the same effect by means of a regular *Barbara* syllogism (**) as he accomplishes by means of (*), as long as a proviso is explicitly or tacitly added to the effect that it is only the widest term [*A*] that carries any existential force." On the contrary, Aristotle claims that the existence of the *A* term is established by discovering the existence of the *B* term. Hintikka does not understand the relation between the discovery and the articulation of the discovered object into the syllogistic form. It is highly unlikely that Aristotle has an abbreviated syllogism in mind, when he puts a demonstrative condition on the process of inquiry.

Chapter 5. Scientific and Metaphysical Approaches to The Self-Explanatory Entity and Its Derivatives

A. The Structural Classifications of The Causal Entity

In the previous Chapter, we have shown that when Aristotle discusses the possibility of proving essence, it is treated within the causal structure of Demonstrative Science. We have seen that Aristotle divides causes into two classes: a cause is either (α) identical with its effect or (β) something different. Then (β) is subdivided into two classes. If it is something different (β), it is either ($\beta 1$) demonstrable or ($\beta 2$) non-demonstrable. A number of interpretations of the criteria associated with these divisions have been offered by Aristotle's commentators. In this Chapter, I would like to consider what criteria Aristotle has in mind in making this division and what method are to be employed in order to grasp these two different kinds of cause. In approaching this issue we should take into consideration not only the issue of the principle and of the chain of proofs in Demonstrative Science which constitutes the method of causal explanation as it is described in *Posterior Analytics*, but also the question of the whole scope of Aristotle's enterprise in *Metaphysics Z, H, Θ*. For Aristotle employs arguments which concern both demonstration and metaphysics to elucidate what kind of entity is meant by (α) and (β). The issue of the criteria governing the classification of the causes of being is the subject which is primarily investigated in metaphysical terms, given that substance as a cause of being is studied in *Metaphysics*. (cf. Z17 1041a9-10, H2 1043a2-3) I would like to show that the account Aristotle gives of this issue in *Posterior Analytics* is developed from the formal perspective of Demonstrative Science as an explanatory system, without being fully committed to the ontological nature of these causal entities. Aristotle has left detailed discussion of this issue to *Metaphysics*. The accounts of the different kinds of cause and of identity in the framework of Demonstrative Science which is given in outline in *Posterior Analytics* is carried through and developed on metaphysical principles in *Metaphysics*. We may be able to see a continuity between the demonstrative and metaphysical explanations of causality, in the sense that *Posterior Analytics* offers the formal framework of explanation while *Metaphysics* attempts to fill out the notion of a cause in a way which is based on the explanatory structure in *Posterior Analytics*. Hence we may be able to shed light on the controversial issue of causality and identity in

Metaphysics, via a consideration of demonstrative explanation.

When Aristotle classifies causes into kinds (α), ($\beta 1$) and ($\beta 2$), he seems to have the following sequence of demonstrations in mind.

$$
\begin{array}{rl}
 & B_n \leftarrow (\alpha) \\
 & = \\
 & A\ \varphi\alpha\ B_n \leftarrow (\beta 2) \\
(\beta 2) \rightarrow & B_n\ \varphi\alpha\ B_{n-1} \leftarrow (\beta 1) \\
 & \cdots\cdots\cdots\cdots \\
 & A\ \varphi\alpha\ B_{n-1} \\
 & \vdots \\
 & A\ \varphi\alpha\ B_2 \\
 & B_2\ \varphi\alpha\ B_1 \qquad \leftarrow (\beta 1) \\
 & \cdots\cdots\cdots\cdots \\
 & A\ \varphi\alpha\ B_1 \\
 & B_1\ \varphi\alpha\ C \\
 & \cdots\cdots\cdots\cdots \\
 & A\ \varphi\alpha\ C
\end{array}
$$

A cause is always a cause of something. And if there is something, there is always some cause of it. (I take it that this is the message of [P'] "there is some cause" at 93a5.) In some cases this something is the cause of itself and in other cases this something has a cause which is different from itself. In this way, Aristotle envisages the world in terms of the two types of cause-effect relation in the causal system. In this diagram, the causes (B_1, B_2, . . , B_{n-1}, B_n) in the structure of Demonstrative Science belong to one of the three groups: (α), ($\beta 1$) and ($\beta 2$). While B_n is something different from its effect: B_{n-1}, and is the non-demonstrable cause ($\beta 2$) of it, B_n is identical with its cause and is the self-causing entity (α). All the other entities ($B_1 - B_{n-1}$) are the demonstrable causes ($\beta 1$). There is nothing odd in the fact that B_n is described as both (α) and ($\beta 2$). Since the causal entity in the apodeictic structure is always seen in relation to its effect and its cause, the same entity can be seen as holding both relations, as it is described from the causal perspective. When B_n which belongs to type ($\beta 2$) is grasped as the cause of B_{n-1} through the formation of a demonstration, it is not necessary that B_n should also be known as the non-demonstrable and self-causing entity i.e. (α). As (α), B_n is grasped by taking into

consideration the whole apodeictic system through the process of induction. (I will discuss this issue in Chapter 6.) At the end of B8, and throughout B9, when Aristotle mentions only two types of cause (α) and (β), and no longer distinguishes (β1) from (β2), he describes these entities from the perspective of their effects. There is no contradiction in his failure to mention (β2) in these passages, given that the distinguishing characteristic of (β2) is as I have described. Now what I would like to claim regarding the critera for distinguishing these causal entities is that Aristotle classifies the types of cause in accordance with the structure of Demonstrative Science as the structure of systematic explanation. This claim will be endorsed by an examination of B9.

In B9 Aristotle aims to establish the methods by means of which one can make clear the essence of a thing/event. At the beginning of B9, Aristotle reaffirms the distinction between (α) and (β) made in B8. He then infers from this division, which is evident (*δῆλον*), that there are two types of thing, according to the two different characteristics of essence; and he introduces a procedure for revealing the essence of these two types of thing. The whole chapter, which requires a lot of clarification, runs as follows:

> (A) Of some entities [(β)], there is some cause different [from itself], of others [(α)], there is not. (B) Hence (*ὥστε*) it is evident that (C) among the entities of which there is an essence too, (D) some of them (*τὰ μὲν*) [(α)] are, on the one hand, immediates and principles, which (*ἃ*) must be supposed or made apparent in some other way, with respect both to their existence and essence. (E) This is what the arithmetician does; for he supposes both the essence and the existence of the unit. (F) On the other hand, it is possible to make clear [the essence] through demonstration, of entities (*τῶν δὲ*) [(β)] which have a middle term, that is (*καὶ*), there is some different cause with respect to the essence, though it does not demonstrate the essence, as we have said. (93b21-28)

Aristotle infers (B)-(F) from (A). This inference tells us that the two types of entity which are discussed in B9 are distinguished on the basis of the division between (α) and (β). His argument for the inference from (A) to (B)-(F) is as follows:

> (P1). There are two types of thing/event ((α) and (β)) in virtue of

their having two kinds of cause. [(A)]

(P2). Essence is identical with a kind of cause. ("Cause") covers both essence and necessary property (ἴδιον).) [93a4-15]

(Co). There are two types of entities ((α) and (β)) and two methods of grasping them in virtue of their having two kinds of essence. [(D) and (F)]

In other words, Aristotle argues here that there are also (καὶ) two types of entity with respect to essence, just as there are two (parallel) types of entity with respect to cause. This shows that in B9 it is the relation between a thing and its essence which is at issue rather than the relation between a thing and its cause, though so far as (A) offers the premise of the inference in (B), the two distinctions between the entities correspond to each other. Then in (D) he characterises entities of kind (α) as being immediate and as being principles. We have made clear in Chapter 2 Section C that the immediate terms (τὰ ἄμεσα) are non-demonstrable principles.

So far as I know, all translators have construed "some of them" (τὰ μὲν) as referring to the essence. For instance, Barnes translates (D) as follows: "Hence it is clear that in some cases what a thing is is immediate and a principle." (p. 63) This rendering is wrong for a number of reasons. Firstly, as in B8, Aristotle does not directly deal with essence in itself in B9. The interpretation of "some of them" as referring to the essence does not follow from the argument in (A), (B) and (C). When Aristotle appeals to the two types of entity which are distinguished by the differing nature of their causes in (A) in order to infer the differing nature of their essences, corresponding to the distinction between the causes in (B)-(F), he has in mind entities which have an essence, as opposed to the entities which are accidental properties/events. In other words, I take it that Aristotle employs the definite article: τῶν, in τῶν μὲν ἕτερόν τι αἴτιον, τῶν δ' οὐκ ἔστιν in (A), in τῶν τί ἐστι in (C) and in τῶν δ' ἐχόντων μέσον in (F), in the sence of the relative pronoun, so as to convey the meaning; "things of which". (cf. H. W. Smyth p. 285)[1]

Secondly, this reading is supported by the phrasing of (F). In (F) Aristotle introduces (β) with the following words "On the other hand,.. of things which have a middle term" (τῶν δ' ἐχόντων μέσον) in contrast to "some of them" (τὰ μὲν) in (D). Here it is clear that the definite article with the participle refers to the things (which have a cause). The contrast

between the two types of thing in (D) and (F) is expressed using the particles *μὲν-δὲ* and this contrast shows that the comparison is made within the same category, that is, in this case, between the things referred to in both (D) and (F), rather than between the essence in (D) and the thing in (F).

Thirdly, the relative pronoun *ἅ* in (D) which is preceded by the noun phrase "some of them" in (D) is followed by an assumption of the existence and essence of whatever it is it refers to. If *ἅ* should be taken as referring to essence, then it would turn out that what is supposed is the existence and the essence of the essence. This is absurd. For the essence is always the essence of some thing/event.

Fourthly, when Aristotle gives an example of the entity (α) in (E), the unit is an immediate and primary thing as a principle of arithmetic rather than an essence, even if the unit and its essence are identical. (cf. 76a31–36)

Hence, it is clear that *τὰ μὲν* refers to (α) the immediate and thus the non-demonstrable entity among those entities which have essence. The existence and essence of the primary terms of a science such as unit in arithmetic must be assumed in the sense that they are non-demonstrable. As regards the assumption of the existence and the definition of the entity (α), this has already been discussed in the section on the ultimate principles of Demonstrative Science, such as the hypotheses and the definition, in Chapter 2 Section B. As regards the procedure for making the entity (α) apparent, I shall discuss it in Chapter 6 which concerns the nature and function of induction.

On the other hand, the essence of the entities (β1) and (β2) other than (α) must be made clear through demonstration, though essence is not demonstrated as the conclusion of a demonstration. This kind of entity can be called a non-self-explanatory entity. The reason why the formation of a demonstration is indispensable for grasping essence was discussed in Chapter 4 Section B. As regards (F), I have suggested a reading which differs from the traditional one. The traditional reading is something like this: "Of those which have a middle term, a cause of their being which is distinct from their own nature, we may make the essence plain by a demonstration, though we do not demonstrate it." (Ross. p. 633) The issue here is how to read the genitive *τῆς οὐσίας* in the sentence: *τῶν δ' ἐχόντων μέσον, καὶ ὧν ἔστι τι ἕτερον αἴτιον τῆς οὐσίας, ἔστι δι' ἀποδείξεως, . .*

It is often thought, as Ross suggests, that this genitive is a genitive of comparison which comes after "different" or "distinct" (ἕτερον), meaning "different from the essence" or "autre que leur substance" (Tricot. p. 194). This interpretation has been put to use in support of the claim that there is no demonstration of substance and essence.

I would read this genitive as a genitive of connection: "with respect to [or concerning] essence", for the following reasons. Firstly, as we have seen in the discussion above, in B9 Aristotle deals with the cause as the essence. Hence Aristotle qualifies "some different cause" by adding "with respect to essence". Just as in the case of the entity (α) there is no cause which is different from it with respect to its essence, in the case of the entity (β) there is some cause which is different from it with respect to its essence. Secondly, Aristotle gives two descriptions of the entity (β). I take it that by inserting καὶ i.e. "that is" in the sentence: "it is possible to make clear [the essence] through demonstration, of entities which have a middle term, "καὶ" there is some different cause with respect to the essence.", Aristotle characterises (β) so as to fit it into the context of B9. In other words, by specifying the cause of things which have a middle term as being "with respect to essence", Aristotle specifies the domain of discourse of "some cause other [than the thing itself]". Thirdly, if we limit causes to being non-essential properties, which is the inevitable result of reading this genitive as the genitive of comparison, the entity (β) would be excluded from the discussion in B9 in which Aristotle considers how we are to grasp the essence of both (α) and (β). Fourthly, to read that phrase as the genitive of comparison is to rule out substance from the scope of inquiry. We have already seen in Chapter 4, Section A that substance is a genuine object of the theory of inquiry.

Now it seems to be clear that Aristotle establishes the criteria by which he distinguishes (α) from (β) from the structural or formal point of view of Demonstrative Science. The entity (α) is to be identified with "the principles and immediate" things in a demonstrative science and this entity is in effect the same as the non-demonstrable (β2), so long as it is observed from the causal perspective. (cf. 71b27, 72b22, 87b1-2, Chapter 2 Section A) On the other hand, the entity (β) which is contrasted with the entity (α) within the system is regarded as the entity which has a middle term. The contrast between (α) and (β) is shown in the different way (ἄλλον τρόπον) in which each of them is grasped. While the one (α) is assumed

(ὑποθέσθαι), the other (β) is revealed through demonstration (δι' ἀποδείξεως). And the entity which is contrasted with the entity (α) is in effect (β1). In this way Aristotle presents the criteria for distinguishing these groups of entity from the viewpoint of the explanatory structure of Demonstrative Science.

Aristotle's commentators have considered these criteria from the ontological viewpoint rather than the viewpoint of the apodeictic structure. Zabarella, for instance, proffers the view that the things whose causes are identical to them are intrinsic causes, that is, form and matter, while the things whose causes are different from them are extrinsic causes, that is, efficient and final causes. Zabarella claims that Aristotle's division among causes makes it "clear" that "all accidents (accidentia omnia) [(β)], have causes extrinsic to them, whereas substances (substantia) [(α)] have causes which are not extrinsic to them". (p. 1130)(2) Concerning the entity (β2), Zabarella claims that "Not only substance, but also the accidental property (accidens) has non-demontrable essence." (p. 1130)

Ross shares this view of the nature of these entities, a view which is representative of the views of contemporary commentators. "A substance" belongs to (α). "There is no room for demonstration here; you just apprehend its nature directly or fail to do so (cf. 93b21-5, 94a9-10)." "A property or event" belongs to (β). Permanent properties or events belong to (β1), whereas contingent or accidental ones belong to (β2). (p. 692)(3)

This traditional view, however, is in sharp contrast to my interpretation. I have claimed that sensible substance accept demonstration as a proof of their essence and that the entity (β2) is in effect the same as the entity (α). Ross and others who take (β2) to comprise accidental properties seem to be wrong for a number of reasons. First, although I agree with them that accidental properties are non-demonstrable, we cannot find at any place in this book the word "non-demonstrable" (ἀναπόδεικτον) employed to characterise accidental properties. This word is employed in the context of discussions concerning either the sequence of demonstrations or the characterization of the primary term of a science. (71b27, 72b22, 75b39, 87b2, 90b27) Secondly, in B2 Aristotle rules out the accidental property as an example of his identification between (2) the reason why and (4) the essence. For an accidental property does not have its cause as its essence. An accidental property can be otherwise, but essence cannot. In fact, when he says that "In *all* these cases, it is evident that the essence and the

reason why are the same" (90a14–15), he carefully avoids mentioning any examples of accidental properties in the preceding sentence, in which he does offer examples of substance and *per se* attributes, which are what is referred by "all" in this sentence. The syllogism which concerns an accidental property, based on heuristic knowledge, can provide only a form of knowledge which is less strict than demonstrative knowledge. (cf. 86a3ff, 87b19ff) Thirdly, at the end of B8, Aristotle, without adding any qualification with respect to (β) says "Hence it is not possible to know the essence without demonstration, in cases where the cause is something else." (93b 18–19) If (β2) comprises the accidental properties, given that they do not accept demonstration because of their contingency, this remark should have been restricted to the case of (β1). (This applies in the same way to his distinction in B9.) But we do not have to distinguish (β2) from (β1), nor add any restriction here. This is because, as we have seen in the diagram above, the essence of B_{n-1} is made clear through a demonstration which contains the non-demonstrable term: B_n, just as the essence of other terms such as B_1 is made clear through demonstrations.

What then are the ontological criteria by means of which the two types of causes (α) and (β) are distinguished? Is, as many commentators think, the distinction one between intrinsic causes (from and matter) and extrinsic causes (efficient and final)? If so, substances like man will never be the object of demonstration. Since it is often the case that the formal cause and final cause are regarded as the same, the intrinsic/extrinsic distinction is not appropriate in this context. (cf. *Met.* H4 1044b1) First of all the distinction is not clear at all. Do proponents of this view have spatio-temporal continuity in mind as the criterion of identity and distinctness? Do they think that, on the one hand, the formal and material causes are internal to substance like constitutive causes such as rationality in man, while on the other hand, the efficient cause as the antecedent cause and the final cause as the consequent cause occupy a spatio-temporal location which is different from that of the object, just as the screening by the earth as an efficient cause, occupies a different place from the darkening of moon? But this claim seems to be rather specious and relative to the situation. A possible counterexample is that of gemstone which sparkles as it spins. Spinning is the cause of sparkling, but occupies the same spatio-temporal location. Another example will be that of human action and its agent as its cause which occupy the same place i.e. the agent's body, (though its

explanation may often be in terms of its final cause.) Besides it might be thought that the extinction of fire and the sound which are regarded as an instance of (β) by all commentators occur in the same place i.e. in the cloud. Hence, the intrinsic/extrinsic criterion does not work.

Notes.

(1). Someone might argue that we cannot find any example of the definite article being used as a relative pronoun in Aristotle. If this is the case, it seems to me still that these four strong reasons give us the right to claim that Aristotle meant to write something like *τούτων ὧν*, but he slipped by writing *τῶν*.

(2). Zabarella comments about the intrinsic cause that "the essence of substance is form which does hot have a cause outside it (extra se), by means of which it is inside matter, but is inside in virtue of itself and immediately." (p. 1130)

(3). Barnes correctly throws doubt on some commentators' claim that the entity (α) is substance: "The commenators suppose that *substances* are self-explanatory and non-substances are non-self-explanatory. There is no evidence for this in Aristotle's text, and it does not fit the general context of his thought." (p. 208) Unfortunately, Barnes does not offer an alternative view.

B. The Metaphysical Classifications of The Causal Entity

It seems that Aristotle employs an ontological criterion which is different from the intrinsic-extrinsic one, besides the structural criterion arising out of Demonstrative Science. Aristotle has left this issue to *Metaphysics*. Now I would like to show that the ontological criterion for distinguishing the two types of cause in *Metaphysics* fit well with the structural criterion in *Posterior Analytics*. This fact will endorse my interpretation of the treatment of substance in Demonstrative Science or at least show that Aristotle has a consistent view on the division between causes in the two works. Aristotle's view of the division is well explained in a passage on necessity in *Metaphysics*. He says;

> With some things, then, another thing is the cause of their being necessary; with others nothing is, but on account of them other things are of necessity. It follows that the primary, and fundamentally, necessary thing is that which is simple (*τὸ ἁπλοῦν*); for it is not possible that this should be in more than one state, nor therefore thus and otherwise — for it would thereby be in more than one state. Conse-

quently, if there are certain eternal and changeless things, there is nothing compulsory or unnatual in them. (*Δ*5 1015b9-15)

Here the simple being (*τὸ ἁπλοῦν*) is treated as a being which is identical with its cause. What Aristotle understands by "the simple being" is clarified in the passage Z11 1037a33-b7, which is regarded as a "post-script" to Z6 (G. E. L. Owen, [3] p. 280), and H3 1043b2, and H4 1044a32ff. Now I will look more closely the passages in Z6 and Z11.

The main topic discussed in Z6 is whether each thing (*ἕκαστον*) is identical with or different from its essence (*τὸ τί ἦν εἶναι* = TEE). The answer to this question will provide us with a criterion which will distinguish (*α*) from (*β*) and make clear what kind of entity (*α*) is. Aristotle's claim in Z6 is that we have an instance of (*α*) only if things are (i) said in respect of themselves [*per se*] and (ii) primary (*τῶν πρώτων καὶ καθ' αὐτὰ λεγομένων*). (1031b13-14, 1032a5) The first condition (i) is introduced in contrast to "things which are said incidentally" (1031a19) such as its being the case that a man is identical with a white man. The second condition (ii) which must be satisfied by entities of type (*α*), that is, being primary, is introduced as a characteristic of substance to which no substances or any natures are prior (*πρότεραι*). (1031a29-30) Examples of such *per se* and primary beings are Platonic Ideas like the Good-itself, the Animal-itself and the Being-itself. Such Ideas, if they exit, are supposed to be identical with their essences. Aristotle's arguments in support of these two conditions (i) and (ii), taking Platonic Ideas as examples, are as follows.

The second condition is defended on the grounds that, if the Good-itself or the Animal-[itself] were different from their essences, then there would have to be "other substances and natures and Ideas" beyond these, which will be "both prior and to a greater degree substances", given that the essence (TEE) is a substance. (1031a31-b3) In other words, Aristotle appeals to the "underlying-ness" of substance which does not allow for any being prior to it to give a condition on being (*α*). This is because "the underlying" (*ὑποκείμενον*) which is defined as "the thing of which another thing is predicated, while it itself is not predicated of anything else" seems to be "substance in the strict sense." (Z3 1028b36-1029a2) This argument, then, rests on the prohibition of an infinite regress or rather on the claim that such an entity must necessarily be a primary being.

His argument for first condition (i) is as follows: if the Ideas and

their essences are "detached" (ἀπολελυμέναι) from one another, then [a] there can be no knowledge of the Ideas [b] nor can essences be beings. These two claims [a] and [b] depend on the way in which Aristotle understands the concept "being detached". He explains this concept as follows;

> I mean by "being detached", if the essence of good neither belongs to the Good-itself, nor belongs to the essence of good. (1031b4-6)

Here Aristotle claims that it is necessary that, if a thing is to be an instance of (α), that thing must be immanent in its essence and vice versa, in the sense that, if the essence does not retain the way of being of the thing, or of "the characters represented by" the thing (Burnyeat [2] p. 37), e.g. if the essence of Good-itself does not retain goodness, the one is not immanent in the other. In other words, for one to belong to the other is for one to be essentially predicated of the other. This argument, then, rests on the claim that there must be a relation of essential predication between this kind of entity and its essence. On this basis, Aristotle explains his two conclusions. The reason for [a] is that if the thing and its essence are detached, in the sense explained above, then since, if we have knowledge of the thing, it is necessary that we know its essence, we can never get knowledge of it. (1031b6-7) The reason for [b] is that what holds for Good will hold for the others, so that, if not even the essence of Good is good, neither will the essence of Being be a being. In the same way, either all essences exist or none of them do, so that if the essence of being is not a being, then the essence of Good-itself will not exist either. (1031b7-10)

Then Aristotle draws the following conclusion from these two arguments: the indispensability of the primary being and of essential predication:

> It is clear that in the case of the things that are said *per se* [καθ' αὐτό=in respect of themselves] and primary, the thing and its essence are one and the same. (1032a4-6, cf. 1031b13-14)

What kind of entity does Aristotle mean by the *per se* and primary being? Are Plato's Ideas the things which Aristotle indeed has in mind? In fact, as Ross remarks, one reason for Aristotle's choice of the Platonic Ideas, in which he does not believe, as an illustration of the entity (α) is to suggest "a covert criticism" of theory of Ideas. ([MII] p. 177, 1031a29-b11) Aris-

totle's claims (i) and (ii) are by themselves criticisms of the claim that the Ideas are separate from anything in the world. If the Ideas are separate entities, they will not satisfy the condition on being a substance, i.e. being an "underlying" being. For the only way of being a separate entity such as an Idea would be by participating in the underlying. (1031b16-18)

However, Aristotle does not employ Ideas as examples of (α) simply to criticise the theory of Ideas. If, as indeed Ross mistakenly thinks, sensible substances like horse and animal meet these two conditions, Aristotle would clearly have taken up these entities as examples as he often does in his *Metaphysics*. (cf. Ross, [MII] p. 178) But the situation is not so simple. At any rate, at the end of this chapter, it is denied that Socrates, who is a particular sensible substance, is identical with his essence. (cf. Furth pp. 236) The delicacy of this issue is conveyed by Aristotle's sarcastic comment on Plato's theory of Ideas, immediately after he sets up his conditions on being an instance of (α). He says "For it is even enough if this [condition] applies, even if they are not Ideas, or rather perhaps even if they are Ideas." (1031b14-15) In this sarcastic remark, Aristotle's real intention is implicit. If the Ideas meet these conditions, they would be welcomed as entities of this kind by Aristotle. In any case, the concern of this chapter does not seem to be what kind of entity meets this condition but rather the question of "in what sense" (πῶς) the essence is the same as each thing and in what sense it is not. (1032a10-11) In Z6, Aristotle proposes the following criteria for the identity of a thing and its essence: a thing and its essence are identical iff (i) they are predicated *per se* of each other and (ii) they are a primary being.

In Z11 1037a32-b7 which is regarded as a "summary" (Furth [AM] p. 30) of Z6, Aristotle explains what kind of entity it is which is stated to be "the *per se* and primary being" in Z6 and which is identical with its essence, by giving a further characterisation and some concrete examples. Some think that the claims in Z11 are subject to an important "qualification" (Weidemann, p. 82) or "restriction" (Hartmann, p. 63 n. 12) concerning how this entity is characterised in comparison to its characterization in Z6. Weidemann thinks that while in Z6 the existence of an essential predication, such as "man is an animal", is sufficient to meet one condition on the identity of the thing and its essence, that is being a "*per se* being" (*καθ' αὐτό*); and that while in Z6, the kind of predication which is contrasted with *per se* predication, that is, "one being said of the other" (*κατ' ἄλλο*

λέγεται) is accidental predication (1031b13, cf. Z4, 1030a11), some of the essential predications mentioned in Z11 belong to the category of "one being said of the other". This latter category, he says, "is expanded in Z11 (cf. 1037b3-7) to cover both accidental and essential predication." And the conclusion he draws from Z11 is that essential predications involving "primary substances" (1037a28) are genuine statements of identity which do not belong to the category of "one being said of the other". (p. 84)

Firstly, however, Weidemann is wrong in thinking that Aristotle offers "animal and the essence of animal" (Z6 1031a32) as example of an identity statement concerning a sensible substance. (p. 82) In this context, there is no doubt that Aristotle has the Platonic Idea of Animal in his mind, as Ross comments ("ζῷον sc. αὐτό τὸ ζῷον"). ([MII] p. 177) Thus there is no evidence that in Z6 Aristotle thinks that a particular material object or species (matter and form) is identical to its essence. Secondly, Weidemann does not consider the second condition (ii) on being (α) in Z6, that is, being a primary being. Since he overlooks this element in Aristotle's account, he is obliged to divide the essential predications required by the first condition (i) into two groups, one of which contains identity statements and the other of which contains " 'secondary substances' (their species or genera)" which is called "predicative in a strict sense". (p. 84, cf. Hartmann, p. 64)

In Z11, the *per se* and primary being is called "the primary substance". It is said that "The essence and the thing are in some instances the same, as is the case with the primary substances." (1037a33-b1) Here it is clearly stated that the primary substances are identical with (α). Aristotle presents the following characterization of the entities (α) and (β);

> (α)=the primary substance, which is not said by way of something being in something else nor by way of being in an "underlying" in the sense of matter.
> (β)=the entity which is (as) matter or (as) something composed of matter. (1037b3-5, cf. H6 1045a33-b5)

The most noticeable thing is that Aristotle introduces the notion of matter as the tool for sorting out the two types of being. Here we understand why Aristotle chooses Platonic Ideas, which are supposed to be immaterial objects as examples of (α) in Z6. For Aristotle thinks that immaterial objects or substantial forms are the primary substances. It seems to be

clear from Z3 1029a33ff, Z11 1037a10ff that Aristotle's discussion of composite substances in Z and H is only preliminary to the investigation of substantial form, owing to the familiarity of composite substances and the fact that they are widely agreed to be substances. That is why, when he starts to sort out what the primary substance is in Z6, composite substance is no longer used as an illustration of the *per se* and primary being. If Ideas which are alleged to be immaterial substances really meet the conditions stated above, then Ideas would be examples of (α), supposing that they really exist. However, in this chapter, Aristotle's examples of the primary substance, or the entity (α), are the soul and concavity, so that the status of primary substance as immanent in composite being is stressed.

> The soul = the indwelling form of man = the primary substance of man
> Man is composed of soul and matter.
> Concavity = the indwelling form of a snub nose = the primary substance of a snub nose.
> A snub nose is composed of concavity and nose. (Z11 1037a28–32)

Thus it is now clear why Aristotle says in H3 that "the soul (*ψυχή*) and the essence of the soul (*ψυχῇ εἶναι*) are identical, whereas the man and the essence of man are not." (H3 1043b1–3) For soul is not made up of matter so that it is free from coming-into-being and corruption, though its mode of being is by indwelling in matter in such a way that it is the actuality of a certain body as something which gives it life and unity, being separate only in its account as a determinate form. (cf. *Θ*8 1050a35–b2, H1 1042a28–29, Z7 1032b14) On the other hand, a man who is also an authentic substance is not simply a human soul which is the formal cause of his being, but a composition of matter (i.e. a particular body) and soul (i.e. the actuality of that matter). Thus a man is not identical with his cause as his essence. Aristotle says:

> Nor is man animal *and* biped, but there must be something besides these (*παρὰ ταῦτά*), if these are matter, something which is neither an element in the whole nor a compound, but is a substance, (H3 1043b10–12)

A sensible substance can be definable or subject to its essential predication, only because, in spite of the indefiniteness (*ἀόριστον*) of the matter of which it is composed, a primary substance which is the object of definition

in the strict sense dwells in it. (Z12 1037b25-29, Z4 1030a6-11, a28-30) On the other hand, since a primary substance like the soul is primary in the sense that it does not depend on any other thing with respect to its being so that it does not suffer from the indefiniteness of materiality, the definition or the essential predication of the primary substance is an identity statement in the strict sense i.e. in the sense that this entity is not subject to any alteration due to being composed of matter. For example, the definition of the soul is "a substance in the sense of the form of a natural body having life potentially within it." (*De Anima* B1 412a19-21) Aristotle here does not appeal to anything else other than the form as the actuality of a certain body. No prior cause of being a soul is implied here. Whereas in the case of a sensible substance, this must depend on its form which actualizes its matter to allow it to exist. The definition of man is not the form *viz.* the soul, but it can be "such and such body's being actually alive due to a human soul". Therefore, any substance which is not composed of matter is regarded as identical to its cause as its essence and so belongs to (α). Whereas any sensible substance like man belongs to (β).

It is not, however, necessarily the case that every primary substance is immanent in the composite object. Among the primary substances, Aristotle distinguishes divine being which exists as pure form, separate from sensible things, and the immanent pure form in sensible substances, by employing a particular expression to mark out the former case. Though neither of these substances is made up of matter, when Aristotle refers to the former kind of entity, he employs the expression "separate from sensible substances" rather than expressions like "without matter" or "not having matter", which he employs in both cases and "separate in account" which he employs in the latter case only. (Λ7 1073a4-5, Z17 1041a8-9, Λ8 1074a35-36, Λ9 1075a7, Z7 1032b14, H1 1042a29, H4 1044b7-8, H6 1045a36, E1 1026a10-19). These entities, as a matter of fact, belong to (α), for which there is a method of inquiry other than, as it were, demonstrative inquiry, though both kinds of inquiry are, in my opinion, subclasses of Aristotle's heuristic inquiry. (cf. H4 1044b6, E1 1025b15, K7 1064a7-10) From this point, I will call divine beings which are not composed of matter entities of type (α1), whereas the immanent substantial forms will be called entities of type (α2).

At this point, an unavoidable problem will arise regarding the immanent substantial form (α2): how does Aristotle allow entities of type (α2)

to be underlying beings and so meet the crucial condition for being a substance which the Platonic Ideas cannot satisfy? A composite being like man is an example of the "underlying" in itself because it is capable of possessing its attributes and because it cannot be predicated of an underlying, while others are predicated of it. However, without form, which is responsible for making matter an actual being, composite being cannot exist. Concerning form's capacity to cause a thing to be, Aristotle writes the following;

> That which, being present in such thing as are not predicated of an underlying, is the cause of their being, as the soul is of the being of an animal. (*Δ*8 1017b14-16)

In this sense, the composite being owes its status as "underlying" to the form which is a more basic and fundamental *per se* being. Thus, the form is a self-subsistent, primary "underlying". As to matter, since it exists only potentially in itself, it cannot be underlying in the sense that it cannot actually receive anything, for example, form or attribute.(1)

Now it should be clear from the above discussion what kinds of ontological criteria Aristotle developed in *Metaphysics* to distinguish (α) from (β) and what kind of entity Aristotle regards as belonging to (α) and (β). It seems that there is nothing to prevent the principles of a science such as number in arithmetic, from satisfying these two conditions (i) and (ii). The first condition is, as I have argued in Chapter 2 Section B, expressed as a thesis: (B) A definition which takes place between a principle and its identical essence. If there is a correspondence between the ontological criteria in *Metaphysics* and the structural criteria in *Posterior Analytics*, an interesting question arises concerning the epistemological issue whether there is also a correspondence between the methods of inquiry which apply to these entities in *Metaphysics* and *Posterior Analytics*. In what follows, I will discuss Aristotle's argument concerning the question of how we come to know the causal entity (β) in *Metaphysics*. I would like to show that Aristotle employs the apodeictic explanatory structure in his inquiry theory in *Posterior Analytics* as the method of inquiry relating to sensible substances (β) in *Metaphysics ZHΘ*. (I shall discuss the question as it relates to (α) in the next Chapter.)

How are the causal entities of type (β) inquired into in *Metaphysics*? I take it that in Z17, Aristotle develops his method of inquiry into "sensi-

ble substances" in accordance with the method of articulation set out in *Analytics*. And this investigation is alleged to be helpful in explaining how we may inquire into (α2) too. (1041a7-9) Aristotle's basic position with regard to inquiry is that there cannot be any inquiry or instruction in relation to "simple beings" (ἁπλῶν) such as pure form or to cases in which something is "being said *simpliciter*" as in the question "What is man?". (1041a33-b2, 1041a9-10) In such cases there is no foothold for inquiry. Hence, the articulation of terms is indispensable for inquiry. Aristotle says "Before we inquire, the object needs to be articulated; if it is not, then it's all one whether we're inquiring into something or nothing." (1041b2-4) And yet Aristotle's method of articulating the object of inquiry fits in with the method of inquiry in *Analytics*, although in Z17, the inquirer's grasp of (1) the fact and (3) existence are presupposed. (1041a15, 1041b4-5)

Any inquiry must be performed by asking "Why does one thing belong to something else?" or "Why is something predicated of something?" To ask "Why is the thing *X* itself *X*?" is rejected as being equivalent to searching for nothing. (1041a10-15, 23) Needless to say, what is sought in this form of question is "the cause" of the thing, just as in the inquiry theory in *Analytics*. However in Z17, the matter-form relation is a subject for inquiry as well as the cause-effect relation which covers a wider range. Aristotle says: "So what we seek is the cause (and this is the form), by reason of which the matter is some definite thing; and this is the substance." (1041b7-8) Thus the method of articulating things which are said *simpliciter*, like man or house for the purpose of inquiry, consists of a division into three items — the cause (the reason why), the piece of matter and the thing itself — so that the inquirer can ask "Why is a particular piece of matter some definite thing?"

the reason why:	the matter:	the thing/effect:
the essence of house; "covering",	bricks and stones,	house
Why are these, bricks and stones, a house? (1041a26-27)		
the essence of man; "human soul",	body,	man
Why is this body, conditioned in such a way, a man? (1041b6-7)		

Hence, if there is anything which is subject to this kind of articulation, it is an instance of (β); the thing and its cause are different. In other words, if we discuss this issue in the context of *Analytics*, Aristotle's criterion for the division between (α) and (β) is concerned with whether the

syllogistic framework can deal with the relevant object or not. That is, whether the relevant object can be articulated into these three items: "the cause" (*αἴτιον*), "the effect (thing/event)" (*οὗ αἴτιον*) and "the underlying" (*ᾧ αἴτιον*). What Aristotle makes clear in Z17 is that if something is analysable into its form and matter, it can be treated in syllogistic terms too and its essence will be made clear "through demonstration". (*An. Post.* B8 93b17-20, B9 93b25-28) Hence it is now clear that sensible substances like man are instances of (*β*), and that these are the genuine objects of Aristotle's theory of inquiry. We do not have to worry about Aristotle's inquiry into sensible substances which are being "said *simpliciter*" i.e. which are referred to by single words, as Aristotle's commentators do. For those things are actually composed of causal elements which are different from the substances themselves. If we go back to the process of inquiry in *Analytics*, what Aristotle makes clear is that the inquiry into (4) the essence, which is asked for by using single terms, should be performed by articulating it into the form of (2) the reason why, which is composed of a number of items, after discovering (3) the existence of thing/event at issue. And that kind of articulation will not be difficult. For when we discover the existence of something, knowledge of its existence is accompanied by some other concomitant knowledge. Thus the demonstration relating to the inquiry into "what a man is" will be set out as follows;

> Body of such and such a kind (e.g. two-footed animal) *φα* human soul
> Human soul *φα* man
> Body of such and such kind *φα* man. (cf. Z17 1041b6-8, H3 1043b b10-14)

The major premise is composed of a matter-form predication which can be expressed as a potentiality-actuality predication too. This potentiality-actuality predication is not happily thought of as an identity statement, which is not supposed to appear in a demontration, though this kind of relation is "in a sense one". (H6 1045b20-21, cf. *An. Post.* B3 90b33-34) On the other hand, the minor premise is an essential predication.But this is not identity statement either, as explained in H3 1043b3. The conclusion is also an essential predication, which is not an identity statement. Thus this syllogism seems to be a genuine demonstration, given that a human soul is the cause of a body of such and such a kind being a man. Hence

we can conclude that the apodeictic explanatory structure offers the basis for inquiry into sensible substances in *Metaphysics*.

Note.

(1). See A. Code p. 12. I am not sure whether form is predicable of "that which is potentially the actual object" as Code suggests. One cannot say that 'Such and such a body is soul' or 'Such and such a nose is concavity.'

Chapter 6. Induction and *Νοῦς*

A. Inductive Syllogism

The final task to be performed in Part II is to elucidate how the primary principle in each Demonstrative Science comes to be known. For this task, it is essential to investigate the nature and roles of induction (*ἐπαγωγή*) and comprehension (*νοῦς*) in the Aristotelian enterprise of Demonstrative Science. In Section A, I will discuss, firstly, the nature and function of induction from both the ontological and the epistemological points of view. Secondly, I will discuss how demonstration and inductive syllogism are functionally related to each other in the context of heuristic inquiry. Then, in Section B, I will trace, through an analysis of B19 and *Metaphysics* A1, how the primary principle, in the sense of the most universal concept in a science, emerges in the soul as comprehension (*νοῦς*) which is a cognitive disposition of the soul.

Induction is, generally speaking, a form of argument based on the credibility of *αἴσθησις* [the broader sense of sense-perception cf. 81b3] which aims to "prove the universal" (*δεικνύντες τὸ καθόλου*). (72b29, 71a8, cf. 91b 35) Aristotle describes induction from both (A) the ontological and (B) the epistemological points of view. His description is based on an analysis of the functions of the senses.

> Induction of type (A) is a passage (*ἔφοδος*) from the particular to the universal. (71a9–10, 81b1, 92a37–b1)
> Induction of type (B) is a passage from what is better known by and prior for us to what is known and prior *simpliciter* or by nature. (72b28–30, 68b35–37, *Phys.* A1 184a16–b4)

If one combines both processes (A) and (B), it will follow that "Induction should proceed from particular cases to the universal and from the known to the unknown." (*Top.* *Θ*1 156a4–6)

According to the epistemological point of view (B), induction is a passage from what is better known and prior for us to what is knowable and prior simply or by nature. Aristotle describes knowability and priority as concerned with whether the relevant item is nearer to or further from the sense. What is nearer to the sense is said to be prior and better known in relation to us, whereas what is further away is said to be prior and better known simply. (72a2-4) From the viewpoint of (A), the most universal is furthest away, particulars being nearest. (72a4-5, cf. *Met.* A2 982a21-28) What about (B)? What is familiar and prior for us (*viz.* closest to our senses) is "something whole" (*ὅλον τι*) which is "compounded" (*συγκεχυμένα*) or "universal" [the content of perception] and "what is such and such" (*τό τοίονδε*). (184a22, 25, 100a16-18, 87b29) Hence, from the epistemological point of view, inductive arguments make something clear and distinct, starting from something obscure and indistinct. In *De Anima* Aristotle describes this epistemological process:

> It is from the thing which are naturally obscure, though more easily recognised by us, that we proceed to what is clear and, in the order of account, better known. (B2 413a11-12)

Aristotle seems to illustrate this point in visual terms, both when he talks about place and when he talks about time. For example, when someone is seen at a distance, we perceptive him to be a white before we perceive that he is an animal, and then a man, and finally Socrates or the son of Diares. Aristotle thinks that it is accidental that one sees the white thing as the son of Diares in the sense that the most direct and *per se* object of sight is colour (e.g. white) and after that some universal like man. Grasping a white thing as Socrates or under a relational description like "the son of Diares" comes later, being indirect and accidental for the senses. (B6 418a20-25) This process of recognising an individual, however, is not an induction of type (A). This illustration tells us nothing about the move from a perceptual grasp of an individual to the grasp of some universal. In this sense, it is not necessarily the case that the processes (A) and (B) correspond to each other in every case.

With reference to time, he gives the following example: infants initially call all men "father" and all women "mother". (*Phys.* A1 184b3-5) This indicates that infants, perceiving an adult, initially discriminate one feature which the object has e.g. maleness/femaleness, rather than one token object

from another e.g. Socrates from Callias. As Modrak suggests, the perceptual features of a particular are type-dependent. (p. 168) The sensible object is a token of a type and we perceive the type in virtue of apprehending particulars. But what we should notice is that it is not the case that in talking about (B) it is the content of the observer's cognitive state which is primarily at issue. It is the knowable elements which each sensible object has which are at issue here, although elements of cognitive states correspond to those knowable features which are in the sensible object in the way that the cognitive faculties in the soul actualise what is potentially in an object. Insofar as (B) is concerned, we should say that inductive argument proceeds from perceiving an unarticulated compound universal which potentially contains distinct elements to a grasp of something distinct.

With respect to the ontological point of view (A), the starting point in the inductive process is, no doubt, the particular sensible object. For with regard to the senses, Aristotle says that "The senses give the most authoritative knowledge (*κυριώταται γνώσεις*) of particulars." (*Met.* A1 981b11) The generalisation which is the conclusion of an inductive argument gains immediate credibility on the basis of its "being evident" (71a8) with respect to the particular case which is apprehended by the senses. So how do the two processes (A) and (B) fit together? It will be something like the following: induction is a universalization or generalisation of a kind which moves from perceiving a particular as an indistinct universal to grasping a universal as a distinct universal.

Now it is essential to make clear what is meant by a "universal" in the context of inductive argument in order to understand the roles which induction plays in the plan of Aristotle's Demonstrative Science. Let us make clear what kind of universal is known by an inductive argument. Is it a straightforward universal generalisation or is it a statement affirming a necessary connection? Does an inductive argument grasp a necessity or stop at a probability? If it grasps a necessary proposition, in what way and in what sense is it established and guaranteed? Or is what induction grasps just a universal term or concept?

Although commentators have not always been clear about this, it is obvious that one can reach the stage at which the universal proposition may be formulated through an inductive argument. For an inductive argument can be syllogized; the experience which is a component of the inductive argument is a kind of propositional judgement and amongst other

things, induction is regarded as a kind of proof. (*An. Pri.* B23, 71a8, 100 a5, *Met.* A1 981a1-9) So what kind of universal proposition does induction end up with? Is it a universal quantification or a necessary proposition? In this respect, the following description is helpful:

> The definer (ὁ ὁριζόμενος) will not prove (δείξει), as the man of induction (ὁ ἐπάγων) proves through the particulars, which are clear, that everything is thus since nothing is otherwise (ὅτι πᾶν οὕτως τῷ μηδὲν ἄλλως). For induction does not prove (δείκνυσιν) essence, but whether it exists or not. (92a37-92b1, cf. 92a34)

This sentence tells us an important feature of the universal proposition which is obtained through induction. Although the phrase "everything is thus since nothing is otherwise" looks like the necessity condition in the definition of epistēmē in A2 ("it is not possible for this to be otherwise" (μὴ ἐνδέχεσθαι τουτ' ἄλλως ἔχειν) (71b12)), it lacks the modal operator: "μὴ ἐνδέχεσθαι" (not being possible). This suggests that induction establishes a universal predication in the sense of a universal quantification which may be, *in fact*, i.e. *as it happens*, a necessary predication, but that induction is weaker than demonstration in terms of explanatory power. In this passage, Aristotle clearly conveys the weaker power of induction, by employing the word "prove" (δείκνυσιν) instead of "demonstrate" (ἀποδείκνυσιν) and the word "everything" (πᾶν) instead of the modal operator indicating necessity: "not being possible" (μὴ ἐνδέχεσθαι). I have argued in Chapter 2 Section C that the "syllogism of the fact" in A13 and the less strict form of demonstration in B8 are also treated as having sufficient explanatory power to establish or prove (δείκνυται) the fact and the existence of the thing/event as being clear (δῆλον). (93b2, 78a36-37, 78b12-13 cf. Chapter 4) I take it that induction grasps the existence and the fact of a thing/event in a looser or weaker way than demonstration.

Insofar as induction is discussed in terms of the clarity of sense perception with regard to particular sensible objects, this argument is concerned with a matter of degree and nothing more. For, as we have seen before, the senses which only deal with *hic et nunc*, cannot present a phenomenon *as* the cause of something else, though they may apprehend a phenomenon which is *in fact* the cause of something else. For instance, if we were on the moon, we could see the earth coming between the moon and the sun. However, by its very definition it is not the case that the senses

can present it *as* the cause of an eclipse, given that the cause which is made clear by the universal proposition is not the object of sense perception. The cause can be made clear through the formation of a demonstration or by quick wit, which is equivalent in function. Moreover, since cause is identical with essence, Aristotle says without any hesitation that "induction does not prove essence". (92a38) Nothing, however, prevents it from being the case that an inductive argument *in fact* grasps a necessary or essential predication. Does an inductive argument never grasp the cause *as* the cause, insofar as it is based on sense perception? But is not any discovery based on sense perception, even if sense perception is only the first stage of discovery? If so, demonstration as another tool of heuristic inquiry will also depend on sense perception. Then why does demonstration differ from induction in terms of explanatory power? Now in order to understand the difference in explanatory power between demonstration and induction, it is essential to compare an inductive argument with demonstration by showing how an induction may be syllogised.

Induction is usually treated as contrasted with *syllogism* (*συλλογισμός*) or demonstration which is scientific *syllogism*. (e.g. *An. Pri.* B23 68b30-37, 81a38-b2, 71a5-11, *Nic. Ethic.* Z3 1139b26-36) But this contrast does not necessarily mean that an inductive argument can never be syllogized. There can be "the syllogism based on induction" (*ὁ ἐξ ἐπαγωγῆς συλλογισμός*), though this accords with none of the three figures. (68b15) Aristotle discusses this issue in *Prior Analytics* B23. I would claim that in the context of heuristic inquiry, by making induction capable of being syllogised, Aristotle tries to fit induction into the structure of Demonstrative Science so that he can show that induction performs a role which is complementary to that of demontration at any level in the hierarchy of a science. This is because the articulation of inductive knowledge into syllogistic form facilitates the formation of a demonstration. In the case of the primary principles of a science, only inductive arguments are available, in the sense that those entities are established by checking the ingredients of the entire system of that science, to confirm that it is these entities which underlie all the ingredients of a science as grounds or principles. (This issue will be discussed in Section B.)

Now, let us take a more specific look at the function of inductive syllogism in B23 with some references to other related passages. As we have seen before, an inductive argument is a kind of proof of a universal

proposition on the basis of the certainty of a particular case. One proves (δείξαι) A's belonging to B through Γ in a case in which B is the middle term in relation to A and Γ. "For this is the manner in which we make inductions." (68b18) The inductive syllogism is set out as follows;

$$(A\ \varphi\alpha\ \Gamma \wedge B\ \varphi\alpha\ \Gamma) \supset (A\ \varphi\alpha\ B) \quad (68b17\text{–}18)$$

If B and Γ are convertible, we can get the same form as the first figure *Barbara* in spite of the different method of setting out the terms, by giving Γ the role of the middle term in that mood. Thus we obtain the necessity of inference *viz* necessitas consequentiae in the following wat:

$$\Box (A\ \varphi\alpha\ \Gamma, \Gamma\ \varphi\alpha\ B, \supset A\ \varphi\alpha\ B). \quad (68b23\text{–}27)$$

In other words, unless one finds that both terms are convertible, an inductive argument will not count as a syllogism and fails to guarantee the necessity of the conclusion. An inductive argument is valid only if B and Γ are convertible. Otherwise A $\varphi\alpha$ B does not necessarily follow from A $\varphi\alpha$ Γ, B $\varphi\alpha$ Γ. Aristotle gives this example of an inductive syllogism;

(I1*) Long-lived $\varphi\alpha$ the particular long-lived animals which are quadrupeds (τετράποδα), e.g. man, horse, mule.
Bileless $\varphi\alpha$ the particular long-lived animals which are quadrupeds.
Long-lived $\varphi\alpha$ bileless. (68b18–24, 99b4–6)

Although it is not made explicit in B23, what Aristotle has in mind as the referent of the term Γ must be a specific kind of animal *viz.* quadruped. Otherwise, the term Γ will not be convertible with the term B *viz.* bileless. (68b23) For in the case of birds which are also long-lived animals, a cause of their long-livedness may be "their being dry". It is only in the case of quadrupeds that the cause of their longevity is bilelessness. (99 b4–6) Otherwise the major premise will be a trivial repetition, something like "All the particular long-lived animals live long." Just as in the example of a demonstration in A13 particular heavenly bodies such as Venus, Mars are gathered together as belonging to a kind: "planet", the particular long-lived animals like man or horse should be unified by some common element or kind (τῷ εἴδει). (99b5) In fact, Aristotle characterises Γ in two ways. He first characterises it as "the particular long-lived beings, e.g. man, horse amd mule." (68b20–21) and he then characterises it as "the being composed of all the particulars". (68b28–29) It is clear from

both descriptions that the particular long-lived animals are gathered together as belonging to a certain kind under a unitary concept. And this kind is, in this case, just that of "quadruped". Hence one can say that the term Γ stands for the particular long-lived animals of a specific kind i.e. quadruped.

The crucial feature of this syllogism is that Γ which is a set of praticulars gathered under a certain concept, takes on the explanatory role which, in the case of a demonstrative syllogism, is supposed to be borne by the B term. Both the major and the minor premises derive from inductions which are based on the certainty (*διὰ τοῦ δῆλον εἶναι*) of particular cases and are performed through examples (*διὰ παραδειγμάτων*). (71a8–10) An inquiry into case (I1*) will start by raising questions like "Do horses live long or not?" etc. The inductive inquirer will then follow something like the following cognitive process.

> Q: The kind, quadrupeds, R: The kind, bird, $m1$, $m2 \ldots mn$: longlived particulars like a horse, a eagle, L: the property, long-livedness, B: the property, bilelessness, D: the property, being dry.
> $L \varphi Qm1$, $L \varphi Rm2$, $L \varphi Qm3$, $L \varphi Qm4$, $L \varphi Rm5$, $B \varphi Qm6$, $B \varphi Qm7$, $L \varphi Qm8$, $D \varphi Rm8 \ldots L \varphi Qmn\text{-}1$, $B \varphi Qmn$.

Through this kind of experimental procedure, the inquirer reaches a state of conviction (*πίστις*) with respect to both the major and minor premises by marking off certain particular cases like man, horse from others like eagle according to their proper kind (*viz.* quadruped) which makes the term Γ convertible with B. Then it will necessarily follow that all bileless beings live long.

Since it is impossible in practice to have a perceptual grasp of all instances of long-lived animals, a universal term such as "quadruped" is the object of "to comprehend" (*νοεῖν*) which is just "to see through mental sight" (*νοεῖν*, cf. *ὁρᾶν τῇ νοήσει*) (77b31). Aristotle says that "We must comprehend (*νοεῖν*) the term Γ as being composed of all the particulars". (68b27–28) It is not only unnecessary but wrong to interpret this "*νοεῖν*" as "intuition" which is postulated to make a momentary inductive leap to the universal. I take it that Aristotle characterises intuition as the faculty of "quick wit" (*ἀγχίνοια*) which is a sort of skill in conjecture (*εὐστοχία τις*). Skill in conjecture may be a sort of mental disposition, given that it is contrasted with other mental dispositions such as epistēmē and opinion.

Aristotle describes it as follows: "Skill in conjectures involves no reasoning (λόγος) and is something that is quick (ταχὺ) in its operation." (*Nic. Ethic.* Z9 1142a33-b6, 89b10-13) What Aristotle meant here is just that while the particular is the object of sense-perception: αἰσθητός, the universal term which is not the object of sense-perception is the object of comprehension: νοήτος. (cf. 86a29-30, 100a17, *De Anima* Γ8 431b22, *Met.* B4 999b1-3) In other words, νοεῖν occurs when a unitary universal is grasped and retained by the soul, regardless of what level in the hierarchy of a science that unitary universal concept belongs to. (100a6-7) The noetic faculty stands in the same relation to intelligible object as that in which the perceptual faculty stands to sensible objects. (429a13) In other words, comprehension is just a mental disposition which is analogous to sense perception in the sense that while particular things are the object of sense perception, universal objects are the object of comprehension.

Although there is nothing to prevent a momentary appearance of a universal in the soul, usually such a concept is shaped gradually through various observations or experiences as in the case of the inductive argument concerning longevity. Through this sort of inductive procedure, the universal term is acquired. But it is not necessary to accomplish this process by a complete enumeration of the members of the kind to which the universal term is applied. Because one who knows a universal by having an account may be ignorant of particular cases (τὸ δ' ἐν τούτῳ [λόγῳ] καθ' ἕκαστον ἀγνοῇ). (*Met.* A1 981a21-22) In this situation, he may fail to know particular cases, say dog, or cat which are members of this universal kind Γ; "quadruped". The important thing in this process is to grasp "the one apart from the many, whatever is one and the same in all those things". (100a7-8)

As I have argued in Chapter 2 Section D, a strict universal predication is composed of three elements: [U1] universal quantification, [U2] *per se* (necessary or essential) predications ([U2a] and [U2b]), [U3] *as such* predication. When the universal term is at issue, it may occupy the place of subject or predicate in this universal predication. I would claim that an inductive syllogism like (I1*) may *in fact* hit on the universal term and then on a predication which meets these conditions, but it cannot establish it as a primary universal. (cf. 74a17) Only demonstration fulfils this role. It seems that what induction obtains by itself is [U1] a universal quantification. In such a context, Aristotle is careful enough to use the word "πᾶν"

(all) instead of "universal". (e.g. 68b28, 29, 88a17, 92a38, 100a6) For an inductive syllogism is valid only if the terms B and Γ are convertible. Insofar as an inductive syllogism is valid, one can claim that the condition of universal quantification between B and Γ is met and the conclusion follows as a matter of logical necessity. Hence what is required for an inductive syllogism is to meet two conditions: (1) universal quantification with respect to A $\varphi\alpha$ Γ and (2) the convertibility of B and Γ. No matter how we grasp the two premises: A $\varphi\alpha$ Γ and B $\varphi\alpha$ Γ, as long as the inductive syllogism meets these two conditions, we are entitled to say that it is a validly syllogized induction. For example, let "grammatical" be A, "capable of laughing" be B and "man" be Γ.

(I2*) Grammatical $\varphi\alpha$ man.
Capable of laughing $\varphi\alpha$ man.
Grammatical $\varphi\alpha$ capable of laughing.

This is a valid inductive syllogism, though there is nothing to guarantee that "Being capable of laughing is *the cause* of man's being grammatical". Thus one cannot claim that, by having an inductive syllogism, one knows the reason why A $\varphi\alpha$ Γ. Now it seems that we can clarify the nature and the explanatory power of inductive argument in the following formula:

> Induction is an argument by which one proves (*δείκνυσι*) on the basis of perceptual knowledge that each member of the kind K (*km*1, *km*2, *km*3.. *kmn*) has a property P that all members of kind K have a property P and P may be *in fact* a necessary or essential property of members of K, though this argument cannot establish it *as* a necessary or essential property.

B. How Primary Principles Come to be Known through Inductive Argument

Now I would like to take a fresh look at B19, in which an inductive argument for grasping the principles of a science is set out in full. At the outset of this chapter, in contrasting knowledge of the principles (*ἀρχαί*) with demonstrative knowledge (*ἐπιστήμη ἀποδεικτική*), Aristotle raises two questions about knowledge of the principles, questions on which the whole chapter is focussed: "As to the principles (*τῶν ἀρχῶν*),

(1) how do the principles become known (*γνώριμοι*) and
(2) what disposition knows (*γνωρίζουσα*) them?" (99b17–18)

There has been controversy over what kind of principle (ἀρχή) is at issue in this chapter. Are the principles of B19 propositions as primary principles? Or are they primary terms that are components of non-demonstrable primary premises?(1) I have already argued that Aristotle is quite conscious of the significance of the distinction between proposition and term. I would like to show that, in discussing these two issues in B19, Aristotle establishes the relationship which holds among the following three senses of the word "principle" (ἀρχή): the primary term of a science (τὰ πρῶτα =ἀρχή), comprehension (νοῦς=ἀρχη ἐπιστήμης) and the immediate syllogistic principle (ἀμέσος ἀρχῆ συλλογιστικῆ=ἀρχή ἀποδείξεως). Firstly, I would like to show that the principles mentioned in these two questions are the primary terms of a science.

Aristotle sets out two preliminary puzzles (προαπορέιν) in order to help him answer his two questions concerning knowledge of the principles; "The answer will be clear, if we first examine some preliminary puzzles." (99b18-19) In order to introduce the puzzles, Aristotle first reconfirms the indispensability of prior knowledge of the primary principles in attaining demonstrative knowledge. He says:

> Now we have said earlier that it is not possible to know$_e$ through demonstration (ἐπίστασθαι δι' ἀποδείξεως), if we do not know the primary principles which are the immediates (μὴ γιγνώσκοντι τὰς πρώτας ἀρχὰς τὰς ἀμέσους). (99b20-22)

Here the reference goes back to A2 72a25-A3 72b18, especially 72a25-29, 72a37-39 and 72b13-15. There Aristotle claims that "the principles" (τὰς ἀρχὰς), which can both be taken as syllogistic immediate principles, such as definition of the primary terms, and the primary terms (τὰ πρῶτα), must be known beforehand (προγινώσκειν) and must be more convincing (μᾶλλον πιστεύειν) than demonstrative knowledge, otherwise there is no epistēmē simpliciter (ἁπλῶς), but only hypothetical knowledge. (cf. 72a14ff) As we have seen in Chapter 2 Section B, the relation between the principles as the primary terms and their derivatives can be compared to the relation between the underlying genus and its *per se* attributes. (75a28-31, 75a42-b2, 75b7-8, cf. 73b5-8) If so, it is obvious that, for Aristotle, unless one knows the underlying and propositions about the underlyings by means of (A) the hypothesis or (B) the definition, one will be unsure not only which science knowledge of its attributes belongs to, but also whether that knowl-

edge has a final ground. For instance, in the sense that number creates and determines the universe of discourse of arithmetic, number is the primary term of arithmetic, on which its attributes are ontologically and epistemologically dependent. (cf. *Met.* *Γ*2 1004b8-13, *Top.* A18 108b26) In establishing this point, Aristotle leaves it open whether the primary immediate principles are to be interpreted as terms or propositions so as to set up some puzzles relating to this issue.

The reason why Aristotle confirms the ontological and epistemological priority of the primary immediate principles over demonstrative knowledge at this point, is that he intends to make clear the place and function of these principles in Demonstrative Science. He then presents his two puzzles in order to distinguish two kinds of knowledge relating to the immediate principles. The puzzles are presented as follows;

> As to knowledge of the immediates (*τῶν δ' ἀμέσων τὴν γνῶσιν*), however, one might puzzle both (3) whether it is the same or not the same [in every case], that is (*καὶ*) whether there is epistēmē of each of the two (*ἑκατέρου*) or rather epistēmē of the one and some other kind [of the knowledge] of the other and (4) whether the dispositions (*αἱ ἕξεις*) are not innate in us but come about in us, or whether they are innate in us but escape notice. (99b22-26)

I take it that here the distinction is drawn not between knowledge of the primary term and demonstrative knowledge, but between knowledge of one kind of immediate, which is non-demonstrable epistēmē, and some other cognitive disposition of the soul as it grasps the primary terms of a science.

Although these preliminary puzzles are so important, in the sense that they contain the key to the correct understanding of B19, commentators have been mistaken in their interpretation of them. For example, Philoponos comments on this phrase as follows:

> Now we seek for whether the knowledge of the immediate proposition is the same as the knowledge which comes to be known to us through demonstration (*δι' ἀποδείξεως*) or different, and whether each knowledge of the two (i.e. the one which comes about through demonstration and the knowledge of principles) is brought back to the same kind which is epistēmē or rather whether of the one (i.e. demonstration) there is epistēmē and of the other (i.e. the knowledge of the principles), there is no epistēmē but some other kind. (p. 433)(2)

According to traditional views such as that of Philoponos, the contrast is drawn between knowledge of the immediate proposition of the primary principle of a science and demonstrative knowledge. But Aristotle has already brought out this contrast in the previous sentence in which he says that it is indispensable to know the primary principles in advance in order to have demonstrative knowledge. Hence there is no reason for Aristotle to raise the same issue again here, by asking whether knowledge of the immediates and demonstrative knowledge are the same or not. Furthermore, there is one piece of textual evidence which is in tension with the traditional view, which is found in Aristotle's answer to (4). Aristotle says:

> Well, if we have them [as innate knowledge], it is absurd; for it results that we have pieces of knowledge (*γνῶσεις*) more certain than demonstration (*ἀποδείξεως*) and yet this escapes notice. (99b26–27)

The "pieces of knowledge" (*γνώσεις*) which are contrasted with demonstration here correspond to "the dispositions (*αἱ ἕξεις*)" in (4). The use of these plural expressions and the fact that Aristotle questions whether the one knowledge is the same as the other clearly indicate that there are two kinds of cognitive disposition of the soul relating to the knowledge of the immediate (*τῶν δ' ἀμέσων τὴν γνῶσιν*) and that both of them are different from that produced by demonstration. Commentators have failed to see that Aristotle here examines two mental dispositions, one concerned with knowledge of the immediate terms and the other concerned with knowledge of the primary immediate propositions. Hence, Aristotle has comprehension (*νοῦς*) and non-demonstrable epistēmē (*ἐπιστήμη ἀναπόδεικτος*) in mind as the two dispositions of the soul involved in knowing the immediate term and the primary immediate proposition. In other words, Aristotle here tries to offer some arguments for what he has claimed in A3. In A3 Aristotle says:

> We claim (*φαμεν*) that neither is all epistēmē demonstrative, but the epistēmē of the immediates (*τὴν τῶν ἀμέσων*) is non-demonstrable (*ἀναπόδεικτον*)... We also claim (*φαμεν*) that there is not only [non-demonstrable] epistēmē, but also some source of epistēmē (*ἀρχή ἐπιστήμης*) by means of which we know the terms. (72b23–25)

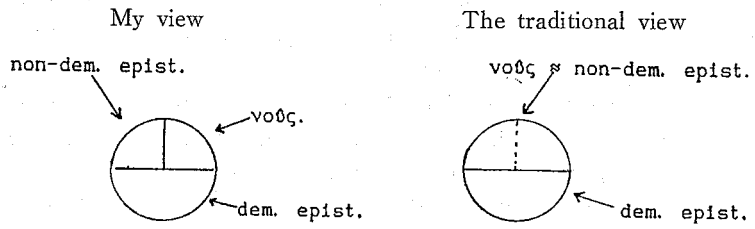
Here he is claiming, as I have already argued in Chapter 2 Section B, that comprehension (*νοῦς*), which is the source of epistēmē, is the disposition

of the soul which emerges in grasping (*γνωρίζομεν*) the non-demonstrable immediate terms and that non-demonstrable epistēmē of these terms is conveyed by the types of proposition: (A) the hypothesis and (B) the definition.

I take it that the ground of this sharp distinction between the non-demonstrable terms and the proposition which is about these terms is set out in B19, in which, having answered questions (1) and (2), Aristotle discusses the relation between the "source of epistēmē" called *νοῦς* which is the answer to (2) and the "principle of demonstration". When it is said that "comprehension (*νοῦς*) is of the principles (*τῶν ἀρχῶν*)" (100b12), the word "principles", without doubt, signifies not the propositions, but the terms.

For firstly, Aristotle contrasts comprehension with epistēmē, whether demonstrative or non-demonstrable, in that, while epistēmē involves "an account (*μετὰ λόγου*)" comprehension does not. (100b10-11)[3] Secondly, as I have argued in Chapter 2 Section B, it is clearly stated in other passage that comprehension grasps not the proposition, but the term. (*Nic. Ethic*, Z11 1143a35-b2, b5, Z10 1143a4-5, *De Anima Γ*6 430b27-30; concerning "the principle of demonstration" as a proposition, see 75b31, 94a9-10, 88b 36-37, 90b24, cf, 100b13) For instance, this distinction is found in *De Anima* as a contrast between comprehension of indivisible things (*νόησις ἀδιαιρέτων*) and the combining of thoughts (*σύνθεσις νοημάτων*) such as combining 'the diagonal' and 'incommensurable with the side'. (*Γ*6 430b26-31, cf. *Met*. E4 1027b20-25, *Θ*10 1051b27) Thirdly, in posing the two questions (1) and (2) concerning "the principles", Aristotle avoids using the word epistēmē but employs the cognates of "*γνῶριζω*". (cf. 99b21, 100b9) In the case of "the primaries" too, which are without doubt, as we have seen, terms like number in arithmetic or magnitude in geometry, Aristotle does not characterise knowledge of these terms as epistēmē. (eg. 72a28, 39, 72b13, 100b4) Thus there seems to be no doubt that the principles which are grasped by comprehension are terms. I conclude that the phrase "the principles" (*αἱ ἀρχαί*) in B19, whenever it appears by itself rather than as part of a longer phrase, as in *ἀποδείξεως ἀρχή*, *ἀρχή ἐπιστήμης*, refers to the non-demonstrable immediate primary terms of a science i.e. the type of entity (*α*) whose causes are identical with themselves. In other words, Aristotle understands "principle" to mean (2b) "what is primary in the genus (*τὸ πρῶτον τοῦ γένους*) about which the proof is" (74b24-25) The difference between my interpretation of the principles in B19 and the tradi-

tional view may be represented by the following diagram:



After denying that the mental disposition: *νοῦς* is innate, Aristotle raises another difficulty which confronts the rival theory.

> If, on the other hand, we acquire them and do not previously possess them, how could we know and learn without a basis of pre-existing knowledge? For that is impossible, as we said in the case of demonstration too. (99b28–30)

Here Aristotle presents the following dilemma: on the one hand, there is no innate disposition which has direct or *a priori* knowledge of immediates; on the other hand, there can be no later acquisition of the dispositions which have direct knowledge of immediates, without presupposing some pre-existing knowledge. This dilemma inevitably raises the following question: How do we acquire comprehension and non-demonstrable epistēmē as cognitive dispositions, given that any knowledge requires pre-existing knowledge?

Then Aristotle presents his solution to this dilemma. His positive proposal in response to this dilemma will also, in effect, provide the answers to the questions with which B19 began: (1) how do the primary principle become known? and (2) what disposition knows them? Aristotle claims that we must have innately "some capacity" (*τινα δύναμιν*) from whose deliverances we can derive our knowledge of primary principles;

> Necessarily, therefore, we have some capacity, but do not have one of a type which will be more valuable than these in respect of exactness (*κατ' ἀκρίβειαν*). (99b32–34)

The reason why this capacity must be less exact than the mental dispositions by which we have knowledge of the primary principles or rather the immediates, in this context, is given by the earlier argument that if we

have more exact knowledge and yet fail to notice or recollect it, this will be absurd. Such "a connate discriminative capacity" is called "sense". (99b35) This is shared by all animals. On the basis of this connate capacity, Aristotle gives an account of the cognitive process that leads from the sensible particulars grasped by the senses *via* memory and experience to the abstraction of a unitary and universal concept which is characterised as "the one apart from the many, whatever is one and the same in all those things". (99b35–100a7) Aristotle takes it that when such a unitary and universal concept is grasped by the soul, the disposition of the soul is that which is called "a source of expertise and epistēmē" i.e. *νοῦς*. (cf. 100b15) This process is none other than induction. (100b4)

What is remarkable in this process is that Aristotle does not take the inductive process any further than the point at which the source of epistēmē and expertise first emerges. (100a8) He makes no mention of the way in which the definition which is the principle of demonstration is to be formulated. At the end of the chapter he just states the relation between the source of epistēmē, i.e. *νοῦς* and the principle of a science as the primary terms which is such that the source of epistēmē is related to the primary terms of a science (*ἀρχὴ τῆς ἀρχῆς*) in the same way (*ὁμοίως*) that every epistēmē is related to every thing/event. (100b15–17) That is, just as without the thing/event in the world we cannot have epistēmē as our cognitive state, so without the primary terms of a science we cannot have *νοῦς* as our cognitive state. (cf. 85a1)[4] From this comparison, it is clear at least that Aristotle does not assign to the source of epistēmē (*νοῦς*) the role of grasping the principles of demonstration of which there is non-demonstrable epistēmē. Thus we should treat the formation of a concept in the soul differently from the formation of the definition of a primary term of a science in the sense that the latter comes one stage after the former, contra Modrak, who sees them as "the same cognitive process". (p. 162) This is not surprising. For Aristotle's main concern in this chapter is to give a genetic account of *νοῦς* which knows or perhaps touches (*θιγεῖν*) the "principles" (*ἀρχῶν*) as the universal terms without an accompanying account (*μετὰ λόγου*) rather than to explain how we grasp the "principles of demonstration" (*αἱ ἀρχαὶ τῶν ἀποδείξεων*) in the definitory articulation of the principles of which there is non-demonstrable epistēmē. (99b17–19, 100b10)

In the final section of B19, Aristotle characterises the mental disposi-

tion involved in grasping the principles. He claims that νοῦς is more accurate (ἀκριβέστερον) and truer (ἀληθέστερον) than epistēmē. (100b8-11) Since νοῦς, in grasping the principles as the primary terms of a science, is more basic in the hierarchy of scientific understanding than any other cognitive state, (including non-demonstrable epistēmē and demonstrative epistēmē), it is characterised as being more accurate than epistēmē. Aristotle uses the terminology to express the point that the more basic a science, in the sense of "its being dependent on fewer items (ἢ ἐξ ἐλαττόνων)", the more accurate (ἀκριβέστερον) it is; and again Aristotle clearly states that "a demonstration more dependent on a principle is more accurate (ἀκριβεστέρα) than one less so." (86a16-17, 87a31-35) Concerning the second characteristic of νοῦς, as being "truer" than epistēmē, this is because νοῦς deals with terms without forming any judgement, in the sense that it either touches the intellectual object or fails to touch it and is ignorant of it, rather than making an erroneous judgement about it, just as the senses may either perceive or fail to perceive a sensible object. On the other hand, epistēmē comes about in the soul by making a discursive judgement in the sense that "every epistēmē involves an account (μετὰ λόγου)." (100b 10) Hence, since forming a propositional judgement is a more complicated intellectual task, we can say that it is more liable to error, though it may be, in fact, always true, insofar as it is characterised from the point of view of successful inquiry. (100b6) I take it that Aristotle used the term "νοῦς" as an honorific title for the mental disposition which grasps the principles of a science, though it is just the same disposition which grasps intelligible universal object at any stage in the hierarchy of a science. In fact, νοῦς is found only in relation to the primary terms of a science in the context of Aristotle's theory of Demonstrative Science. (cf. 85a1, 88b36, 100b12) The reason why Aristotle does not use the term "νοῦς" to describe the mental disposition involved in grasping universal terms other than the primary of a science is that there may be a demonstration of these entities eventuating in epistēmē which involves another kind of mental disposition. In such cases, Aristotle employs expressions such as "νοήσις", "νοῆσαι" and "νοεῖν" in describing how the subject grasps the universal. (68b28, 88a6-7, 88a16-17)

Now, on the basis of my argument concerning the nature and function of induction, together with my analysis of B19, it seems that we can extract some conclusions which can solve many of the perplexities which

have troubled Aristotle's commentators. Firstly, the genetic and empirical explanation of *νοῦς* as based on the senses is in itself an implicit criticism of Plato's intellectualism which arises from his own understanding of *νοῦς*. The reason why Aristotle raises the preliminary puzzle concerning the question whether knowledge of the primary principle is innate or acquired is obviously linked to the problem of Plato's dualistic metaphysics in which *νοῦς* is supposed to be a purely intellectual faculty which grasps the Forms in an *a priori*, non-empirical manner and on which the Theory of Recollection is based. Hence, Aristotle's empirical treatment of these puzzles implies a criticism of Plato's intellectualism. Or rather, one can say that the difficulties to which the Platonic understanding of *νοῦς* may give rise provide an endorsement of Aristotle's enterprise in constructing an empirical Demonstrative Science. (cf. *Republic* 508c1, 511b-e, *Meno* 86a6, cf. J. Lesher pp. 49-51)

A second point, which is related to the first, is that my reading of B19 and my account of induction reject the traditional understanding of *νοῦς*. Traditionally, *νοῦς* has been understood as a kind of self-warranting intellectual intuition and has been viewed as a sort of *deus ex machina*, in the sense that it has been seen as filling a deficiency in induction in enabling the primary principle, (grasped by *νοῦς* as the primary proposition of a science), to give rise to a more accurate or certain kind of knowledge than demonstrative knowledge, and so be the foundation of apodeictic certainty. (e.g. Le Blond pp. 136ff) But Aristotle's empirical explanation of the emergence of *νοῦς* tells us that it has its origin in sense-perception and is a mental disposition which grasps the unitary and universal term, which may not only be the primary term of a science, but may be at any level in the hierarchy of a science. As far as the object of comprehension (*νοῦς*, *νοήσις*) is concerned, since *νοῦς* or *νοήσις* is contrasted with sense-perception, in that while the particular is the object of sense, the universal is the object of *νοῦς* or *νοήσις*, there is no difference between the non-demonstrable universal term and the demonstrable universal term.

However, comprehension has a different value in grasping (*α*) the thing whose cause is identical with itself, e.g. the primary term of a science and in grasping (*β*) the thing/event whose cause is different from itself i.e. the thing/event of which there can be a demonstration. Aristotle says:

> The universal is valuable because it makes clear the cause. Hence the universal demonstration (*ἡ καθόλου*) is more valuable (*τιμωτέρα*) than

> senses (*τῶν αἰσθήσεων*) and comprehension (*τῆς νοήσεως*), with regard to those things/events whose cause is something different [(*β*)]; but for the primaries (*τῶν πρώτων*) [(*α*)] there is a different account. (88a6–8)

Here I take it that *νοήσις* is functionally identical with *νοῦς* in the sense that it too is a mental power of grasping the unitary whole in a thing/event, though it is confined to entities of type (*β*). (cf. 77b31, 88a16–17, 89b12) The key to understanding this phrase is to make clear what is meant by "more valuable". This is different from "more accurate" and "more true", but similar to "superior (*κρείττων*)" and "more important (*κυριωτέρα*)" which are mentioned in a similar context. (cf. 86a18, a23) I take it that Aristotle here contrasts the explanatory power of universal demonstration with that of sense and comprehension which belong to the category of inductive explanation. With respect to the thing/event of which there is a demonstration, universal demonstration which establishes the cause of a thing/event *as* its cause is more valuable in terms of explanatory power than sense and comprehension which may *in fact* grasp the term which corresponds to the cause without establishing it *as* the cause. In the case of a thing/event of type (*β*), the inductive argument or inductive syllogism should be taken up by the demonstration, so that what is made clear by induction can be employed in establishing something not merely *in fact*, which is the task of induction, but *as* the cause, *via* a "syllogism through the reason why".

On the other hand, in the case of an entity of type (*α*), since we cannot have a demonstration of it through its reason why, its existence and essence cannot be but supposed in the sense that they cannot be demonstrated but must be made apparent by a different method. In B9, Aristotle, referring to entities of type (*α*), states: "Hence one must suppose, or make apparent in some other way, both their existence and essence." (93b23–24) I take it that this "other way" is an inductive argument based on sense-perception. In *Metaphysics*, Aristotle, after affirming that every science deals not with being *simpliciter*, but with some particular being and some genus, explains how we grasp the essence of genera by "making some genera plain by sense (*αἰσθήσει*) and others by assuming them as a hypothesis (*ὑπόθεσιν*)". (*Met.* E1 1025b11–12, cf. K7 1064a7–8) It is natural to see this passage as related to the passage in B9. Hence, as regards entities of type (*α*), since it is impossible to compare a demonstrative argument and an inductive argument with respect to their explanatory power, Aristotle,

instead of saying that inductive argument is more valuable than demonstration, just remarks that "there is another account of the primaries." (88a7-8)[5] In what follows I would like to show that the existence and essence of the primary term or the genus term of a science will come to be known through a process of induction which involves a search for something in common among the ingredients of a science so as to unify its extension.

In order to do this, I would like to show how the primary principles are grasped through the inductive process by using an example. Besides the discussion in B19, Aristotle gives a genetic account of what is involved in knowing the universal in *Metaphysics* A1, employing the example of health. Let us trace the formation of the universal concept in B19 and *Metaphysics* A1, by taking up the case of health of which there is an expertise *viz.* medicine. Health is the goal of medicine. (*Nic. Ethic.* A1 1094a8) All medical projects are performed for this purpose. In this way health is a genus term which creates medicine's universe of discourse, just as arithmetic is performed whenever its genus-term, number, is involved in any problem. He says, "There is one science which deals with all healthy things." (*Met.* *Γ*2 1003b11) Then how can one acquire the source of this expertise? In other words, how does the most universal term or basic concept of medicine emerge in order to unify this kind of expertise?

The acquisition of any expertise or science is initially based on the discriminative capacity of sense perception. We perceive that Socrates has such and such a symptom, say red spots. Then we perceive that Callias has the same symptom as Socrates. How is this realised? There is a retention of the sensory content of a perception (*μονὴ τοῦ αἰσθήματος*) and a capacity for representation (*ἡ φαντασία*) in some animals like man. (99b36, 100a3, 980b26) Representation or mental imagination (*φαντασία*) is a motion generated by actual perception which yet remains in us and resembles the corresponding sensations. (*De Anima* *Γ*3 428b10-429a5, cf. R. D. Hicks, p. 1iii) When a sensory content (*αἴσθημα*) is again an object of awareness, it is called a phantasma. (*De Insomniis* 3 461a18-19 cf. Modrak, p. 166) Animals perform many actions under the influence of phantasmata.

Now, from memory, a single experience (*μία ἐμπειρία*) is produced in mankind. The word "experience" has a wide range of application. On the one hand, each action e.g. curing Socrates by such and such a treatment, is counted as an experience which can be revived by memory as a unit later on. This individual experience is expressed by a judgement

(ὑπόληψις) which is based on a perceptual grasp of the event and on reasoning (λογισμός). On the other hand, a combination of memories is also called an "experience" in that one can collect together various memories which are based on particular experiences so as to find a common element or a single experience (μία ἐμπειρία) among them. (981a1) "For the many memories of the same thing produce finally the capacity for a single experience." (980b30-981a1); and "For the memories that are many in number are a single experience." (100a5-6) To judge that when Socrates was ill with this disease this treatment did him good, and to make a similar judgement in the case of Callias and in many more individual cases, will result in a single judgement that *this* disease, say measles, is cured by such and such a treatment. Socrates and Callias become healthy again. This is a matter of experience.

At this point, Aristotle's concerns in tracing the process of inductive argument in these two passages diverge. In the passage in B19 Aristotle is concerned with the process of induction up to the production of νοῦς, (but in the passage in A1, he is concerned with the difference between experience and expertise, going one step further than the emergence of νοῦς.) In other words, in B19 Aristotle tries to make clear how νοῦς emerges in the soul on the basis of a single experience. The passage runs as follows:

> On the basis of experience, or on the basis of the whole universal, i.e. the one apart from the many, whatever is one and the same in all those things, which has come to rest in the soul, there comes a source of expertise and epistēmē [i.e. νοῦς]. (A source of expertise in the sphere of coming to be and a source of epistēmē in the sphere of being.) (100a6-8)

It is essential for the emergence of "νοῦς" that one gathers various experiences together so that one and the same concept, which is separate from any single predication, can be formed in the soul. With respect to our current example, we have to accumulate and examine various experiences in relation to disease, drugs, food and exercise, until one and the same concept "Health" in terms of which all these things and activities are defined or occupy their proper places, comes into existence in the soul as the most universal concept unifying the common features shared by these all things. When such a concept is fixed in the soul, then, as far as the structure of Demonstrative Science is concerned, the corresponding disposi-

tion is called νοῦς. Hence a particular instance of νοῦς may be epistemologically justified by referring back to various accumulated experiences to see whether they are the components of a basic term which they comprise as its unified attributes. In other words, if a scientist finds a term which marks off a single domain of discourse, by means of which the entities belonging to that domain, (which have not previously been treated in a unified way) are functionally related to each another, the inductive process can be said to give rise to νοῦς in his soul. In this way, the primary term of Demonstrative Science comes to be known by induction as a process of epistemological justification.(6) On the basis of this type of comprehension i.e. νοῦς, the definition of the comprehended term is formed *as* (A) the definition of the primary term of a science. In this way, induction which grasps the source of epistēmē and the source of expertise based on experience, provides the foundation of Demonstrative Science.

Notes.

(1). For instance, Philoponos takes the principles to be "the immediate, *per se* and primary propositions" (p. 432) Barnes thinks that Aristotle vacillates between primitive propositions and primitive terms. (p. 249) Ross, on the one hand, says that "the ἀρχαί, with the knowledge of which this chapter is concerned, are the premises from which science or demonstration starts." (p. 675) but on the other hand, finds the genetic account to be primarily about the acquisition of concepts. (p. 675) C. Kahn suggests that we should take Aristotle to be concerned with the definitory proposition of the subject matter of a science, on the ground that "there is no gap between the conceptual and the propositional view of principles, since the only propositions in question are essential definitions and assertions of existence". (p. 391, p. 395) Recently, D. Modrak claims that Aristotle has both in mind. She says "I shall argue.. that Aristotle does not distinguish between primitive concepts and indemonstrable proposition. The genetic account is throughout a description of the same cognitive process, namely, how we come to know basic concepts and first principles; it is however, a twofold description." (p. 162) As I shall argue in due course, Aristotle never vacillates between proposition and term, nor is it the case that he fails to distinguish them. Aristotle has a clear distinction between them in mind and in B19 what he means by ἡ ἀρχή is the primary term of a science like number in arithmetic and magnitude in geometry.

(2). Waitz and Ross, for instance, understand the passage in the same way as Philoponos. (Waitz, p. 429, Ross, p. 674) When Barnes describes the contrast between knowledge of the principles and knowledge of theorems,

it is clear that Barnes does not mean by "theorems" the principles of demonstrations of which there is non-demonstrable epistēmē. (p. 249)

(3). When Burnyeat writes "Aristotle calls νοῦς both γνῶσις (99b22; cf. b18) and ἐπιστήμη (99b24; cf. A2 71b16; A3 72b18–21; A9 76a16–22; A33 88b36)", he fails to distinguish the source of epistēmē i.e. the comprehension (νοῦς), which grasps the term, from the non-demonstrable epistēmē which concerns the principle of demonstration i.e. the definitory proposition [(B) the Definition]. ([1] p. 131)

(4). Ross seems to be wrong in interpreting this as follows: "Science as a whole garsps its objects with the same certainty with which intuitive reason grasps the first principles." (p. 678) Aristotle clearly states that νοῦς is more certain than epistēmē. (100b8–9, cf. 100b11–12, 99b26–27) Barnes also seems to miss the "philosophical importance" of this "aphoristic" sentence by saying "I do not think that we are expected to pay any philosophical attention to it [the last sentence].... Nous has no philosophical importance in *An. Post.*" (p. 259) See Tricot, p. 247 n4 as well.

(5). Lesher fails to explain anything when he comments on this passage as follows: "We are told that *in cases of this sort* (where there is a middle term), ἐπιστήμη is superior to νοήσις, and Ross explains this by contending that there is no νοήσις at all of subordinate principle (p. 599). But there is an alternative account possible. There may well be νοήσις of the subordinate principles which would still be inferior to ἐπιστήμη of them, since ἐπιστήμη but not νοήσις is knowledge of a universal principle *qua* demonstrated. On this reading, νοήσις would be understood as the grasp of the universal principle based on the repeated observations of constant conjunctions. Since there can be νοήσις but not ἐπιστήμη of first principles, we would obviously have to reverse our ranking of νοήσις and ἐπιστήμη in that context." (p. 54) Here Lesher just takes it for granted that a demonstration, if it is available, is more valuable than νοήσις, by saying that "ἐπιστήμη is knowledge of a universal principle *qua* demonstrated", and thus fails to explain why it is more valuable.

(6). I disagree with T. H. Irwin on his following view of νοῦς in two points. He says "The product [of induction i.e. νοῦς], however, cannot depend for its warrant on the induction that has produced it; for such warrant would not explain how a proposition grasped by *nous* could be naturally prior to the demonstrated propositions derived from it." (p. 135) Firstly, νοῦς, as we have seen, does not grasp a proposition but a term. Secondly, νοῦς is warranted or epistemologically justified *from our own perspective* by induction. There is always a chance of νοῦς arising in the soul, in the sense that every experience, provided that it is capable of being successfully united with other experiences under a common nature, directly or indirectly refers to

the unifying term (which is the object of νοῦς, and which is ontologically and naturally prior to the object presented by the experience) as the ultimate component or goal of that experience. In other words, νοῦς is implicitly warranted by any successful experience in the sense that, if investigation fails to unify a class of experiences, there is no chance of νοῦς appaering.

Conclusion

I have tried to give a reading of *Posterior Analytics* as both philologically consistent and philosophically convincing, in order to resolve the various difficulties which have been raised in connection with this book, from Aristotle's Greek commentators onward. In Part I, my discussion has mainly been concerned with the structure of Demonstrative Science and has been based for the most part on Book A. In Chapter 1, I have proposed a view of how Aristotle understands the concept "Science". I characterised it, primarily, as a systematic method by means of which a scientist in any particular science produces epistēmē and, secondarily, as a sequence of demonstrative propositions which are the result of a scientific venture, which is based on a systematic method of that kind. I have argued that Aristotle views his enterprise from both a scientific and an epistemological perspective without confusing them, in developing his Demonstrative Theory as a single project. Aristotle conveys the difference between these two perspectives by means of a contrast between the preposition ἐκ (from) and the preposition διὰ (through). When Aristotle employs ἐκ, which I would call his "scientific preposition", he always uses it conjunction with a verb denoting inference such as "to demonstrate" or "to deduce" and not with verb "to know". On the other hand, ἐπιστήμη as knowledge is always accompanied, not by the preposition ἐκ, but by διὰ, which I would call his "epistemic preposition". I have claimed, *pace* various commentators, that Aristotle makes not only a conceptual but also a terminological distinction between "Demonstrative Science" which is expressed by the phrase ἡ ἀποδεικτικὴ ἐπιστήμη and demonstrative knowledge which is expressed by phrases such as ἐπιστήμη ἀποδεικτικὴ, ἐπίστασθαι (ἐπιστήμη, εἰδέναι) δι' ἀποδείξεως. Hence, it is not the case, as Burnyeat complains, that Aristotle did not distinguish his enterprise as a venture in philosophy of science from his epistemological enterprise.

In Chapter 2, I have proposed several arguments in support of my claim that "the principles", which are described in terms of the six condi-

tions set out in the A2 passage are the ultimate principles of a science. Aristotle distinguishes the ultimate principles from the relative principles in the structure of his Demonstrative Science on the basis of non-demonstrability. (Section A) I have claimed that (A) the hypothesis in A2 plays the role of the ultimate principle on which a demonstrated conclusion ultimately depends, and that only this type of hypothesis possesses the property of non-demonstrability. (Section B) In other words, in the system of Aristotelian Demonstrative Science, non-demonstrability is a characteristic only of the primary, which is called "the primary of the genus" or "the principle(s) in each genus". I have stressed that in order to understand the structure of Aristotle's Demonstrative Science, it is essential to distinguish immediate terms which are non-demonstrable from immediate propositions whose constitutive terms are subject to demonstration with respect to their existence. The distinction between an immediate term and an immediate proposition should have been recognised by commentators in the difference between the Greek expressions *ἐκ τῶν ἀμέσων* and *δι' ἀμέσων*. (Section C) Without this distinction, Aristotle's Demonstrative Science would be quite unacceptable as an explanatory system in the sense that it would leave the world full of non-demonstrable and so inexplicable entities. I have also argued that Aristotle has presented the four kinds of *per se* predications as the four types of immediate propositions which have various role relating to the different aspects of Demonstrative Science. (Section D)

In Chapter 3, I have contended that Aristotle is quite aware of the theoretical significance of his axiomatization of Demonstrative Theory as independent of its pragmatic significance as a pedagogical method. Aristotle presents the model of Demonstrative Science as a model which is common to any particular science, in a purely general and abstract way. By putting these general constraints on the structure of any science, Aristotle presents the axiomatized deductive system as the model of Demonstrative Science.

In Part II, I have discussed Aristotle's methods of inquiry into essence within the framework of his Demonstrative Science mainly on the basis of Book B. In Chapter 4, I have argued for the heuristic nature of inquiry. That is, the method and the range of inquiry, as Aristotle develops it, is determined by the complexity involved in discovery rather than by the applicability of demonstration. If this is correct, we will not find any difficulty in Aristotle's identification of the inquiry into the existence of a substance which is expressed by a singular term and the inquiry into the existence

of the middle term which requires two extreme terms. Discovery is complex in the sense that, when the existence of a substance is discovered, the discovery takes place via the discovery of its necessary and essential properties. Hence, demonstration is available as a route to heuristic knowledge regarding the existence of substances, which have been ruled out from the scope of Aristotle's inquiry theory by commentators. Heuristic knowledge therefore turns out to be a form of scientific knowledge. Demonstration as the tool for inquiry reveals the practical aspect of Demonstrative Theory.

In Chapter 5, I have investigated two types of causal entity: (α) the cause whose effect is identical with itself, and (β) the cause whose effect is different from itself. I have investigated these entities both in terms of their nature and in terms of their appropriate methods of inquiry, from both the structural point of view provided by Demonstrative Science and from the metaphysical point of view which is developed in *Metaphysics* by employing metaphysical principles. I have argued that the primary principles of a science and substantial form belong to type (α) and that the derivatives of the primary principles of a science and composite substance belong to type (β). I have argued that the structural and metaphysical viewpoints match up very well, so that both perspectives have complementary roles with respect to inquiry into causal entities.

In Chapter 6, I have discussed the nature and function of inductive argument. I have argued that inductive explanation has the explanatory role of grasping *in fact* the cause of something, though it cannot establish it *as* the cause, which is the role of demonstration. But I have shown in what way inductive argument is available and useful in Aristotle's Demonstrative Science. The primary principles of a science are inquired into and come to be known through inductive argument in such a way that induction makes it possible to unify the various ingredients of a science under a common feature, that is, the primary term of a science which is shared by its ingredients.

(In the Appendix, I argue that the demonstration of essence is impossible because such a proof would be guilty of a form of question-begging which arises in the case of a syllogism which contain two identical terms, each of which proves the other.)

Appendix

The Non-Demonstrability of Essence

In this Appendix, I will discuss in what sense it is true that there is no demonstration of essence. The reason why Aristotle investigates the possibility of demonstrating essence in such detail in *Posterior Analytics* B is that he hopes to reveal how a definition, whose acquisition is the final goal of an inquiry, is built into a demonstration which is an indispensable tool of inquiry. (cf. 90a36–38) As we have seen in Chapter 5, Aristotle offers two possible methods of demonstrating essence which meet the logical requirement: syllogistic figure *Barbara*. In Chapter 5, we have examined the second method and made clear in what sense demonstration is indispensable for grasping essence. Now I would like to examine why the first method is rejected as an authentic method of demonstrating essence. The first method runs as follows:

> Well, the first method (*τρόπος*) would be the one just examined [in B4] — proving the essence through another essence (*τὸ δι' ἄλλου τὸ τί ἐστι δεικνυσθαι*). For in the case of [proving] the essence, it is necessary for the middle term to give the essence (and in the case of the property, the middle term must be the property as well). Hence of [the descriptions of] what it is to be [=essence] the same object (*τῶν τί ἦν εἶναι τῷ αὐτῷ πράγματι*), the one (*τὸ μὲν*) will prove, the other (*τὸ δὲ*) will not prove. Now that this method will not be a demonstration was said earlier [in B4], but it is a formal syllogism (*λογικὸς συλλογισμὸς*) of the essence. (93a9–15)

I will defer an analysis of this paragraph until the last part of this appendix. For in order to reveal the nature of formal syllogism, it is necessary to examine B4 on which this first method is based and which is referred to twice in this paragraph. (93a10, 93a14) The question discussed in B4 is whether there is syllogism and demonstration of essence, or not. (91a12–13) In the course of the chapter, Aristotle shows that there cannot be any demonstration of essence due to the fact that when the essence of something is proved through conversion among the terms, the syllogism commits a *petitio principii*. (91a35–37) Hence it is necessary to know, amongst other things, what Aristotle understands by *petitio principii* and

what sort of syllogism commits *petitio principii*. Then I will give an analysis of B4 so as to make clear the relation between definition and demonstration.

Aristotle discusses *petitio principii* (begging a question) in *Prior Analytics* B16 in terms of truth (*κατ' ἀλήθειαν*).[1] First Aristotle describes a general context in which one commits *petitio principii*;

> Since we get to know some things naturally through themselves, and other things by means of something else, . . ., whenever a man tries to prove by means of itself what is not known by means of itself, then he begs the question. (64b34-38)

That is, one epistemic situation in which one begs a question is that in which one is not sure (*ἀδήλον*) which of the premise and the conclusion is naturally prior. (cf. 64b33-34, 65a10-13) Then, Aristotle gives some logical conditions for *petitio principii*. There is some controversy concerning the interpretation of the syllogistic conditions for this fallacy. The conditions described in the sentence 65a14-16 have been interpreted in a number of ways;

> *εἰ μέντοι τὸ B πρός τὸ Γ οὕτως ἔχει ὥστε* (i) *τἀὐτὸν εἶναι,* (ii) *ἢ δῆλον ὅτι ἀντιστρέφουσιν,* (iii) *ἢ ἐνυπάρχει θάτερον θατέρῳ, τὸ ἐν ἀρχῇ αἰτεῖται.*

Ross's commentary on this sentence, together with that of H. Tredennick (*ad locum*) and J. Jenkinson (*ad locum*) would appear to be wrong. Ross says

> There is *petitio principii* if (a) we assume All *B* is *A* when this is as unclear as All *C* is *A*, and (b) *B* is (i) identical with *C* (i.e. if they are two names for the same thing), or (ii) manifestly convertible with *C* (as a species is with a differentia peculiar to it) or (iii) *B* is included in the essential nature of *C* (as a generic character is included in the essence of a species). (p. 463)

Ross seems to take *οὕτως* in an indefinite sense "in such a way", and as implying (i), (ii) and (iii), while leaving other possibilities of *petitio principii* open. However (ii) and (iii) do not seem to be independent of (i), but should be taken as modifying the ways in which (i) may give rise to an identity between the two terms in the minor premise.

Waitz correctly says in objection to Pacius, who interpreted this line

in the same way as Ross does, that "As is apparent from a22, the phrase *ὥστε ταὐτὸν εἶναι* in a14 does not signify any third relation [(i)] between terms *B* and *C*, but the same relation, in which the remaining relations [(ii) and (iii)] which are added by *ἢ*.. *ἢ* are comprised." (p. 514) Waitz translates as follows:

> Si igitur termini *B* et *C* ita se habent, ut sint idem, [(ii)] sive permutari possint inter se [(iii)] sive alter alterum complectatur.[2]

I would like to read *οὕτως* with a demonstrative sense, such that one possible translation of this passage will be the following:

> (I) But if *B* and *C* are identical in the following way that either (ii) they are either clearly convertible, or (iii) the one belongs to the other, *petitio principii* arrises.

Line a21–23 gives a piece of evidence in support of this reading. In this passage, Aristotle is talking about *petitio principii* in the case of the major premise. He writes (II) as follows:

> But if *A* and *B* are the same either [(ii′)] by being convertible or [(iii′)] by *B*'s being followed by *A* (*ἐὰν δὲ ταὐτὸν ᾖ τὸ A καὶ B* [(ii′)] *ἢ τῷ ἀντιστρέφειν* [(iii′)] *ἢ τῷ ἕπεσθαι τῷ B τὸ A*), he is begging a question, for the same reason. (a21–23)

Here, instead of using phrase *οὐτῶς*.. *ὡστέ*, Aristotle employs the definite article in the dative case which expresses a cause. It is natural to think, as Waitz implicitly suggests, that the functions of the phrase *οὕτως*.. *ὡστέ* and the Dative of Causation are the same.

The question is what kind of identity we should understand by (iii): "one belongs to the other" and (iii′): "*A* follows *B*". The difficulty arises from the fact that in this chapter Aristotle characterises *petitio principii* only in terms of convertibility, not employing (iii) and (iii′) at all. We can see rather easily how *petitio principii* arises in the case of (ii) and (ii′). For example, if the conclusion "*A φα C*" and a premise "*B φα A*" are equally unclear in the sense that one cannot judge which is supposed to be the premise, and if *B* and *C* are convertible, we can formulate the following syllogisms which are circular, so that "One tries to prove by means of itself what is not known by means of itself." (64b36–37)

$$(*)\quad (A\ \varphi\alpha\ B \wedge B\ \varphi\alpha\ C) \supset (A\ \varphi\alpha\ C)$$

Since $B=C$, (*) will turn out as follows:

$$(**)\ (A\ \varphi\alpha\ C \wedge C\ \varphi\alpha\ B) \supset (A\ \varphi\alpha\ B) \quad (65a16\text{–}17)$$

Whereas if we take two terms which are related as a part to a whole like man and animal, we cannot make this kind of circular syllogism. In a case of a premise, which takes the form of a universal affirmation of a part-whole relation, Aristotle denies that the conclusion $A\ \varphi\alpha_{df}\ C$ has been proved on the grounds that the two terms are not identical. Aristotle says:

> For it is true that every case of what it is to be a man is what it is to be an animal, just as every man is an animal, but not in the sense of their being one. (B4 91a5–7)

Although Ross takes (iii) and (iii′) as concerned with "quasi-identical terms", it does not seem to be supported by the text. If Aristotle had thought that (iii) and (iii′) are concerned with quasi-identical terms, he would have explained this type of question-begging, given that this case is different from (ii) which is often mentioned. Aristotle comments on (I) and (II) as follows:

> *Petitio principii*, then, is proving by means of itself what is not clear by means of itself, and this is failing to prove, when conclusion and premise are equally unclear either [(II)] because identical predicates [*B*, *A*] belong to the same subject [*C*] (*τῷ ταὐτὰ τῷ αὐτῷ*) or [(I)] the same predicate belongs to identical subjects (*τῷ ταὐτὸν τοῖς αὐτοῖς*). (65a26–29)

In this sentence both (ii) and (iii) or (iii′) seem to be characterised in terms of identity so that they are indistinguishable. It seems that Aristotle has in mind only the coextensive cases of (iii) and (iii′), in which each term belongs to the other. The difference between (ii) and (iii) or (iii′) is a matter of the way in which the identity between the two terms is grasped and characterised. One way of characterising/grasping this identity is to make a conversion as follows: if $B\ \varphi\alpha\ C$, then $C\ \varphi\alpha\ B$; the other way is to give a definition, such as $B\ \varphi\alpha_{\ df}\ C$, or $C\ \varphi\alpha_{\ df}\ B$. And these two terms will also be converted at the end, though the definitional predication cannot be retained in the converted predication. Mignucci says:

> Ora, l'equiestensione di '*B*' e di '*C*' può dipendere dal fatto che il pre-

> dicato costituisce un 'proprio' del soggetto, come nel caso di 'uomo' e 'risibile'...., oppure perché il predicato è contenuto nell'essenza del soggetto e viceversa. ([1] p. 665)

Hence, viewed from the perspective of "truth" (65a36), *petitio principii* seems to be understood in a very limited or strict way, in that the identity, in the sense of the convertibility of the two yerms, plays a key role in Aristotle's characterization of this fallacy.

In *Postetior Analytics* B4, the brief of which is to investigate whether there is a demonstration of essence, Aristotle has in mind "the case of two premises and the primary and immediate terms" (91a33-34) as the example of a syllogism. In other words, he is concerned with a case of (α), such as the primary terms of a science and the substantial form. (cf. Chapter 5 Section B) Since, in this case, the thing and its cause are identical, we can see that *petitio principii* will be "most evident" (91a34) in the syllogism, in the sense that it is easy to make a syllogism whose terms are convertible. In B4, Aristotle argues that there is no demonstration of essence due to its committing *petitio principii*. To begin with, Aristotle gives a positive explanation of what sort of predication is involved in definition.

> The essence of X (*τὸ τί ἐστί*) is composed of what is both proper (*ἴδιον*) to it and is predicated in what X is (*ἐν τῷ τί ἐστι κατηγορεῖται*). (91a15-16, cf. 92a7-9, Concerning the relation between *τί ἐστί* and *τὸ τί ἦν εἶναι* (=TEE), see Chapter 2 Section D p. 94. n. 2)

Hereafter I shall call the former component of what X is i.e. *ἴδιον* "id" and the latter i.e. *ἐν τῷ τί ἐστι κατηγορεῖται* "kat". When Y necessarily belongs to all X and X necessarily belongs to all Y, Y belongs properly to X (Y $\varphi\alpha_{\text{id}}$ X).[3] But this relation does not guarantee that Y is the essence of X. This is because there is another kind of property (*ἴδιον*) which does not make clear the essence of X, but only belongs to X. For example, being capable of learning grammar is proper to man. But this is not an essential component of man. To satisfy "id" is not enough for Y to be the essence of X. In order to be the essence of X, Y must satisfy another requirement, that is, "kat". When Y is predicated of all X as belonging to what X is, Y is an essential component of X (Y $\varphi\alpha_{\text{kat}}$ X). But conversely, to satisfy the "kat" condition is not sufficient for being the essence of X in the sense that, unless we employ the "id" condition,

we cannot know whether one has exhausted all the essential components of the object.

Some might argue against the necessity of this component, on the ground that Aristotle is begging the question or is producing a tautology, when he employs *τῷ τί ἐστί* in the context of explaining *τὸ τί ἐστί*. (cf. Shröder p. 230) But *τὸ τί ἐστί* in the expression "kat" has a different connotation from its connotation elsewhere. The expression "kat" is introduced in *Topics* in the explanation of genus as follows:

> 'Predicates in the essence of a thing' should be described as such things as are fittingly mentioned in reply to the question 'What is the object before you (*τί ἐστί προκείμενον*)?' For example, in the case of man, if someone is asked what the object before him is, it is fitting for him to say 'An animal'. (A5 102a32–35)

In other words, *τὸ τί ἐστί* in "kat" is, as it were, preserving the original meaning of this phrase as the question "what is it?" Whereas the first *τὸ τί ἐστί* in 91a15 stands for TEE i.e. the essence. And what is interesting here is that the passage in which the expression "kat" is introduced, is not concerned with "definition", but with "genus". (cf. A5 101b38–101a 17) That is, the example of "kat" is not a unified account like "two-footed rational animal", but just "an animal" which is the genus of man. This suggests that the "kat" condition does not require that all the essential components of the object are exhausted. In other words, the elements of "kat" in themselves are not required to be coextensive with the subject. That is why *τί ἐστί* and TEE are contrasted with the essential components (*τὰ ἐν τῷ τί ἐστί κατηγορούμενα*). And if, in a definition, the predication must be made between the same and the same, as opposed to the one of the other (*ἕτερον ἑτέρου*) as in the case of demonstration, "kat" should not be treated as "definitional predication" as it is by Barnes. (p. 199). The *τὸ τί ἐστί* which is made clear by a definitional predication should be distinguished from its components (kat 1, kat 2, . . kat n).

If our reading is correct, the relevant sentence will be something like this: "The essence of *X* (*τὸ τί ἐστί*) is composed of what is both proper to *X* and predicated of it, as replying to the question "What is *X* (*τί ἐστί*;)?" And this is neither begging the question nor tautological, but is a constitutive claim. "Kat" is a necessary condition for the essence of *X* as well as "id". If and only if some description satisfies both "id" and

"kat", that description is entitled to be called a "definition" which makes clear the essence.

The essence of $X \Leftrightarrow Y(L+M+N)\ \varphi\alpha_{\text{id}}\ X\ \&\ Y(L, M, N)\ \varphi\alpha_{\text{kat}}\ X$.
[L, M, N indicate the elements of the definiens Y]
$Y\ \varphi\alpha_{\text{df}}\ X$ implies $Y\ \varphi\alpha_{\text{id}}\ X\ \&\ Y\ \varphi\alpha_{\text{kat}}\ X$.

And "these ("the definiendum X" and "the definiens Y") are necessarily convertible." (92a16) Schröder takes "these" as referring to "die drei Begriff" with Ross and Zabarella. (p. 229) But this does not seem to be the case. What Aristotle is going to do with "because" (*γάρ*) in 91a16ff is to explain the convertibility of definitional predication in terms of the syllogistic form. "These" (*ταῦτα*) does not refer to the three syllogistic terms which appear in the following sentence, but the preceding definitional predication between two terms: the definiendum X and the definiens Y which explains the essence in terms of "id" as well as "kat". If we build two terms which are proper to each other, as in a definitional predication, into the syllogistic conclusion, e.g. $A(Y)\ \varphi\alpha_{\text{id}}\ C(X)$, then "it is clear that it is also proper to B and this to C; so that all are proper to one another." (91a17-18)

$$(A\ \varphi\alpha_{\text{id}}\ B \wedge B\ \varphi\alpha_{\text{id}}\ C) \supset (A\ \varphi\alpha_{\text{id}}\ C)$$

Then he explains "kat" in terms of the syllogistic form. (a18-23) (cf. Concerning lines a21-23, see Schröder pp. 231ff.)

$$(A\ \varphi\alpha_{\text{kat}}\ B \wedge B\ \varphi\alpha_{\text{kat}}\ C) \supset (A\ \varphi\alpha_{\text{kat}}\ C).$$

Having put the "id" and "kat" relations between two terms into syllogistic form, he now connects both the components of the definition again and examines them within the framework of a syllogism at 91a24ff. Aristotle says "Now[4] both of these ["id" and "kat"] will contain the (*τὸ τί ἐστί*); therefore (*ἄρα*) B too will hold of C in its essence." (a24-25) I take "*ἄμφω*" (both) as referring to "id" and "kat", agreeing with Schröder, not as two premises as do Ross and others. (p. 241 n. 29) For what Aristotle aims to do in this sentence is to offer as a necessary and sufficient condition for making the claim that $B\ \varphi\alpha_{\text{df}}\ C$, that both $B\ \varphi\alpha_{\text{id}}\ C$ and $B\ \varphi\alpha_{\text{kat}}\ C$ produce $B\ \varphi\alpha_{\text{df}}\ C$, so that he can introduce TEE which is, since it is composed of both elements "id" and "kat", assumed in the premise ($B\ \varphi\alpha_{\text{df}}\ C$) in the next line 91a25-26. If we follow Ross' suggestion, then $B\ \varphi\alpha_{\text{df}}\ C$ would have had to be taken as the conclusion of

the syllogism. In that case, one would not have been able to explain the connection which is expressed by "*therefore*" between the two sentences "both these premises will contain the essence" and "$B\ \varphi\alpha_{\ \mathrm{df}}\ C$", nor to see the link with the next sentence a25–26. Then he states the significance of this consequent.

> Thus if both [$A\ \varphi\alpha_{\ \mathrm{df}}\ C$ & $B\ \varphi\alpha_{\ \mathrm{df}}\ C$] contain *τὸ τί ἐστί* namely[5] TEE of C, TEE of C will be in the case of the middle term (B) [$B\ \varphi\alpha_{\ \mathrm{df}}\ C$], before the conclusion is drawn. (a25–26)

If the minor premise expresses TEE of C ($B\ \varphi\alpha_{\ \mathrm{df}}\ C$), before the conclusion ($A\ \varphi\alpha_{\ \mathrm{df}}\ C$) is drawn, this will be a *petitio principii*, given that there is only one TEE of any kind.

Then, Aristotle gives an example of this kind of syllogism. If we assume that the essence of man (C term) is demonstrable, the A term gives its essence, "whether two-footed animal, or something else" (a28) with the effect that the conclusion becomes a definitional predication. If $A\ \varphi\alpha_{\ \mathrm{def}}\ C$ is deduced, since the syllogistic mood must be *Barbara*, the major premise is necessarily a universal affirmative too ($A\ \varphi\alpha\ B$). He says "If, then, it is deduced, it is necessary for A to be predicated of every B." (a28–29) I read 91a30–32, leaving the *τούτου* of the MSS., instead of taking *τούτο* by Bonitz and Ross in line a30 as follows:

> There will be another account [B] which is a middle term other than this [A] (*τοῦτου*), so that this [B] too will be what man [C] is. So you assume what you have to prove; for B is what man is.

Ross thinks if we take *τούτου*, this would naturally refer to B.

> Then the words would mean 'and there will be another definitory formula intermediate between C and B' (as B is, between C and A), 'and this new formula too will state the essence of C (man)'. I.e. Aristotle's argument will show that an infinite regress is involved in the attempt to prove a definition. (p. 617)

That is, Ross reads *τούτο* for *τοῦτου* to avoid the infinite regress of the proof. As Ross points out, giving three reasons, "there is no reference to an infinite regress" in this sentence. (91a30–31) (p. 617) Apart from the three difficulties which Ross raises against the interpretation which finds a reference to an infinite regress in this sentence, the following point will

also count against that interpretation. When Aristotle mentions *petitio principii*, he does not appeal to an infinite regress with respect to the essential part of the thing *X* at all, but rather, to the identity (*ταὐτὸν*) of the terms which is confirmed by the possibility of conversion or coextensive inclusion. (cf. *An. Pri.* B16 65a14-16, a21-23) If this were not the case, Aristotle would not have introduced TEE i.e. the unified totality of the components of the essence of *X* (91a26), nor would he have said that "*B* is what man is." (91a31-2) Moreover he would not have suggested that in order to see clearly how *petitio principii* may arise, we must inquire into the case of the two premises which contain the primary and immediate entities of a science which do not allow the possibility of a regress in the syllogism. (91a33-4) As Ross suggests, in this context, Aristotle does not have the possibility of an infinite regress in mind.

However, I do not think that we should change *τούτου* to *τοῦτο*, as Ross does. In general, it is better to leave the MSS. as it is, if we can give a consistent reading of the text. I would retain *τούτου* and take it as referring to the term. *A*. I cannot see why Ross thinks that "the emphatic words *κἀτὰ τοῦ B*" mean that *τούτου* "would necessarily refer to *B*" (p. 618). Is that the only possible reading of *τούτου*? We can find the same expression elsewhere without any intention of emphasis. (e.g. A11 77a19, *An. Pri.* A. 23 40b30ff) And *λόγος* often refers to the term. (e.g. B8 93a33, 93b6, 93b12, B17 99a21-22)[6] Now the essence of *C* is supposed to be unique. Otherwise the object *X* which is denoted by the term *C* could not retain its identity, although this does not prevent us from having another description of what *X* is, so long as it signifies the same thing *X* and each term is convertible with the other. The sentence "A what man is — whether two-footed animal or *something else* (*ἄλλο τι*)." (91a28) seems to suggest this possibility. For what *C* is which is unique, already appears in the minor premise, "you assume what you have to prove". (91a31) This is nothing but a *petitio principii*.

Then Aristotle looks for a *petitio principii* in the case of the two premisses which refer to the primary and immediate entities. "For what we are saying becomes specially evident." (91a34-35) He introduces one way of proving the essence of the soul, by conversion, a method which was employed Xenocrates and others.[7]

> A number that moves itself [*A*] *φα* what is explanatory of its own being alive [*B*].

> What is explanatory of its own being alive [*B*] *φα* the soul [*C*].
> A number that moves itself [*A*] *φα* the soul [*C*].

Only one thing can be TEE of the soul, which is supposed to give the unified totality of the elements of the definition of the soul. Here both [*B*] and [*A*] manifest the same TEE or *τί ἐστί* of the soul, though the descriptions of [*B*] and [*A*] are different. For each of these two terms is convertible with the other and also with the soul. Now given that "to beg and assume the original question is a species of failure to demonstrate the problem proposed" (*An. Pr.* B16 64b28–29), this kind of syllogism of the essence of *X* cannot be a demonstration, as long as we assume the essential terms which are "one" (91b7) and "the same" (91b1) with the thing *X* (ie. convertible with *X*). Aristotle says:

> But if you do not assume in this way (ie. convertibly (91b5–7), that is, a middle term as TEE of *C*), you will not deduce that *A* is what it is to be *C* (*viz.* *C φα* $_{\text{df}}$ *A*), but if you do assume in this way, you will already have what it is to be *C*; i.e. *B*. Hence it has not been demonstrated. (91b9–11)

Now let's examine the relevant paragraph in B8, which we have quoted at the beginning of the appendix, on the basis of our analysis of B4. Aristotle here introduces a syllogism called a "formal syllogism" which fails to be a demonstration. The reason why formal syllogism cannot be a demonstration does not seem to have been made clear by commentators. When some commentators such as Philoponos and Aubenque divide the essence (*τί ἐστι* and TEE) into two components, they fail to see that this passage is based on the argument in B4. Philoponos divides TEE into two parts: form and matter so that he interprets the phrase; *τὸ δι' ἄλλου τὸ τί ἐστί δείκνυσθαι* as "demonstrate the material definition through the other definition, *viz.* the formal." (*τοῦ ὑρικόν ὁρισμόν, ἀποδείξαι δι' ἄλλου ὁρισμοῦ, τοῦ εἰδικοῦ*). (p. 365) Philoponos' reading of this passage is as follows;

> Since there are many definitions of the same thing (i.e. one is material, the other is formal), the one (definition) of TEE (*τὸ μὲν τῶν τί ἦν εἶναι*) demonstrates the other of the definitions of thing, i.e. the material, but the other does not demonstrate the formal because of its being immediate. (p. 366)

Aubenque also thinks that "logique (λογικὸς) syllogisme" is insufficient in the sense that:

> L'on aura démontré une partie du τί ἐστί par une autre, mais que l'on n'aura pas démontré la totalité du τί ἐστί. La raison profonde est qu'une essence ne peut être démontrée ni par une autre (puisque) la démonstration consiste à démontrer un attribut *d'*une essence) ni par elle-même (puisqu'il n'y a pas alors de moyen terme). (p. 77)

Now I will show that it is a misunderstanding of this passage to divide the essence (τί ἐστί and TEE) into two types: the total definition as definition *par excellence* and the partial definition as either material or formal definition. Given this scheme, Philoponos and Aubenque cannot explain the proof of essence by conversion in B4 either. In B4 Aristotle does not talk about a higher order essence, in the sense in which the formal element of essence is higher than the material element, but rather establishes the circularity of the proof which has three convertible terms. (*An. Pri.*, B16 65a1–4, 72b18–73a20). For nothing in this scheme guarantees that one part of the essence is identical with the other so that both are convertible. Secondly, since the type of syllogism whose components are articulated into matter and form and their composite matches the method of articulation of terms which is developed in *Metaphysics* Z17, as we have seen in Chapter 5, this should rather be counted as a genuine demonstration, given that *B*, the formal cause, and *A*, the material cause are not convertible.

If Aristotle, in the B8 passage, had a part of τί ἐστί in mind, he would not have used τὸ τί ἐστί in a10, but would have used the indefinite pronoun τι with τοῦ τί ἐστί. Further if one divides TEE into two parts, one cannot explain the significance of the plural article τῶν in τῶν τί ἦν εἶναι τῷ αὐτῷ πράγματι (a13–14). The reason why Aristotle puts τῶν and "the same" (αὐτῷ) in this phrase is not to suggest a division of TEE, but to suggest the availability of more than one description of the essence of a single thing. Since the TEE of a single thing must be unique, (otherwise the thing cannot keep its identity), we must take it that this plural article applied to TEE manifests the complexity of its description. In this paragraph also, TEE and τὸ τί ἐστί should not be thought of as being different. If we can read every τί ἐστί which appears in this paragraph as TEE, we can say that the argument of this paragraph, according to which we cannot have a demonstration of the essence of *X*, is the same as the one

in B4. It will be this;

> One method is... to prove *τὸ τί ἐστί* [as TEE] of *X* by another [definition of *τὸ τί ἐστί* as TEE of *X*]. For in the case of things *X* which have *τί ἐστί* [as TEE], it is necessary for the middle term to give *τί ἐστί* [as TEE] of *X*. ... Hence among descriptions of TEE for the same thing, one description will prove, whereas the other will not prove. [This is nothing but committing a *petitio principii*]. (93a9–13)

With regard to the phrase *τῶν τί ἦν εἶναι τῷ πράγματι*, Aristotle has a particular purpose in describing the thing (*πράγμα*) as "the *same* thing" and in using the plural definite article. This is concerned with his intention to allow for the availability of different descriptions of *τί ἐστί* as TEE of the same object. "The same thing is spoken of in several ways." (89a28–29) Aristotle clearly admits different descriptions of TEE in *Metaphysics*, when he says, "things are called one when the account saying what it is to be (*τὸ τί ἦν εἶναι*) is indivisible relative to another account which makes clear what the thing is to be (*τί ἦν εἶναι*)." (*Δ*6. 1016a34, cf. 1017a6, *De Anima*. A1 403b4ff, *Phys.* *Θ*8 262a21, *An. Pr.* A39 49b3–5) and makes use of these differences in establishing the unity of the thing.

Notes.

(1). In *Topics* *Θ*13, there is another discussion of *petitio principii*. But Aristotle does not commit himself to the views described in that chapter. For he discusses *petitio principii* there from the viewpoint of opinion in the sense of people's general understanding of *petitio principii*. (162b32–33)

(2). M. Mignucci agrees with Waitz, saying "per questa ragione l'espressione *ὥσετ ταὐτὸν εἶναι* della l. 14 deve essere intesa come affermazione di tale equidiestensione. Cosí interpreta, correttamente, il Waitz (p. 514), giustificato anche da Filopono, *In An. Pr.*, p. 454, 20–1." ([1] pp. 664–5)

(3). Aristotle expresses the subject-predicate relation using the verb *Y ὑπάρχει τῷ* (belongs to) *X*. If we express this relation by the copula *εἶναι*, this sentence becomes as follows; *X* is *Y*.

(4). I read *δὴ* with Bekker for Ross' *δὲ*.

(5). I take *καὶ* as epexegetical, as Tricot translates "autrement dit" (*ad locum*) Schröder also says "Einmal wird durch den Zusatz *καὶ τὸ τί ἦν εἶναι* verdeutlicht, in welchem Sinn *τὸ τί ἐστί* gemeint ist." (p. 241)

(6). I. Bywater says "A *λόγος*, in Aristotle's sense of the term, does not necessarily involve predication." (p. 270)

(7). Although Aristotle introduces "the man" along with "the soul" in

this context, it is not necessary to take "the man" as an example of a primary and immediate being. This is because it is those (οἱ μὲν), like Xenocrates, who claim the possibility of proving the essence of the soul or man. In fact, Aristotle takes up only the proof concerning the soul, probably taking it for granted that according to Aristotelian classification, man does not belong to the category of primary and immediate being. Furthermore, Aristotle has already mentioned and expounded the syllogism of the essence of man which is a being composed of animal and two-footed and so on in 91a26–32, before the introduction of the primary and immediate being. Thirdly, when Aristotle mentions the relation of inclusion holding between man and animal in 91b4–5, this example is used to illustrate the negation of identity. Since a substantial form such as the soul (α) is not composed of material components, it is liable to give rise to a *petitio principii*, insofar as it is characterised by an identity statement.

BIBLIOGRAPHY

Texts, Translations, and Commentaries

Texts of *Posterior Analytics*

Bekker I, *Aristotelis Opera* Tomus I. (Berlin, 1831)

Ross W. D. and Minio-Paluello, L. *Aristotelis Analytica Priora et Posteriora* (Oxford, 1964)

Ross W. D, *Aristotle's Prior and Posterior Analytics* (Oxford, 1949)

Waitz T, *Aristotelis Organon II* (Leipzig, 1846)

Commentaries and Translations of *Posterior Analytics* (referred to by the name of the authors)

Barnes J, *Aristotle's Posterior Analytics* (Oxford, 1975)

Mignucci M, *L'Argomentazione Dimonstrativa in Aristotele* (Padova, 1975)

Mure G. R. G, *Analytica posteriora* (1955) [in Smith J. A. and Ross D, (eds.) *The Works of Aristotle* (Oxford, 1910–1952)]

Tredennick H, *Aristotle II Posterior Analytics* (Loeb, 1960)

Tricot J, *Aristote Organon IV Les Seconds Analytiques* (Paris 1970)

Wallies M and Hayduck M, *Commentaria in Aristotelem Graeca* (Berlin, 1900–1907)

Eustratios, *Anal. Post.* 2 Paraphrasis, ed. M. Wallies (Berlin, 1900)

Philoponos, *Anal. Post.* ed. M. Wallies (Berlin, 1909)

Themistios, *Anal. Post.* 2, ed. M. Hayduck (Berlin, 1907)

Zabarella J, *Opera Logica* (Frankfurt 1608, reprinted 1966)

Texts and commentaries of Aristotle's other books. (referred to by the name of author sometimes with [ ].)

Burnet J, *The Ethics of Aristotle* (London, 1900)
Bywater I, *Aristotelis Ethica Nicomachea* (Oxford, 1894)
Cooke H. P, *Aristotle The Organon I The Categories, On Interpretation* (Loeb, 1938)
Forster E. S, *Aristotle II Topica* (Loeb, 1960)
Furth M, [AM] *Aristotle Metaphysics (VII-X)* (Indianapolis, 1985)
Hicks R. D, *Aristotle De Anima* (Cambridge, 1907)
Jaeger W, *Aristotelis Metaphysica* (Oxford, 1957)
Mignucci M, [1] *Aristotele Gli analytici Primi* (Napoli 1969)
Ross W. D, [MI, MII] *Aristotle's Metaphysics I, II* (Oxford, 1924)
Ross W. D, [P] *Aristotle's Physics* (Oxford, 1939)
Ross W. D, [PN] *Aristotle Parva Naturalia* (Oxford, 1955)
Ross W. D, [TSE] *Aristotelis Topica et Sophistici Elenchi* (Oxford, 1958)
Tricot J, [PM] *Aristote Organon III Les Premiers Analytiques* (Paris, 1971)
Tricot J, [T] *Aristote Organon V Les Topiques* (Paris, 1974)
Tredennick H, *Aristotte The Organon I Prior Analytics* (Loeb, 1938)

Index.

Bonitz H. *Index Aristotelicus* (Berlin, 1870)

Grammar.

Smyth H. W, *Greek Grammar* (Cambridge, Massachusetts, 1920, [8th edition, 1973])

General (Only works cited in the text appear here.)

Ackrill J. L, Aristotle's Theory of Definition: Some Questions on *Posterior Analytics* II 8–10. [in Berti]
Anscombe G. E. M, *Three Philosophers Aristotle Aquinas Frege* (Oxford, 1967)
Arpe C, *Das Τί ἦν εἶναι bei Aristoteles* (Hamburg, 1938)
Aubenque P, La pensée du simple dans la *Metaphysique* (Z17 et Θ10) in *Études sur la Metaphysiques d'Aristote* (Paris, 1979)
Barnes J, [1] Proof and the Syllogism. [in Berti]
Barnes J, [2] Aristotle's Theory of Demonstration. (1969, [1975 in Barnes [3]])
Barnes J, *et al* (eds.) [3] *Articles On Aristotle, 1 Science* (London, 1975)
Berti E (ed), *Aristotle on Science The «Posterior Analytics»* (Padova, 1981)
Bolton R, [1] Essentialism and semantic theory in Aristotle: *Posterior Analytics* II. 7–10, *Philosophical Review* 85 (1976) pp. 514–544.
Bolton R, [2] Definition and scientific method in Aristotle's *Posterior Analytics* and *Generation of Animals*. [in Gotthelf and Lennox]

Brunschwig J, [1] L'objet et la structure des *Seconds Analytiques* d'après Aristote. [in Berti]

Burnyeat M. F, [1] Aristotle on Understanding Knowledge. [in Berti]

Burnyeat M. F, (ed.) [2] *Notes on Book Z of Aristotl'es Metaphysics* (Oxford, 1979)

Burnyeat M. F, (ed.) [3] *Notes on HΘ of Aristotle's Metaphysics* (Oxford, 1984)

Charles D, *Aristotle's Philosophy of Action* (London, 1984)

Cherniss H. F, *Aristotle's Criticism of Plato and the Academy* (Baltimore, 1944)

Code A, The Aporematic approach to Primary Being in *Metaphysics* Z, in *New Essays on Aristotle* (Ontario, 1984)

Dancy R. M, *Sense and contradiction: a study in Aristotle* (Dordrecht, 1975)

Edel A, *Aristotle And His Philosophy* (North Carolina, 1982)

Einarson B, On certain mathematical terms in Aristotle's logic, *American Journal of Philology* 57 (1936), pp. 33–54, 151–72.

Engmann J, Aristotle's distinction between substance and universal, *Phronesis* 18 (1973) pp. 139–155

Frede M, *Substance in Aristotle's Metaphysics*, in his *Essays in Ancient Philosophy* (Oxford, 1987)

Frede D, Comment on Hintikka's Paper 'On the Ingredients of an Aristotelian Science', *Synthese* 28 (1974) pp. 79–89

Fritz von K, Die ARXAI in der Griechischen Mathematik, in his *Grundprobleme der Geschichte der antiken Wissenchaft* (Berlin, 1971)

Furth M, *Substance, form and psyche: an Aristotelean metaphysics* (Cambridge 1988)

Goméz-Lobo A, [1] Aristotle's Hypotheses and the Euclidean Postulates, *The Review of Metaphysics* 30 (1977) pp. 430–439

Goméz-Lobo A, [2] The so-called Question of Existence in Aristotle, *An Post.* 2, 1–2, *Review of Metaphysics* 34 (1980) pp. 71–89

Gotthelf A, Introduction to Part II, in Gotthelf A and Lennox J. G, *Philosophical Issues in Aristotle's Biology* (Cambridge, 1987)

Granger G. G, *La Théorie Aristotélicienne de la Science* (Paris, 1976)

Hartmann E, *Substance, Body, and Soul* (Princeton, 1977)

Heath T. L, [1] *The Thirteen Books of Euclid's Elemments* vol. 1. 2. 3. (2nd edition, Cambridge, 1925)

Heath T. L, [2] *Mathematics in Aristotle* (Oxford, 1970)

Hempel C. G, *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science* (New York, 1965)

Hintikka J, [1] On the Ingredients of an Aristotelian Science, *Nous* 6 (1972) pp. 55–69

Hintikka J, [2] The varieties of Being in Aristotle, in Knuuttila S and Hin-

tikka J (eds.) *The Logic of Being* (Dordrecht 1986)

Kahn C. H, [1] The Role of *nous* in the cognition of First Principles in *Posterior Analytics* II 19. [in Berti]

Irwin T, *Aristotle's First Principles* (Oxford 1988)

Kahn C. H, [2] The Greek verb 'To Be' and the concept of Being, *Foundations of Language* 12, (Dordrecht, 1966)

Kosman L. A, Understanding, explanation and insight in the *Posterior Analytics*, in *Exegesis and Argument* (edd. Lee E. N, Mourelatos A. P. D. and Rorty R. M.) *Phronesis* suppl. 1, 1973.

Kullman W, *Wissenschaft und Methode* (Berlin, 1974)

Kneale W. C & M, *The Development of Logic* (Oxford, 1962)

Knorr W. R, *The Evolution of The Euclidean Elements* (Dordrecht 1975)

Landor B, [1] Definitions and Hypotheses in *Posterior Analytics* 72a19–25 and 76b35–77a4, *Phronesis* 26 (1981) pp. 374–392

Lennox J. G, Divide and explain: The *Posterior Analytics* in practice, [in Gotthelf and Lennox]

Le Blond J. M, *Logique et méthode chez Aristote* (Paris 1939)

Lesher J. H, The meaning of *Nous* in the *Posterior Analytics*, *Phronesis* 18 (1973) pp. 44–68

Leszl W, Mathematics, Axiomatization and the Hypotheses. [in Berti]

Lukasiewicz J, *Aristotle's Syllogistic* (2nd edition, Oxford, 1957)

Mansion S, *Le Jugement d'existence chez Aristote* (Louvain, 1946)

Modrak D, *Aristotle The Power of Perception* (Chicago, 1987)

Owen G. E. L, [1] *Logic, Science and Dialectic* (London, 1986)

Owen G. E. L, [2] Logic and Metaphysics in Some Earlier Works of Aristotle, (1960) in [1]

Owen G. E. L, [3] Particular and General. (1978–9) in [1]

Owen G. E. L, [4] Aristotle: Method, Physics, and Cosmology, (1970) in [1]

Owens J, *The Doctrine of Being in the Aristotelian Metaphysics* (Toronto, 1951)

Robinson R, *Plato's Earlier Dialectic* (2nd edition, Oxford, 1953)

Smith R, Immediate Propositions and Aristotle's Proof Theory, *Ancient Philosophy* 6 (1986) pp. 47–68.

Scholz H, The Ancient Axiomatic Theory. (1930, [1975 in Barnes [3])

Schröder J, Eine aristotelische Argumentation zur Unbeweisbarkeit von Definitionen, *Arch. Gesch. Philosophie* 66, (1984) pp. 225–242

Scriven M, Explanation, Predictions and Laws, in Feigel H and Maxwell G (eds.) *Scientific Explanation, Space and Time* (Minnesota Studies in the Philosophy of Science vol. iii 1962)

Smart J. J. C, *Between Science and Philosophy* (New York 1968)

Sorabji R, [1] *Necessity Cause and Blame* (London, 1980)

Tiles J. E, Why the Triangle has Two Right Angles Kath' Hauto *Phronesis* 27, (1982) pp. 1–16

Treptow E, *Der Zusammenhang zwischen der Metaphysik und der Zweiten Analytik des Aristoteles* (München 1966)

Tugendhat E, *TI KATA TINOΣ* (Freiburg/München, 1982)

Weidemann H, In Defence of Aristotle's Theory of Predication, *Phronesis* 25, (1980) pp. 76–87

Williams C. J. F, Aristotle's Theory of Description, *The Philosophical Review*, 94 (1985) pp. 63–80

ACKNOWLEDGEMENTS

Many people have been involved in some way in the production of this piece of work, and it is marvellous to be able to acknowledge their assistance and thank them here. Professor Jonathan Barnes, who was the primary cause of my coming to Oxford in the spring of 1985, read a whole draft of the thesis and offered me valuable comments and criticisms. I will not be able to forget a few sentences in his letter which was given to me at the last stage of my thesis. "I do think that your argument is now *much* clearer and more convincing. I won't say that I'm *wholly* convinced—but that is probably only a reflection on my own stubbornness" Carolyn Price and Pantazis Tselemanis put a lot of effort into improving my Japanese English to a decent standard throughout the various stages of the draft as well as offering helpful comments and criticisms of its contents. For their help I am enormously grateful. At various stages of the work, I have directly and indirectly benefited from discussions with Kevin Flannery, Takashi Iida, Tomomasa Imai, Christopher Kirwan, Gavin Lawrence, Iku Matsuya, Christopher Megone, Michael Morris, Tsutomu Okabe, Professor Alex Orenstein, Alan Padgett, Mary Perrett, Ram Prasad, Andrew Roberts, Professor Fredrick Stoutland, Professor Takafusa Tanaka, Timothy Williamson and Michael Woods. I thank them heartily. In another way, Margareta Biller, David Brown, Mrs. Elizabeth Charles, Mikio Furuta, Austin Gee, Gregory Glazov, Ian Henderson, Masatsugu Hisatsune, Yukinobu Kitamura, the late Mrs. Magda Minio-Paluello, Roberto Minio-Paluello, Professor Dana and Mrs. Scott and Paulo Vaciago supported me with sympathetic encouragement. I thank them heartily. I thank also members of Oriel Philosophy Society and the Oriel-Zagreb Philosophy Colloquia in Dubrovnik.

Professor Shinro Kato, the late Professor Norimichi Magata, Professor

Akira Ohide, Professor Masao Sekine and Professor Noriko Ushida provided my preparatory studies in Japan. Without this basic intellectual and spiritual discipline, I would not have been able to produce this work. My biggest thanks must go to my supervisor, David Charles, whose sympathetic encouragement and endurance for years made it possible for me to finish this work. My tutorials with him have been the most joyous times in my Oxford life. His comments and constructive criticisms were so inspiring that they often made my eyes open and filled my soul with joy. Finally, I would like to thank my parents the late Minji and Yukiko Chiba for their tolerance and understanding for their prodigal son.

I am grateful to the support given to me by The British Council as a British Council Fellow and by ORS committee as a ORS Award holder.

ABSTRACT

The goal of this thesis is to offer a reading of *Posterior Analytics* as both philologically consistent and philosophically convincing, in order to resolve the various difficulties which have been raised by commentators since the Greeks. In Part I, I discuss the structure of Demonstrative Science. I argue that Aristotle distinguishes between philosophy of science and epistemology, by maling a clear conceptual and terminological distinction between "demonstrative knowledge" and "Demonstrative Science". (Chapter 1) Aristotle distinguishes between an ultimate principle (which is the hypothesis of and is characterised by the six conditions given in A2) and the relative principles [hypotheses]. The basis of the distinction is non-demonstrability. It is essential to distinguish immediate terms which are the non-demonstrable primary terms of a science from immediate propositions whose constituent terms are demonstrable with respect to their existence. Otherwise, the world would be full of inexplicable entities. (Chapter 2) I extract both the theoretical and pragmatic significance of his axiomatization of Demonstrative Theory. (Chapter 3)

In Part II, I discuss Aristotle's methods of heuristic inquiry into essence. The method and the range of inquiry is determined by the complexity involved in discovery. Because of the complexity of any discovery involving necessary and essential properties, Aristotle finds no difficulty in identifying the inquiry into the existence of a substance with the inquiry into the existence of a middle term which requires two extreme terms. (Chapter 4)

I investigate the nature of two types of causal entities both from the perspective of the structure of Demonstrative Science and from the metaphysical perspective. I argue that while the primary principles of a science and substantial from are concerned with the thing whose cause is identical with itself, the derivatives of primary principles and composite substance belong to the thing whose cause is different. (Chapter 5) I argue that inductive argument makes it possible to unify the various ingredients of a science under a common feature i.e. the primary term of a science which is shared by its ingredients. (Chapter 6)

Faculty of letters Hokkaido University JAPAN.