AN EXAMINATION OF ARISTOTELIAN MODALITY

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CONTENTS

LIST OF ABBREVIATIONS

The following is a list of the abbreviations of the titles of the Aristotelian works quoted in the text. With the exception of the translation of the Categories and the De Interpretatione (which is Ackrill's translation), the translation used is the "Oxford Translation", namely, The Works of Aristotle, which is translated under the general editorship of W.D. Ross.

Cat.	Categories, trans. J.L. Ackrill (1963)
De Cae.	De Caelo, trans. J.L. Stocks (1928)
De Gen. et Cor.	De Generatione et Corruptione, trans. H. Joachim (1930)
De Int.	De Interpretatione, trans. J.L. Ackrill (1963)
Metaphys.	Metaphysics, trans. J. Warrington (1956)
Phys.	Physics, trans. R.P. Hardie and R.K. Gaye (1930)
Post. An.	Posterior Analytics, trans. G.R.G. Mure (1928)
Pr. An.	Prior Analytics, trans. A.J. Jenkinson (1928)
Top.	Topics, trans. W.A. Pickard-Cambridge (1928).

LIST OF SYMBOLS

'p', 'q', 'r'	stand for	variables
'a', 'b', 'c'	stand for	terms
'$\overline{a}$'	stands for	"non-A" (i.e. the contrary of A)
'Aab'	stands for	"All A is B"
'Eab'	stands for	"No A is B"
'Iab'	stands for	"Some A is B"
'Oab'	stands for	"Some A is not B"
'Aa$\overline{b}$'	stands for	"All A is non-B"
'A$\overline{a}$b'	stands for	"All non-A is B"
'$\overline{Aab}$'	stands for	"not Aab" (i.e. the contradictory of Aab)
'Aa$\overline{b}$ $\supset$ Eab'	stands for	"If Aa$\overline{b}$ then Eab"
'N(Aab)'	stands for	"It is necessary that All A is B" or "All A is necessarily B"
'P(Aab)'	stands for	"It is possible that All A is B" or "A is possibly B" (Where "possible" is used in the sense of "non-contingent", compatible with the necessary)
'C(Aab)'	stands for	"It is contingent that All A is B" or "All A is contingently B".
'Aab $\equiv$ $\overline{Oab}$'	stands for	"Aab if and only if $\overline{Oab}$" or "Aab is equivalent to $\overline{Oab}$".
'Aab v Iab'	stands for	"Aab or Iab".

INTRODUCTION

A popular misconception regarding Aristotle's views on modality is that Aristotle adhered to the doctrine of no unrealized possibilities. According to this doctrine, all possibilities are realized in time; in other words, if it is possible that something happen, then at some time it is the case that that happens. For example, if it is *possible* for Socrates to escape from prison, then there will be a time at which Socrates *will* actually escape from prison. On this view, the possible and the actual co-incide; whereas there is abundant evidence that Aristotle was careful to maintain a distinction between the possible and the actual.

That Aristotle adhered to the doctrine of no unrealized possibilities is only one of the misconceptions which abound, concerning Aristotle's views on modality. The result of all these misconceptions has been the charge that Aristotle's modal logic is fundamentally incoherent and full of errors. From Aristotle's successor Theophrastus through to modern logicians like the Kneales, no other part of Aristotle's logic has encountered as much opposition as his theory of modality.

The aim of the present work is to refute the claim that Aristotle's theory of modality is fundamentally incoherent and full of errors. It will be shown, rather, that Aristotle's theory is coherent: his account of modal concepts is consistent with his theory of modal syllogisms, and his theory of modal syllogisms could be formalized in the way that the theory of assertoric syllogisms is. It will also be shown that Aristotle's modal logic is separable from his metaphysics (although the former has implications for the latter, in that Aristotle draws

metaphysical implications from the discussion of logical concepts).

Since the aim of this thesis is to investigate Aristotelian modality, only certain parts of Aristotle's logic will be examined, namely, the theory of modal concepts, the assertoric syllogistic, the modal syllogistic and the theory of predication. However, not even these areas will be examined fully: only portions of them will be subjected to detailed examination, and the texts to which I shall devote the most attention are the De Interpretatione and the Prior Analytics.

In chapter one, I present my own interpretation, and, in doing so, I consider three problems. The first problem concerns the function of the modal word in a sentence; that is, whether the modal word is a property of the whole predication or whether it describes the relation holding between the terms of a predication. I argue that the modal word describes term-term relations. I argue further that a distinction may be drawn between the mode and the modality of a predication: the mode describes the relation holding between subject- and predicate-*terms*, while the modality has to do with the relation holding between subject- and predicate-items. The second problem dealt with in chapter one concerns the bearer of modality, i.e. whether modality is primarily logical, metaphysical, ontological or linguistic. I argue that modality is primarily logical, but that it has metaphysical implications. The third problem considered in chapter one has to do with whether or not modality is temporalized, that is, with whether or not a reference to time is implicit in the modal concepts. I argue that while Aristotle's characterization of modal concepts incorporates references to time, these modal concepts are not reducible to temporal concepts. In other words, the modal concepts "necessary" and

"possible" are not replaceable by the temporal concepts "always" and "sometimes", respectively.

In chapter two, I consider alternative interpretations of Aristotle, namely, the interpretations of the Kneales, al-Farabi, Hintikka and Waterlow. The Kneales are representative of the group of philosophers and logicians who regard Aristotle's modal logic as being inherently confused. According to the Kneales, the function of the modal word in a predication is to qualify the whole predication, and, for this reason, they maintain:

> The necessary basis for a modal logic is a logic of unanalysed propositions [i.e. a sentential logic] such as was developed by the Stoics. Lacking this, Aristotle had no clear thread to guide him ...[1]

I argue against the Kneales that Aristotle's modal logic is a coherent one in which the function of the modal word in a predication is to characterize the relation between terms and that it follows from this that Aristotle does not require a sentential logic as a basis for his modal logic. After considering the Kneales' interpretation of Aristotle, I turn to that of al-Farabi. Al-Farabi is of importance because, even though he wrote so many centuries after Aristotle, his interpretation is one which is faithful and exact, and which aids enormously in understanding Aristotle. The next interpretation I consider is that of Hintikka, who is an exponent of the view that Aristotle adhered to the doctrine of no unrealized possibilities. I argue against Hintikka by showing that his misconception of Aristotle's views on modality rests on a fundamental mistake, namely, the conflation of two different senses of "possibility" which Aristotle clearly distinguishes. The final interpretation I examine is that of Waterlow. Waterlow argues, correctly, that while Aristotle does

regard modality as being linked to time, he would not subscribe to an equivalence between "always" and "necessarily" and between "at some time" and "possibly".

In chapter three, I examine the three Aristotelian modes,[2] namely, the assertoric (or simple or pure) mode, the possibility mode and the necessity mode. I argue (1) that Aristotle employs the assertoric mode to express that which is universally true as opposed to that which is necessary (which is expressed by the necessity mode); (2) that Aristotle distinguishes two senses of "possibility", one compatible with necessity, and the other, a sense of "contingency" incompatible with necessity; (3) that he regards "contingency" as the basic sense of "possibility", and that he has a modal logic of contingency that is not simply a notion of temporalized truth, and (4) that he regards the necessary as the most primitive mode from which the impossible, the possible and the contingent may be derived.

In chapter four, I examine Aristotle's theory of the negation of modal concepts and I provide a representation of the logical relationships between the modal concepts. Both the examination and the representation reveal that Aristotle's modal logic is coherent and methodical, and that he works according to clearly formulated (though not explicitly articulated) rules. Also in chapter four, I examine al-Farabi's interpretation of Aristotle on the negation of modal concepts. Al-Farabi's interpretation is particularly helpful because al-Farabi explicitly formulates the rules according to which Aristotle proceeds.

Chapter five may be divided into two sections: in the first section, I show that Aristotle's theory of modal syllogisms can be axiomatized in the way that the assertoric syllogistic is, and that

it is consistent with his concept of modality. In the second section, I relate Aristotle's theory of modality to two problems associated with ancient modal logic, namely, the problem of future contingents and the Master Argument. With respect to the problem of future contingents, I argue that Aristotle bases his line of argument on the idea that the relevant sense of possibility is the sense of "contingency", and with respect to the Master Argument, I argue that the thesis which it was designed to establish is in opposition to Aristotle's theory of modality.

INTRODUCTION : Notes.

1 Kneale, W. and Kneale, M. The Development of Logic, Oxford 1962 p 91.

2 These are, properly speaking, modalities, since they concern the relation between predicate- and subject-items. I refer to them, here, as "modes" because of Aristotle's phrase "modes of attribution".

CHAPTER 1

Aristotle's Theory of Predication and Bearer's of Modality.

Introduction.

Any work dealing with the Aristotelian modalities needs first to settle what modality is and what the bearers of modality are. It is important to settle this issue because there is little agreement, amongst writers on Aristotelian logic, on the subject. The Kneales[1], for example, suggest that the modal word modifies the whole sentence, while Bochênski[2] argues that the modal word modifies only part of the sentence. Some logicians ignore the issue, while others charge that Aristotle's whole account of modal logic is confused and incoherent, and so evade the question. Since one of the aims of this thesis is to refute the claim that Aristotle's account of modal logic is confused, such an option is not open to me.

Given that the question of the bearer of modality concerns the function of the modal word in the sentence, one way of approaching the issue is through Aristotle's account of the sentence, namely, his theory of predication, and it is to this that I shall now turn. I should point out that my concern will be with sentences of the type "A is B" (including its mode-ified and quantified forms) - the subject-matter of the syllogistic.

1. Aristotle's Theory of Predication.

One of Aristotle's major concerns throughout the Organon is the consideration of reasoning, which he characterizes as "... an argument in which, certain things being laid down, something other than these necessarily comes about through them" (Top.I, 1,100^{a}25). Aristotle distinguishes between demonstrative reasoning and dialectical reasoning;

he regards true demonstrative reasoning as reasoning which starts from premisses that are true and primary (Top.I, 1,100^{a}26) and dialectical reasoning as reasoning which starts from opinions that are generally accepted (Top.I, 1,100^{a}30).

Aristotle observes that both the demonstrator and the dialectician argue syllogistically, and he describes a syllogism as "... discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so" (Pr.An.I, 1,24^{b}18-19).

A syllogism is composed of premisses, and Aristotle chracterizes a premiss as "... a sentence affirming or denying one thing of another" (Pr.An.I, 1,24^{a}16). Aristotle also characterizes a premiss as follows: "... a syllogistic premiss without qualification [i.e. as dialectic or demonstrative] will be an affirmation or denial of something concerning something else" (Pr.An.I, 1, 24^{a}29).

Aristotle recognizes that a premiss may be universal, particular or indefinite[3]:

> By universal I mean the statement that something belongs to all or none of something else; by particular that it belongs to some or not to some or not to all; by indefinite that it does or does not belong, without any mark to show whether it is universal or particular, e.g. ...'pleasure is not good' (Pr.An.I, 1, 24^{a}16-21)..

For Aristotle, a premiss is resolved into terms:

> I call that a term into which the premiss is resolved, i.e. both the predicate and that of which it is predicated, 'being' being added and 'not being' removed, or vice versa (Pr.An.I, 1, 24^{b}16-18).

According to this passage, a premiss consists of two terms: one term is the predicate and the other term is that of which the predicate is predicated. These two terms are joined by "is" or "is not" to form an affirmation or denial, respectively. Aristotle considers "All A is B",

"Some A is B", "No A is B" and "Some A is not B" as examples of such premisses.[4] In these examples, "A" is the subject-term and "B" is the predicate-term, and these are joined by "is" or "is not". It may be pointed out that Aristotle's description of how premisses are formed is essentially syntactic: nothing specific need follow about the semantic relation of what "A" stands for to what "B" stands for in virtue of the "is/is not" of affirmation/denial.

The account of predication just given is that provided by Aristotle in the Prior Analytics. Aristotle provides another account of predication in the De Interpretatione. It is the view of some logicians - for example, Peter Geach[5] - that the De Interpretatione theory differs from the Prior Analytics theory. I disagree with this view, and I shall consider it in a little more detail, later in the chapter. For the present, I shall provide my interpretation of the De Interpretatione theory of predication.

In chapter four of the De Interpretatione, Aristotle marks what is distinctive of sentences as:

> ... a significant spoken sound some part of which is significant in separation - as an expression, not as an affirmation (De Int., 4, $16^{b}26$).

For Aristotle, an expression S is a sentence[6] if and only if

(1) S is a significant unit of speech,

(2) S has some proper part s which is significant, but

(3) S's significance makes no affirmation or denial.

Thus, as Aristotle points out (at De Int.4, $16^{b}33$), while every sentence is significant, not every sentence is a statement-making sentence; only sentences which affirm or deny make statements. When *so used*, what they yield will be true or false.[7] Sentences which affirm or deny consist of nouns (*onoma*) and verbs in combination

(De Int., 1, $16^{a}10$-11). Aristotle characterizes a noun as "... a spoken sound significant by convention, without time, none of whose parts is significant in separation" (De Int. 2, $16^{a}19$), and a verb as "... what additionally signifies time" and "... a sign of things said of something else" (De Int. 3, $16^{b}6$-7).

As Aristotle continues in chapter ten of the De Interpretatione,

> ... Every affirmation will contain either a name and a verb or an indefinite name and a verb. Without a verb there will be no affirmation or negation. 'Is', 'will be', 'was', 'becomes', and the like are verbs according to what we laid down, since they additionally signify time. So a first affirmation and negation are: 'a man is', 'a man is not' ... (De Int., 10, $19^{b}11$-15).

Aristotle's point here is not that all affirmations should contain *only* a name (or an indefinite name) and a verb, but that they should contain *at least* these two elements. Aristotle here characterizes "is" as a verb, and "A man is" as a first affirmation. It should be noted that in "A man is", "is" is used existentially, not copulatively.

In the passage following the one above, Aristotle provides "A man is just" as another example of an affirmation. However, "A man is just" differs from "A man is" in that, in the former expression, "... 'is' is predicated additionally as a third thing" (De Int. 10, $19^{b}19$):

> ... Here I say that the 'is' is a third component - name or verb - in the affirmation (De Int.,10, $19^{b}20$).

This passage introduces a problem: in an affirmation such as "A man is just", it is not clear what "is" and "just" are. Aristotle says that "is" may be a name *or* a verb, and he says nothing about "just". A related problem concerns an affirmation like "Callias is walking".

A solution to this problem has been provided by J.L. Ackrill[8], who reasons as follows: In an affirmation like "Callias is walking", it is clear that "Callias" is the noun, but it is not clear what the verb is.

"Is" carries the time reference, but it cannot be the verb on its own unless it is occurring existentially. But in "Callias is walking", it is obvious that "is" does not carry the force of "exists". On the other hand, "walking" cannot count as the verb either, since it contains no time-reference. Aristotle is not very clear on this, but his remark at De Int.,12,21^{b}9 that "A man walks" is equivalent to "A man is walking" might suggest that he would regard "is walking" or "is just" as verbs, and "walking" and "just" as fragments of verbs. On this interpretation, "is" would be regarded simply as a copula, as a sign of synthesis.

It seems to me that Ackrill's interpretation is correct. It is borne out by what Aristotle says elsewhere in the De Interpretatione, and it explains Aristotle's characterization of "is" as a "noun or verb". What Aristotle means when he says that "is" is a "noun or verb" is that "is" functions as a name (along with "was", "will be", "becomes", etc.) in signifying the time at which the predicate applies; but then, as part of the verb phrase, its role or function is to combine, i.e. it acts as a copula (e.g. "A man is just"). This "naming" use of "is" may be contrasted with the existential use of "is" (e.g. "A man is") where "is" does not name the time but asserts the existence of something.

The above, then, is the De Interpretatione theory of predication. Elements of Aristotle's theory of predication may also be found in the Categories and the Topics, and I shall now proceed to a consideration of these.

In the Topics, Aristotle claims that every *problema* indicates either a 'definition', a '*proprium*',[9] a 'genus' or an 'accident' (Top.I, 1,101^{b}17). It is clear from the ensuing discussion that he regards a *problema* as a statement of the form "A is B" (Top.II, 1,108^{b}37) and that the headings

'definition', '*proprium*', 'genus' and 'accident' indicate the relation which "B" has to "A". In other words, the four headings may be seen as four types of predicate.

Aristotle characterizes a 'definition' as "... a phrase signifying a thing's essence" (Top.I, 5,101^{b}39), i.e. in "A is B", B signifies what is essential to A. The definition is a convertible predicate, since we may argue from "A is B" to "B is A", and if B is the definition of A, then A is necessarily B.

Aristotle describes a '*proprium*' as "a predicate which does not indicate the essence of a thing, but yet belongs to that thing alone, and is predicated convertibly of it" (Top.I, 5,102^{a}18-19). Aristotle regards the capability of learning grammar as a *proprium* of man "... for if A be a man, then he is capable of learning grammar, and if he be capable of learning grammar, he is a man" (Top.I, 5, 102^{a}20).

A 'genus' is characterized by Aristotle as the larger kind to which the species in question belongs and within which it is distinguished by its specific difference (Top.I, 5,102^{a}31). The genus is predicated necessarily of the subject, and it is a convertible predicate (Top.II, 1,109^{a}13), since, "... if 'to be an animal is an attribute [i.e. genus] of S' then 'S is an animal'".

An 'accident' is described by Aristotle as a character which can belong to instances of the species, but need not so belong (Top.I, 5,102^{b}6-7). An accident is not predicated necessarily of the subject, and it is not a convertible predicate.

The following table summarizes these predicates:

Predicate	How the Predicate belongs to the subject	Convertibility
Definition	necessarily	convertible
Proprium	not necessarily	convertible
Genus	necessarily	convertible
Accident	not necessarily	non-convertible

It may be noted that the *proprium* is very similar to the accident, and distinguishing the two sometimes presents a problem. One of the differences between the two, though, is that the *proprium* is a convertible predicate while the accident is not. This problem is discussed later in the relation of the predicables to the modes. (See chapter 3 pp 70-71.

The Topics is recognized to be an intermediate work (between the De Interpretatione and the Prior Analytics) and the theory of predicables presented in the Topics is an extension of the discussion of the De Interpretatione. In the De Interpretatione Aristotle first introduces statements of the form "A is B", and in the Topics he characterizes different ways in which B relates to A. Now "A" and "B" are terms, and, as such, they may fall into any of ten categories. As Aristotle points out, in the Categories

> Of things which are said without any combination, each signifies either substance or quantity or qualification or a relative or where or when or being-in-a-position or having or doing or being affected (Cat.,4, $1^{b}25$-27).

In the Topics, Aristotle draws the relation between the predicables and the ten categories as follows:

> ... We must distinguish between the classes of predicates in which the four orders in question [namely, definition, *proprium*, genus and accident] are found. These are ten in number: Essence, Quantity, Quality, Relation, Place, Time, Position, State, Activity, Passivity. For the accident and genus and property and definition of anything will always be in one of these categories: for all the propositions found through these signify either something's essence or its quality or its quantity or some one of the other types of predicate (Top.I, 9,103^{b}20-27).[10]

In this passage, Aristotle establishes that in any statement of the form "A is B", B predicates the definition, *proprium*, genus or accident of the subject-term A, and both terms "A" and "B" signify what a thing is,

or the quantity, quality, etc., of the thing. Thus, for example, in a statement like "Man is white", the subject-term "man" denotes that the subject-item falls in the category of substance, while the predicate-term "white" denotes that the predicate-item falls in the category of quality and applies to man accidentally.

Aristotle is concerned with affirmations and negations, and he emphasizes that terms on their own do not form affirmations and negations:

> None of the above [i.e. substance, quantity, quality, time, place, relation, being-in-a-position, having, doing or being affected (viz. things said without any combination)] is said just by itself in any affirmation, but by the combination of these with one another, an affirmation is produced. For every affirmation, it seems, is either true or false, but of things said without any combination none is either true or false (e.g. 'man', 'white', 'runs', 'wins') (Cat., 4,2^{a}4-10).

In this passage, Aristotle makes a point that he makes again, later, in the De Interpretatione, namely, that a term on its own cannot be true or false. A combination of terms constitutes an affirmation or negation, and this combination must include a name and a verb.

Thus, in both the Categories and the Topics, Aristotle is putting forward a theory of predication consistent with that provided in the De Interpretatione and the Prior Analytics.

At this point, it would be instructive to consider, briefly, the relation of the predicate-term to the subject-term in a premiss of the form "A is B" in Aristotle's theory of predication.

The most plausible interpretation[11] of this relation (i.e. the interpretation for which there is the most evidence in Aristotle's writings) is the following: Firstly, any affirmation of the form "A is B" asserts that the individual referred to by its subject-term has the attribute designated by its predicate-term. Individuals are regarded, not only as persons, but as any "things" of which attributes can be

significantly predicated. Attributes can be designated not only by adjectives, but also by nouns or even verbs: thus "Callias runs" and "Callias is running" have the same meaning. Secondly, in an affirmation of the form "A is B", the "is" is simply a copula, a sign of synthesis which can perform its function only in association with two terms:

> ... [The "is" in "A is B" is] not an element of the proposition on all fours with the subject and the predicate ... It is simply the expression of the act of asserting a connexion, in distinction from the elements of reality whose connexion is asserted.[13]

The copula thus represents the further unanalysable notion of predication. Finally, in an affirmation of the form "A is B", the subject- and predicate-terms are freely interchangeable - in other words, "B is A" has the same significance as "A is B".

I shall now summarize the discussion thus far. I began by pointing out that since the question of the bearer of modality has to do with the function of the modal word in the sentence, a preliminary enquiry into Aristotle's theory of predication was required. I then proceeded to conduct such an enquiry, concentrating mainly on the elements of the theory germane to this thesis. The results of this investigation may be summarized as follows: For Aristotle, the sentence is the bearer of meaning, and only statement-making sentences may be true or false. Aristotle recognizes, as simple statements, statements which affirm or deny something of something else. Statements which affirm something of something else are affirmations, while statements which deny something of something else are negations.[14] Every affirmation consists of, at least, a name (or a "non-name") and a verb. Names, non-names and verbs are spoken sounds, significant by convention. Aristotle distinguishes names from verbs by saying that verbs carry a time-reference, while names do not, and he distinguishes names from "non-names" (or indefinite names) by pointing out that the latter are prefixed by "not". Aristotle

regards "A man is just" and "A not-man is just" as affirmations, and he regards "A man is not just" and "A not-man is not-just" as negations. For Aristotle, affirmations and negations may be universal, particular, indefinite or singular. A universal statement is the statement that something belongs to (or is predicated of) all or none of something else, for example, "Every man is just" and "No man is just"; a particular statement is the statement that something belongs to some or not to some of something else, for example, "Some man is just" and "Some man is not just"; an indefinite statement is a statement that contains no sign of quantity, for example, "Man is just" and "Man is not just"; finally, a singular statement is the statement that something belongs or does not belong to an individual, for example, "Callias is just" and "Callias is not just". Of all these types of statement, universal (affirmative and negative) statements and particular (affirmative and negative) statements constitute the subject-matter of the syllogistic, i.e. Aristotle's theory of inference. With respect to premisses of the form "A is B", Aristotle's position is that in such an affirmation: (1) the individual referred to by the subject-term "A" has the attribute designated by the predicate-term "B", (2) the "is" functions simply as a copula and represents the further unanalysable notion of predication and (3) the subject- and predicate-terms are freely interchangeable.

The above, then, is my interpretation of Aristotle's theory of predication. As I have already mentioned (see page three, above), my interpretation of Aristotle differs from that of Peter Geach. Whereas I have interpreted Aristotle as adhering to a single continuous theory of predication from the Categories, through the De Interpretatione and the Topics to the Prior Analytics, Geach sees Aristotle as propounding one theory in the De Interpretatione, and a different theory in the Prior Analytics.

In a lecture entitled "History of the Corruptions of Logic", Geach claims that Aristotle, in the De Interpretatione, adopted Plato's view that the simplest proposition consists of two heterogeneous elements, a noun and a verb. It is probable that Geach gained this interpretation from the following passage:

> ... Every affirmation will contain either a name and a verb or an indefinite name and a verb. Without a verb there will be no affirmation or negation (De Int., 10,19^{b}11-14).

Geach commends Aristotle for adopting the Platonic view, but then goes on to express his regret that Aristotle, after writing the De Interpretatione and before writing the Prior Analytics, abandoned this position:

> He lost the Platonic insight that any predicative proposition splits up into two logically heterogeneous parts; instead, he treats predication as an attachment of one term (*horos*) to another term. Whereas the *rhema* was regarded as essentially predicative, 'always a sign of what is said of something else', it is impossible on the new doctrine for any term to be essentially predicative; on the contrary, any term that occurs in a proposition predicatively may be made into the subject-term of another predication. I shall call this "Aristotle's thesis of interchangeability": his adoption of it marks a transition from the original name-and-predicable theory to a *two-term* theory.

According to this passage, Aristotle eventually abandoned a name-and-predicable theory of predication in favour of a two-term theory of predication. On a name-and-predicable theory, a predication - for example, "a man walks" - may be analysed into a name ('man') and a predicable ('walks'). The predicable is essentially predicative, and so cannot be made to stand in the position of the subject-term. On a two-term theory, however, a predication - for example - "Socrates is white" - may be analysed into two terms, a subject-term ('Socrates') and a predicate-term ('white') joined by the copula "is". These terms are fully interchangeable, thus the predicate-term can be made to stand in

the position of the subject-term, and vice versa. Geach's view is that the two-term theory is mistaken, because, as he understands it, it is logically impossible for a term to shift about between subject and predicate position without undergoing a change of sense as well as a change of role.

It is important to recognize that what is at issue between the two-term theorist and the name-predicable theorist[15] is not so much the merely syntactic question: where is the main division of *form* within the sentence? Rather, it is the contention that *one* analysis of the logic of simple sentences captures, in a way that the other does not, the difference in what separable sentence-parts do, in being *used* to make affirmations and denials. For just as whole sentences are classified into "affirmations" or "denials" according to *what is done* in uttering them (e.g. "'running' is affirmed of Callias"), so a name-and-predicable theory of predication is an account of the minimum necessary conditions for expressions to be predicatively *used*.

For Aristotle, the position of the term is independent of the role played by the term in the sentence; while terms are neutral with respect to where they can appear, they are not neutral with respect to function. The following example illustrates this point:

1: Walking is good for the health.
2: Socrates is walking.
3: Therefore Socrates is doing something good for the health.

In (1), "walking" functions as the subject-term, while in (2), "walking" functions as the predicate-term. "Walking" functions differently in each sentence, but it retains the same meaning, and therefore the argument is valid. If "walking" did not retain the same meaning, the argument would be invalid. Clearly, then, the syntactic role of a term is independent of the semantic meaning of the term, and Geach is

mistaken in his claim that if a term changes its position, it also changes its meaning.

Geach is also mistaken in his claim that Aristotle propounds two different theories of predication in the De Interpretatione and the Prior Analytics. I have already shown that Aristotle presents the same theory of predication in the Categories, the De Interpretatione, the Topics and the Prior Analytics. It seems to me that Geach has missed a crucial point in the De Interpretatione, namely:

> ... For there is no difference between saying that a man walks and saying that a man is walking (De Int. $12,21^{b}9$).

According to this passage, Aristotle regards the two forms of predication - "A man walks" and "A man is walking" - as equivalent. Geach's missing this point has much to do with his claim that Aristotle adheres to a name-and-predicable theory in the De Interpretatione.

Concerning Geach's remark that it is logically impossible for a term to shift about between subject and predicate position without undergoing a change of sense as well as a change of role, Strawson[16] makes the following response. He argues that, for Geach, an assertion of the form "A is B" is about the subject-item (i.e. the individual that the subject-term "A" refers to). This means that Geach would regard the assertion "B is A" as being about the individual which "B" refers to. Geach would thus regard the two statements as unequivalent since, for him, they are *about* different things. Strawson objects to Geach's view that an assertion of the form "A is B" is about "A". He observes that there might be circumstances in which "A is B" would be about "B".

I think that Strawson is right. Geach's argument rests heavily on the notion "about", but this itself is a problematic notion, which needs to be explained (and so cannot be used to explain something else).

This concludes my consideration of Geach's argument. I shall now continue my account of Aristotle's theory of predication by examining the function of the modal word in a predication.

In the Prior Analytics, Aristotle identifies three kinds of premisses:

1 : premisses which merely assert (Pr.An.I, $8,29^{b}36$),

2 : possible premisses (Pr.An.I, $3,25^{a}37$), and

3 : necessary premisses (Pr.An.I, $3,25^{a}28$).

Premisses which merely assert (I shall refer to these as 'assertoric', 'pure' or 'simple' premisses), e.g. "A is B", state that something belongs to (is predicated of, is the attribute of)[17] something else. In other words, assertoric premisses state that the predicate-item is the attribute of the subject-item.[18] For example, the assertoric premiss "Man is capable of learning grammar" asserts that the capability of learning grammar is an attribute of man.

Possible premisses (I shall refer to these as 'problematic' premisses), e.g. "A is possibly B", state that the predicate-item is possibly the attribute of the subject-item. For example, the problematic premiss "Man is possibly white" asserts that whiteness is a possible attribute of man.

Necessary premisses (I shall refer to these as 'apodeictic' premisses), e.g. "A is necessarily B", state that the predicate-item is necessarily the attribute of the subject-item. For example, the apodeictic premiss "Man is necessarily two-footed" asserts that being two-footed is a necessary attribute of man.

Assertoric, problematic and apodeictic premisses may be: (1) affirmative or negative, and (2) universal, particular or indefinite

(Pr.An.I, 2,25^{a}1-4) (the table on the next page sets out Aristotle's classification of premisses.) All these premisses express a relation - the relation of belonging, predication or attribution - between the predicate-and-subject-items, and this relation may be simple, possible or necessary. There are thus three "modes of attribution" (Pr.An.I, 2,25^{a}3) and "simply", "possibly" and "necessarily" are 'modal' words, describing the way in which the predicate-item is attributed of the subject item. For Aristotle, therefore, the modal word does not qualify the subject- or predicate-term[19]: *terms* are not simple, possible or necessary; rather, it is the relation between what terms denote which is simple, possible or necessary. In other words, the relation between predicate- and subject-items is what is simple, possible or necessary, and the predicate-term is simply, possibly or necessarily true of the subject-term. For example, in "Man is necessarily animal", the predicate-item (animal) belongs necessarily to the subject-item (man), and the predicate-term ("animal") is necessarily true of the subject-term ("man"). Clearly, then, *things* are related simply, possibly or necessarily, and the modal word describes the quality of this relation between things.

At this stage, it is necessary to consider where, for Aristotle, modality may be located: is modality primarily linguistic (i.e. is a state of affairs said to be possible because the corresponding statement is possibly true) or is modality primarily ontological (i.e. is a statement possibly true because the corresponding situation is possible)? What, for Aristotle, is the bearer of modality?

2. The Bearer of Modality.

We know that Aristotle draws a distinction between the level of language and the level of things[20] because of remarks like the

Mode	Pure					
Quality	AFFIRMATIVE			NEGATIVE		
Quantity	Universal	Particular	Indefinite	Universal	Particular	Indefinite
Schema	All A is B	Some A is B	A is B	No A is B	Some A is not B	A is not B
Example	All man is animal	Some state is good	Contraries are subjects of the same science	No horse is man	Some horse is not white	Pleasure is not good

Mode	Necessary					
Quality	AFFIRMATIVE			NEGATIVE		
Quantity	Universal	Particular	Indefinite	Universal	Particular	Indefinite
Schema	All A is nec. B	Some A is nec. B	A is nec. B	Nec. No A is B	Nec. Some A is not B	Nec. A is not B
Example	All horses are nec. animals	Some white things are nec. animals	no example	It is nec. that no garments are animals	no example	no example

Mode	Possible					
Quality	AFFIRMATIVE			NEGATIVE		
Quantity	Universal	Particular	Indefinite	Universal	Particular	Indefinite
Schema	All A is poss. B	Some A is poss. B	A is poss. B	Poss. No A is B	Poss. some A is not B	Poss. A is not B
Example	All animals are poss. white	Some white things are possibly animals	no example	It is possible that no animal is white	no example	no example

NOTE: All the examples have been drawn from the text of the Prior Analytics.

following:

> Now spoken sounds are symbols of affections in the soul, and written marks symbols of spoken sounds. And just as written marks are not the same for all men, neither are spoken sounds. But what these are in the first place signs of - affections of the soul - are the same for all; and what these affections are likenesses of - actual things - are also the same (De Int.1,16^{a}3-7).

This is an extremely difficult passage, a thorough analysis of which would take us far beyond the scope of the present work. What is relevant to the present work is that Aristotle here draws a mediated distinction between the linguistic and the ontological by claiming that written marks represent actual things.

Aristotle is not consistent in maintaining this distinction and, in the words of Sarah Waterlow[21], he glides to and fro between the material and formal modes of discourse".[22] An example of this inconsistency is the Categories, since it is not clear whether the Categories is about words or things. Some writers have argued that it is about words, while other writers - among them, J.L. Ackrill - have argued that it is primarily about things. Ackrill argues, correctly I think, that the Categories is about what words signify, and he points out[23] that Aristotle relies on linguistic facts to discover truths about non-linguistic items. This last point is, it seems to me, especially true of the Prior Analytics, where Aristotle uses words in order to construct syllogisms which allow him to discover the relations that hold between things.

With respect to Aristotle's distinction between the linguistic and the ontological, the question that needs to be answered is whether modality, for Aristotle, is linguistic or ontological. Are "possibly" and "necessarily" to be understood as "possibly true" and "necessarily true" or 'possibly actual" and "necessarily actual"? It seems to me that, for Aristotle, modality is ontologically prior to linguistic: it is

because *something* is necessary or possible that the corresponding statement is necessarily or possibly true, just as it is because something *is* the case that the corresponding statement is true or false:

> ... It is because of a change in the actual thing that it [i.e. the statement] comes to be true at one time and false at another (Cat. 5,4[a]35).

But while Aristotle considers modality to be logically prior to linguistic, I want to suggest that he regards modality as primarily logical, with metaphysical consequences. This makes modality a matter of *logic*, which obviously has ontological and linguistic implications, but which need not be either one or the other, since it concerns itself with the "form of valid reasoning" as such.

I have already argued that, for Aristotle, the function of the modal word in a premiss is to describe the way in which the predicate-item relates to the subject-item. From this it follows that modality has to do with the *relation* between predicate-and-subject-items. However, this relation is not a linguistic relation - rather, it is a logical relation. Modality should thus be located at the level of logic, and not at the level of ontology or linguistics.

It needs to be pointed out that there is an obvious difference in the *function* of the modal qualifier between:

1 : "It is *necessary* that ..." expressing "logical consequence"

and

2 : "A is *necessarily* B" expressing the relation between predicate-and-subject-items.

That Aristotle recognised this difference is shown by passages like:

> ... Everything necessarily is or is not, and will be or will not be; but one cannot divide and say that one or the other is necessary. I mean, for example: it is necessary for there to be or not to be a sea-battle tomorrow; but it is not necessary for a sea-battle to

> take place tomorrow, nor for one not to take place - though it is necessary for one to take place or not to take place (De Int. 9,19^{a}28-33).

and

> ... The conclusion is not necessary without qualification, though it is a necessary conclusion from the premisses (Pr.An.I, 10,30^{b}32-33).

This concludes my discussion of the bearer of modality. In summary: the answer to the question, "Where, for Aristotle, is modality located?" is: for Aristotle, modality may be located at the level of logic rather than at the level of ontology or linguistics; further, although modality is primarily logical, it has metaphysical consequences.

Thus far in the chapter, I have provided an account of Aristotle's theory of predication in order to determine what the function of the modal word in a predication is, and I have also tried to answer the questions "What is modality?" and "Where is modality located?". It is now necessary to consider another important question: "Is Aristotelian modality temporal?". In other words, it needs to be ascertained whether modal concepts are reducible to temporal ones.

3. The Modal Concepts and Temporality.

There can be no doubt that Aristotle has a temporalized approach to modality, since there is ample evidence in his work that he sees modality and time as being somehow connected:

> ... If [a thing's] coming-to-be is to be 'necessary', it must be 'always' in its coming-to-be. For what is 'of necessity' coincides with what is always, since that which 'must be' cannot possibly 'not be'. Hence a thing is eternal if its 'being' is necessary: and if it is eternal, its 'being' is necessary (De Gen. et Cor. II, 338^{a}1-3).

> ... Since not all things are or come to be of necessity and always, and the majority of things happen usually, the accidental must exist; otherwise everything would be of necessity (Metaphysics,E,2).

> ... It cannot be true to say that a thing is possible but will never be ... (Metaphsics,Θ, 4,1047^{b}3-6).

> ... It is impossible that the destructible should not at some time be destroyed (De Caelo I, 12,283^{a}25-26).

It is evident from these passages that Aristotle sees modality and time as being linked, but the question is, how are they linked? Are modal concepts reducible to temporal ones or are modal and temporal concepts irreducibly different? According to Jaakko Hintikka,

> In passage after passage, he [i.e. Aristotle] explicitly or tacitly equates possibility with sometime truth and necessity with omnitemporal truth.[24]

Hintikka's view is that although Aristotle never actually *defines* possibility and necessity in purely temporal terms, he seems to go as far as to be ready to do so.

In the remainder of this chapter, I shall consider the question whether Aristotle equated possibility with sometime truth - i.e. whether Aristotle believed that all possibilities are realized at some time. In order to answer this question, I shall examine three passages from Aristotle, two of which suggest that he did, and the third, that he did not.

In chapter nine of the De Interpretatione, Aristotle states,

> ... In things that are not always actual, there is the possibility of being and of not being; here both possibilities are open, both being and not being ... Many things are obviously like this. For example, it is possible for this cloak to be cut up, and yet it will not be cut up but will wear out first. But equally, its not being cut up is also possible, for it

> would not be the case that it wore out first unless its not being cut up were possible. So it is the same with all other events that are spoken of in terms of this kind of possibility (De Int. 9,19[a]8-18).

Here, "this kind of possibility" refers to contingency.[25] It is contingent (i.e. not impossible and not necessary) for a cloak to be cut up or for a cloak to wear out - neither *have* to happen. But if a cloak is cut up, then the possibility of its wearing out will not be realized, and if a cloak wears out, then the possibility of its being cut up will not be realized. Clearly, then, when possibility is used in the sense of "contingency", the possibility need not be actualized at some time.

This is supported by what Aristotle says in the Metaphysics:

> ... It is possible that a thing may be capable of being and yet not *be*, capable of not being and yet be ... That which is capable of walking [moving, standing, etc.] may not walk [move or stand, etc.] and that which is capable of not walking may walk (Metaphysics Θ,3).

In other words, contingencies need not be realized at some time.

We must now turn to those passages in which Aristotle does seem committed to the view that all possibilities are realized in time. For example, one such passage occurs in the De Caelo:

> It is clear also on other grounds that it is impossible that the destructible should not at some time be destroyed. For otherwise it will always be at once destructible and in actuality indestructible, so that it will be at the same time capable of always existing and of not always existing. Thus the destructible is at some time actually destroyed (De Caelo I, 12,283[a] 25-28).

In this passage, Aristotle's point is that if it is possible for something to be destroyed (that is, if something is destructible), then that thing will at some time be destroyed. "Possible", here, is used, not in the sense of "contingent", but in the sense of "possible" which is compatible with necessity. For if something is destructible, then it is necessary

that it should at some time be destroyed, and the possibility of its being destroyed follows from this necessity. One cannot interpret "possible" in "it is possible for something to be destroyed" in the sense of "contingent", because it does not make sense to say that if something is destructible, it is contingent for it to be destroyed. Were it contingent, then equally, it may not be destroyed; that is, there should be no time at which it is destroyed. But this makes something both destructible and indestructible - which is absurd.

In chapter twelve of De Caelo Book I, Aristotle is concerned with proving the metaphysical thesis that the heaven is ungenerated and indestructible, and in proving this thesis, he argues that (1) whatever is generable had to be generated at some time since an eternal thing cannot be generable, and (2) whatever is destructible must at some time be destroyed since otherwise it would be an eternal (and thus indestrucible) thing. For Aristotle, then, if something is destructible, it *must* at some time be destroyed; and it is because it must at some time be destroyed that it is possible for it to be destroyed. It is for this reason that "possible" in the sentence "If it is possible for something to be destroyed, it must at some time be destroyed"[26] is used in the sense of "possibility" compatible with necessity, and not in the sense of "contingency".

The following conclusions now emerge with respect to Aristotle's use of possibility:

A : When possibility is used in the sense of "contingency", that which is possible does not *have* to happen at some time: it may happen or it may not happen.

B : When possibility is used in the sense compatible with necessity, that which is possible *is* realized at some time.

The question whether Aristotle believed that all possibilities are realized may now be answered, and the answer must clearly be "No." Aristotle did not believe that all possibilities are realized in time - only those of which "possibility" is affirmed in sense B are.

It follows from this, then, that - for Aristotle - modal concepts are not reducible to temporal concepts. Modal concepts are linked to temporal concepts, but they cannot be defined purely in terms of temporal concepts.

This concludes my discussion of Aristotle's theory of predication and modality. I shall now proceed to my second chapter, in which I shall consider alternative interpretations of Aristotle's theory of predication and modality.

Chapter 1 : Notes.

1 Kneale, W. and Kneale, M. The Development of Logic, Oxford 1962 p 83.

2 Bochênski, I. The History of Logic, Indiana 1961.

3 Aristotle also recognizes singular premisses, e.g. "Socrates is white", in which the subject-term is the name of an individual that cannot itself be predicated of anything else. However, Aristotle excludes singular premisses from his theory of syllogistic inference since they lack generality and thus do not advance knowledge in demonstrative science.

4 The form of expression "A is B" is equivalent to the forms "A is in B as in a whole", "B is predicated of A", and "B belongs to A". Aristotle uses these expressions interchangeably.

5 Geach, P. "History of the Corruptions of Logic" in Logic Matters, Oxford 1972.

6 In his account of sentences, Aristotle is attempting to give a syntactic description of a sentence, keeping aside notions of truth and falsity. He recognizes that truth is a semantic relation, not a syntactic requirement.

7 For Aristotle, truth and falsity do not have to do with mere "combinations of terms"; rather, they have to do with the relation of what is affirmed in the use of term-term combinations to what obtains, *when* it obtains hence the reference to time in his characterization of a verb, but not in that of a noun . While a noun, for Aristotle, is separably significant, a verb is not separably significant because it is what is affirmed or denied *at a time*, of what is named, in some sentential use. The significance of the verb is thus essentially related to what, at that time, by means of that use, it affirms or denies. For Aristotle, then, a sentence which affirms or denies contains a reference (either explicit or implicit) to the moment of time at which it is uttered, hence his characterization of truth as saying "of that which is that it is" (Metaphysics, *Gamma*, 7, $1011^{b}26$-27).

8 Ackrill, J.L. Aristotle's Categories and De Interpretatione, Oxford 1979 pp 119-120.

9 '*proprium*' is sometimes translated as "property".

10 Note the difference in translation between this passage and the preceding one. This (older) translation uses mediaeval terms.

11 This interpretation is one of seven considered by the Kneales in their book The Development of Logic Oxford 1962 pp 63-66.

12 See Ackrill, op. cit., p 122.

13 Ross, D. Aristotle, London 1974 p 28.

14 Pending further discussion, I am preserving translation by contrasting affirmation with negation - see chapter 4 for Aristotle's use of negation/denial.

15 It may be noted that the debate between two-term and name-predicable theorists described here is only the most recent instance of a debate continuing back for at least a millenium into mediaeval scholastic and Islamic writings. The debate has implications for the "problem of universals" discussed by many ancient writers, but this is not the significance the debate has which is addressed in this thesis.

16 Strawson, P.F. Individuals, London 1974 pp 143-147.

17 I have already pointed out that Aristotle regards "belongs to", "is predicated of" and "is the attribute of" as equivalent.

18 For the moment, I shall proceed to preserve the difference between the matter of logic and the matter of ontology by using "subject-term" and "predicate-term" for expressions, and "subject-item" and "predicate-item" for what those terms are about (or stand for). I observe that "about" and "stand for" are ambiguous expressions which raise further problems; however, I cannot enter into a discussion of these problems, here.

19 Problematic and apodeictic premisses may be expressed in either of two ways: (1) with a modal adverb attached to the copula - as in "A is necessarily (possibly) B" - , or (2) with a modal adjective qualifying the whole premiss - as in "It is necessary (possible) that B". These formulations mislead one into regarding the modal word as qualifying the predicate or the whole premiss.

20 Although Aristotle recognizes a distinction between the level of language and the level of things (or reality), as many commentators have observed, it is a troublesome distinction for Aristotelian logic in general. That, however, is not an issue I can take up here.

21 Waterlow, S. Passage and Possibility, Oxford 1982 p 117.

22 One need not suppose, of course, that the distinction between "formal" and "material" modes of discourse is any clearer in modern writings on logical theory.

23 Ackrill, op. cit., p 71.

24 Hintikka, J. Time and Necessity, Oxford 1973 p 151.

25 In a later chapter, I shall show that Aristotle recognized two senses of "possibility": (1) a sense of "contingency" as opposed to necessity, and (2) a sense of "possibility" which is compatible with necessity.

26 In other words, if it is possible for X to be destroyed, this possibility holds of X only in virtue of it being *necessary* that X (being a non-eternal item) be destroyed at some time; i.e. then it *must* at some time be destroyed.

CHAPTER 2

Alternative Interpretations of Aristotelian Modality.

Introduction.

In my interpretation of Aristotelian modality in chapter one, I made the following claims: (1) For Aristotle, the function of the modal word in a predication is to describe the way in which the predicate-item relates to the subject-item, thus, Aristotelian modality has to do with the relation between predicate- and subject-items, (2) Aristotelian modality is primarily logical, with metaphysical implications; however, modality is ontologically prior to linguistic and (3) Aristotelian modality is not temporal, i.e. the modal concepts are not reducible to temporal ones.

In this chapter, I shall consider alternative interpretations of Aristotelian modality: on the question of the theory of predication and the function of the modal word in a predication, I shall examine the views of the Kneales[1] and al-Farabi[2], and on the question of temporal modality I shall evaluate the interpretations of Hintikka[3] and Waterlow.[4]

After Aristotle's death in 322 B.C. Aristotelian philosophy went into decline and was revived only towards 100 A.D. in Greek Alexandria. According to historians, the philosophical school of Greek Alexandria survived the Arab conquest and re-emerged two and a half centuries later in the Aristotelian movement of Arab Baghdad[5]. The school of Baghdad consisted of a number of logicians who virtually monopolised Arabic logic. One of these logicians was Abu Nasr al-Farabi, the first major representative of Muslim Aristotelianism. Al-Farabi's commentaries covered the entire Aristotelian Organon in great detail and Zimmerman

observes,

> ... Al-Farabi, rethinking Aristotle's concepts along more abstract lines, was led to ask new questions and attempt new answers, for example, in the theory of the copula.[6]

Zimmerman further observes,

> Al-Farabi's own treatises under the titles of Categories, De Interpretatione, etc. cannot be described as mere epitomes of their Aristotelian counterparts. They recognize, and select from, Aristotle's subject matters with considerable freedom; and they draw on the whole range of known philosophical tradition.[7]

It is clear from Zimmerman's observations that al-Farabi was not merely concerned with writing exegeses of Aristotle's works; rather, in addition to writing commentaries and treatises, he developed some of Aristotle's doctrines and also sought to solve certain problems in novel ways. It is not surprising, therefore, that al-Farabi earned the title "second teacher" (Aristotle held the title "first teacher"), and an examination of his views is justified.[8]

Regarding the Kneales: in their book, William and Martha Kneale have devoted extensive discussion to the status of Aristotle's modal syllogistic. Their general conclusion is that where Aristotle's modal syllogistic is not incoherent, it is redundant. In my consideration of the Kneales interpretation of Aristotle, I shall be concerned to show that the Kneales are mistaken and that their conclusion rests on their inability to properly characterize the function of the modal word in a predication.

1. The Kneales on Aristotelian Modality.

In their discussion of Aristotle's modal logic, the Kneales[9] maintain that:

1 : Assuming that syllogisms concern relations between quantified

statements, modal statements have no place in the syllogistic since they may be regarded as singular statements, to which distinctions of quantity do not apply.

2 : Aristotle takes an internal view of modality in treating of modal syllogisms, i.e. he is misled by his adverbial formulation of premisses (e.g. "Every B is necessarily A" or "Some B is possibly A) into thinking of the modal qualification as internal to the proposition. But if the modal words modify predicates, there is no need for a modal syllogistic since the assertoric syllogistic is adequate.

3 : Aristotle (apparently inconsistently) takes an external view of modality in his theory of the conversion of modal statements, that is, he regards the modal words as modifying the whole sentence in which they occur:

> ... Aristotle's thought seems to be that we should regard the subordinate clause as the subject of the modal sentence, which as a whole is used to affirm or deny possibility or one of the other modal notions of what is expressed by the subordinate clause [for example, "'P' is possible" or "It is necessary that - P"] ... Aristotle is therefore led to realize that in a modal statement the modal expression forms the main predicate of the sentence and is, as it were, external rather than internal to the rest.[10]

There are good reasons against interpreting Aristotle in this way. In the first place, it is not the case that Aristotle takes the external view of modality in his theory of the conversion of modal statements. For, on the external view, "It is contingent that - P", for example, would convert to "It is contingent that not-P" (the Kneales actually claim[11] that such a conversion holds). But such a conversion cannot hold. It will be seen, later, that "P" and "not-P" are contradictories, and that a contingent proposition does not convert to its *contradictory*, but to its *contrary*. Thus it is not true that Aristotle, in his theory of modal conversion, regards the modal word as qualifying the whole sentence in which it occurs.

In the second place, the Kneales cannot be right in regarding modal statements as singular statements (i.e. unquantified statements in which the subject-term is the name of an individual). If modal statements were singular, then conversion would be able to proceed indiscriminately (with no reference to quantity). But conversion does not proceed indiscriminately: how a modal statement converts depends on the quantity of that statement. For example, in the case of problematic premisses, universal affirmative premisses are mutually convertible with universal negative premisses,[12] but not with particular negative premisses. In other words, "It is contingent that all B is A" implies "It is contingent that no B is A", and *vice versa*, but "It is contingent that all B is A" implies "It is contingent that some B is not A", *but not vice versa*. Thus, since quantity does have a hearing on conversion, modal statements cannot be singular. Further, if modal statements were singular, then negation would have no effect on the quantity of the statement. But Aristotle's claim, "... both the propositions 'A necessarily belongs to some B' and 'A necessarily does not belong to some B' are opposed to the proposition 'A may belong to all B'" (Pr.An.I, 17,37^{a}25-26) shows that contradiction of a modal statement affects both its mode and its quantity, since the contradictory of a universal affirmative problematic statement is a particular negative apodeictic statement. It follows from this, then, that modal statements cannot be regarded as singular statements, and that the Kneales must be mistaken in regarding them as such.

In the third place, the Kneales' "internal/external "distinction is an unreasonable dichotomy, since "internal/external" does not exhaust the possible interpretations of the *function* of modal words. The function of the modal word may be interpreted as characterizing the manner in which the predicate-item relates to the subject-item. This

interpretation is supported by Aristotle's claims in the Prior Analytics:

> Every premiss states that something either is or must be or may be the attribute of something else; of premisses of these three kinds some are affirmative, others negative, in respect of each of the three modes of attribution ... (Pr.An.I, 2,25^{a}).
>
> ... Every syllogism proves that something belongs either simply or necessarily or possibly (Pr.An.I, 14,33^{b}10).
>
> ... There is a difference according as something belongs, necessarily belongs, or may belong to something else ... [and] it is clear that there will be different syllogisms to prove each of these relations ... (Pr.An.I, 8,29^{b}29).

It is clear from these passages that, for Aristotle, the function of the modal word is to indicate how the predicate-item holds of the subject-item. The modal word describes the relation between *things* (for example, the relation between individual and attribute). *Things* are connected simply, necessarily or possibly, and the modal word describes the quality of the connection. The modal word, therefore, does not modify only the predicate or only the subject, or even the whole sentence - instead, it expresses how the items denoted by the subject- and predicate-terms in a premiss are related.

This concludes my evaluation of the Kneales' interpretation of Aristotelian modality. I shall now turn to al-Farabi's interpretation.

2. Al-Farabi on Aristotelian Modality.

In my consideration of al-Farabi's interpretation of Aristotelian modality, I shall begin by providing a short summary of al-Farabi's theory of predication. I shall then proceed to focus on certain parts of al-Farabi's interpretation, particularly those parts which represent a clarification of (or even an advance upon) Aristotle's views.

Al-Farabi begins his Commentary to the De Interpretatione with the

following words:

> Aristotle's *purpose* in the De Interpretatione is to discuss the simple categorical statement in terms of composition, not of subject matter, and to discuss the various kinds of opposition between simple categorical statements, again in terms of composition (Commentary, 17.4-6),

and he continues, a few paragraphs later,

> For it has to be explained that logic is concerned with thoughts, more specifically with thoughts as signified by expressions and as somehow related to entities (Commentary, 18.4-5).

It is clear from these passages that for al-Farabi, the De Interpretatione - and, indeed, logic - is about the form, and not the content, of statements. Al-Farabi distinguishes between "composition" (the *form* of phrases or sentences) and "matter" (the *content* of sentences) and he argues that logic examines the composition of statements, and in so doing, it explains the composition of thoughts (Commentary, 26). Al-Farabi's view is that logic is not an inquiry into "the nature of things" and he criticizes those commentators who interpret the De Interpretatione as such an inquiry.[13] Al-Farabi's theory of predication must therefore be understood in the light of his form/content distinction, for his description of how predications are formed is essentially *syntactic*.

Al-Farabi's theory of predication may be summarized as follows: significant expressions may be single or compound. Nouns, verbs and particles are single expressions, and they signify single notions. Nouns and verbs signify notions which can be understood by themselves, but verbs additionally signify time, while nouns do not. Particles (for example, "from" and "on") cannot be understood by themselves, but have to be attached to nouns or verbs in order to be understood. Nouns and verbs may be definite or indefinite: they become indefinite when "not" is attached to them. Neither indefinite nouns nor indefinite

verbs are negations. Instead, they signify a kind of privation (e.g. "Zayd is not-knowing" signifies the same as "Zayd is ignorant"), and statements whose predicates are indefinite are affirmative. Verbs may be hyparctic or non-hyparctic. Hyparctic verbs are verbs which, when attached to a predicate noun, signify that they are connected with, and hold of, the subject-noun (e.g. "Zayd is just"). Non-hyparctic verbs are used as predicates in their own right (e.g. the "is" in "Zayd is" or the "walks" in "Zayd walks"). While nouns, verbs and particles are simple significant expressions, statements are an example of compound significant expressions, and they signify compound notions. Statements are composed of a subject and a predicate, and they are sentences which may be true or false. Statements may be either of two opposite kinds: affirmations or negations. Negations are formed from affirmations by linking the verb with the particle "not". Affirmations and negations may be of several types, depending on the nature of the predicate: a statement whose predicate is a definite noun signifying possession is a plain statement, a statement whose predicate is a definite noun signifying privation is a privative statement, and a statement whose predicate is an indefinite noun is a metathetic statement. The notions signified by statements or by nouns are either individual or universal. A universal notion is one which can be predicated of more than one thing while an individual notion is one which can be predicated of only one thing. Affirmations and negations divide into those whose subjects are universal notions and those whose subjects are individuals. If the subject is a universal notion it is either unquantified or quantified. If it is quantified, then the quantifier is either universal or particular. Statements may also be modified or unmodified. Modified statements are statements containing modes, and modified statements may be affirmative or negative, plain or metathetic, and quantified or unquantified. These

statements interrelate as do unmodified sentences. Modes are expressions which, when linked with the verb, signify how the predicate holds of the subject. There are three primary modes: the necessary, the possible and the absolute. They are referred to as "primary" because they signify the differentiae leading to a basic division of entities. Every entity divides into opposite pairs, one of which is the division into the potential and the actual. The necessary is what is actual and the possible is what is potential; in other words, the necessary is what exists permanently, while the possible is that which does not presently exist, but which is apt to exist or not to exist in the future.[14] "Possible" is a wider term than "necessary" since it is applied both to things which are necessary and to things which are not necessary. "Actual" and "necessary" apply to three kinds of things: (1) what is permanent without interruption in the past or future, (2) what is necessary as long as its subjects exists and (3) what is necessary to exist as long as it itself exists. "Possible" applies to the same kinds of things, but it also has an additional meaning, namely, that of having the possibility in the future of being and of not being.[15] The latter is the true meaning of "possible", while the true meaning of "necessary" is "that which is permanent without interruption in the past or future". The absolute is that which is midway between the possible and the necessary: the absolute is that which presently exists. The absolute, the possible and the necessary, then, are the three primary modes. Modes are not the same as material modalities. Modes signify how the predicate holds of the subject, while the material modalities are the things connected when brought together in an informative way by a statement: their connection produces the qualities signified by modes. For this reason, modes belong to the part of logic which examines the composition of statements. Accordingly, modes can occur in statements

whose material modalities are contrary to those signified by their modes, for there are three primary modes, and correspondingly, three primary modalities, and these can combine in different ways in statements.

The foregoing is al-Farabi's interpretation of Aristotle's theory of predication. I shall now proceed to a more detailed examination of certain parts of al-Farabi's interpretation, namely (1) his notion of hyparxis, and (2) his distinction between mode and modality. Al-Farabi's theory of negation is also worthy of closer scrutiny, but since I aim to examine negation in more detail in chapter four, I shall defer a thorough discussion of al-Farabi's theory of negation until then.

2.1 Hyparxis.

In the De Interpretatione, a sentence such as "Callias is walking" presents a problem since it is not clear how Aristotle would analyse it. The problem centres around what is to count as the verb: "is" cannot be the verb since, though it carries the time reference, it would have to carry the force of "exists" if it were the verb (which, in "Callias is walking" it does not), and "walking" cannot be the verb since it carries no time-reference.

Al-Farabi solves this problem by distinguishing between hyparctic and non-hyparctic verbs. Hyparctic verbs are verbs which are attached to a predicate noun and non-hyparctic verbs are verbs which are predicates on their own. Thus, for example, the "is" in "Callias is walking" is a hyparctic verb (since it is attached to the substantive predicate "walking" and indicates how the whole predicate holds of the subject "Callias"), and the "is" in "Callias is" is a non-hyparctic verb (since it is a predicate in its own right and does not need to be attached to a predicate-expression). The distinction between hyparctic and non-hyparctic verbs captures the difference between the copulative

and existential use of "is", for when "is" is used copulatively, it is a hyparctic verb, and when "is" is used existentially, it is a non-hyparctic verb.[14]

Al-Farabi is careful to point out (Commentary, 36.16) that a hyparctic verb can signify the same as a non-hyparctic verb - in other words, he agrees with Aristotle that "Callias is walking" is equivalent to "Callias walks". He remarks that the difference between the two is that the non-hyparctic verb "signifies by its own formation what is signified by the hyparctic verbs attached to predicated nouns" (Treatise, 39); that is, the non-hyparctic verb is "sufficiently equipped" to connect itself with the subject to form a statement, but the hyparctic verb requires a predicate- and a subject-expression in order to form a statement. The difference between hyparctic and non-hyparctic verbs draws attention to a difference between nouns and verbs:[15] according to al-Farabi, a verb can be a predicate without requiring anything to be attached to it, but a noun will not be a predicate unless a hyparctic verb is attached to it (Treatise, 44).

With respect to whether the distinction between hyparctic and non-hyparctic verbs occurs in the De Interpretatione, al-Farabi observes,

> Aristotle does not explicitly mention this division. But later on in the chapter, he expresses himself in such a way as to show that he has in fact divided the verbs into hyparctic and non-hyparctic ones (Commentary, 43.1-3).

It seems to me that al-Farabi is right: in chapter ten of the De Interpretatione, where Aristotle discusses the negations of "A man is", "A man is just" and "A man walks", he does appear to be making a distinction between (what al-Farabi calls) "hyparctic"

and "non-hyparctic" verbs:

> ... Every affirmation will contain either a name and a verb or an indefinite name and a verb ... so a first affirmation and negation are: 'a man is', 'a man is not' ... But when 'is' is predicated additionally as a third thing, there are two ways of expressing opposition. (I mean, for example, 'a man is just'; here I say that the 'is' is a third component - whether name or verb - in the affirmation.) ... In cases where 'is' does not fit (e.g. with 'recovers' or 'walks') the verbs have the same effect when so placed as if 'is' were joined on ... (De Int. 10,19^{b}11-20^{a}5).

The question that now remains is: to what extent is al-Farabi's solution of the problem of the analysis of a sentence like "Callias is walking" consistent with that of Ackrill (as discussed in chapter one)? It may be recalled that Ackrill interprets the "is" simply as a copula, a sign of synthesis, while al-Farabi interprets the "is" as a hyparctic verb. Zimmermann, in his introduction to al-Farabi's Commentary and Short Treatise, sheds some light on al-Farabi's understanding of the concept "verb":

> ...[Al-Farabi] all but eliminates the grammatical concept of the verb from the logical theory of predication ... He winds up (47.16-8) with the suggestion that with Aristotle the word 'verb' [*kalima*] can have three distinct meanings: 'word', 'copula', and 'word co-signifying time'. Only the last relates to the *grammatical* sense of 'verb' ... [But] as a term of logic *kalima* in al-Farabi's view always refers, exclusively or *inter alia*, to the copula. In its strictest sense it denotes the pure, tenseless copula alone; in a broad sense, it covers all the four elements distinguished as being expressed by *verba finita* like 'walks': the predicate proper, attributivity [i.e. the predicative role], tense, and the copula.[16]

If Zimmermann is correct, then al-Farabi's solution is consistent with that of Ackrill.

The above then, is a consideration of al-Farabi's notion of hyparxis.

I shall now proceed to a consideration of al-Farabi's distinction between mode and modality.

2.2 Mode/Modality.

Most relevant to present concerns is al-Farabi's use of the distinction between mode and modality to characterize Aristotle's use of modal concepts in both logical and metaphysical contexts. Al-Farabi draws this distinction as follows:

> Modes are expressions which, when linked with the hyparctic verb or verb containing the force of the hyparctic verb, signifies how the predicate holds of the subject (Commentary, 163.8-10).
>
> Modes are not the same as material modalities. Modes signify how the predicate holds of the subject, while the material modalities are the things connected when brought together in an informative way by a statement: their connection produces the qualities signified by modes. This is why modes belong to the part of logic which examines the composition of statements - for they are modes and qualities of composition -, and not to the part which examines subject-matters. Accordingly, these modes can occur in statements whose material modalities are contrary to those signified by their modes, which signify the mode and quality of the connection alone. (Commentary, 164.9-14).

A number of important points emerge from these passages. Firstly, whereas, for Aristotle, modes are *ways* in which the predicate-item holds of the subject-item("modes of attribution"), for al-Farabi, modes are *expressions*; they are the *words* "possible", "necessary", "may", "must", "possibly", "necessarily", and so forth, that indicate how the predicate holds of the subject. It is not clear, however, how "predicate" and "subject" should be interpreted here; that is, whether they should be interpreted as "predicate-item" and "subject-item", or as "predicate-term" and "subject-term". In other words, it is not clear from al-Farabi's terminology whether modes signify how the predicate term holds of the subject-term or how the predicate-item

holds of the subject-item. The solution lies in al-Farabi's firm distinction between form (matters of syntax) and content (matters of semantics): for him, the De Interpretatione is about the composition (and not the subject-matter) of statements, and since the mode is a part of a statement (i.e. one of the structural components of the statement), the subject and predicate must be, too, and therefore these should be interpreted as "subject-term" and "predicate-term". It may be taken, then, that for al-Farabi, modes signify how the predicate-term holds of the subject-term.

Secondly, it is clear that, for al-Farabi, modality has to do with subject-matter, i.e. with the ways in which things are connected. Al-Farabi recognizes three primary modalities, corresponding to the three primary modes, and he points out that (1) the mark of statements with a necessity modality is that the predicate-item is wholly inseparable from the subject-item at any time, and (2) the mark of statements with a possibility modality is that the predicate-item, while not presently "existing in"[19] the subject-item, is apt to exist, and apt not to exist, in it in the future (Treatise, 76). Thus, for example, the subject-matter of the statement "Man is an animal" involves necessity since the predicate-*item* "animal" is "wholly inseparable at any time" from the subject-*item* "man", and the subject-matter of the statement "Socrates will run" involves possibility since the predicate-*item* "runs" does not now but is apt to 'exist in' the subject-*item* "Socrates". It may be taken, then, that for al-Farabi, modality has to do with the way in which the predicate-item relates to the subject-item.

Thirdly, since, for al-Farabi, modes signify how the predicate term holds of the subject-term, and modality concerns the relation of the predicate-item to the subject-item, statements can have modes which

differ from the modality of what they describe. For example, in "Zayd necessarily walks", the modality is possibility, but the mode is necessity, while in "Fire possibly heats", the modality is necessity and the mode is possibility. On the other hand, statements can have modes which are the same as the modality of what they are about. For example, "Every three is necessarily an odd number" has both a necessity mode and a necessity modality, while "Zayd possibly walks" is a possibility statement in both respects.

It is clear from these examples that a distinction may be drawn between a statement's mode and its modality, and it is commendable that al-Farabi noticed this distinction. As presented, the mode/modality distinction embodies many problems of interpretation. In a sense, the task of chapters three and four is to provide a coherent account of how this distinction fits Aristotle's conceptions of modality.

Aristotle does not make an explicit distinction between mode and modality, but an examination of his writings reveal that he readily uses this distinction. For instance, in his modal syllogistic, where he considers the "different syllogisms" which result from "differently related terms" (Pr.An.I, 8,29^{b}33), his premisses are usually statements in which the modes and modalities are the same. Thus, when he considers problematic premisses, he uses statements with a possibility mode and a possibility modality (for example, "Some white things are possibly animals"), and when he considers apodeictic premisses, he uses statements with a necessity mode and a necessity modality (for example, "All snow is necessarily white"). Besides working with statements whose modes and modalities are the same, Aristotle also employs statements whose modes differ from their modalities, and examples of these are scattered throughout his works. The conclusion of a problematic syllogism, for

instance, always has a necessity mode but a possibility modality (Pr.An.I, 14-16). In a sense, statements with differing modes and modalities are more interesting than statements whose modes and modalities are the same. For when it is known that the modality of a statement is necessity or possibility, the addition of the modes "necessarily" or "possibly", respectively, does not tell us anything new. For example, "Fire necessarily heats" tells us nothing that "Fire heats" does not tell us in virtue of our understanding of what is, for Aristotle, definitive of fire. On the other hand, statements with differing modes and modalities do convey additional information. For example, "Zayd necessarily walks" does convey more than "Zayd walks" since the necessity is external to the subject-matter. That is, if true, then the necessity for Zayd to walk must be grounded in something other than what "Zayd" and "walks" stand for (i.e. the subject- and predicate-items themselves), since the modality is possibility (in the sense of "contingency").

In chapter three, we shall see that Aristotle recognizes two senses of "possibility", namely, a sense of "non contingency" compatible with necessity (this may be termed "one-sided possibility") and a sense of "contingency" opposed to necessity (this may be termed "two-sided possibility"). We shall also see that Aristotle regards "contingency" as the basic sense of "possibility". The difference between these two senses of "possibility" may be drawn in terms of the mode/modality distinction. For, while there is both a contingency mode and a contingency modality, there is only a possibility mode. So, whenever a possibility mode is combined with a necessity modality, possibility is used in the one-sided sense. For example, in "Multiples of two

are possibly even", "possibly" is used in the one-sided sense and our warrant for asserting the possibility of multiples of two being even is that the evenness of multiples of two is a matter of necessity. "Possibly" cannot be used in the two-sided sense in such a statement since "Multiples of two are contingently even" makes no sense. On the other hand, whenever a necessity mode is combined with a possibility modality, possibility is used in the two-sided sense. For example, in "Zayd necessarily walks", the modality is possibility in the two-sided sense since the relation between the predicate- and subject-items is one of contingency. Clearly, then, a difference may be drawn between the two senses of "possibility" in terms of the mode/modality distinction.

It will be important, later, to take up how this distinction between mode and modality relates to Aristotle's distinction between absolute and relative possibility, and absolute and relative necessity. Such an investigation, though, has to be deferred until the notions of relative and absolute possibility and necessity are properly explicated (see chapter three).

What is clear from the above, though, is that al-Farabi's mode/modality distinction stands in some relation to the more familiar *de re/de dicto* distinction of scholastic logic. Storrs McCall describes this distinction as follows:

> For those authors who followed Abailard, the distinction between modalities *de dicto* and *de re* was an essential one; for them, the propositions 'It is necessary (possible) that A is B', and 'A is necessarily (possibly) B' differed not only in form but in meaning. In the first case necessity (or possibility) is predicated of a *dictum*, *de dicto* in the second case of a thing, *de re*.[21]

McCall continues later, after a consideration of the opposition of modal premisses,

> It does not matter to the sense of these modal premisses whether we write them in their *de dicto* or *de re* forms, i.e. whether we write 'Necessarily all A is B' or 'All A is necessarily B'. Care is called for in the case of negative propositions, however, since the *de re* equivalent of 'Possibly some A is not B' is not 'Some A is not possibly B', but 'Some A is possibly not B', i.e. 'Some A is not necessarily B'.[22]

In the Kneales discussion[23] of Abelard's version of the *de re/de dicto distinction* it is apparent that Abelard recognized the distinction between mode and modality. For him (as for Aristotle) a truly modal proposition is one in which the modal words concern the relation of subject- to predicate-items. Abelard therefore sees the modal proposition as one in which the mode expresses (correctly or incorrectly) a modality which holds between what the subject- and predicate-expressions stand for (i.e. *expositio de rebus* or *de re*). In the *expositio de sensu* interpretation, for example "That any man be white is not possible" (false), the embedded proposition contains no modal word; and, thus, for Abelard, is not genuinely modal. Such a proposition simply attributes necessary or possible truth to the sense, or propositional content, of a sentence - and is, thus, *de dicto*.

It seems to me that Abelard, with this distinction between *expositio de sensu* and *expositio de rebus* (later taken up by the mediaeval logicians as the *de dicto/de re* distinction) is trying to draw a contrast similar to the mode/modality distinction. A true modal proposition interpreted *de re* for Abelard is one in which

the mode correctly expresses the modality, but where Abelard differs from al-Farabi is in supposing that the embedded proposition (in, for example, "That any man be white is not possible") has no mode. As I have shown above, for al-Farabi, non-problematic, non-apodeictic premisses are in the absolute mode and are thus modal. Nonetheless, Abelard and al-Farabi agree that where the modal word does not characterize the link between subject- and predicate-item, i.e. in the *de dicto* reading, no genuine modality is expressed.

McCall, in writing about Abelard's distinction, does not correctly identify it because of his use of the statements "A is necessarily B" and "It is necessary that A is B" which give no indication of the subject-matter. He is entirely correct in recognizing that there is no essential difference between "A is necessarily (possibly) B" and "It is necessary (possible) that A is B" (when *both* are given either the *de re* or *de dicto* reading). Where he is mistaken is in seeing these as *de re* and *de dicto* forms, respectively. Were he rather to substitute terms for variables and change the example somewhat, he would be better able to appreciate the *de dicto/de re* distinction.

This concludes my discussion of al-Farabi's distinction between mode and modality. It is evident from the foregoing that this distinction is an important one and that by making such a distinction al-Farabi contributes significantly to the understanding of Aristotelian logic.

I shall now turn to a consideration of Hintikka's interpretation

of Aristotelian modality.

3. Hintikka on Aristotelian Modality.

As I pointed out in the first chapter, Hintikka[24] interprets Aristotelian modality as being temporal. According to him,

> In passage after passage, he [Aristotle] explicitly or tacitly equates possibility with sometime truth and necessity with omni-temporal truth.

Hintikka's view[25] is that although Aristotle never actually *defines* possibility and necessity in purely logical terms, he seems to go so far as to be ready to do so, and Hintikka remarks, in this connection,

> Defining necessity and possibility in temporal terms, using the formulations (T) [no unqualified possibility remains unactualized through an infinity of time] and $(T)_2$ [what always is, is by necessity] of the principle of plenitude (strengthened into equivalences) as a bridge between time and modality, would have meant for Aristotle to base his modal notions entirely on what might be called a *statistical* model of modality: Something's being possible must be shown by its *sometimes* happening, and what is always must be by necessity. Applications of modal notions reduce in effect to comparisons of what happens at different moments of time. Such a classificatory approach to modal concepts was not foreign to Aristotle.

Hintikka's formulation is ambiguous, since the "Something" in "something's being possible ..." may (ambiguously) range over event-types (item-kinds) or event-tokens (particulars). From the truth that "some-event-*type*-thing's being possible must be shown by its sometimes happening", it does NOT follow that every particular possibility must at some time happen - not all instances of kinds are realized. Hintikka's not being clear about this distinction leads him into problems, as I shall soon show.

One of the consequences of Hintikka's interpretation of Aristotle is the misconception that Aristotle adhered to the doctrine of no unrealized possibilities. According to this doctrine, all possibilities are

realized in time; in other words, if it is possible that something happen, then at some time it is the case that that happens. For example, if it is possible for the Russians to participate in the Los Angeles Olympics, then there will be a time at which the Russians *will* actually participate in the Los Angeles Olympics. On this view, the possible and the actual coincide when viewed over an infinity of time; whereas there is abundant evidence that Aristotle was careful to maintain a distinction between the possible and the actual.

In what follows, I shall first present Jaakko Hintikka's interpretation of Aristotle as an adherent to the doctrine of no unrealized possibilities. I shall then try to show that Hintikka is mistaken, and that his mistake results from his discarding "contingency" as a genuine modal concept for Aristotle.

Jaakko Hintikka, in chapter five of his book Time and Necessity, argues that there is no doubt that Aristotle subscribed to the doctrine that every possibility is at some time realized. This principle of realized possibilities (which I shall henceforth refer to as 'RP') may be stated as follows:

(RP): If some state of affairs "p" is possible, then at some time it is the case that "p".

Hintikka's formulation of the principle (which I shall refer to as "RP-H" is as follows:

(RP-H): Possibility is equivalent to sometime truth.

As evidence for (RP-H), Hintikka cites some passages from Aristotle's Metaphysics. One passage he cites reads as follows:

> If that which is deprived of potency is incapable, that which is not happening will be incapable of happening and he who says of what is incapable of happening that it is or will be, is in error, for the word 'incapable' denotes precisely that which neither is nor will be (Metaphysics Θ, 3).

According to Hintikka, this passage asserts that that which never is, is impossible, and Hintikka claims that this is a qualified form of (RP-H). Another passage which Hintikka cites is the following:

> If, as we have said, that is possible which does not involve an impossibility, it cannot be true to say that a thing is possible but will never be - which would imply that there is nothing incapable of being [because at this rate anything may be possible] (Metaphysics Θ, 4).

Hintikka believes that this passage provides very strong support for the ascription of the principle (RP-H) to Aristotle.

Hintikka does acknowledge, though, that in some of Aristotle's texts, there is evidence against this view. For example, in chapter nine of the De Interpretatione, Aristotle states,

> ... It is possible for this cloak to be cut up, and yet it will not be cut up but will wear out first (De Int. 9,19^{a}12-14),

and Hintikka correctly interprets this as a clear instance of possibility that, according to Aristotle, will not be realized.

Hintikka resolves the (supposed) inconsistency in Aristotle as follows: he points out that Aristotle intends (RP-H) only in a restricted form; that is, (RP-H) is meant to cover only *general* possibilities (i.e. possibilities for *kinds* of states of affairs) and not particulars.[26] This restricted principle may be formulated as follows:

RP-HR: If some state of affairs "p" is possible, then "p" is one of a class of others like it, *some one* of which must be realized at some time.

According to this principle, the possibility of a particular thing's occurring depends on another thing of that kind having at some time taken place, for example, from its being possible that cloaks be cut up, it follows that something of the kind did, does or will happen at some time, but it does not follow *that* this cloak will be cut up. In other

words, it is because a cloak at some time was cut up that it is possible for this cloak to be cut up. In this way, Hintikka reconciles Aristotle's adherence to (RP) with Aristotle's view that there is a clear distinction between the possible and the actual. As a result, Hintikka is forced to deny that Aristotle permitted possible states of affairs concerning individuals (i.e. primary substances) to be genuine possibilities. In other words, on Hintikka's interpretation, Aristotle's modal notions concern only event-tokens.

There is something problematic about Hintikka's resolution of the dilemma. In the first place, Aristotle's remark "... It is possible for *this* cloak to be cut up" (De Int. 9,19^{a}13) (my emphasis) demonstrates that a *particular* is possible, and this makes nonsense of Hintikka's view that modal notions concern only event-tokens.

In the second place, we need to make sense of Hintikka's notion that a particular state of affairs is possible because of general states of affairs. The problem is that this implies an inference from the general to the particular - for example, that "Socrates is rational" is true in virtue of Socrates being of a rational species - whereas, in view of Aristotle's insistence on the primacy of individual substances, inferences proceed more properly from the particular to the general (i.e. that the rationality of humans is grounded in the particular rationalities of Socrates and Callias and so on).

In the third place, Hintikka is not faithful to Aristotle's intention that the logic of a modal concept be explored in order to draw metaphysical implications from it. It will be seen (in the chapter on the Aristotelian modes) that Aristotle, in his characterization of possibility, introduces the concept of possibility in a *logical* context; whereas he introduces the concept of possibility-at-a-time in a *metaphysical* context. The Prior Analytics and the De Interpretatione

are recognized as logical works, and Aristotelian scholarship has established that these treatises were written before the metaphysical treatises. Aristotle's logic is thus prior to his metaphysics, and his metaphysics is based on logical principles. Hintikka, in appealing to the Metaphysics when characterizing a logical notion, has not gone to the *primary source*, i.e. the logical context. Instead, Hintikka offers metaphysical support for the interpretation of a logical concept. This means that he looks first to the Metaphysics rather than to the logical writings for an account of contingency, whereas Aristotle first explains contingency in logical terms, and it is from these logical properties that he draws metaphysical implications. For Aristotle, not all potentialities are actualized, and the notion of contingency comes into play at this point in his metaphysics. But if "contingency" is first defined logically before it is used in the Metaphysics, then it remains an open question whether all contingencies or possibilities for Aristotle are realized at some time. For Hintikka, however, that all contingencies are realized is an analytic consequence of Aristotle's description of potentiality in the Metaphysics; whereas the discussion of contingency in the logical writings (for example, the De Interpretatione and the Prior Analytics) does not commit Aristotle to this consequence.

There are further grounds for objecting to Hintikka's interpretation of Aristotle. To begin with, Hintikka is guilty of conflating the two senses of "possibility" which, as we shall soon see, Aristotle kept separate. For example, in the (by now familiar) passage,

> It is possible for this cloak to be cut up, and yet it will not be cut up but will wear out first (De Int. $9,19^{a}12-14$).

Hintikka interprets "possible", not in the sense of "contingent", but in the sense of "possible" compatible with necessity. It is strange that

Hintikka should make this mistake because he is not ignorant of Aristotle's distinction. In his book, he constantly refers to "the distinction between possibility proper and contingency,[27] yet he fails to recognize the distinction when he encounters it in Aristotle, and it is this failure which leads him to a restriction of the principle of realized possibilities (RP) - a restriction which is unnecessary in view of Aristotle's distinction between possibility and contingency.

Hintikka is committed to the view that, for Aristotle, all possibilities are realized at some time. But if Hintikka is right, then there is no point to Aristotle's distinction between the possible and the actual (since if all possibilities are realized at some time, the potential "collapses" into the actual). It was precisely this consequence to which Aristotle objected in his protracted harangue against the Megarian conception of modality in the Metaphysics Θ, chapter three.

In brief, according to the Megarians, the possible is that which is or will be, and so a thing *can act* only when it *is acting*. For example, it is possible for a builder to build only when he is building. Aristotle objects to the Megarian view on the grounds that it identifies potentiality with actuality, and thereby does away with all change. But to do away with all change, Aristotle continues, is to "deny an absolutely crucial fact", and since we cannot admit the Megarian view, we must draw a distinction between potentiality and actuality. One of the consequences of the Megarian view is determinism: if the possible is that which is or will be, then there are no genuine unrealized possibilities, and everything that happens, happens of necessity. One of the consequences of the Megarian view is determinism: if the possible is that which is or will be, then there are no genuine unrealized possibilities, and everything that happens, happens of necessity - there being no genuine alternatives to what actually happens. Aristotle, I believe,

did not subscribe to *this form of* determinism, hence his insistence that the potential be distinguished from the actual, and his view that only some possibilities are realized in time. Hintikka must therefore be mistaken. It must be noted, though, that Hintikka attributes the doctrine of realized possibilities to Aristotle in the belief that, despite Aristotle's protestations, Aristotle was a determinist. Though I disagree with Hintikka's view, it is outside the scope of this thesis to consider in detail the question of Aristotle's indeterminism or the form that Aristotle's determinism may take.

Hintikka's interpretation of Aristotle may be objected to on yet another ground. To support his view that Aristotle held to the principle of realized possibilities, Hintikka cites a passage which he claims provides strong support for his view. The passage referred to is the following:

> If, as we have said, that is possible which does not involve an impossibility, it cannot be true to say that a thing is possible but will never be - which would imply that there is nothing incapable of being [because at this rate anything may be possible] (Metaphysics Θ, 4).

This quotation is from a longer passage, the rest of which reads as follows:

> Suppose, for example, that a man - one who takes no account of the impossible - were to say that the diagonal of the square is capable of being calculated from the side but will never be so calculated, on the grounds that there is nothing to prevent a thing which is capable of being from neither being nor being likely ever to be. Well, on the strength of our rule [that before pronouncing a thing possible one must be certain that none of the consequences is impossible] it follows that if we are to suppose that something which is not but which is possible either exists or has come into being, we must make sure that nothing impossible is involved. But on the view now under attack, something impossible *is* involved; for the diagonal cannot in fact be calculated from

> the side. The untrue, of course, is not the same as the impossible; it is untrue that you are now standing, but it is not impossible for you to be standing (Metaphysics Θ, 4).

In this passage, one of Aristotle's main concerns is to show that the possibly false (in the sense of "contingent") must be distinguished from the impossible. Since the impossible is that which will never be, the possible cannot be that which will never be; it must be something different.

Hintikka interprets Aristotle as saying that, since the *impossible* is that *which will never be*, the *possible* is that *which at some time will be*. Hintikka, on the basis of this interpretation, proceeds to attribute the principle (RP) to Aristotle.

I wish to argue that, in this passage, Aristotle is not committing himself to the thesis that all possibilities are realized at some time.

I have already remarked that one of Aristotle's objects, in this passage, is to point out that the possible, but untrue, (in the sense of "contingent"), must be distinguished from the impossible. We must now consider why Aristotle was concerned to do this. The reason is not hard to find when one examines the notion of contingency. If some state of affairs "p" is contingent, then it is possible for "p" not to be the case. But if "p" is never actualized, what makes "p" a possibility rather than an impossibility? For example, a cloak may be cut up, or it may wear out - it is contingent for either to happen. But if the cloak is cut up, the possibility of its wearing out is never realized. Yet this is not to say that the cloak's wearing out is impossible. Aristotle's concern, then, is to distinguish between possibilities (i.e. contingencies) which are never realized, and impossibilities; and with regard to making this distinction, he provides clear directions. Those are as follows: given some state of affairs "p" which one wants to call

possible, one should (a) suppose that "p" *is* the case and (b) test whether any absurdities follow from this supposition. If no contradiction follows from the assumption that "p" is the case, then "p" may be said to be possible, but if a contradiction does follow from such an assumption, then "p" must be said to be impossible. Thus, for example, it is *possible* for man to climb the highest mountain on Mars, since no contradictions follow from the supposition of John Smith's actually climbing that mountain; but it is *impossible* for man to have wings and fly since the supposition of this (i.e. man's having wings and flying) being the case is contradicted by the species characteristic of man as a featherless biped.

Aristotle is therefore not committing himself to the thesis that all possibilities are realized in time, rather, his point is that before pronouncing a thing possible, we should determine whether anything absurd follows from *supposing* it to be realized. The focal sentence in the passage is thus the one which reads,

> ... It follows that if we are to suppose that something which is not but which is possible either exists or has come into being, we must make sure that nothing impossible is involved (Metaphysics Θ,4).

Hintikka misses this point. He bases his interpretation of Aristotle on the fact that, since the impossible is that which will never be, and since the possible is different from the impossible, the possible is that which will at some time be. But this interpretation is not borne out by the rest of the passage.

Aristotle clearly recognizes that there are some possibilities whose realization is prevented by circumstances. For example, the possibility of a cloak's wearing out is prevented by the circumstance of its being cut up. An unrealized possibility is prevented from being realized by external circumstances, but it remains a possibility because

one can conceive of a situation in which the external hindrances are absent, so that the possibility can be realized. A further example may help to drive the point home: it is possible for a block of wood to burn, but this possibility would remain unrealized if the wood remained at the bottom of the ocean. However, the wood's burning is still a possibility because if it were to be placed on a fire - everything else being equal - the possibility of its burning would be realized.

It seems to me that part of the reason for Hintikka's insistence, that Aristotle ascribed to the doctrine that all possibilities are realized in time, is that if there were unrealized possibilities, how could these be distinguished from impossibilities? I have tried to show that Aristotle had a coherent method for distinguishing unrealized possibilities from impossibilities. Thus Aristotle's view that not all possibilities are realized in time is perfectly reasonable, and Hintikka's worries are unfounded.

This concludes the present discussion. The argument up to this point may now be reviewed. In this section, I have been concerned to argue that, for Aristotle, modal concepts are not reducible to temporal ones. In particular, I have been concerned to argue against the interpretation of Aristotle as committed to the view that all possibilities are realized at some time. I shall now turn - briefly - to Sarah Waterlow's refutation of the charge that Aristotle merges modal with temporal concepts.

4. Waterlow on Aristotelian Modality.

According to Sarah Waterlow[28] the most frustrating puzzles in Aristotle's logic arise over the various connections he draws between temporal and modal concepts. Waterlow points out that Aristotle has no

doubt that:

A : If at some time it is the case that "p", then it is possible that "p"

nor does Aristotle have any doubt that:

B : If it is necessary that "p", then it is always the case that "p".

But Waterlow adds that, in addition to (A) and (B), Aristotle maintains the reverse entailments, namely:

A^1 : If it is possible that "p", then at some time it is the case that "p"

and

B^1 : If it is always the case that "p", then it is necessary that "p".

It thus appears, observes Waterlow, that Aristotle subscribes to some form of equivalence between the temporal quantifiers "always" and "at some time", and the modal operators "necessarily" and "possibly".

Waterlow continues that, if a biconditional relationship holds between "possibly" and "at some time" and between "necessarily" and "always", and given that (A) and (B) are analytically true implication - statements, if (A^1) and (B^1) were also analytically true implication-statements, it would follow that the modal operators and the temporal quantifiers are analytically equivalent. On such an interpretation, concludes Waterlow, alethic modality is not logically independent of of non-modal concepts, and modal logic turns out to be an application of quantification theory in which the quantifiers are taken as ranging over times.

Waterlow disagrees with this view: she refuses to accept that possibility and necessity are reducible to extensional terms. According to Waterlow,

> That Aristotle merges modal with extensional concepts is a baseless charge, appearances notwithstanding. The "appearances" are his doctrines A^1 and B^1 which link possibility and necessity with realization at some and at all times. Correctly interpreted these propositions support the opposite view, that for him these connections are syntheses of irreducibly different concepts. If the interpretation is not obvious, it is because A^1 and B^1 incorporate a multiplicity of more or less obscure references to time. These are liable to confusion not only because of the temporal theme in common, but because the concepts and principles in play here lie off the main tracks of modern analysis ...
> In the first place there is his temporalized approach to modality, whereby possibility is seen as relative to an actual state of affairs in the history of the universe. Time has a double bearing here, since the possibility itself belongs at a time, as would the realization should it occur. This is Aristotle's central and, I have argued, his only conception of possibility ... Secondly, A^1 and B^1 in the versions considered here depend on non-formal assumptions cogent only in the archaic context of Aristotle's organic metaphysic of substance. Time enters in here too as a dimension in which states and activities may be realized to a point of completeness whose attainment sets an unimposed bound to the duration of the condition.
>
> A^1 and B^1 require both this logic and this metaphysics, each of which could occur without the other. Theoretically, Aristotle could have spelt out modality in absolute terms while retaining his fundamental notion of substance as organic unity. He could not then have reached A or B unless by a fallacy. On the other hand, the temporalized notion of possibility may also be used in conjunction with a non-organic metaphysics, and in this context too there would be no foundation for A^1 and B^1.[29]

In this passage, Waterlow's main claims are: (1) that though A^1 and B^1 link necessity and possibility with time, these modal notions are not reducible to temporal notions, and (2) that while Aristotle's modal concepts differ from other modal concepts (for example, the "modern" concepts "logical possibility" and "logical necessity") in being temporally relativized, his modal concepts are comprehensible within

the frame of his logic and metaphysics.

Waterlow's view - as regards the first claim - is that Aristotle sees possibility (and indeed, modality) as relative to an actual state of affairs. She reaches this conclusion through a thorough analysis of some of Aristotle's writings, in particular, chapter twelve of the first book of De Caelo, and she regards the following passage as being particularly relevant:

> A man has at the same time the possibility of being seated and of standing, because when he has the one possibility, he has the other also: but not in such a way that he can be standing at the same time as sitting, but only at another time (De Caelo I, 12,281^{b}15-18).

According to Waterlow, this is the temporalized version of the principle of possibility provided in the Prior Analytics, namely,

> ... The terms 'to be possible' and 'the possible' are used of that which is not necessary, but, being assumed, results in nothing impossible (Pr.An.I, 13,32^{a}18-19).

Waterlow correctly points out[30] that, according to the latter, a false proposition "p" is possible (contingent)[31] if and only if nothing impossible follows from supposing it true, whereas according to the temporalized version, a false proposition "p" is possible (contingent) if and only if nothing impossible follows from supposing it *true at a time other than the time when it is false*. Thus for example, continues Waterlow, if we wish to ascertain that a currently sitting man has the possibility of standing, we must convince ourselves that nothing impossible follows from supposing him to be standing at some other time.[32]

Waterlow correctly concludes that Aristotle's approach to modality is temporalized since: (1) that which is claimed to be possible is shown to be so by way of supposing it actual at another time (thus possibility is relativized to the actual) and (2) the possibility of what is possible

is itself a temporal fact (since, for example, the man currently sitting has *at present* the possibility of standing). However, Waterlow notes that although there is this interpenetration of time and modality, time and modality remain irreducibly different concepts.

In summary, then, Waterlow is concerned to argue that while Aristotle does regard modality as being linked to time, he would not subscribe to an equivalence between "always" and "necessarily" and between "at some time" and "possibly". Waterlow correctly identifies the proper sense of "possibility" as that of "contingency" and she shows that while Aristotle does indeed maintain (A^1) and (B^1), these are not analytically true like (A) and (B), i.e. true by reason only of the logic governing the use of modal and temporal terms involved, but depend on premisses of a non-formal nature. To this extent, Waterlow's interpretation of Aristotle is compatible with my own.

This concludes my account of Waterlow's interpretation of Aristotle, and also brings chapter two to a close.

CHAPTER 2 : Notes

1 Kneale, W. and M. The Development of Logic, Oxford 1962.

2 Zimmermann, F.W. Al Farabi's Commentary and Short Treatise on Aristotle's *De Interpretatione*, London 1981.

3 Hintikka, J. Time and Necessity, Oxford 1973.

4 Waterlow, S. Passage and Possibility, Oxford 1982.

5 Zimmermann, Op. cit., Preface.

6 Ibid., Preface.

7 Ibid., Introduction, p.xxiii.

8 In my account of al-Farabi's interpretation of Aristotle, I shall draw mainly from the Short Treatise on the De Interpretatione, since the views expressed there are clear and concise. Where there is a lack of clarity or where there are omissions, in the Short Treatise, I shall resort to the Commentary. In my references to these works, I shall indicate the page numbers and the lines, thus, for example, "Commentary, 39.5-8" refers to page 39, lines 5 to 8, of the Commentary, and "Treatise, 74" refers to page 74 of the Short Treatise.

9 Kneale, W. and M. The Development of Logic, Oxford 1962 pp 81-96.

10 Ibid., p 83.

11 Ibid., p 87.

12 This would be complementary conversion; see later.

13 Such a claim concurs with my earlier view that Aristotle's purpose here is to do with the logical, and has consequences for the ontological.

14 In chapter one, I briefly discussed the debate between the name-and-predicable theorist and the two-term theorist. I want to note that I consider al-Farabi's version of the role of the copula as worth considering in the light of this debate.

15 This relates to Aristotle's own mark of the noun/verb distinction (which holds of both hyparctic and non-hyparctic verbs, i.e. that verbs incorporate essential reference to time), and will weaken those interpretations of passages which commit Aristotle to temporalized modal concepts since the inference to "truth at some (all) time" may occasionally result from the presumption that every *lekton* has implicit or explicit reference to a moment or period of time.

16 Zimmermann, F.W. Al-Farabi's Commentary and Short Treatise on Aristotle's *De Interpretatione*, London 1981 pp 1ix-1x.

17 Ibid., p.1iii.

18 It is clear from what al-Farabi says at Treatise, 75, that he interprets modality in temporal terms; however, al-Farabi at no stage in his work subscribes to an equivalence between the modal operators "necessarily" and "possibly" and the temporal quantifiers "always" and "at some time" (respectively). To this extent, al-Farabi's interpretation is faithful to Aristotle.

19 It is evident from this that al-Farabi regards the proper meaning of "possible" as that which is possible in the sense of "contingent", for the contingent is that which is "apt to exist and apt not to exist at any time in the future". This is an issue which will be clarified later.

20 The notion of how a predicate-item relates to a subject-item introduces the complex issue of universals. Some of what I say later addresses this problem, but it is not a problem I can solve here.

21 McCall, S. Aristotle's Modal Syllogisms. Amsterdam, 1963, p.3.

22 Ibid., p 34.

23 Kneale, W. and M. Op. cit. p 212.

24 Hintikka, J. Time and Necessity, Oxford 1973 p 151.

25 Ibid. p 102.

26 This is precisely the point made earlier about Hintikka's ambiguity. (RP-H) concerns types (kinds) and not tokens (particulars) - but had Hintikka been clear about this distinction, he would not have had to impose the restriction on (RP) in the first place to accommodate the "cloak cut up/wear out" quotation (at De Int. 9,19^{a}12-14).

27 Hintikka, J. Op. cit. Chapters I, II, V, VIII and IX.

28 Waterlow, S. Passage and Possibility, Oxford 1982 pp 1-15.

29 Ibid., p 159.

30 Ibid., p 21.

31 This quotation is being read as applying to contingency rather than one-sided possibility since the sense of "possibility" incompatible with necessity ("that which is not necessary") is contingency rather than one-sided possibility (which is compatible with necessity). (See later.

32 This kind of supposition only makes sense if "possibility" is construed as asserted of event-types (several tokens of which can obtain/not obtain at different times. One cannot *suppose* of the possibility that Socrates is sitting at 12 noon on 28/8/400 B.C. that *it* (the event-token) obtains at some other time - because "suppose Socrates sitting at 12 noon 28/8/400 B.C. at 6 p.m. on 29/8/400 B.C." makes no sense.

CHAPTER 3

The Aristotelian Modes.

Introduction

In Aristotelian logic, modes are the ways in which the predicate-item relates to the subject-item. Aristotle recognizes three basic (or primary) modes: the assertoric (or pure or simple) mode, the necessity mode and the possibility mode. In this chapter, I intend to subject these three modes to a more detailed examination. In particular, I shall be concerned to show that for Aristotle, (1) the assertoric mode expresses that which is universally true (as distinct from that which is necessary), (2) the necessary is the most primitive mode from which the possible, the impossible and the contingent may be derived, and (3) the possible may be understood in two senses, one compatible with the necessary and one opposed to the necessary.

1. The Assertoric Mode.

> Only four modes are taken into account by Aristotle for his theory of modified propositions: 'necessary', 'possible', 'contingent', and also 'impossible' ... But there is yet another, cognate, mode - taken into account by Aristotle for his theory of propositions elsewhere and neglected here - or is there not? Most of his commentators hold that there *is* one, and that it is the hyparctic mode mentioned in the Analytics. [$25^{a}1$f.,$29^{b}29$ff.] before the necessary and the contingent. It seems to me that they have completely missed the truth as well as Aristotle's meaning; for on no account is hyparxis a mode. (Ammonius)[1]

The quotation above suggests that some confusion exists as to how many modes are taken into consideration by Aristotle. Ammonius' own view is that Aristotle takes only four modes (namely, "necessary", "possible", "contingent" and "impossible") into account, but he points out that there are some commentators who interpret Aristotle's remarks in the Prior Analytics (for example, "Every premiss states that something

either is or must be or may be the attribute of something else ..." - Pr.An.2,25^{a}1) as indicating that he (Aristotle) regards hyparxis (i.e. 'pure' belonging) as a mode as well. Ammonius disagrees with this view, arguing that commentators who interpret Aristotle as recognizing hyparxis as a mode have misunderstood Aristotle, since hyparxis can "on no account" be a mode.

I think that Ammonius is wrong: Aristotle does recognize hyparxis as a mode, as the following passages show:

> Every premiss states that something either is or must be or may be the attribute of something else; of premisses of these three kinds some are affirmative, others negative, in respect of each of the three modes of attribution ... (Pr.An.I, 2,25^{a}1-3).
>
> Since there is a difference according as something belongs, necessarily belongs, or may belong to something else (for many things belong indeed, but not necessarily, others neither necessarily nor indeed at all, but it is possible for them to belong), it is clear that there will be different syllogisms to prove each of these relations, and syllogisms with differently related terms, one syllogism concluding from what is necessary, another from what is, a third from what is possible (Pr.An.I, 8,29^{b}29ff.)
>
> There is hardly any difference between syllogisms from necessary premisses and syllogisms from premisses which merely assert (Pr.An.I, 8,29^{b}36).
>
> It is clear then that a simple conclusion is not reached unless both premisses are simple assertions, but a necessary conclusion is possible although only one of the premisses is necessary (Pr.An.I, 12,32^{a}6-8).
>
> ... Every syllogism proves that something belongs either simply or necessarily or possibly (Pr.An.I, 14,33^{b}10).

The passages above are all from the Prior Analytics and they constitute evidence that Aristotle recognizes three modes of attribution: (1) the simple (or pure or assertoric) mode, (2) the necessity (or apodeictic) mode, and (3) the possibility (or problematic) mode. In the simple mode, the predicate-item belongs simply to the subject-item, and the

predicate-term is true of the subject-term, for example, "Some horses are white". In the necessity mode, the predicate-item belongs necessarily to the subject-item, and the predicate-term is necessarily true of the subject-term, for example, "Multiples of two are necessarily even". In the possibility mode, the predicate-item belongs possibly (i.e. may belong) to the subject-item, and the predicate-term is possibly true (i.e. may be true) of the subject-term, for example, "Mammals swim".

The confusion about how many modes Aristotle recognizes stems from his discussion of the assertoric syllogistic. In dealing with the assertoric syllogistic, Aristotle employs examples in which the universal premisses are statements of necessary belonging, for example, "All horses are animals" and "All snow is white". This leads to the charge that Aristotle recognizes only two modes (the necessity mode and the possibility mode), since the pure mode is indistinguishable from the necessity mode.

Clearly, what is required is a way of distinguishing an apodeictic universal premiss from a pure universal premiss, a way of distinguishing the necessary from the universally true. According to the Kneales, Aristotle does make such a distinction:

> This is done in the Posterior Analytics where necessary predication is characterized as not only universal (*kata pantos*) but also essential (*kath auto*) [Post.An.I, 4,73^b25-28]. Predication *kata pantos* is defined here as predication that holds in every instance, which agrees with the definition of the same term in the Prior Analytics [Pr.An.I, 24^b28].[2]

For Aristotle, then, necessary predication is that which states an essential ("such as belong to their subject as elements in its essential nature" - Post.An.I, 4, 73^a35) connection, and universally true predication is predication that holds in every instance. Examples of such predications are provided by Aristotle at Pr.An.I, 15,34^b33-37 :

"No intelligent thing is a raven" is an example of an assertoric universal premiss, and "Raven necessarily belongs to no man" is an example of an apodeictic universal premiss. Whereas the connection between "raven" and "man" is based on definitions, the connection between "intelligent" and "raven" is not. For this reason, "No intelligent thing is a raven" is an example of universally true predication, and "Raven necessarily belongs to no man" is an example of necessary predication.

In their discussion of Aristotle's distinction between necessary and universally true predication, the Kneales[3] suggest that the distinction between necessary and universally true predication corresponds to the distinction between definition and *proprium*[4] (as drawn in the *Topics*). It seems to me that their suggestion is a good one, for since definitions are phrases which signify what is essential to a thing, statements which are definitions or based on definitions express a necessary connection between subject- and predicate-items. For example, the definition "All men are animals that walk on two feet" expresses a necessary connection between men and animals walking on two feet. Thus, a statement with a definition as predicate is an apodeictic universal premiss. On the other hand, since *propria* are predicates which do not indicate what is essential to a thing, but yet belong to the thing alone,[5] statements which have *propria* as predicates express a non-necessary or simple connection between subject and predicate-items. For example, the statement "All men are capable of learning grammar" expresses a non-necessary, though universally true, connection between men and the ability to learn grammar. Thus, a statement with a *proprium* as predicate is an assertoric universal predicate.

Another confusion associated with the pure mode is that the assertoric

premiss is often construed as asserting what is presently the case. That this is a misconstrual is clear from Aristotle's claim,

> We must understand 'that which belongs to all' with no limitation in respect of time, e.g. to the present or to a particular period, but simply without qualification. For it is by the help of such premisses that we make syllogisms, since if the premiss is understood with reference to the present moment, there cannot be a syllogism (Pr.An.I, 15,34^{b}7-10).

It is tempting to construe the assertoric premiss as expressing what is presently the case, for that would be one way of distinguishing an assertoric universal premiss from an apodeictic universal premiss. But, as Aristotle clearly states in the passage above, the assertoric premiss is not limited to the present time - "the universal must be understood simply, without limitation in respect of time" (Pr.An.I, 15,34^{b}18). Aristotle repeats this point when he discusses the notion of universally true predication. There, he says,

> I call 'true in every instance' what is truly predicable of all instances - not of one to the exclusion of others - and at all times, not at this or that time only ... (Post.An.I, 73^{a}18-29).

This passage reinforces Aristotle's claim that assertoric premisses do not merely express what is presently the case.

This concludes my discussion of the assertoric mode. I shall now turn to a discussion of the necessary.

2. The Necessary.

Aristotle defines the necessary, in its primary sense, as that which cannot be otherwise than it is; it is that which is inevitable and invariable (Metaphysics, *Delta*, 5)

Aristotle distinguishes between that which is absolutely necessary

and that which is conditionally necessary:

> ... To say that everything that is, is of necessity, when it is, is not the same as saying unconditionally that it is of necessity (De Int. 9,19^{a}25-26).

Things which are absolutely necessary are things which are eternal and unchangeable, and the causes of necessity in other things (Metaphysics, *Delta*, 5). For example, the rotation of the earth around the sun is absolutely necessary, and it is the cause of the necessarily cyclical occurence of the seasons.

Things which are conditionally necessary are things which are necessary on a hypothesis (Physics II, 9), things which are necessary in virtue of something distinct from themselves (Metaphysics, *Delta*, 5). For example, the necessity of the cyclical occurrence of the seasons is conditional upon the absolute necessity of the rotation of the earth around the sun, and the necessity of the conclusion of a valid syllogism is conditional upon the relation of the premisses to each other.

The distinction between absolute and conditional (or relative) necessity[6] is an important one, since it is sometimes not immediately obvious that things which are necessary in relation to something else need not be necessary in relation to themselves. The significance that this distinction has for logic is that to neglect this distinction would result in a fallacy, for, as Aristotle observes,

> [With respect to contradictories] ... everything necessarily is or is not, and will be or will not be; but one cannot divide and say that one or the other is necessary. I mean, for example: it is necessary for there to be or not to be a sea-battle tomorrow; but it is not necessary for a sea-battle to take place tomorrow, nor for one not to take place - though it is necessary for one to take place or not to take place (De Int. 9, 19^{a}28-32).

Aristotle's point is that statements which are jointly necessary need not

be separately necessary and that consequently a distinction may be drawn between absolute necessity and conditional necessity. For example, it is absolutely necessary for one of a pair of contradictories to be true (or false), but the necessity of a particular contradictory is conditional upon something else.

While Aristotle's view is that the necessary, in its primary sense, is that which cannot be otherwise, he also holds (at various places throughout his writings) that the necessary coincides with what is always - that is, if something is necessarily the case, it is always (at all times) the case (De Gen. et Cor.II, 11,337^{b}30-338^{a}4). Aristotle's linking of the necessary with the omnitemporal has been interpreted by some as a commitment to the view that all modal concepts are reducible to temporal ones. I have already, in chapter two, referred to the arguments of Sarah Waterlow to show that such an interpretation of Aristotle is mistaken. For the present, however, I shall characterize the relation of the necessary to the impossible.

Aristotle discusses the impossible in Metaphysics, *Delta*, in a chapter on potency:

> That is impossible whose contrary is necessarily true. For example, the commensurability of the diagonal with the side of a square is impossible because such a proposition is a lie, whose contrary is not only true but necessarily true. Accordingly, to say that the diagonal is commensurate with the side is not only false but necessarily false. The opposite of 'impossible', i.e. possible, is applied (a) to that whose contrary is not necessarily false ... (Metaphysics, *Delta*, 12)

Aristotle also discusses the impossible in the De Interpretatione, and one of the important points he makes there is,

> ... It is when applied in a contrary way that 'impossible' and 'necessary' have the same force (De Int. 13,22^{b}2-3).

A number of important claims are made in these passages:

1 : A distinction may be drawn between that which is true, that which is necessarily true, that which is false and that which is necessarily false.

2 : The impossible is that which is necessarily false and the necessary is that which is necessarily true.

3 : The impossible and the necessary are contrary opposites, while the impossible and the possible are contradictory opposites.

As regards the first point: Aristotle is very careful to distinguish between what is merely true and what is necessarily true, on the one hand, and between what is merely false and what is impossible, on the other. He sees clearly that whereas "No raven is intelligent" is merely true, "No raven is white" is necessarily true, and whereas "All men are just" is false, "All men are winged" is impossible (or necessarily false).

Aristotle is particularly concerned with the distinction between the false and the impossible, and he draws this distinction repeatedly:

> The untrue, of course, is not the same as the impossible; it is untrue that you are now standing, but it is not impossible for you to be standing (Metaphysics, *Theta*,4).[7]
> The impossible and the false have not the same significance (De Caelo, I, 12,$281^{b}3$).
> Now it is one thing to be absolutely false, and another thing to be absolutely impossible. To say that you are standing when you are not standing is to assert a falsehood, but not an impossibility ... To say, however, that you are at once standing and sitting, or that the diagonal is commensurable, is to say what is not only false but also impossible. Thus it is not the same thing to make a false and to make an impossible hypothesis; and from the impossible hypothesis impossible results follow (De Caelo I, 12,$281^{b}8$-16).
> ... It is evident that if a false and not impossible assumption is made, the consequence of the assumption will also be false and not impossible: e.g. if A is false, but not impossible, and if B is the consequence of A, B also will be false but not impossible (Pr.An.I, 15,$34^{a}25$-28).

The reason for Aristotle's emphasis on the distinction between the false and the impossible is twofold. In the first place, Aristotle wants to establish (as we have seen on page 51) that what is now false may still be possible. He recognizes that if the false has the same significance as the impossible, then what is now not the case will never be the case. And this will have the ultimate consequence that nothing ever changes: everything remains the same. This sounds very complicated: perhaps an example will elucidate matters: suppose you are sitting. Then it is false that you are standing, but it is possible for you to stand at some other time. However, if the false is the same as the impossible, then your standing becomes impossible, and you will remain forever sitting. But this is absurd, so the false cannot be the same as the impossible. What is now false may later be true; but whatever is impossible is always false.[8]

The other reason for Aristotle's differentiating between the false and the impossible concerns his *reductio ad impossibile* method of proving syllogisms valid. In this method, Aristotle assumes the contradictory of the conclusion of a syllogism as one premiss, and one of the premisses of the original syllogism as another premiss; but the conclusion of this syllogism contradicts the other premiss of the original syllogism. I shall discuss the *reductio* proof in a little more detail in another chapter. What has to be noted for the present, though, is that a contradiction will be generated only if an impossibility is assumed. If a merely false premiss is assumed, the conclusion will be merely false, and such a proof would not amount to a genuine reductio *proof*.

It is clear then, that Aristotle has good reasons for distinguishing between the true, the necessarily true, the false and the necessarily false.

With respect to Aristotle's second claim, namely that the impossible is that which is necessarily false and the necessary, that which is necessarily true: Aristotle's view is that the necessary, in being that which cannot be otherwise, and in being that which always is, is what is always true; so the necessary is also what is necessarily true. The impossible, on the other hand, is that which can never be; it is that which always is not - so the impossible is also what is necessarily false. And further, since the necessary is that which is eternal, the impossible is that which neither is nor will ever be.

As regards Aristotle's third claim, i.e., that the impossible and the necessary are contrary opposites, while the impossible and the possible are contradictory opposites: in the De Interpretatione,13, Aristotle devotes a long discussion to the relations which hold between the impossible, the contingent, the possible and the necessary, and he represents the relations between the necessary, the possible and the impossible in the following table:

I	II
necessary to be not possible not to be impossible not to be	necessary not to be not possible to be impossible to be
III	**IV**
not necessary not to be possible to be not impossible to be	not necessary to be possible not to be not impossible not to be

With respect to this table, he claims that: (1) the elements of quadrant I are related to the elements of quadrant II as contraries, (2) the elements of quadrant I are related to the elements of quadrant III as contradictories, (3) the elements of quadrant III are related to the elements of quadrant IV as contraries, (4) the elements of quadrant II

are related to the elements of quadrant III as contradictories, and (5) the elements within each quadrant are equivalances.

I shall discuss these logical relations in a little more detail, later. For the present, it is plain that for Aristotle, the impossible is contrary to the necessary, but contradictory to the possible. This concludes my examination of the necessary and the impossible. I shall now proceed to the possible.

3. The Possible.

Aristotle recognizes two senses of the term "the possible". That he does so is evident in as early a work as the De Interpretatione, where he writes,

> ... In general, in things that are not always actual there is the possibility of being and of not being ... and, consequently, both coming to be and not coming to be. Many things are obviously like this. For example, it is possible for this cloak to be cut up, and yet it will not be cut up but will wear out first. But equally, its not being cut up is also possible, for it would not be the case that it wore out first unless its not being cut up were possible. So it is the same with all other events that are spoken of in terms of this kind of possibility (De Int., 9,19^{a}8-18).

Aristotle's use of the words "this kind of possibility" strongly suggests that there is another kind of possibility, and given that "this kind of possibility" is the possibility of being and not being, both coming to be and not coming to be, it is likely that the other kind of possibility concerns what either may be (come to be) or may not be, but not both. The difference between these two "kinds of possibility" is what I seek to clarify.

There is another passage in the De Interpretatione which suggests that Aristotle recognizes two senses of "possibility":

> Well now, it is evident that not everything capable either of being or of walking is capable of the

> opposites also. There are cases of which this is not true ... Fire, for example ... is not capable of heating and of not heating, and similarly with everything else that is actualized all the time ... For the capable is spoken of in more than one way: either because it is true as being actualized (e.g. it is capable of walking because it walks, and in general capable of being because what is called capable already exists in actuality), or because it might be actualized (e.g. it is capable of walking because it might walk). This latter capability applies to changeable things only, the former to unchangeable things also ... Thus it is not true to assert the second kind of capability of that which is without qualification necessary, but it is true to assert the other. So, since the universal follows from the particular, from being of necessity there follows capability of being - though not every sort (De Int.13, $22^{b}29$-$23^{a}19$).

In this passage, Aristotle points out that there is a clear distinction between changeable things and unchangeable things. Changeable things are capable both of being *and* of not being (for example, a man is capable both of walking and of not walking), while unchangeable things are capable only of being *or* of not being (for example, fire is not capable both of heating and of not heating - it is capable only of heating). The capability of unchangeable things follows from their being of unconditional (i.e. *haplos*) necessity - so fire is capable of heating because fire necessarily heats; on the other hand, changeable things do not have necessary being, and their capability does not follow from being of necessity.[9]

The relevance that this passage has for the distinction between two senses of "possibility" is the following: in the passage, Aristotle distinguishes between two kinds of capability: the capability of changeable things and the capability of unchangeable things. Since possibility is derivable from capability (Metaphysics, *Delta*, 12) the distinction between two kinds of capability is also the distinction between two kinds

of possibility, namely:

(1) : the possibility associated with changeable things, and

(2) : the possibility associated with unchangeable things.

(1) is the possibility of being *and* of not being; for example, it is possible for a man to walk *and* it is possible for a man not to walk. (2) is the possibility only of being *or* of not being; for example, one cannot say of fire that it is both possible for fire to heat and not to heat. It is not possible for fire not to heat (since fire necessarily heats), so it is possible only for fire to heat.

It is clear from the quoted passage, then, that Aristotle recognizes two senses of "possibility". One is a sense of "contingency" as opposed to necessity (this is the possibility both of being *and* of not being), the other is a sense of "possibility" which is compatible with necessity (this is the possibility only of being *or* of not being).

In the foregoing passages, Aristotle's recognition of the two senses of "possibility" is implicit. It is only in the Prior Analytics that Aristotle explicitly articulates the distinction between two senses of "possibility":

> I use the terms 'to be possible' and 'the possible' of that which is not necessary, but, being assumed, results in nothing impossible. We say indeed ambiguously (homonymously) of the necessary that it is possible. But that my definition of the possible is correct is clear from the phrases by which we deny or on the contrary affirm possibility (Pr.An.I, 13,32^{a}18-22).

In this passage, Aristotle explicitly differentiates between two senses of "possibility":

(1) : the possible is that which is not necessary and from the assumption (or supposition) of which nothing impossible follows, and

(2) : the possible is that which *may* also be necessary (but not impossible).

He points out that these two senses of possibility are *homonymous*, i.e. their meanings are incompatible and they do not apply to things in the same way.

It is easier for us to understand Aristotle's distinction between (1) and (2) if we appreciate that (1) refers to contingency and (2) to possibility. Contingency may be distinguished from possibility since contingency is opposed to (and incompatible with) necessity, while possibility follows from necessity (and is compatible with it). Contingency and possibility are thus very different notions, and in a later chapter I shall provide a logical characterization of the differences between them.

To grasp the difference between contingency and possibility, consider the following examples:-

(1) It is possible for man to breathe.
(2) It is contingent for man to walk.
(3) It is possible for pigs to have four legs.
(4) It is contingent for pigs to play the piano.
(5) It is possible for it to snow in Grahamstown.
(6) It is contingent for it to snow in Grahamstown tomorrow.
(7) It is possible for acorns to become oaks.
(8) It is contingent for this acorn to become an oak.

These examples illustrate how contingency and possibility may be seen to be quite different notions, since Aristotle would not permit the substitution of "contingent" for "possible" in any of the above.

Besides the distinction between contingency and possibility, Aristotle makes a further distinction within the category of contingency between:

(1) things which happen naturally and generally, and

(2) things which happen indefinitely and by chance

(Pr.An.I, 13,32^{b}4-14). This distinction is illustrated by examples (2) and (4) above. It is contingent for man to walk because man generally walks - it is in the nature of man to walk; but it is contingent for

pigs to play the piano, not because it is in the nature of pigs to play pianos, but because it just so happens that pigs can be taught to play the piano. A pig's playing the piano is *accidental*, while a man's walking is *natural*, and it is to capture this difference that Aristotle makes the distinction *within* the category of contingency.

Aristotle points out (Pr.An.I 13,32^{b}18-21) that science and demonstrative syllogism are not concerned with things which are indefinite; but with things that are natural, and arguments are constructed about things which are possible in this sense. As a result, Aristotle says little about indefinite contingencies in the Prior Analytics. Nonetheless, the distinction between two kinds of possibility remains.

At this point, it is instructive to reflect on the relation of the contingent to the predicable "accident". The Kneales suggest[10] that the theory of the predicables (namely, definition, *proprium*, genus and accident) is based in part on the distinction between the necessary and the non-necessary. I think that the Kneales are right because, in the first place, Aristotle characterizes a definition as a phrase which signifies that which belongs necessarily to a thing (Topics I, 5,101^{b}39), and in the second place, Aristotle says, of "accident":

> An accident is ... (2) something which may possibly either belong or not belong to any one and the self-same thing, as (e.g.) the 'sitting posture' may belong or not belong to the self-same thing (Topics I, 5,102^{b}6-7).

Here Aristotle characterizes an accident as that which belongs contingently (i.e. it may or may not belong) to a thing; clearly, then, the notion of "accident" is based on the notion of "contingent".

In summary, then: Aristotle distinguishes between possibility and contingency. Possibility does follow from necessity, whereas contingency does not. Aristotle makes a further distinction within the category of

contingency between that which is natural and that which is indefinite. "Natural" contingency is that which happens as a general rule, while "indefinite" contingency is that which happens purely by chance. Of all these senses of "possibility", Aristotle regards "natural" contingency as the most basic (in a logical sense, i.e. it implies, but is not implied by, possibility - see chapter four), and it is the sense of "possibility" used in the problematic syllogistic.

Before I conclude this section, I want to state a few general points about the necessary, the possible, the impossible and the contingent.

Firstly, of all these modal concepts, Aristotle regards the necessary as the most primitive, i.e. it is from the necessary that all the others, (namely, the possible, the contingent and the impossible) are derived:

> Perhaps, indeed, the necessary and not necessary are first principles of everything's either being or not being, and one should look at the others as following from these (De Int. 13,23^{a}20).

In this passage, Aristotle suggests that one regard the other modal concepts as following from the necessary. It is indeed the case that he regards them as such, for he defines the impossible as that whose contrary is the necessary (Metaphysics, *Delta*, 5), the possible as that which is said homonymously of the necessary (Pr.An.I, 13,32^{a}19), and the contingent as that which is neither necessary nor impossible (Pr.An.I, 13,32^{a}18).

Secondly, the impossible is, for Aristotle, not a primary mode, but a secondary one. In the Prior Analytics, in his theory of the syllogism, Aristotle recognizes only three modes:

> Every premiss states that something either is or must be or may be the attribute of something else ... (Pr.An.I, 2,25^{a}).

It is apparent from this passage that, for Aristotle, there are three

primary modes: the necessary, the simple (or pure) and the possible (which, in the light of Pr.An.I, 13,32^{a}18, may be interpreted as "the contingent"). These are the three primary ways in which the predicate-item relates to the subject-item. The impossible, on Aristotle's theory, is the "necessary not", and so it is a secondary mode. For Aristotle, modal statements may be regarded as affirmative, and since "it is", "it is necessary", and "it is contingent" are affirmative in character, these are the primary modes. "It is impossible", on the other hand, is negative in character, and since it is re-definable as "it is necessary not", it is not a primary, but a secondary (or derivative) mode.

Finally, it must be noted that what Aristotle refers to as a "mode", al-Farabi refers to as a "modality". Properly speaking, therefore, the Aristotelian "modes" discussed in this chapter are "modalities", since Aristotle's discussion is about the relations between items (and only derivatively about the relation between terms).

The issue that now needs to be considered is the relation of the mode/modality distinction to the distinction between relative and absolute necessity.

4. Relative and Absolute Necessity and the Mode/Modality Distinction.

That Aristotle recognizes the distinction between relative and absolute necessity is clear from his writings. For example, in chapter nine of the De Interpretatione, he writes,

> For to say that everything that is, is of necessity, when it is, is not the same as saying unconditionally that it is of necessity (De Int. 9,19^{a}25-27),

and in chapter ten of the Prior Analytics he observes,

> ... The conclusion is not necessary without

> qualification, though it is a necessary conclusion from the premisses (Pr.An. 10,30^{b}32-33).

It needs to be pointed out that relative and absolute necessity are not the same kind of necessity. For it is not the case that a relatively necessary predication, when the conditions for its necessity are satisfied, possesses the same necessity which an absolutely necessary predication has unconditionally. In this regard, consider the following:

1 : All triangles necessarily have an angle-sum of 180°.

2 : Zayd necessarily walks.

3 : Man is necessarily capable of learning grammar.

Example (1) is an absolutely necessary predication, and both the mode and modality are necessity. Examples (2) and (3) are relatively necessary predications. In example (2), the mode is necessity and the modality is possibility, while in example (3), the mode is necessity and the modality is pure (or absolute). From these examples it follows that a relatively necessary predication differs from an absolutely necessary predication in that it could never have a necessity modality; it could only ever have a possibility or an absolute modality.

The relative-absolute distinction can be drawn in terms of the mode/modality distinction since a relatively necessary predication has a differing mode and modality, while an absolutely necessary predication has the same mode and modality. However, "relative" and "absolute" necessity are terminologically misleading since they are not the same kind of necessity. For this reason, it is preferable to use the mode/modality distinction rather than the relative/absolute distinction.

This concludes my chapter on the Aristotelian modes.

CHAPTER 3 : Notes

1 Zimmermann,F.W. Al-Farabi's Commentary and Short Treatise on Aristotle's *De Interpretatione*, London 1981 p.XC.

2 Kneale, W. and M. The Development of Logic, Oxford 1962 p.94.

3 Ibid.

4 This distinction has been characterized in chapter one.

5 *Propria* express what is universally true of one thing only.

6 Later in this chapter, I shall consider the relation of the relative/absolute distinction to the mode/modality distinction.

7 This quote implies the distinction between possibility and "truth at a time"; i.e. if it is *untrue* that p-now, what is impossible is "that p-now" (e.g. you cannot be *both* sitting and standing, or standing *when* you are not). What is not impossible and not necessary is that you stand - so, it is *now* contingent that you be standing (which, of course, does *not* entail that it is contingent that you *now* be standing - when you are not). Of course, affirming the *mode* "It is now contingent that you be standing" is quite different from the *modality* of "You are *now* standing" which, though possible, does not obtain.

8 It has been pointed out to me that Aristotle's point, here, is a logical one, in that he opposes the fallacious shift (a version of the quantifier shift fallacy in predicate logic) from "M (a-b, now)" to "Now M (a-b)" - where "M" is any modal expression. In other words, if you are *now* sitting, though it is impossible that you are *now* standing, Aristotle wants to resist the "carry across" the modifier to yield "*Now*, it is impossible that you stand". Thus, Aristotle's distinction is between "the impossibility of what is *now* true being (now) false" and "the possibility of what is now true being (at some time) false". If the "what is now true" is in the necessity modality, then "being (at some time) false" *is* impossible (and entails, therefore, but is not entailed by) "being (at no time) false". While I agree that Aristotle would not allow the shift from "M (a-b, now)" to "Now M (a-b)", it seems to me that this is not the point Aristotle is making in this context. In Book *Theta* of the Metaphysics, Aristotle's intention in distinguishing the false from the impossible is to show that the Megarian view, which does away with all change, is mistaken.

9 Usually, for Aristotle, the difference between changeable and unchangeable things corresponds to that between primary and secondary being.

10 Kneale, W. and M. op. cit., p.35.

CHAPTER 4

The Negation of Modal Concepts.

Introduction.

In this chapter, I want to consider how the modal concepts are affected by negation.

Affirmations and negations are important basic elements of Aristotelian logic and Aristotle was especially careful in his discussion of negation, which he considered fraught with problems. In this respect, I.M. Bocheński observes,

> The situation with regard to negation and opposition which Aristotle met can be understood from his own early teaching as it appears in the Topics and Metaphysics *Gamma*. It may be seen there that while those problems seemed very important (which is natural, considering that logic was then above all dialectics, i.e. a theory of discussion), at least three things were confused; (1) terms and sentences and, consequently, their negations, (2) quantified and non-quantified sentences, (3) negative sentences and negation of sentences. The very fact that Aristotle himself reasons in Metaphysics *Gamma* [e.g. at 4, $1007^{b}19ff$] according to the false principle
>
> $$- SaP \supset SeP$$
>
> [i.e. the negation of "All S is P" is "No S is P"] suffices to show how great the difficulty must have been to get a clear theory on those points. However, Aristotle was able to overcome these initial confusions almost completely.[1]

It is clear from Bocheński's observation that negation was a difficult operation for Aristotle, but that Aristotle managed to solve the problems associated with negation, eventually.

Aristotle's writings on negation are complicated, and in this respect, it is worthwhile to consider al-Farabi's interpretation of Aristotle, since al-Farabi's interpretation provides us with a better

grasp of the workings of Aristotle's theory. According to al-Farabi,

> ... the De Int. is about affirmations and negations, and especially examines the conditions under which the opposite versions of the same proposition are such that one is true if and only if the other is false ... The ulterior motive in placing such heavy emphasis on the central place of contradiction emerges towards the end ... [and] turns on the concept of the dialectical question. Since it is the purpose of the book to define the kind of opposition required to obtain between the alternatives of a dialectical question, a necessary part of the task is to eliminate [opposites which are not proper contradictories, for example, contraries].[2]

Given his conception of the central place of negation in the De Interpretatione, al-Farabi devotes long passages in both his Commentary and his Short Treatise to careful discussions of the many different ways in which statements may be negated. For this reason, al-Farabi's interpretation of Aristotle is indispensable to a proper understanding of Aristotle's theory of negation.

In what follows, I shall present (a) an account of Aristotle's theory of opposition and (b) an account of Aristotle's theory of the negation of modal concepts. I shall supplement both these accounts with a characterization of al-Farabi's interpretation of these subjects.

1. Aristotle's Theory of Opposition.

Aristotle's early theory of opposition is to be found in the Categories, and Bocheński refers[3] to this theory as "the theory of four opposites". According to this theory, things may be opposed to one another in four ways: (1) as relatives (or reciprocals[4]), for

example, the double and the half; (2) as contraries, for example, the good and the bad; (3) as privation and possession, for example, blindness and sight; or (4) as affirmation and negation, for example, "He is sitting" and "He is not sitting" (Categories, $10,11^{b}17$-23). Of these types of opposition, only affirmation and negation are necessarily (or truly) opposed, as regards truth and falsity, since if the affirmation is true, it is necessary that the negation be false, and if the negation is true, it is necessary that the affirmation be false. Moreover, an affirmation and a negation cannot both be true, nor can they both be false: the truth of an affirmation entails the falsity of the negation, and *vice versa*. But while the affirmation and negation are necessarily opposed, as regards truth and falsity (Aristotle later calls these "contradictory opposites"), contraries are not so opposed: contraries may both be false (although they may not both be true), and the falsity of one need not entail the truth of the other. For example, the good and the bad are contraries which may both be false of a man (that is, when he is intermediate between good and bad).

Aristotle's later theory of opposition is developed in the De Interpretatione. The important points which emerge from the discussion there are the following:

Firstly, an affirmation is a statement which affirms something of something else, and a negation is a statement which denies something of something else. Every affirmation has one and only one negation which denies the same thing that the affirmation affirms and which is the contradictory opposite of the affirmation, since the truth of the affirmation necessarily entails the falsity of the negation, and *vice versa*.

Secondly, affirmations and negations may be universal, particular, singular or indefinite. Examples of these statements are set out in the following table:

	Affirmation	Negation
Universal	Every man is just	No man is just
Particular	Some man is just	Some man is not just
Singular	Callias is just	Callias is not just
Indefinite	Man is just	Man is not just

With regard to these statements, (1) universal affirmations are contradictorily opposed to particular negations, and universal negations are contradictorily opposed to particular affirmations (since if the one is true, the other must be false); (2) universal affirmations are opposed to universal negations as contraries (since they may both be false, but cannot both be true); (3) particular affirmations are opposed to particular negations as what may be termed "sub-contraries" (since they may both be true, but cannot both be false); (4) singular affirmations are opposed to singular negations as contradictories; and (5) indefinite affirmations are opposed to indefinite negations as sub-contraries.

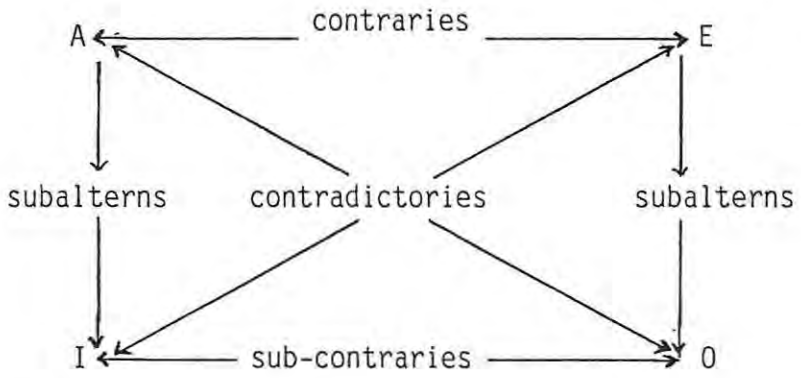
Thirdly, a clear distinction may be drawn between contradictoriness and contrariety. This distinction is important to our subsequent discussion of logical relations, for, of the two types of opposition, only contradictoriness may be regarded as "true" or "proper" opposition. Contradictory statements are such that they cannot both be false, and they cannot both be true: if one is true, the other must be false. On the other hand, contrary statements are such that they may both be false, though they cannot both be true; thus the falsity of one does not necessarily entail the truth of the other.

It is for this reason that contraries may not be termed "true opposites".

The above, then, is Aristotle's later theory of opposition. The relations between some of the different types of statement identified in this theory were later set out on a "square of opposition" by late Greek or early mediaeval logicians. The following is an example of a square of opposition.

UNIVERSAL AFFIRMATIVE (A)
Every man is just

UNIVERSAL NEGATIVE (E)
No man is just



PARTICULAR AFFIRMATIVE (I)
Some man is just

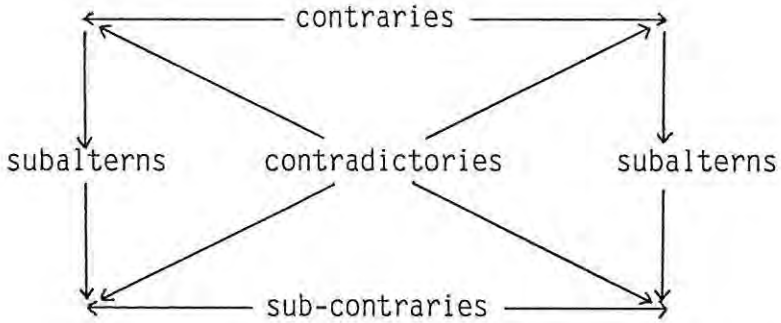
PARTICULAR NEGATIVE (O)
Some man is not just

(Note: Each universal statement entails its subaltern.)

The figure above provides a useful summary of Aristotle's theory of opposition as presented in De Int. 7. It provides an equally useful summary of the theory of opposition presented in Pr.An.I, 46. Whereas in De Int. 7, Aristotle is concerned with statements whose predicates are definite nouns signifying possession, in Pr.An.I, 46, he is concerned also with statements whose predicates are (1) definite nouns signifying privation, and (2) indefinite nouns. The relations between these statements may be set out on two different squares of

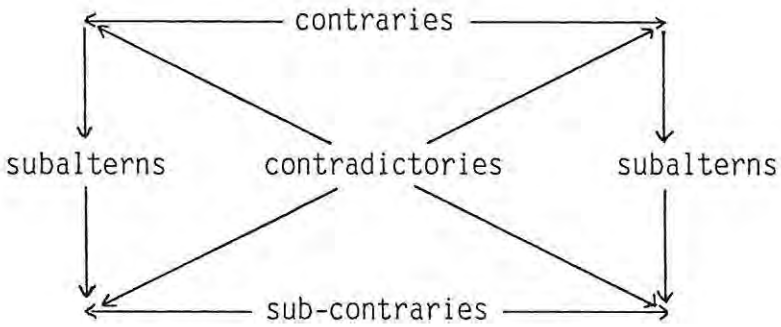
opposition, as follows:

The man is just — The man is non-just



The man is not non-just — The man is not just

The man is just — The man is unjust



The man is not unjust — The man is not just

An important point which emerges from the Pr.An.I, 46, discussion is Aristotle's characterization of a statement, whose predicate is an indefinite noun, as an affirmation. Aristotle points out that a statement like "Every animal is non-white" is an affirmation since it affirms that whatever is an animal *is non*-white, but that a statement like "Every animal is not white" is a negation, since it denies of

every animal that it is white (Pr.An.I, 46,52^{a}22-30). Thus "Every animal is non-white" is the contrary (and not the contradictory) opposite of "Every animal is white", for if it were the contradictory opposite, it would have to be a negation, which it is not. Al-Farabi terms statements, whose predicates are indefinite nouns, "metathetic" statements, and he discusses such statements at considerable length. I shall deal with al-Farabi's discussion of metathesis when I examine his interpretation of Aristotle's theory of negation. For the present, however, I want to draw attention to a problem raised by Aristotle's theory of negation.

Aristotle, in his theory, does not distinguish between the negation which yields a contradictory and the negation which yields a contrary:

> I call an affirmation and negation *contradictory* opposites when what one signifies universally the other signifies not universally, e.g. 'every man is white' and 'not every man is white', 'no man is white' and 'some man is white'. But I call the universal affirmation and the universal negation contrary opposites ... (De Int., 7,17^{b}16-20).

Clearly, Aristotle refers to both contradictories and contraries as "negations". Aristotle's terminology presents a problem because we do want a way of differentiating between the negation which yields a contradictory and the negation which yields a contrary, especially since contradictories and contraries are such different types of statements.

One way out of this problem would be to distinguish between "negation" and "denial". "Negation" could then be used to refer to the operation (or statement resulting from the operation) of attaching the negative particle "not" to the verb, mode or quantifier

of a statement, and "denial" could be used to refer to the operation (or statement resulting from the operation) of forming the contradictory of a statement. On this view, denial would be a species of negation, and "negation" a broader term than "denial". The following would be the consequences of the distinction: (1) Every affirmation would be contradicted by its denial. For example, the affirmation "Every man is just" would be contradicted by the denial "Not every man is just" which denies of every man that he is just; (2) The negation of the predicate-term would yield an affirmation. For example, "Every man is non-just would be an affirmation, affirming of every man that he is non-just (rather than denying of every man that he is just); (3) Universal affirmations and universal negations could be seen to be contraries rather than contradictories, and (4) Particular affirmations and negations could be seen to be sub-contraries rather than contradictories.

Another way out of this problem is suggested by al-Farabi in his interpretation of Aristotle's theory of negation, and I shall now turn to al-Farabi's solution.

2. Al-Farabi on Aristotle's Theory of Opposition.

Al-Farabi's interpretation of Aristotle's De Interpretatione is thorough, and he examines in great detail that which is merely suggested by Aristotle. Al-Farabi holds that the De Interpretatione is about affirmations and negations, and he gives painstaking attention to the ways in which negations are formed from affirmations.

Al-Farabi's first task in this connection is to identify different kinds of affirmations, and, to begin with, he differentiates (Treatise, 60) between three main classes or categories of affirmations: (1) plain

affirmations (i.e. affirmations whose predicates are definite nouns signifying possession), (2) privative affirmations (i.e. affirmations whose predicates are definite nouns signifying privation), and (3) metathetic affirmations (i.e. affirmations whose predicates are indefinite nouns). Al-Farabi then distinguishes, in each of these categories, between individual, unquantified and quantified affirmations. Al-Farabi's classification of affirmations is set out in the following table:

Affirmation:	Plain	Privative	Metathetic
Individual	Zayd is just	Zayd is unjust	Zayd is non-just
Unquantified	The man is just	The man is unjust	The man is non-just
Quantified			
Universal	Every man is just	Every man is unjust	Every man is non-just
Particular	Some man is just	some man is unjust	Some man is non-just

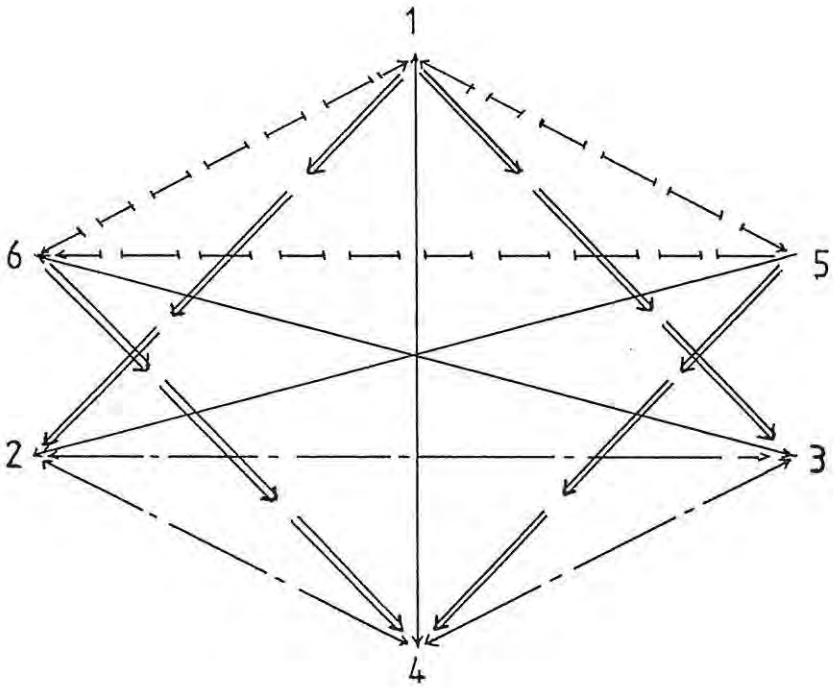
Having identified different kinds of affirmations, al-Farabi then proceeds to form their corresponding negations. Al-Farabi provides purely syntactic criteria for forming negations from affirmations, and his directions are as follows:

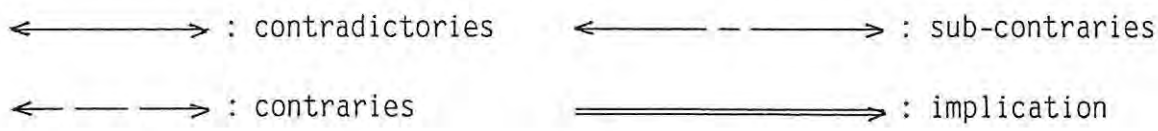
> It is customary in languages in which hyparctic verbs are articulated in statements with nominal predicates to place the negative particle with the hyparctic verb, at least in individual and unquantified statements, as in 'Zayd is not knowing' and '(the) man is not knowing'. If the negation is quantified, the negative particle is placed with the quantifier, not with the hyparctic verb, as in 'not every man is white'. It is the mark of negations, in these languages, that the negative particle accompanies the hyparctic verb whenever there is no quantifier, and that it accompanies the quantifier in the case of quantified statements. Hence if the negative particle does not accompany the hyparctic verb of an unquantified statement, or the quantifier of

> a quantified statement, the statement is affirmative to the speakers of these languages, no matter whether the predicate is a definite or an indefinite noun (Treatise, 60).

Al-Farabi's classification of affirmations and negations is set out in the table on the next page.

According to al-Farabi, these affirmations and negations are related to one another in various ways, in terms of truth and falsity. The interrelations between individual (i.e. singular) statements are represented by the following diagram:





1 : plain affirmation
"Zayd is knowing"

2 : privative negation
"Zayd is not ignorant"

3 : metathetic negation
"Zayd is not non-knowing"

4 : plain negation
"Zayd is not knowing"

5 : privative affirmation
"Zayd is ignorant"

6 : metathetic affirmation
"Zayd is non-knowing"

	PLAIN	
	Affirmation	Negation
Individual	Zayd is just	Zayd is not just
Unquantified	The man is just	The man is not just
Quantified		
Universal	Every man is just	Not every man is just
Particular	Some man is just	No man is just
	PRIVATIVE	
Individual	Zayd is unjust	Zayd is not unjust
Unquantified	The man is unjust	The man is not unjust
Quantified		
Universal	Every man is unjust	Not every man is unjust
Particular	Some man is unjust	No man is unjust
	METATHETIC	
Individual	Zayd is non-just	Zayd is not non-just
Unquantified	The man is non-just	The man is not non-just
Quantified		
Universal	Every man is non-just	Not every man is non-just
Particular	Some man is non-just	No man is non-just

For al-Farabi, (1) a plain negation like "Zayd is not knowing" is true both when Zayd is an infant and when he is an adult, (2) a privative affirmation like "Zayd is ignorant" is false when Zayd is an infant, but true when he is an adult, and (3) a metathetic affirmation like "Zayd is non-knowing" is true when Zayd is an infant, but false when he is an adult (Treatise, 59).

Al-Farabi claims that the diagram that is used to represent the interrelations between the various types of individual statements can also be used to represent the interrelations between the various types of (1) unquantified, (2) universally quantified and (3) particularly quantified statements.[5]

Al-Farabi's characterization of the interrelation of the different kinds of statement is based on, but goes far beyond, Aristotle's square of opposition. In the first place, al-Farabi does not oppose universal negations to universal affirmations: rather, he considers the relations which hold between the plain, privative and metathetic versions of universal statements as such. In the second place, al-Farabi has a well-developed theory of metathetic statements, the like of which is not seen in Aristotle's system. I shall now proceed to discuss these two points in greater detail, because they contribute to an understanding of the negation of modal concepts.

2.1 Al-Farabi's Theory of Metathesis.

Al-Farabi's discussion of indefinite nouns is much more detailed than Aristotle's. Whereas Aristotle mentions indefinite nouns almost in passing, al-Farabi claims that the theory of indefinite nouns is "of enormous benefit to the sciences" (Treatise, 70). According to al-Farabi, indefinite nouns signify, not negation, but kinds of

privation; and he claims that "Zayd is non-knowing" signifies the same as "Zayd is ignorant"[6] (Treatise, 59). Al-Farabi argues further that statements in which the predicate is an indefinite noun are affirmations:

> A statement whose predicate is an indefinite noun is affirmative, not negative. The difference between such a statement [e.g. "Zayd is non-knowing"] and a negation [i.e. the denial "Zayd is not knowing"] is that the negation is more generally true than the statement with an indefinite predicate. For if something is negated it is eliminated both from things designed to have it [e.g. "The man is not knowing"] and from things not designed to have it [e.g. "The stone is not knowing"], while an indefinite noun eliminates something from things designed to have it [e.g. "The man is non-knowing"] (Treatise, 59).

For al-Farabi, whatever an indefinite noun is predicated of must be held to exist, and whenever something is negated of something existent (e.g. "Zayd is not knowing") this negation has the same force as a metathetic affirmation (e.g. "Zayd is non-knowing"). Al-Farabi demonstrates that this has implications for the syllogistic, since a negation may be changed into a metathetic affirmation, rendering a syllogism valid:

> ... If it so happens that someone negates something of something existent, putting it in the negative so as to prevent it being made part of a syllogism (such as the minor premiss in the first figure), we may change his negation into a metathetic affirmation and form a valid syllogism with it (Treatise, 70).

For example, there is no syllogism when the premisses are "All A is C" and "No A is B". However, if the universal negation "No A is B" is changed into the metathetic affirmation "Every A is non-B", and the latter is converted into the particular premiss "Some non-B is A", there is a valid syllogism in the mood Darii, i.e.

1. Aac premiss

2. Eab premiss

3. Aa$\overline{b}$ 2, metathetic affirmation

4. I$\overline{b}$a 3, conversion to particular affirmative

5. I$\overline{b}$c 1,4 Darii.

Similar procedures may be followed to construct valid syllogisms in the mood Ferio.

Zimmermann, in his introduction to the Commentary and Short Treatise, points out[7] that al-Farabi's discussion of metathetic statements (and their relation to plain and privative statements) resembles what he tentatively calls "Theophrastus' theory of metathesis". But even if the theory of metathesis had its origins in Theophrastus, it is clear that al-Farabi contributes a great deal to it in terms of exposition and clarity. In this connection, Zimmermann observes that there are three aspects of the theory of metathesis that are worth noting: (1) the particle "not" has the widest possible meaning when negating a proposition rather than a term; according to this view of negation, it is true to say that X is not Y not only if X does not happen to be Y, but also if X could not conceivably be Y, (2) the differences between statements is drawn in terms of the truth-values assigned, and (3) the distribution of truth-values in these tables presupposes that there is one and only one negation to any affirmation, and that the negation is the contradictory opposite to the affirmation. This last aspect of the theory of affirmation is particularly important to our concerns, since it represents al-Farabi's solution to the problem raised in Aristotle's theory of negation, namely, the problem of the ambiguity of the term "negation". It was mentioned earlier that Aristotle uses the term "negation" to apply to both the contradictory and the contrary of an affirmation, and that this results in some confusion, since,

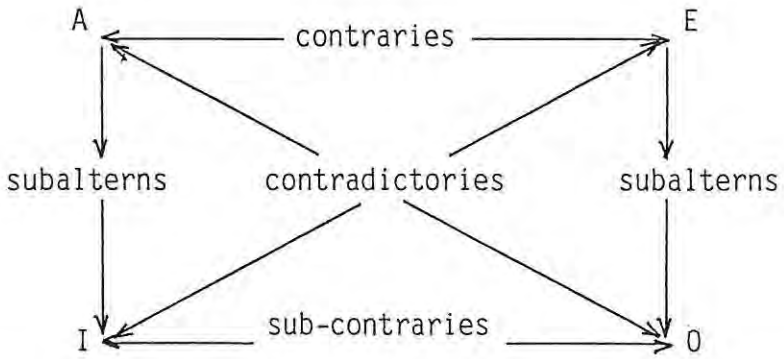
while both the contradictory negation and the contrary negation are opposed to the corresponding affirmation, only the contradictory negation is the "true" opposite (such that, if it is true, the affirmation is false, and if it is false, the affirmation is true). Al-Farabi overcomes this problem by reserving the term "negation" to refer specifically to a contradictory opposite. A consequence of this reservation is al-Farabi's careful classification of universally quantified statements, and his "re-structuring" of the square of opposition.

2.2 Al-Farabi's Classification of Universally Quantified Statements.

We saw, earlier, that Aristotle distinguishes between universal and particular affirmations and negations, and that the relations between these statements could be set out on the following square of opposition:

UNIVERSAL AFFIRMATIVE (A)
Every man is just

UNIVERSAL NEGATIVE (E)
No man is just



PARTICULAR AFFIRMATIVE (I)
Some man is just

PARTICULAR NEGATIVE (O)
Some man is not just

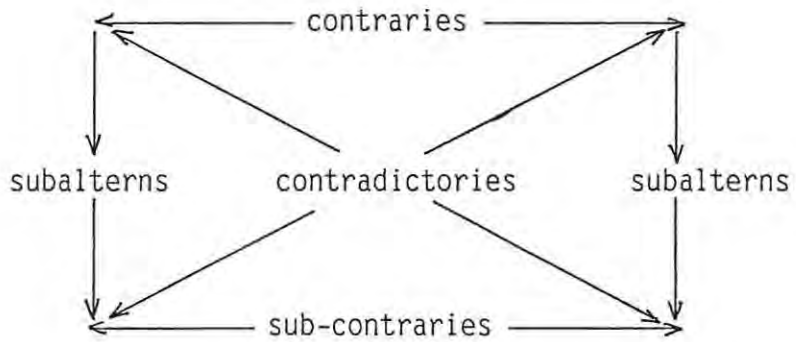
It is clear from this diagram that, while there are two types of negative statement opposed to the universal affirmation, only the

particular negation is contradictorily opposed to the universal affirmation.

Since al-Farabi reserves the term "negation" to refer to the contradictory opposite of an affirmation, his classification of quantified statements differs from that of Aristotle. Instead of differentiating between universal and particular affirmations and negations, al-Farabi differentiates within the category of universally quantified statements between plain, privative and metathetic affirmations and negations. Given this system of classification, al-Farabi's square of opposition would be as follows:

PLAIN AFFIRMATION
Every man is just

METATHETIC AFFIRMATION
Every man is non-just



METATHETIC NEGATION
Not every man is non-just

PLAIN NEGATION
Not every man is just

The question that now arises is how this system of classification relates to Aristotle's system. How, for example, does the metathetic affirmation (e.g. "Every man is non-just") relate to the universal negation (e.g. "No man is just")? Al-Farabi discusses this question at length, pointing out that the commentators regard the following

statements as equivalent:

1 : "Every man is just" and "No man is non-just"

2 : "Some man is just" and "Not every man is non-just"

3 : "No man is just" and "Every man is non-just".

Al-Farabi criticizes the commentators for regarding these as equivalences, and he points out, correctly, that only entailment relations hold between such statements:

1 : "Every man is just" entails "No man is non-just"

2 : "Every man is non-just" entails "No man is just"

3 : "Some man is just" entails "Not every man is non-just".

These sentences may be symbolized as

1 : $Amj \supset Em\bar{j}$

2 : $Am\bar{j} \supset Emj$

3 : $Imj \supset Em\bar{j}$

and may be referred to as instantiations of the "laws of obversion".[8] It is important to note that although al-Farabi's system of classification differs from that of Aristotle, the logical relationships between the statements are the same (since Aristotle presents the same laws of obversion[9] at De Int. 10,20^{a}16-20).

This concludes my examination of al-Farabi's interpretation of Aristotle's theory of opposition. I shall now proceed to a consideration of Aristotle's theory of the negation of modal concepts.

3. Aristotle's Theory of the Negation of Modal Concepts.

Aristotle presents his theory of the negation of modal concepts in chapter twelve of the De Interpretatione. He opens his discussion

with the following statement:

> ... Those are the contradictory opposites of one another which are ordered by reference to 'to be' and 'not to be'. For example, the negation of 'to be a man' is 'not to be a man', not 'to be a non-man' ... [and] the negation of 'a man walks' is not 'a non-man walks' but 'a man does not walk'... (De Int. 12,21^{a}39-21^{b}8).

In this passage, Aristotle points out that the contradictory negation is formed from the affirmation by placing the "not" with the verb or copula. Having made this point, Aristotle now speculates whether this rule can be extended to modified statements:

> So, then, if this holds good everywhere, the negation of 'possible to be' is 'possible not to be' and not 'not possible to be' (De Int. 12,21^{b}10-11).

But Aristotle hesitates in applying this rule to modified sentences because

> ... It seems that for the same thing it is possible both to be and not to be. For everything capable of being cut or of walking is capable also of not walking or of not being cut (De Int. 12,21^{b}11-13).

Aristotle is aware that when "possible" is used in the sense of "contingent", "It is possible to be" and "It is possible not to be" may both be true. But if statements can both be true, they cannot be contradictories:

> But it is impossible for [contradictory] opposite expressions to be true of the same things. This then is not negation.

Aristotle concludes that since "It is possible to be" and "It is possible not to be" may both be true, "It is possible not to be" cannot be the contradictory negation of "It is possible to be", and the rule (i.e. that to form a contradictory negation, the "not" must be added to the verb or the copula of an affirmation) can thus not be applied to modified statements. Instead, in the case of modified

statements, an affirmation may be changed into its contradictory negation by attaching the "not" to the mode:

> The negation of 'possible to be', therefore, is 'not possible to be' (De Int. 12,21^{b}23).

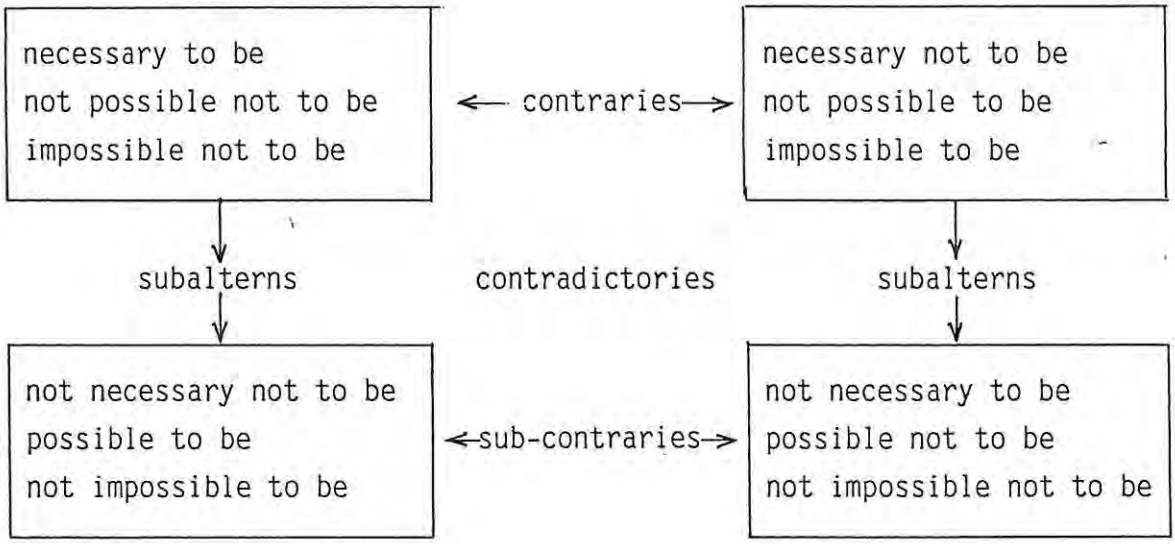
Aristotle points out that the same holds good for "admissible to be", "necessary to be", "impossible to be", "admissible not to be", "possible not to be", "necessary not to be" and "impossible not to be".

The results of the De Int. 12 discussion are summarized in the following table:

Affirmation	Contradictory	Contrary	Sub-contrary
possible to be	not possible to be	-	possible not to be
admissible to be	not admissible to be	-	admissible not to be
contingent to be	not contingent to be	-	contingent not to be
necessary to be	not necessary to be	necessary not to be	-
impossible to be	not impossible to be	impossible not to be	-
possible not to be	not possible not to be	-	possible to be
admissible not to be	not admissible not to be	-	admissible to be
contingent not to be	not contingent not to be	-	contingent to be
necessary not to be	not necessary not to be	necessary to be	-
impossible not to be	not impossible not to be	impossible to be	-

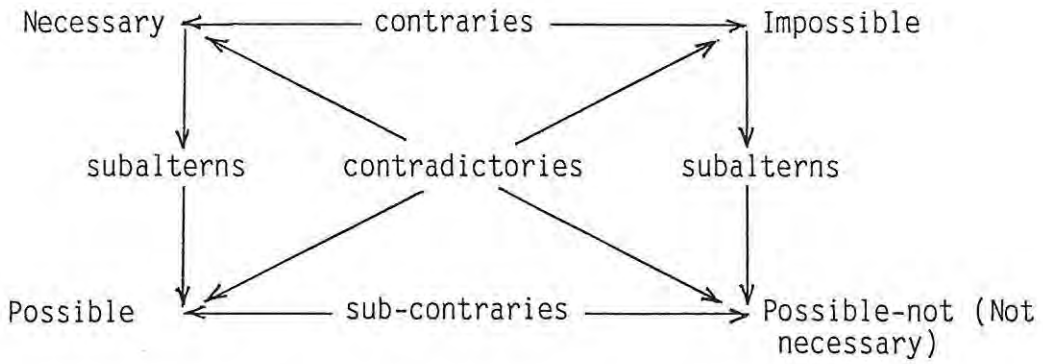
In chapter thirteen of the De Interpretatione, Aristotle is concerned with identifying the relationships which hold between the different types of modified statements. The results of this

discussion are summarized in the following table:



In this table: (1) "possible" is used in the one-sided sense, that is in the sense compatible with the necessary; and (2) the statements within each quadrant are equivalences.

The table above is really a modal square of opposition, a simplified version of which is the following:



Some examples may serve to illustrate the relationships holding in this square of opposition:

1 : a) It is necessary that acorns become oaks

b) It is impossible that acorns become oaks

These are contraries, because both may be false (i.e. when there are no acorns).

2 : a) It is possible for Callias to learn Greek

b) It is possible for Callias not to learn Greek

These are sub-contraries, because both may be true (at different times). However, both may not be false, otherwise learning Greek would be impossible or necessary.

Note: the contradictory of "necessary" is "possible not" or "not necessary" - and not "impossible". For example: if it is false that it is necessary for this acorn to become an oak, then it is possible that it does not become one, but not impossible for it to become one.

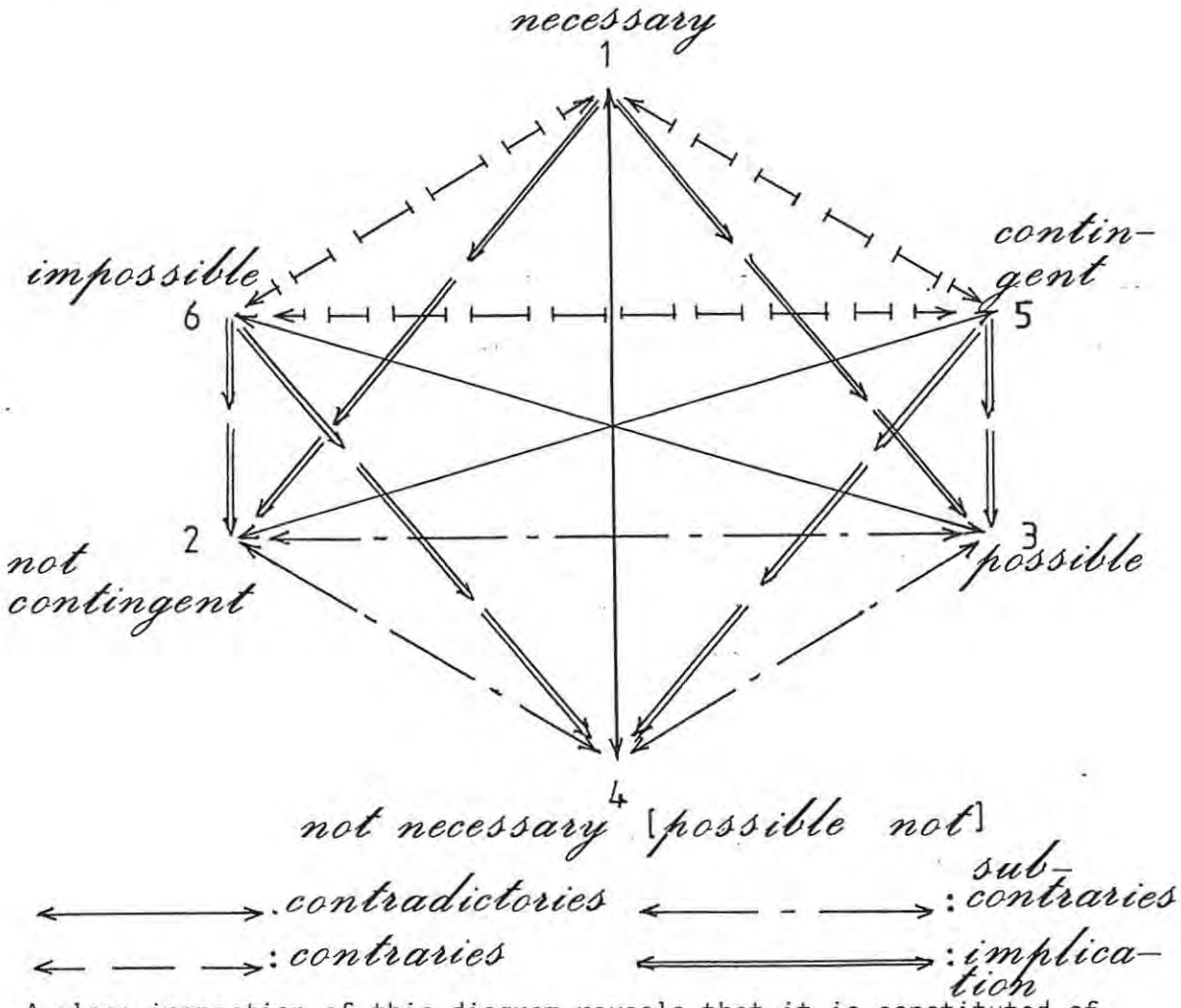
Finally, "necessary" and "impossible" imply but are not implied by the corresponding "possible" and "possible not", respectively. This is the analogue of Aristotle's commitment to the existential import of universal affirmatives and negatives. Thus, for example:

3 : a) If multiples of 2 must be even, then this multiple of 2 may be even.

b) If it is impossible for squares of numbers greater than one to be prime, then this square of a number greater than one may not be prime.

The modal square of opposition, above, does not include the concept of contingency - the reason for this is that a more complicated structure is required to characterize the relationship of contingency

to the other concepts:



A close inspection of this diagram reveals that it is constituted of three different squares of opposition, namely:

(1) Necessary - Impossible - Possible - Not Necessary

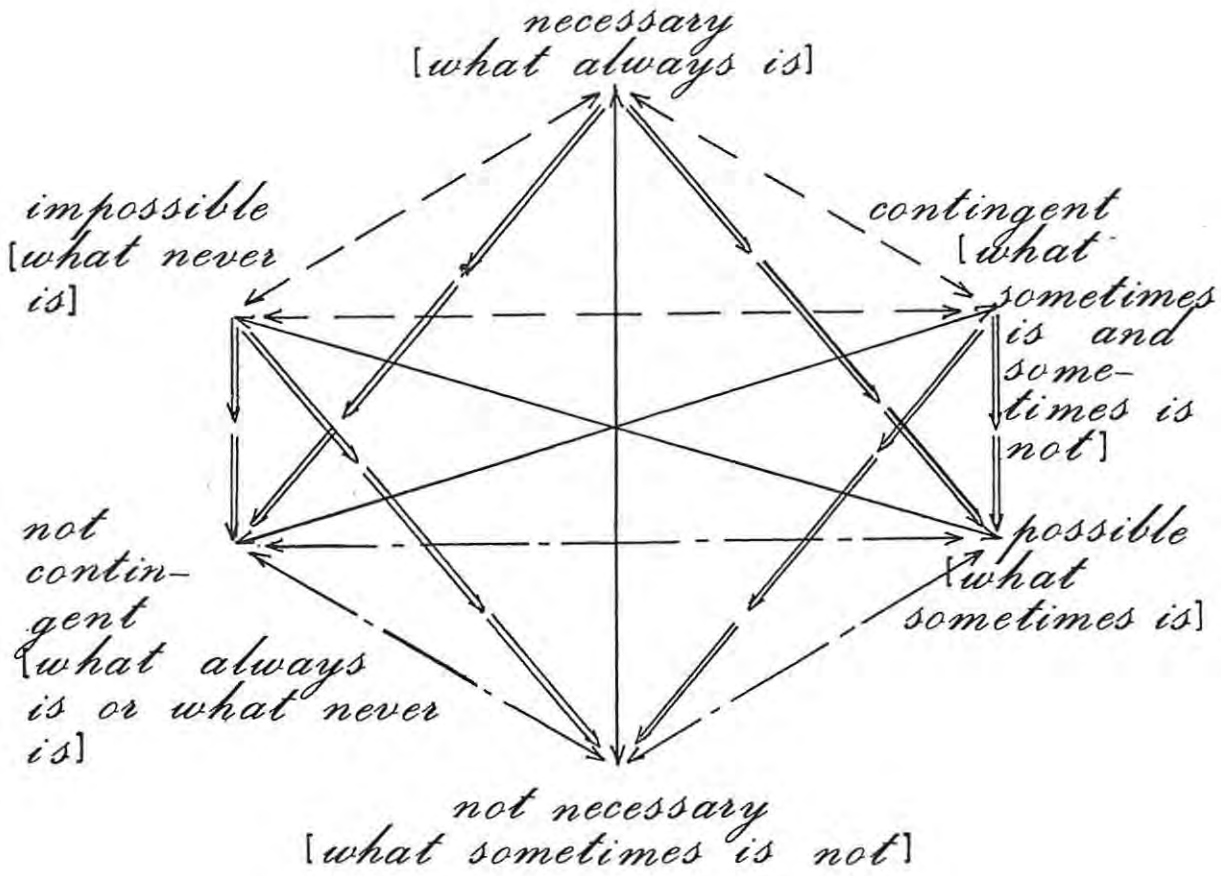
(2) Necessary - Contingent - Not Contingent - Not Necessary

(3) Impossible - Contingent - Not Contingent - Possible

(in the A - E - I - O positions, respectively). The advantage of placing the modal notions on a hexagon of opposition is obvious: the relationships between all the modal notions may be seen at a glance.

During the discussion of the Aristotelian modalities (in chapter three), it was pointed out that the necessary is that which always is, while the impossible is that which never is. The following diagram

represents these temporal relationships:

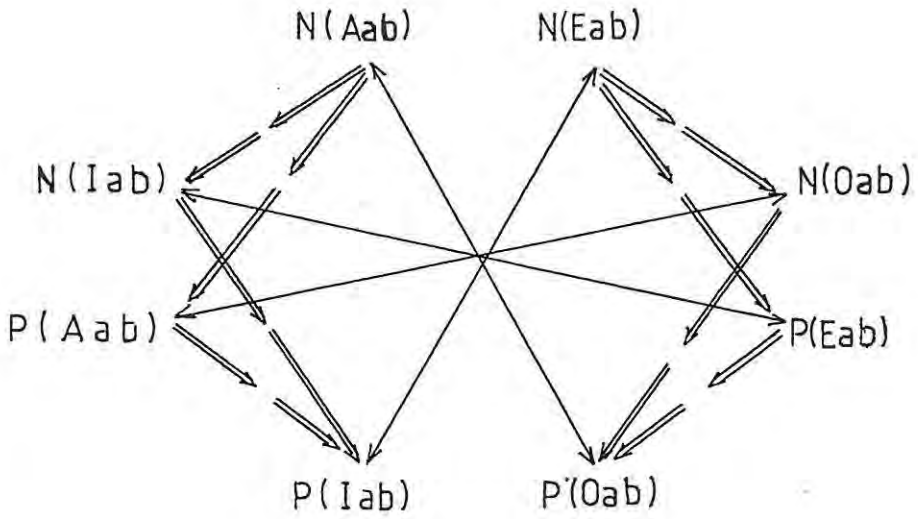


This diagram has relevance for the discussion of actualized possibilities, since it is obvious that that which is contingent is sometimes actualized (and sometimes not), while of that which is possible, it has to be that it is at some time actualized. That this diagram is correct is confirmed by a passage in De Caelo:

> ... Intermediate between what always is and what always is not, there should be that to which being and not-being are both possible: for the contradictory of each will at times be true of it unless it always exists (De Caelo, I, 12, 282^{a}8-10).

Aristotle's discussion of the opposition of modified statements in chapters twelve and thirteen of the De Interpretatione is limited to

a consideration of unquantified statements, and nowhere in his logical writings does Aristotle present a similar discussion of the opposition of quantified statements. However, a careful study of the Prior Analytics reveals that Aristotle has equally well worked out rules for the opposition of quantified modal statements. The relationships between quantified modal statements are represented in the following diagram:[10]



In the Prior Analytics, Aristotle points out that, while "No B is A" is a universal negation and "Some B is not A" is a particular negation, the modified forms "It is possible (necessary) that no B is A" and "It is possible (necessary) that some B is not A" are *affirmations* and not negations. The reason for Aristotle's insistence that these are affirmations has to do with his laws of conversion. Aristotle's laws of conversion are based on the interchanging of the subject- and predicate-terms of a proposition. Aristotle discusses conversion in chapters two, three, and thirteen of the Prior Analytics, and the

following table represents the results of this discussion:

N(Eab)	$\Longrightarrow$	N(Eba)
N(Aab)	$\Longrightarrow$	N(Iba)
N(Iab)	$\Longrightarrow$	N(Iba)
P(Eab)	$\Longrightarrow$	P(Eba)
P(Aab)	$\Longrightarrow$	P(Iba)
P(Iab)	$\Longrightarrow$	P(Iba)
C(Iab)	$\Longrightarrow$	C(Iba)

C(Aba)	$\Longleftrightarrow$	C(Eba)
C(Aba)	$\Longrightarrow$	C(Oba)
C(Iba)	$\Longleftrightarrow$	C(Oba)
C(Eba)	$\Longrightarrow$	C(Iba)

$\Longrightarrow$: conversion $\Longleftrightarrow$ mutual conversion

In this table, the last four types of conversion may be referred to as "complementary conversion".[11]

It should now be clear why Aristotle refers to "It is possible that No A is B" and "It is possible that Some A is not B" as affirmations: if they were negations, the conversion of, for example, "It is possible that No A is B" with "It is possible that All A is B" (where "possible" is used in the sense of "contingent") would not be permissible.

This concludes my account of Aristotle on the negation of modal concepts. I shall now proceed to a consideration of al-Farabi's interpretation of Aristotle.

4. Al-Farabi on the Opposition of Modified Statements.

It has been already been stated (in chapter two) that al-Farabi draws a clear distinction between the composition of statements (i.e. matters of syntax) and the subject-matter of statements (i.e. matters of semantics), and that he regards the discussion of the De Interpretatione as being about the various kinds of opposition between simple categorical statements, in terms of composition (Commentary, 17). In accordance with this, his account of negation is purely syntactic, and his rules are explicit.

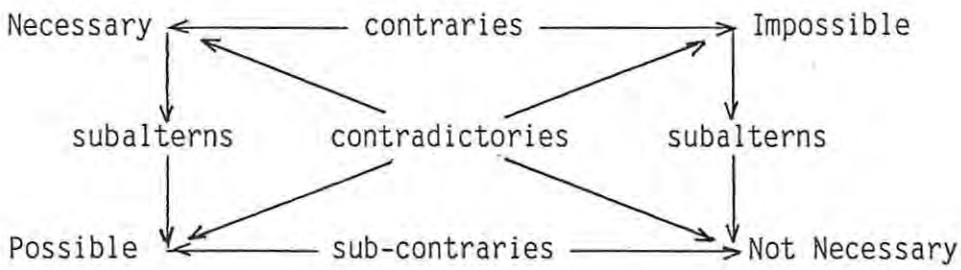
Concerning modified statements, al-Farabi's rule (Treatise,60) is that the negation is formed from the affirmation by attaching the negative particle to the mode, irrespective of whether the affirmation is individual, quantified or unquantified.[12] Examples of modified affirmations and negations are set out in the following table:

Affirmation	Negation
It is possible that Zayd is just	It is not possible that Zayd is just
Every man can walk	Every man cannot walk
It is necessary that some man is knowing	It is not necessary that some man is knowing
It is necessary that every man is not just	It is not necessary that every man is not just
The man is possibly ignorant	The man is not possibly ignorant
Every man is possibly not just	Every man is not possibly not just

Al-Farabi distinguishes between possibility and necessity negations and negative possibility and necessity statements. He points out that possibility negations (e.g. "Every man is not possibly just") negate

possibility and affirm hyparxis, while negative possibility statements (e.g. "Every man is possibly not just") affirm possibility and negate hyparxis. Similarly, necessity negations (e.g. "Zayd is not necessarily just") negate necessity and affirm hyparxis, while negative necessity statements (e.g. "Zayd is necessarily not just") affirm necessity and negate hyparxis. In making the distinction between possibility (necessity) negations and negative possibility (necessity) statements, al-Farabi is differentiating between (1) modified affirmations and negations and (2) plain, privative or metathetic (modified) affirmations and negations. Thus, "Every man is not possibly just" is a *modified* negation, contradictorily opposed to the *modified* affirmation "Every man is possibly just", and "Zayd is necessarily not just" is a *plain* (modified) negation contradictorily opposed to the *plain* (modified) affirmation "Zayd is necessarily just".

Al-Farabi also distinguishes between the plain and metathetic versions of necessity and possibility affirmations and negations (individual, unquantified and quantified), and he says that these interrelate in the same way that unmodified statements do. From this it follows that the modal notions may be placed on a diagram like the following:



1. Plain Necessity Affirmation
   Necessary to be

2. Metathetic Necessity Negation
   Possible to be

3. Plain Necessity Negation.
   Not necessary to be

4. Metathetic Necessity Affirmation
   Impossible to be

Although al-Farabi distinguishes contingency from possibility in the sense compatible with necessity, he does not say anything about the logical relation of contingency to the other modal concepts. For this reason, no diagram can be constructed to represent al-Farabi's view of the interrelations between all the modal concepts.

This concludes the present discussion. The argument up to this point may now be reviewed. In this chapter, I have been concerned to show: (a) that Aristotle presents a coherent account of negation for modified statements, and (b) that contingency is a genuine modal concept for Aristotle.

With respect to (a): Although Aristotle does not provide explicit syntactic rules for the formation of modified negations from modified affirmations, Aristotle's theory is nevertheless a systematized one: it is not haphazardly intuitive and full of confusions, as some philosophers and logicians have claimed. With respect to (b): it is clear from Aristotle's discussion of the negation of modal concepts that he makes a distinction, in logic, between possibility and modality: it follows from this that contingency is a genuine modal concept for Aristotle.

This concludes the present chapter.

CHAPTER 4 : Notes

1 Bocheński, I.M. Ancient Formal Logic, Amsterdam 1963 p 36.

2 Zimmermann, F.W. Al-Farabi's Commentary and Short Treatise on Aristotle's *De Interpretatione*, London 1981 p liii.

3 Bocheński, I.M. op. cit., p 36.

4 As Aristotle points out, "All relatives are spoken of in relation to correlatives that reciprocate. For example, the slave is called slave of a master and the master is called master of a slave; the double double of a half, and the half half of a double ..." (Categories, 7,6^{b}28-30).

5 There is disagreement between al-Farabi and those whom he refers to as "the commentators", regarding the interrelations between particularly quantified statements, namely:

1: Plain Affirmation "Some man is just"	4: Plain Negation "No man is just"
2: Privative Negation "No man is unjust"	5: Privative Affirmation "Some man is unjust"
3: Metathetic Negation "No man is non-just"	6: Metathetic Affirmation "Some man is non-just".

According to al-Farabi, the commentators deny that particular statements interrelate in the same way that universal, unquantified and individual statements do. This is because the commentators, in comparing particular statements, change the subjects regarding which the comparison is made. For example, the commentators hold that "Some man is just" is true if *all* men are just, and "No man is just" is false if *all* men are just. Al-Farabi argues that one should not change the subjects regarding which the comparison is made: one should take just one subject (for example, Zayd) and make him successively an infant, an adult who is neither just nor unjust, an unjust adult, and a just adult, and then test the truth of a statement (for example, "some man is just") in each case. Al-Farabi concludes that when statements are compared in this way, particular statements interrelate in the same way that other statements do.

6 "Zayd is non-knowing" signifies the same as "Zayd is ignorant" only when Zayd is an adult who does not know.

7 Zimmermann, op. cit., pp lxiii-lxv.

8 Bocheński, op. cit., p 50.

9 With respect to laws of obversion, it is held by some (for example, Copi, I.M. Introduction to Logic, New York 1978 p 181) that every standard-form categorical proposition is logically equivalent to its obverse. It is clear from De Int. 10,20^{a}16-20, however, that Aristotle does not regard a categorical proposition as logically equivalent to its obverse.

10 This diagram is based on McCall's table 6 (op. cit., p 35).

11 Kneale W. and Kneale M. op. cit., p 87.

12 At Treatise, 71, al-Farabi provides a different set of rules for forming negations from modified affirmations. His directions are as follows: (1) If the statement is individual or unquantified, we get a negation if the "not" is attached to the mode; (2) If the statement is quantified, we get a negation if the "not" is attached to the quantifier. A consequence of this set of rules is that "It is possible that not every man is just" gets counted as the negation of "It is possible that every man is just". But these statements cannot be contradictories, since they can both be true (i.e. they are sub-contraries). There is, however, an explanation for al-Farabi's regarding "It is possible that not every man is just" as the negation of "It is possible that every man is just" : in al-Farabi's terminology, the latter statement is a modified-quantified-*plain affirmation*, while the former statement is a modified-quantified-*plain negation*.

CHAPTER 5

Related Problems

Introduction.

I have three aims in this chapter. Firstly, I intend to show, very briefly, that there is a basis, in the Prior Analytics, for a modal syllogistic which could be formalized in the way that the assertoric syllogistic is. Secondly, I shall consider the relation of Aristotle's theory of modality to his discussion of future contingents in De Int. 9. Finally, I shall subject the Master Argument to a brief examination and relate it to Aristotle's theory of modality. This would then conclude my investigation of Aristotelian modality.

1. The Formalization of the Modal Syllogistic.

In chapter four, I provided an examination of Aristotle's theory of the negation of modal concepts in order to show that Aristotle's modal logic is coherent and methodical. I now want to support this claim by showing that there is a basis, in the Prior Analytics, for a modal syllogistic which could be formalized in terms of figures, moods and reductions in the way that the assertoric syllogistic is. In other words, I want to argue against the claim[1] that the Aristotelian theory of modal syllogisms is confused and unsatisfactory, a late and unfinished work inserted into the Prior Analytics long after the completion of the rest of the book.

Firstly, the modal syllogistic should not be viewed as independent of the assertoric syllogistic, for the assertoric syllogistic lays the groundwork for the modal syllogistic. As Rescher points out, Aristotle views the assertoric syllogistic as a heuristic preliminary to his modal syllogistic[2], and he (Aristotle) tries consistently to

apply the second and third figure justification procedures of the assertoric case in the cases of other modalities.[3] For example, the proof of the assertoric mood Cesare is the same as the proof of the apodeictic mood Cesare, i.e.:

Assertoric Cesare:	1. Eab	premiss
	2. Acb	premiss
	3. Eba	1, conversion
	4. Eca	3,2 Celarent
Apodeictic Cesare:	1. N(Eab)	premiss
	2. N(Acb)	premiss
	3. N(Eba)	1, conversion
	4. N(Eca)	3,2 apodeictic Celarent

Secondly, the development of the modal syllogistic is guided by a set of modal rules, which are summarized in the following table:

Conversion Rules	Negation Rules	Additional
$N(Erp) \supset N(Epr)$	$\overline{N(Arp)} \supset P(Orp)$	$N(Arp) \supset Arp$
$N(Arp) \supset N(Ipr)$	$\overline{N(Erp)} \supset P(Irp)$	$Arp \supset P(Arp)$
$N(Irp) \supset N(Ipr)$	$\overline{N(Irp)} \supset P(Erp)$	$N(Arp) \supset N(Irp)$
$P(Erp) \supset P(Epr)$	$\overline{N(Orp)} \supset P(Arp)$	$N(Arp) \supset P(Arp)$
$P(Arp) \supset P(Ipr)$	$\overline{P(Arp)} \supset N(Orp)$	$N(Irp) \supset P(Irp)$
$P(Irp) \supset P(Ipr)$	$\overline{P(Erp)} \supset N(Irp)$	$P(Arp) \supset P(Irp)$
$C(Irp) \supset C(Ipr)$	$\overline{P(Irp)} \supset N(Erp)$	$N(Erp) \supset N(Orp)$
$C(Arp) \equiv C(Erp)$	$\overline{P(Orp)} \supset N(Arp)$	$N(Erp) \supset P(Erp)$
$C(Arp) \supset C(Orp)$	$\overline{C(Arp)} \supset (N(Irp) \vee N(Orp))$	$N(Orp) \supset P(Orp)$
$C(Erp) \supset C(Irp)$	$\overline{C(Erp)} \supset (N(Irp) \vee N(Orp))$	$P(Erp) \supset P(Orp)$
$C(Irp) \equiv C(Orp)$		

The table above is not meant to be complete: it merely serves as proof that Aristotle did not proceed haphazardly, but that he was guided by carefully thought-out rules.

Finally, Aristotle's modal syllogistic has been successfully axiomatized by McCall,[4] who shows that Aristotle's modal syllogistic exhibits a high degree of logical consistency:

> His system of apodeictic moods has been axiomatized in a purely formal calculus whose theorems coincide perfectly with Aristotle's intuitions. This calculus can be shown to be complete in the sense that every formula not provable from its axioms may be demonstrably rejected on the basis of certain axiomatic rejections. Not so much success has greeted the attempt to provide a formal counterpart to Aristotle's system of contingent moods, the degree of correlation of the two systems being only 85%, but this figure is nonetheless higher than that exhibited by, for example, a system such as Lucasiewicz's.[5]

It is clear from the foregoing that there is a basis, in the Prior Analytics, for a modal syllogistic which could be formalized.

I now want to examine the relation of Aristotle's theory of modal concepts to his discussion of future contingents.

2. Aristotle's Theory of Modal Concepts and De Int. 9.

No work on Aristotle's modal logic is complete if it does not in some way address Aristotle's discussion of future contingents in chapter nine of the De Interpretatione. This discussion has been the subject of debate for more than two thousand years, and, according to Hintikka,

> Aristotle's problem is problematic ... Scholars disagree not only about the details of Aristotle's discussion; they have given different answers to the question: what is Aristotle's problem in De Int. 9? What is the view he wants to refute there, and what is the view for which he wants to argue?[6]

Hintikka points out that the traditional interpretation of De Int. 9 is that Aristotle there denies the applicability of the law of

excluded middle (which Hintikka formulates as: every sentence of the form 'p or not-p' is true) to statements concerning individual future events.

I do not wish to enter into a discussion of the intricacies of this debate since such a discussion would take me beyond the scope of the present work. What I shall do, instead, is briefly provide my own interpretation of the De Int. 9 discussion and then show that Aristotle's theory of modal concepts is compatible with his discussion of future contingent propositions.

In De Int. 9, Aristotle is concerned to argue that one cannot say of *every* affirmation or negation that it is true or false, for such a view leads to deterministic consequences. Take, for example, the proposition "There will be a sea battle tomorrow": if this statement is true, now, then it is necessary that there be a sea battle tomorrow, and so, nothing happens by chance: what is to happen tomorrow is determined already and nothing we can do will alter the course of events. Aristotle argues against such determinism since, in his view, natural contingencies do exist: a cloak, for example, may be cut up or it may wear out. It is not necessary for one or the other to be the case: either might happen:

> Clearly, therefore, not everything is or happens of necessity: some things happen as chance has it ... (De Int. 9,19^{a}17).

Aristotle's position on statements concerning individual (singular) future events is that such statements lack truth-values until the corresponding events take place. They acquire truth-values only when the corresponding events take place because " ... statements are true according to how the actual things are ... " (De Int. 9,19^{a}33).[7] Thus,

for example, the statement "There will be a sea battle tomorrow" lacks a truth-value at present, but acquires one when the sea battle occurs or fails to occur: if a sea battle occurs tomorrow, the statement will be made true; if not, it will be made false.

My interpretation of Aristotle on the problem of future contingent statements is supported by al-Farabi, who states,

> Every pair of contradictories distributes ... truth and falsity. But contradictories about matters of necessity and absolute matters of the past or present distribute truth and falsity intrinsically definitely. The true one, that is, is definitely one rather than the other, while the false one is the other rather than the first ... By contrast, future matters of possibility - like 'Zayd will go to the market tomorrow' and 'Zayd will not go to the market tomorrow' - are contradictories which, though they do distribute truth and falsity between themselves, do so intrinsically indefinitely. For it is not possible that truth should definitely attach to this particular one of them and falsity to this particular one in such a way as to make it impossible for the true one to be false and the false one to be true (Treatise, 79).

According to al-Farabi, it is only when matters of possibility change from non-existence to existence that statements about them distribute truth and falsity definitely.

Aristotle's theory of modal concepts is compatible with his discussion of future contingent statements since in both cases he bases his line of thought on the idea that the relevant sense of possibility is contingency. It is because Aristotle recognizes that some things do happen contingently that he argues against the view that everything that happens, happens of necessity, and so handles satisfactorily the problem of determinism.

With respect to Aristotle's discussion in De Int. 9, I disagree with Hintikka's interpretation: according to Hintikka[8], Aristotle in

De Int. 9 bases his line of thought on the idea that the relevant sense of "possibility" is the one in which "it is possible that p" is equivalent to "it is or will be the case that p". (This sense of "possibility" is the sense of "non-contingency" compatible with necessity (see chapter three), and it has already been argued that Aristotle does not regard this as the basic sense of "possibility".) In showing that the deterministic view leads to awkward consequences, Aristotle employs the notion of "possibility" according to which both being and not being (and hence, both coming to be and not coming to be) are possible - and this is the sense of "contingency". It follows from this that Hintikka is mistaken.

I shall now - very briefly - consider the relation of the Master Argument to Aristotle's discussion of modality.

3. Aristotle's Theory of Modal Concepts and the Master Argument.

According to Alexander, the Master Argument of the Megarian, Diodorus Cronus, was designed to establish Diodorus' definition of possibility as "that which is or will be". The only complete account of the Master Argument is given by Epictetus, who writes,

> The Master Argument seems to have been formulated with some such starting points as these. There is an incompatibility between the following three propositions:
>
> (1) Everything that is past and true is necessary;
>
> (2) The impossible does not follow from the possible;
>
> (3) What neither is nor will be is possible.
>
> Seeing this incompatibility, Diodorus used the plausibility of the first two propositions to establish the thesis that nothing is possible which neither is nor will be true.[9]

At first, Diodorus' definition of possibility strikes one as being strange, since one generally regards the possible as that which

may or may not be - not as that which is or will be. However, Diodorus' definition of possibility has to be examined against his background of determinism. Diodorus subscribed to a particularly strong form of determinism, according to which past events necessitate what happens in the present and future; thus, something will either be or not be. There is thus a distinct category of things that will be - whether they happen immediately or at some time in the future - and things in this category are what Diodorus refers to as being possible. For Diodorus, there is no category of things which may or may not happen (i.e. contingencies): there is a category of things which will happen (i.e. the possible) and there is a category of things which will not happen (i.e. the impossible). On Diodorus' view, therefore, no distinction may be drawn between the possible and the actual since the possible is that which actually is or will actually happen.

With respect to the Master Argument, Diodorus was prepared to accept premisses (1) and (2), but he rejected premiss (3) since it conflicts with his characterization of the possible. For premiss (3) is consistent with contingency, whereas Diodorus' characterization of possibility (i.e. that the possible is that which is or will be) excludes it.

It has been claimed (by Hintikka[10]) that all the materials of the Master Argument - the premisses (1) to (3) and the conclusion ((4): the possible is that which is or will be) - are in Aristotle. I think this claim is correct. (1) is compatible with Aristotle's definition of the necessary as that which cannot be otherwise than it is, and if (1) is construed as stating that the past is unalterable, it is acceptable to Aristotle. (2) is a thesis which is actually stated by Aristotle, at Pr.An.I, 15,34^{a}5-12, so he has no quarrel with it. As

regards (3) and (4): these are inconsistent on Diodorus' view, so the question that may now be asked is: do (3) and (4) conflict in Aristotle's system, and if not, why not?

It has repeatedly been stated, in the preceding chapters, that Aristotle distinguishes two senses of possibility: one is a sense of "contingency", opposed to necessity, and the other is a sense of "non-contingency", compatible with necessity and predicated of those things of which necessity is predicated. Of these two senses of "possibility", the first sense is the basic sense: the truly possible is that which is contingent. It is clear from a logical representation of these two senses of "possibility", however, that the first sense entails the second sense; that is, contingency entails the possibility compatible with necessity. It may now be seen why Aristotle is able to retain both (3) and (4): Aristotle regards contingency as the proper sense of "possibility", and since contingency entails both (3) and (4), Aristotle is able to maintain both. On the other hand, Diodorus is not able to maintain both, since he is not prepared to accept the concept which entails them, namely contingency. Diodorus is thus forced to choose between (3) and (4), so he chooses (4) because it is consistent with his determinism.

The relation of Aristotle's theory of modal concepts to the Master Argument may now be stated: the Master Argument is designed to refute one of Aristotle's concepts, namely, contingency.

This concludes my examination of Aristotle's theory of modality. What has been shown, then, is that Aristotle has a coherent theory of modality, separable from his metaphysics.

CHAPTER 5 : Notes

1 Kneale, W. and Kneale, M. The Development of Logic, Oxford 1962 p 86.

2 Rescher, N. "Aristotle's Theory of Modal Syllogisms and its Interpretation" in Bunge, M. (ed.) The Critical Approach to Science and Philosophy, London 1963 p 155.

3 Ibid., p 157.

4 McCall, S. Aristotle's Modal Syllogisms, Amsterdam 1963.

5 Ibid., p 95.

6 Hintikka, J. Time and Necessity, Oxford 1973 p 147.

7 Aristotle makes a similar claim (to the one made at De Int. 9,19^{a}33) at Cat. 5,4^{a}39-4^{b}1: "... It is because of a change in the actual thing that it [i.e. the statement] comes to be true at one time and false at another."

8 Hintikka, J. op. cit. p 199.

9 Ibid., pp 180-181.

10 Ibid., p 182.

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