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Aristotle's Treatment of Fallacious Reasoning in Sophistical Refutations and Prior Analytics

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ARISTOTLE ON FALLACIOUS REASONING IN
SOPHISTICAL REFUTATIONS **AND** *PRIOR ANALYTICS*

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Abstract:

Aristotle studies syllogistic argumentation in *Sophistical Refutations* and *Prior Analytics*. In the latter he focuses on the formal and syntactic character of arguments and treats the *sullogismoi* and non-*sullogismoi* as argument patterns with valid or invalid instances. In the former Aristotle focuses on semantics and rhetoric to study apparent *sullogismoi* as object language arguments. Interpreters usually take *Sophistical Refutations* as considerably less mature than *Prior Analytics*. Our interpretation holds that the two works are more of a piece than previously believed and, indeed, that Aristotle's treatment of fallacious reasoning presupposes the results of the formal theory.

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1. Introduction.

Aristotle defines "*sullogismos*" (syllogism) in *Topics*, *Sophistical Refutations*, *Rhetoric*, and *Prior Analytics* in virtually the same way: "a *sullogismos* is a discourse [*logos*] in which, certain things having been supposed, something different from the things supposed necessarily results".[1] Interpreters of Aristotle's logic customarily take a *sullogismos* to be a topic specific, object language argument or deduction and not to be a topic neutral argument form or pattern. Interpreters also customarily believe *Sophistical Refutations* and *Topics* to be considerably less mature than *Prior Analytics*, and, accordingly, they have not studied the one in relation to the other.

While Aristotle does treat a *sullogismos* in *Sophistical Refutations* as an object language phenomenon, it is evident that he specifically treats the *sullogismoi* and non-*sullogismoi* in *Prior Analytics A4-7* as topic neutral argument forms or *argument patterns* whose *instances* are either valid or invalid arguments. In *Prior Analytics* Aristotle establishes all the argument patterns whose instances are valid arguments-that is, all the *sullogismoi* of the three figures-by means of metalogical deductions. And he just as surely establishes metalogically all the argument patterns whose instances are invalid arguments-that is, all the non-*sullogismoi*-by means of the method of contrasted instances. His logical investigations at *Prior Analytics A4-7* are strictly *formal* and *syntactic*. In *Sophistical Refutations* he defines a *sullogismos* just as at *Prior Analytics*, and he defines a refutation (*elenchos*) as "a *sullogismos* whose conclusion is the contradiction of a given statement". But there he systematically treats actual arguments, in particular, those than appear to be valid but are really only apparent or *phainomenoi sullogismoi* and sophistical refutations or *sophistikoi elenchoi*. The emphasis, then, in *Sophistical Refutations* is on *semantic* and *rhetorical matters* having to do with argumentation.

Modern interpreters have referred to the subject matter of *Sophistical Refutations* as "informal fallacies" without regard to the formal results of *Prior Analytics* as both works bear on the practice of argumentation. We believe that Aristotle's logical investigations in *Sophistical Refutations*, which emphasizes semantics, are better understood in relation to his syntactic considerations in *Prior Analytics*, that *Sophistical Refutations* and *Prior Analytics* (indeed, that all the treatises of the *Organon*) are more of a piece that previously believed. We aim to show that

Aristotle's treatment of the fallacies depending on and those not depending on language may presuppose the formal results of *Prior Analytics A4-7*. In this respect, we take Aristotle more determinately to distinguish semantics and logical syntax than have previous interpreters. Accordingly, we can better appreciate Aristotle's original contributions to formal logic and to the study of argumentation.

2. Misinterpreting Aristotle's project in Prior Analytics

Three principal interpretive trends characterize studies of Aristotle's logical investigations. The *deductionist* interpretation mathematically models Aristotle's logic as a natural deduction system. J. Corcoran, T. Smiley, and R. Smith consider a *sullogismos* to be a *deduction*-a fully interpreted argumentation having a cogent chain of reasoning in addition to premises and conclusion. The *axiomaticist* interpretation takes *Prior Analytics* to lay out an axiomatized deductive system of syllogistic theorems. J. Lukasiewicz, I. M. Bochenski, and G. Patzig take a *sullogismos* to be a single, relatively uninterpreted, logically true conditional *proposition*. Only the *traditionalist* interpretation continues to hold that *Prior Analytics* is a logic manual for studying categorical arguments or syllogisms. Proponents such as J. N. Keynes, R. M. Eaton, and W. D. Ross usually treat a *sullogismos* as a fully interpreted, valid or invalid premise-conclusion *argument*.

Notwithstanding important differences, these interpretations hold quite similar views concerning Aristotle's methods for establishing knowledge of invalidity. However, none of these interpretations provides an account that fits the text of *Prior Analytics*. On the one hand, traditionalists usually apply six rules of the syllogism, namely, those pertaining to quality, quantity, and distribution.[2] This certainly does not resemble any practice of Aristotle. Axiomaticist and deductionist interpreters, on the other hand, equally take Aristotle (1) to consider arguments or deductions and (2) to use the method of counterargument. On both counts they are mistaken. First, Aristotle does not especially treat arguments or deductions in *Prior Analytics A4-7*. Rather, with a view toward their corresponding argument patterns, he expressly treats patterns of two categorical sentences or *premise-pair patterns*. Second, there is no instance of Aristotle explicitly using the method of counterargument as is commonly maintained by interpreters such as J. Lukasiewicz (1958: 70) and J. Corcoran (1974: 105, 1989: 31; cf. 1993: xxxi). Rather, he principally uses the *method of constrasted instances* (W. D. Ross 1949) to invalidate premise-pair patterns and, consequently, their four corresponding argument patterns.

Our interpretive standpoint takes Aristotle in *Prior Analytics* as verifying the results of his constructing a natural deduction system. At *A4-7* Aristotle exhaustively treats only and all possible combinations of three different terms in premise-pair patterns to demonstrate (1) which pair patterns are concludent and generate a *sullogismos* and (2) which pair patterns are inconcludent and do not generate a *sullogismos* (see G. Patzig 1968 and L. Rose 1968). Accordingly, we hold that a *sullogismos* as treated in *Prior Analytics A4-7* is neither a valid or invalid premise-conclusion argument, nor a single, logically true conditional proposition, nor a deduction. Rather, as a relatively uninterpreted object, it is an *elemental argument pattern* in one of three figures, consisting in a premise-set of two categorical sentence patterns and a conclusion of a single categorical sentence pattern and having all valid argument instances. Aristotle recognized the epistemic efficacy of such elemental patterns and formulated them in corresponding sentences to express *rules of deduction*. Section three below addresses how Aristotle eliminates argument patterns unproductive of deduction rules and, thus, how he identifies invalid arguments and fallacious reasoning from *formal* considerations.

3.0 Some preliminary matters

3.1 Logic terminology. We use the following terminology, following J. Corcoran 1989 and 1993, to examine Aristotle's logic.[3] An *argument* is a two part system consisting in a set of sentences in the role of premises and a single sentence in the role of conclusion; an argument is either valid or invalid. A *sentence* is either true or false. An *argumentation* is a three part system consisting in a chain of reasoning in addition to premises and conclusion and is either cogent, in which case it is a *deduction*, or fallacious, a non-deduction. A sentence, an argument, and an argumentation are object language phenomena. An *argument pattern* is a two part system consisting in a set of sentence patterns in the role of a premise-set and a single sentence pattern in the role of conclusion. A pattern is a metalinguistic object distinguishable from a form and is commonly represented schematically (see below note 11 on distinguishing "form" and "pattern"). An argument is said to fit or to be an instance of one or more argument patterns. A given argument pattern may have all valid instances, all invalid instances, or some valid and some invalid instances. An argument pattern is not properly valid or invalid, although logicians have used "valid" in this connection. Corcoran (1993: xxxiv-xxxv) has helped to clarify category differences here by using the following terminology: an argument pattern with all valid instances is *panvalid*, that with all invalid instances is *paninvalid*, and that having instances of both is *neutrovalid*. We add that an *elemental panvalid argument pattern* is one having a *simple* premise-set pattern whose epistemic value consists in its being "immediately" evident to someone that its conclusion follows necessarily. An elemental argument pattern may be formulated in a corresponding sentence to express a *rule of deduction*. In addition, we follow G. Patzig to distinguish in Aristotle's logic a concludent pattern of two *protasesis* or a premise-pair pattern from an inconcludent premise-pair pattern. A *concludent* pattern has a necessary result, that is, it results in a *sullogismos*, while an *inconcludent* pattern has no necessary result and cannot result in a *sullogismos*.

3.2 Aristotle's focus on logical syntax in Prior Analytics. Aristotle knew that deductions about geometric objects are topic specific and that they employ a topic neutral deduction system,[4] even if that system is used implicitly by a participant. In *Prior Analytics* he turned his attention not to geometric or biological objects, nor even to geometric or biological discourses, but to the *deduction apparatus* used to make evident that a given categorical sentence necessarily follows from other given categorical sentences. Aristotle had observed a number of elemental argument patterns in various object language discourses, some of which he recognized always to result in something following necessarily, others of which he recognized never to result in something following necessarily. He subsequently extracted these patterns for *systematic* examination. In *Prior Analytics* Aristotle models his syllogistic logic and presents the results of his investigations.[5] In this connection, then, *Prior Analytics* is a scientific study of the *syllogistic deduction system*, which, taken with *Categories* and *De Interpretatione*, comprises Aristotle's treatment of the syllogistic *underlying logic*.

The results of our study of *Prior Analytics* show that there a *sullogismos* is not a fully interpreted object according to an intended meaning in a given topical sub-language, and that Aristotle distinguishes logical syntax from semantics. One way sufficient for determining whether or not a logician distinguishes logical syntax from semantics is to ascertain whether a logician works with a notion of *substitution* (in contrast to a notion of "interpretation"). In a substitution one changes the language, or the content words and phrases in a given language, while leaving their meanings and the logical form fixed. In this light, observing Aristotle's pervasive use of schematic letters and his practice of substitution for establishing inconcludence, we recognize him more determinately to distinguish semantics and logical syntax and, indeed, to focus on the patterns of valid and invalid arguments at *A4-7*.

Aristotle's syllogistic syntax. The following practices in treating an underlying logic as a subject matter indicate Aristotle's attention on formal considerations apart from particular subject matters. (1) Aristotle systematically treats patterns of two *protaseis* or premise-pair patterns and their corresponding argument patterns and treats neither premises nor arguments themselves. Arguments are introduced to establish that certain premise-pair patterns are inconcludent. (2) Aristotle uses three sets of schematic letters to mark places for terms, one set for each figure

(*schema*). He names terms by their schematic positions-first (or major), middle, last (or minor)-and he calls the first and last extremes (*akra*). Most significant, perhaps, is (3) Aristotle's treating categorical sentence patterns schematically with a strict syntax. His common schematic representations of the four kinds of categorical sentence are:

> *A* belongs to every *B*
> *A* belongs to no *B*
> *A* belongs to some *B*
> *A* does not belong to some *B*.

Here '*A*' and '*B*' are schematic letters[6] marking places for the predicate and subject terms respectively. Although Aristotle does not abbreviate each of the four logical constants with a letter as modern logicians, namely, with '*a*', '*e*', '*i*', and '*o*', he names them just as modern logicians do (*A4*, 26b30-33):

belongs to every (*a*)	belongs to none (*e*)
belongs to some (*i*)	does not belong to some (*o*).

Thus, using Aristotle's schematic letters and our abbreviations for the logical constants, we may represent the four categorical sentence patterns schematically as '*AaB*', '*AeB*', '*AiB*', and '*AoB*'. Finally, (4) throughout *A4-6* Aristotle works with schematic letters for three terms in various premise-pair patterns according to three figures. In every case, whatever order he presents the 'sentences' in a premise-pair pattern, that is, whether he states first the major or the minor premise pattern, he always understands the predicate term (*P*) of the conclusion pattern (*PxS*) to be the *first* term in the premise-pair pattern and the subject term (*S*) of the conclusion pattern to be the *last* term ('*P*' and '*S*'are schematic letters and '*x*' holds a place for one of Aristotle's four logical constants). This syntax is strict. He always considers the conclusion of an argument to fit the sentence pattern *PxS* and not its converse.[7] A familiar way of schematically representing the standard syntax of the three figures follows (the 'premises' are numbered and the 'conclusion is indicated by '?')

First figure	Second figure	Third figure
PxM, MxS | PxS	*MxP, MxS | PxS*	*PxM, SxM | PxS*
1. *PxM*	1. *MxP*	1. *PxM*
2. *MxS*	2. *MxS*	2. *SxM*
? *PxS*	? *PxS*	? *PxS*

Aristotle is well aware of a distinction between syntax and semantics, indeed, in a way familiar to A. Church, A. Tarski and other modern logicians.

3.3 Establishing the sullogismoi. At *A5-6* Aristotle *uses* a natural deduction system-which consists in four kinds of categorical sentence, two pairs of contradictories and one pair of contraries, three conversion rules, four *teleioi-sullogismoi*, and two kinds of proof (direct and indirect)-to show that a given second or third figure argument

pattern is, in fact, a *sullogismos*. In each case Aristotle demonstrates *by means of* a metalogical deduction that a given premise-pair pattern generates a *sullogismos* with a certain conclusion. The text concerning Camestres (27a9-14) makes this evident.8

> If M belongs to every N but to no X, then neither will N belong to any X. For if M belongs to no X, neither does X belong to any M; but M belonged to every N; therefore, X will belong to no N (for the first figure has again been generated). And since the privative converts, neither will N belong to any X.

We can exactly express what Aristotle writes here in the familiar manner of a modern deduction.

1.*MaN*
2.*MeX*
?*NeX*

3.*MeX* 2 repetition
4.*XeM* 3 *e*-conversion
5.*MaN* 1 repetition
6.*XeN* 4, 5 Celarent
7.*NeX* 6 *e*-conversion

Every second and third figure *sullogismos* is determined in just this manner, whether by direct or indirect deduction. Thus, he establishes all the panvalid elemental argument patterns or *sullogismoi* in this way.9 Every argument with semantically precise terms fitting one of these patterns is valid.

*3.4 Aristotle's notion of "following necessarily".*10 Aristotle defines "that which is necessary" in *Metaphysics 5.5* as "that having no other relationship possible" (1015a34). At *Metaphysics 4.5* he writes much the same: "for it is not possible for what is necessary to be one way and another way, and so if something is of necessity, it cannot be so and not so" (1010b28-30). Respecting a demonstration he writes that "if there is a *sullogismos* it is [logically] impossible for there to be another relationship among them [i.e. three terms in two premises]" (1015b7-9). The statements defining "*necessary*" in *Metaphysics 4.5* and *5.5* (see also 1011b13-14; cf *Posterior Analytics 6*) certainly help to inform our understanding of Aristotle's definition of a *sullogismos* in *Prior Analytics A1* (24b18-22): "a *sullogismos* is a discourse in which, certain things having been supposed, something different from the things supposed *results of necessity* because these things are so" (24b18-20; emphasis added). In *Prior Analytics* he summarizes his findings concerning the *sullogismoi*: "it is evident both that a *sullogismos* is generated necessarily whenever the terms are related to one another as was stated, and that if there is a *sullogismos*, then it is necessary for the terms to be so related" (*A5*, 28a1-3; cf. A6, 29a11-14). For there to be a *sullogismos* it is necessary and sufficient that the terms be formally related as Aristotle states, albeit tersely, in a number of rules. Likewise, as we shall see below (section 4.4), for there *not* to be a *sullogismos* it is necessary and sufficient that terms be formally related in the other ways he systematically covers.

4.0 Establishing invalidity in Prior Analytics.

4.1. Modern methods for determining invalidity. Modern logicians most often use six methods to determine that a given arbitrary argument is invalid: (1) the method of fact; (2) the method of counterargument and its variant the method of counterinterpretation; (3) the method of deduction or the axiomatic method, sometimes called reduction;

(4) the method of truth tables; and, in relation to traditional Aristotelian logic, there are (5) the traditionalist method of applying rules of the syllogism and (6) the methods of Venn and Euler diagrams. Aristotle no doubt was familiar with the method of fact; otherwise, he applied none of these methods except, perhaps in some instances, a variation of the axiomatic method. We briefly review only the methods of fact and counterargument to help establish that Aristotle's method of contrasted instances is a different method.

The method of fact. A given argument is determined to be invalid when the premises are known to be true sentences and the conclusion is known to be a false sentence. Knowledge that the premises are true and that the conclusion is false is sufficient to determine that a given argument is invalid. The ontic principle underlying the application of this method holds that no argument is valid whose premises are true and whose conclusion is false. The following example of an obviously invalid argument illustrates this method (premises numbered, the conclusion indicated by the '?'):

> 1. Every even number divides itself.(T)
> 2. Every odd number divides itself. (T)
> ? Every even number divides every odd number.(F)

The method of counterargument. A given argument is determined to be invalid when a counterargument is exhibited for the given argument. A counterargument for a given argument is an argument having all true premises and a false conclusion and is in the same form as the given argument. Knowing that a counterargument exists for a given argument is sufficient for establishing knowledge that the given argument is invalid. The method of fact underlies applying the method of counterargument. The method of counterinterpretation is a variant of this method: a counterinterpretation is an argument in the same logical form as a given argument, but a model of the premise-set is not a model of the conclusion. In a counterargument one changes the language but leaves its interpretation fixed; in a counterinterpretation one leaves the language fixed but changes its meaning. The methods of counterargument and counterinterpretation are both established on the ontic principle that two arguments in the same form[11] are either both valid or both invalid. This principle of form makes it possible to reduce the invalidity of arguments not obviously invalid to the invalidity of obviously invalid arguments. The following example, in which the invalidity of argument A1 is to be established and argument A2 is known to be a counterargument, illustrates the method of counterargument.

A1	A2
1. If two is prime then three is prime. (T)	1. If two is odd then three is odd.(T)
2. Three is prime. (T)	2. Three is odd.(T)
? Two is prime (T)	? Two is odd.(F)

4.2 Aristotle's method for establishing inconcludence and invalidity. At *A4-6* Aristotle uses other methods to demonstrate which premise-pair patterns are inconcludent. Once grasping that Aristotle treats premise-pair patterns and that a *sullogismos* is a panvalid elemental argument pattern, we can see the metalogical character of his methods of invalidation. Accordingly, he demonstrates not the invalidity of arbitrary object language arguments but (1) the inconcludence of premise-pair patterns and, consequently, (2) the paninvalidity of the four argument patterns associated with each inconcludent pair in the standard syntax. In Aristotle's logic, panvalidity and paninvalidity are exhaustive for argument patterns; no pattern is neutrovalid. And in the case of premise-pair patterns, being

concludent and inconcludent are likewise exhaustive.

Our first encounter in *Prior Analytics* with Aristotle's methods of invalidation is his treatment of the premise-pair pattern *PaM, MeS* (26a2-9), which follows his treatment of *PaM, MaS | PaS* (Barbara) and *PeM, MaS | PeS* (Celarent) in *A4*. He then immediately treats the premise-pair pattern *PeM, MeS* (26a9-13) in the same manner. These four considerations together exhaust all possible premise-pair patterns with universal sentences in the first figure. The passage at 26a2-9 provides Aristotle's fullest statement of his principal method of invalidation used in *A4-6*. Of the 34 premise-pair patterns that do not generate a *sullogismos* in the three figures, only in six instances is another method used and in two of these six instances he uses a third method.[12] We here examine only his method of contrasted instances which covers 28 premise-pair patterns. Aristotle writes:

> However, if the first extreme follows [i.e. belongs to] all the middle and the middle belongs to none of the last, there will not be a *sullogismos* of the extremes, for *nothing necessarily results* in virtue of these things being so. (26a2-5; emphasis added)

This sentence states a set of necessary relationships of three terms in two universal premises for *not* generating a *sullogismos* in the first figure. We take this passage to state a *rule* (a direct counterpart of those for the *sullogismoi*[13]) concerning the premise-pair pattern *PaM, MeS*, that *no* sentence is a logical consequence of two sentences fitting this pattern. Thus, Aristotle eliminates four argument patterns in the standard syntax from being *sullogismoi*. He continues:

> For *it is possible* for the first extreme to belong to all as well as to none of the last. Consequently, neither a particular nor a universal conclusion results necessarily; and, since nothing is necessary because of these, there will not be a *sullogismos*. Terms for belonging to every are animal, man, horse; for belonging to none, animal, man, stone. (26a5-9; emphasis added)

Aristotle clearly uses neither the method of counterargument nor the method of counterinterpretation, each of which requires finding an instance of an argument having true premises and a false conclusion in the same form as a given argument. Rather, by substituting two sets of three terms for the schematic letters, he constructs two arguments each of whose premises are true sentences fitting the same premise-pair pattern and whose conclusions *also* are *true* sentences, but in the one argument it is an *a* sentence, in the other an *e* sentence. We can express what he says at 26a2-9 as follows.

Argument instance	Schematic pattern	Truth value	Argument instance	Schematic pattern	Truth value
1. Animal *belongs to every* man.	*PaM*	T	1. Animal *belongs to every* man.	*PaM*	T
2. Man *belongs to no* horse.	*MeS*	T	2. Man *belongs to no* stone.	*MeS*	T
? Animal *belongs to every* horse.	*PaS*	T	? Animal *belongs to no* stone.	*PeS*	T
? Animal *belongs to some* horse.	*PiS*	T	? Animal *does not belong to some* stone.	*PoS*	T

For Aristotle this demonstrates that "nothing necessarily results" from sentences is this premise-pair pattern since, as he shows, the results "could be otherwise". Thus, any sentences of three terms fitting this premise-pair pattern are shown never to result together in a valid argument: no *sullogismos* of the extremes through a middle is possible. This premise-pair pattern is thereby shown to be inconcludent. Aristotle does not explicitly treat *i* and *o* sentences as possible results, although his implicitly doing so is suggested at 26a6-7 by his writing that "neither a particular nor a universal conclusion results necessarily". It is evident, moreover, that he treats *at one time* in this way four argument patterns in the standard syntax for each premise-pair pattern; *he does not show that each of the four patterns is paninvalid by using counterarguments* in each case.

Aristotle's method of contrasted instances is easily adapted to the method of counterargument. Both methods achieve the same results. We can apply Aristotle's two sets of three terms to the two argument patterns but switch the terms for *belonging to none* to *belonging to every* and vice versa. Thus:

Argument instance	Schematic pattern	Truth value	Argument instance	Schematic pattern	Truth value
1. Animal *belongs to every* man. 2. Man *belongs to no* stone.	*PaM* *MeS*	T T	1. Animal *belongs to every* man. 2. Man *belongs to no* horse.	*PaM* *MeS*	T T
? Animal *belongs to every* stone. ? Animal *belongs to some* stone.	*PaS* *PiS*	F F	? Animal *belongs to no* horse. ? Animal *does not belong to some* horse.	*PeS* *PoS*	F F

In these cases the premises are all true sentences and the respective conclusions are false sentences. Here, then, are counterarguments for the arguments provided by Aristotle, which may serve as modern counterparts to Aristotle's ancient method. It is apparent that Aristotle does *not* use this method in *A4-6*.

It is evident, then, that Aristotle's focus in *Prior Analytics A4-7* is on the formal matters of logic, in particular, on determining which argument patterns have all valid instances and just as surely on determining which argument patterns have all invalid instances. He makes there determinations without special reference to semantic matters, or, that is, by assuming the semantic unambiguity of terms substituted for his schematic letters so as not to alter an argument's logical pattern. The result of his logical investigations, then, enables him to determine the validity or invalidity of a given 'syllogistic' argument *by virtue of its form alone*. He has identified all the argument patterns whose instances, in the case of valid arguments, have conclusions which follow logically from premises. Aristotle's accomplishment to establish the epistemic value of these formal results should not be underplayed.

5.0. Fallacious argumentation in Sophistical Refutations.

In *Sophistical Refutations* Aristotle treats sophistic and eristic argumentation. He refers to this kind of reasoning as producing *phainomenoi sullogismoi* or apparent *sullogismoi*. These are arguments that *appear* to be *sullogismoi* and refutations (*elenchoi*) but which are really instances of faulty reasoning. Aristotle has a somewhat broad notion of a sophistical argument: "by a sophistical refutation and *sullogismos* I mean not only a *sullogismos* or refutation which appears to be valid but is not, but also one which, though it is valid, only appears to be appropriate to the thing in question" (*SR8*). Below we only treat those fallacies which appear to produce a refutation and not those arguments that are valid but which draw an irrelevant conclusion, such as the fallacy of treating as cause what is not cause (*SR5*, *29*).14

At the outset of *Sophistical Refutations* Aristotle identifies a pervasive source of error that serves as a theme throughout the treatise. He attributes most mistakes in reasoning to a person's *inexperience* with the formal matters of argumentation, with the semantic matters of language, and with having insufficient information. He writes:

> Both *sullogismos* and *elenchos* are sometimes genuine and sometimes not, though inexperience may make them appear so-for inexperienced people obtain only, as it were, a distant view of these things. For a *sullogismos* rests on certain statements such that they involve necessarily the assertion of something other than what has been stated, through what has been stated; an *elenchos* is a *sullogismos* to the contradictory of the given conclusion. Now some of them do not really achieve this, though they seem to do so for a number of reasons; and of these the most prolific and usual is the argument that turns upon names. It is impossible in a discussion to bring in the actual things discussed: we use their names as symbols instead of them; and we suppose that what follows in the names, follows in the things as well-For names are finite and so is the sum-total of accounts, while things are infinite in number. Inevitably, then, the same account and a single name signify several things. In the same way in arguments too those who are not well acquainted with the force of names misreason both in their own discussions and when they listen to others. (*SR1*: 164b25-165a17; cf. *SR33*)15

Aristotle alerts his readers, both those who intend to engage publicly in disputation and those wishing privately to improve their own reasoning, to two matters. On the one hand, there are the formal matters of argumentation and, on the other hand, there is the matter of the content, the 'what' that is treated in an argumentation. Aristotle asks for precision in both matters. In this connection, we cite at length Aristotle's synopsis at *SR7* on the causes of error in respect of each genus of fallacy, namely, the six that depend upon the language used and the seven independent of the language used. Both sources of error indicate his attention to semantic matters in relation to an underlying logical syntax.

> The error comes about in the case of arguments that depend on *equivocation* and [*ambiguity*] because we are unable to distinguish the various senses (for some terms it is not easy to distinguish, e.g. one, being, and sameness), while in those that depend on *combination* and *division*, it is because we suppose that it makes no difference whether the phrase is combined or divided, as is indeed the case with most phrases. Likewise also with those that depend on *accent*-With those that depend on the *form* it is because of the likeness of expression. For it is hard to distinguish what kind of things are signified by the same and what by different kinds of expression (for a man who can do this is practically next door to the understanding of the truth, and knows best how to assent) because we suppose every predicate of anything to be an individual thing, and we understand it as being one thing; for it is to that which is one and to substances that individuality and being seem especially to belong.-With those fallacies that depend on *accident*, error comes about because we cannot distinguish what is the same and what is different, what is one and what many, or what kinds of predicate have all the same accidents as their subject. Likewise also with those that depend on the *consequent*; for the consequent is a branch of accident. Moreover, in many cases it seems and it is claimed that if this is

inseparable from that, so also is that from this. With those that depend upon *deficiency in the account of a refutation*, and with those that depend upon the difference between a *qualified and an unqualified statement*, error consists in the smallness of the difference involved; for we treat the limitation to the particular thing or respect or manner or time as adding nothing to the meaning, and so grant a statement universally. Likewise also in the case of those that *assume the original point*, and those of *false cause*, and all that treat a *number of questions* as one; for in all of them the error lies in the smallness of the difference; for our failure to be quite precise in our definition of propositions and of *sullogismoi* is due to the aforesaid reason. (169a22-169b17; emphases added)

Lack of precision, relative to a particular person in respect of an inability to distinguish various senses of words and expressions or a failure to distinguish what is the same and what is different, points to a person's inexperience with linguistic usage and meaning and with scientific and philosophical understanding, and, we may add, with ignorance of what a *sullogismos* is. Aristotle in *Sophistical Refutations* also draws attention to a person's inexperience not only with public disputation, for example, by not having secured a statement that has a single meaning, but only one that appears to have (see, e.g. *SR10* on not distinguishing the word from the thought or the thing signified), but also with other semantic and formal matters of argumentation, for example, not recognizing that the conclusion may follow not in fact but only verbally (*SR8*). In this latter respect also consider his reducing all thirteen fallacies to *ignoratio elenchi* or ignorance of what a *sullogismos* is. Moreover, a passage at *SR6* reminds of us of what Aristotle writes in *De Interpretatione* and *Prior Analytics* on propositions. He writes:

> Those fallacies that depend upon the making of several questions into one consist in our failure to articulate the account of a proposition. For a proposition predicates a single thing of a single thing. For the same definition applies to one single thing only and to the thing without qualification, e.g. to man and to one single man only; and likewise also in other cases. If, then, a single proposition is one which claims a single thing of a single thing, a proposition, without qualification, will be the putting of a question of that kind. Now since a *sullogismos* starts from propositions and a refutation is a *sullogismos*, a refutation, too, will start from propositions. (169a6-14)

Surely, knowledge of 'formal' logic is crucial for reasoning well, whether in constructing an argumentation or in defending oneself from refutation. In particular, attention must be directed to how terms of different semantic categories determine different underlying logical forms.

Below we show that Aristotle's use of '*sullogismos*' in *Sophistical Refutations* denotes an argument that fits a panvalid argument pattern as treated in *Prior Analytics* and that '*phainomenos sullogismos*' denotes an argument that *appears* to fit such a pattern. However, such an argument really fits another pattern, for example, one with four terms as in a case of equivocation, which is not a *sullogismos* at all. A sophistical refutation or *phainomenos sullogismos*, as we treat it below, is an argument that appears to be a *sullogismos* but is really an invalid argument. As Aristotle remarks, such arguments need solution, whether a refutation or a proof of their invalidity.

5.1 Equivocation and ambiguity. Aristotle recognizes three varieties of equivocation and ambiguity: "[1] when either the account or the name properly signifies more than one thing ... [2] when by custom we use them so,-[3] when words that have a simple sense taken alone have more than one meaning in combination" (*SR4*). At *SR17* he addresses solving erroneous reasoning when fighting eristic persons by treating them not as refuting, but as merely appearing to refute. He writes at 175a36-175b3 (emphases added):

> For if *refutation is a non-equivocal contradiction* arrived at from certain premises, there will be no need to *draw distinctions* against ambiguity and equivocation; for they do not effect a *sullogismos.* The only motive for drawing further distinctions is that the conclusion reached looks like a refutation. What, then, we have to beware of, is not being refuted, but seeming to be, because of course the asking of ambiguities and of questions that turn upon equivocation, and all the other tricks of that kind, both conceal a genuine refutation and make it uncertain who is refuted and who is not.

His comments here are complemented by what he says at *SR17* that if people never made two questions into one question, the fallacies relating to equivocation and ambiguity would never arise, rather there would either be genuine refutation or none at all. He continues:

> Accordingly wherever it is uncertain in which of two senses the premiss proposed is usually meant- whether as maxims are (for people call both true opinions and general assertions maxims), or like 'the diagonal of a square is incommensurate with its side'; and moreover whenever opinions are divided as to the truth, we then have subjects of which it is very easy to change the terminology undetected. For because of the uncertainty in which of the two senses the premiss contains the truth, one will not be thought to be playing any trick, while because of the division of opinion, one will not be thought to be telling a falsehood; for the change will make the position irrefutable. (176b17-25)

Aristotle recognizes that a case of equivocation amounts to an argument appearing to be an instance of a given *sullogismos,* that is, of a given panvalid argument pattern. However, the argument is really an instance of another pattern, usually one having four terms and not three, and not valid. This condition is disguised by a linguistic phenomenon not immediately recognized by a participant who takes the argument to be a *sullogismos.* Thus, while the grammatical pattern makes the argument seem to conform to one of the *sullogismoi, its underlying logical pattern is different*.

We take the following example of *equivocation* from *SR4* to illustrate Aristotle's thinking and to show that underlying his thinking are the formal considerations reached in *Prior Analytics A4-7.*

> Or again, "Evils are good, for what must exist is good, and evil must exist". Here "must exist" is used in two senses; it means "what is necessary", which is often true of evils (for some evil is necessary), and we also say that good things "must [ought to] exist". (165b34-38)

This argument may be expressed more formally by using Aristotle's 'syllogistic' methods as follows (schematic letters as above, premises numbered, conclusion indicated by '?').

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprt truth value
1. Good [G] *belongs to every* that which must exist [M]. 2. That which must exist *belongs to some* evil [E]. ? Good *belongs to some* evil.	1. G*a*M	1. P*a*S	1. P*a*M	T
	2. M*i*E	2. P*i*S	2. M*i*S	T
	? G*i*E	? P*i*S	? P*i*S	F

This argument appears to fit the pattern Barbara, and thus it appears also that the conclusion follows necessarily from the premises. The **absurdity** is that, while the premises are thought to be true, the conclusion is thought to be false but nevertheless to follow logically. Taking Aristotle's comments on the equivocal use of 'must exist', we can recast the argument to make explicit its underlying logical pattern as follows, and thus we can recognize it to be an instance of a *phainomenos sullogismos* or a non-*sullogismos*, that is, an invalid argument ('*X*' and '*Z*' are also used as schematic letters).

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Good [G] *belongs to every* that which ought to exist [O].	1. G*a*O	1. *PaS*	1. *PaX*	T
2. That which is necessary [N] *belongs to some* evil [E].	2. N*i*E	2. *PiS*	2. *ZiS*	F
? Good *belongs to some* evil.	? G*i*E	? *PiS*	? *PiS*	F

Here we see that there is no middle but a fourth term. Aristotle provides three other instances of equivocation at *SR4*. Two of them follow.

> 'The same man is both seated and standing and he is both sick and in health; for it is he who stood up who is standing, and he who was recovering who is in health; but it is the seated man who stood up, and the sick man who was recovering.' For 'The sick man does so and so', or 'has so and so done to him' is not single in meaning: sometimes it means the man who is sick now, sometimes the man who was sick formerly. Of course, the man who was recovering was the sick man, who really was sick at the time; but the man who is in health is not sick at the same time: he is the sick man in the sense not that he is sick now, but that he was sick formerly.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apparnt argmnt pattern	Apprttruth value
1. Standing [T] *belongs to every* person who stood up [W].	1. T*a*W	1. *PaS*	1. *PaM*	T
2. Person who stood up *belongs to every* seated man [M].	2. W*a*M	2. *PaS*	2. *MaS*	T
? Standing *belongs to every* seated man.				

	? TaM	? *PaS*	? *PaS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Standing [T] *belongs to every* person who stood up [W]. 2. Person who stood up *belongs to every* seated man [M]. ? Standing *belongs to every* formerly seated man [F].	1. TaW 2. WaM ? TaF	1. *PaS* 2. *PaS* ? *PaS*	1. *PaM* 2. *MaX* ? *PaZ*	T T T

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprt truth value
1. Being in health [H] *belongs to every* was recovering [R]. 2. Was recovering *belongs to every* sick man [K]. ? Being in health *belongs to every* sick man.	1. HaR 2. RaK ? HaK	1. *PaS* 2. *PaS* ? *PaS*	1. *PaM* 2. *MaS* ? *PaS*	T T F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Being in health *belongs to every* was recovering. 2. Was recovering *belongs to every* sick man while ailing. ? Being in health *belongs to every* formerly sick man [F].	1. HaR 2. RaK ? HaF	1. *PaS* 2. *PaS* ? *PaS*	1. *PaM* 2. *MaX* ? *PaZ*	T T T

In these two cases the third or minor term is used equivocally to make the subject term of the conclusion a fourth term. At *SR22*, in addressing fallacies of identical form of expression, Aristotle notes that the same thing happens in these cases as happens in cases of equivocation: "for in dealing with equivocations the tyro in argument supposes that the fact and not the name which he affirmed has been denied". Aristotle cites the following argument with its solution.

'Does a man tread upon what he walks through?-But he walks through a whole day'. But the words denote not what he walks through, but when he walks.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprt truth value
1. A man's treading upon [T] *belongs to every* a man's walking through [W].	1. TaW	1. *PaS*	1. *PaM*	T
2. A man's walking through *belongs to every* whole day [D].	2. WaD	2. *PaS*	2. *MaS*	T
? A man's treading upon *belongs to every* whole day.	? TaD	? *PaS*	? *PaS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. A man's treading upon [T] *belongs to every* a man's spatially walking through [W].	1. TaW	1. *PaS*	1. *PaX*	T
2. A man's [temporally] walking through [R] *belongs to every* whole day [D].	2. RaD	2. *PaS*	2. *ZaS*	T
? A man's treading upon *belongs to every* whole day.	? TaD	? *PaS*	? *PaS*	F

Here the 'would-be' middle term is used equivocally. This argument could be remedied by addressing the equivocation in the following way, which eliminates both the appearance of a *sullogismos* and a case of an invalid argument by producing a *sullogismos*. Consider the following:

Argument: a *sullogismos* but not a refutation	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. A man's [spatially] treading upon [T] *belongs to no* a man's[temporally] walking through [W].	1. T*e*W	1. *PeS*	1. *PeM*	T
2. A man's[temporally] walking through *belongs to every* whole day [D].	2. W*a*D	2. *PaS*	2. *MaS*	T
? A man's [spatially] treading upon *belongs to no* whole day.	? T*e*D	? *PeS*	? *PeS*	T

We can now see that the above arguments really fit other logical patterns, in most cases one with four terms, and thus these arguments are not *sullogismoi* at all. In such cases Aristotle recognizes that a given word or expression may have two different meanings and thus fall into two different semantic domains/categories, or denote two different terms. Thus, while an argument with an equivocal expression has a given grammatical pattern that makes it appear to be a *sullogismos*, it really has an underlying logical pattern different than a *sullogismos*.

It is similar with *ambiguity*: while a given argument with an ambiguity has one grammatical pattern, which helps to make it appear to be a *sullogismos*, it really has two underlying logical patterns. At *SR4* Aristotle cites five cases of ambiguity, two of which are arguments: First: 'There must be sight of what one sees; one sees the pillar; ergo the pillar has sight'.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprt truth value
1. Sight [S] *belongs to every* what is seen [W].	1. S*a*W	1. *PaS*	1. *PaM*	T
2. What is seen *belongs to some* pillar [P].	2. W*i*P	2. *PiS*	2. *MiS*	T
? Sight *belongs to some* pillar.	? *SiP*	? *PiS*	? *PiS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Being seen [B] *belongs to every* what is seen [W].	1. B*a*W	1. *PaS*	1. *XaM*	T
2. What is seen *belongs to some* pillar [P].	2. W*i*P	2. *PiS*	2. *MiS*	T
? Having capacity to see [S] *belongs to some* pillar				

		? S*i*P	? *PiS*	? *ZiS*	F

This argument might also be addressed in the following way, in which case we produce a *sullogismos*.

Argument: an instance of a *sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Being seen [B] *belongs to every* what is seen [W].	1. B*a*W	1. *PaS*	1. *PaM*	T
2. What is seen *belongs to some* pillar [P].	2. W*i*P	2. *PiS*	2. *MiS*	T
? Being seen [B] *belongs to some* pillar	? B*i*P	? *PiS*	? *PiS*	T

The second argument-"What you profess to be, that you profess to be; you profess a stone to be; ergo you profess to be a stone."-is more difficult to formalize strictly and at the same time preserve the effect. Still, however, consider the following:

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprntargmnt pattern	Apprttruth value
1. Your professing that to be [B] *belongs to every* your professing something to be [E].	1. B*a*E	1. *PaS*	1. *PaM*	T
2. Your professing something to be *belongs to some* stone [S].	2. E*i*S	2. *PiS*	2. *MiS*	T
? Your professing that to be *belongs to some* stone.	? B*i*S	? *PiS*	? *PiS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Agmnt pattern	Truthvalue
1. Your professing that to be [B] *belongs to every* your	1. B*a*E	1. *PaS*	1. *XaM*	T

professing something to exist [E].				
2. Your professing something to exist *belongs to some* stone [S].	2. E*i*S	2. *PiS*	2. *MiS*	T
? Your professing to be that [T] *belongs to some* stone.	? T*i*S	? *PiS*	? *ZiS*	F

The other meaning of this argument expresses a *sullogismos* as follows.

Argument: a *sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Agmnt pattern	Truthvalue
1. Your professing that to exist [B] *belongs to every* your professing something to exist [E].	1. B*a*E	1. *PaS*	1. *PaM*	T
2. Your professing something to exist *belongs to some* stone [S].	2. E*i*S	2. *PiS*	2. *MiS*	T
? Your professing that to exist [T] *belongs to some* stone.	? B*i*S	? *PiS*	? *PiS*	T

5.2 Combination and division. Aristotle at *SR4* treats the fact that the meanings of words in combination and in division differ; but there he does not provide examples of faulty arguments. At *SR20* he takes up solving refutations that depend on division or combination. The following is one of his argument examples (177a36-177b12).

'Was he being beaten with that with which you saw him being beaten?' and 'Did you see him being beaten with that with which he was being beaten?' This has also in it an element of ambiguity in the questions, but it really depends upon combination. -It is evident also that not all refutations depend upon ambiguity as some people say they do. The answerer, then, must divide the expression; for to see a man being beaten with my eyes is not the same as to say I saw a man being beaten with my eyes.

Formalizing this argument 'syllogistically' we have the following:

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprnt truth value
1. Being beaten with that with which I saw him being beaten	1. B*a*S	1. *PaS*	1. *PaM*	T

	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
[B] *belongs to every* that with which I saw him being beaten [S].				
2. That with which I saw him being beaten *belongs to every* my eyes [E].	2. S*a*E	2. *PaS*	2. *MaS*	T
? Being beaten with that with which I saw him being beaten *belongs to every* my eyes.	? B*a*E	? *PaS*	? *PaS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Being beaten with that with which I saw him being beaten [B] *belongs to every* that with which I saw him being beaten [S].	1. B*a*S	1. *PaS*	1. *XaM*	T
2. That with which I saw him being beaten *belongs to every* my eyes [E].	2. S*a*E	2. *PaS*	2. *MaS*	T
? Being beaten with the thing which I saw him being beaten [T] *belongs to every* my eyes.	? T*a*E	? *PaS*	? *ZaS*	F

5.3 Without qualification or not without qualification. Aristotle treats the fallacy of using an expression without qualification or not without qualification but with some qualification of respect, or place, or time, or relation. Of the four examples there we cite the following.

'What is, is not, if it is not a particular kind of being, e.g. if it is not a man.' For it is not the same thing not to be something and not to be without qualification: it looks as if it were, because of the closeness of the expression, i.e. because to be something is but little different from to be, and not to be something from not to be.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprnt truth value
1. Not to be something [N] *belongs to every* man [M].	1. N*a*M	1. *PaS*	1. *PaM*	T
2. Man *belongs to some* what is[W].	2. M*i*W	2. *PiS*	2. *MiS*	T
? Not to be something *belongs to some* what is.	? N*i*W	? *PiS*	? *PiS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Not to be something (unqualified) [N]*belongs to every* man [M].	1. N*a*M	1. *PaS*	1. *XaM*	F
2. Man *belongs to some* what is [W].	2. M*i*W	2. *PiS*	2. *MiS*	T
? Not to be something else in particular (qualified) [E] *belongs to some* what is.	? E*i*W	? *PiS*	? *ZiS*	T

Now the absurdity is resolved because the underlying logical pattern has been made evident. At *SR25* Aristotle provides other examples relating to solving those fallacies without qualification or not without qualification. Consider the following two.

'Is health, or wealth, a good thing?-But to the fool who does not use it a LEFT it is not a good thing; therefore it is both good and not good'.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprntargmnt pattern	Apprt truth value
1. Good [G]] *belongs to every* wealth [W].	1. G*a*W	1. *PaS*	1. *PaM*	T
2. Wealth *belongs to some* bad thing [B].	2. *WiB*	2. *PiS*	2. *MiS*	T
? Good *belongs to some* bad thing.	? G*i*B	? *PiS*	? *PiS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Good [G]] *belongs to every* wealth (unqualified) [W].	1. G*a*W	1. *PaS*	1. *PaX*	T
2. Wealth (qualified) [F] *belongs to some* bad thing [B].	2. F*i*B	2. *PiS*	2. *ZiS*	T
? Good *belongs to some* bad thing.				

			? GiB	? PiS	? PiS	F

'Is that which the prudent man would not wish, an evil?-But he would not wish to lose the good; therefore the good is an evil'. But it is not the same thing to say that the good is an evil and to lose the good is an evil. Similarly with the argument of the thief: for it is not the case that if the thief is an evil thing, acquiring things is also evil; what he wishes, therefore, is not what is evil but what is good; for to acquire is good.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Apprnt argmnt pattern	Apprttruth value
1. Evil [E] *belongs to every* what the thief wishes [T].	1. E*a*T	1. *PaS*	1. *PaM*	T
2. What the thief wishes *belongs to every* acquiring things [A].				
	2. T*a*A	2. *PaS*	2. *MaS*	T
? Evil *belongs to every* acquiring things.				
	? E*a*A	? *PaS*	? *PaS*	F

Argument: non-*sullogismos*	Argmnt: abbrev term constants	Sentence patterns	Argmnt pattern	Truth value
1. Evil [E] *belongs to every* what the thief wishes (unqualified, viz. stealing) [T].	1. E*a*T	1. *PaS*	1. PaX	T
2. What the thief wishes (qualified) [Q] *belongs to every* acquiring things [A].	2. Q*a*A	2. *PaS*	2. ZaS	F
? Evil *belongs to every* acquiring things.	? E*a*A	? *PaS*	? PaS	F

Aristotle remarks in general on the causes of this fallacy at *SR5*. An occurrence of this fallacy depends upon whether an expression is used without qualification or in a certain respect and not strictly, that is, when an expression is used in a particular sense but is taken without qualification.

5.3 Consequent. At SR5 Aristotle explicitly attributes the causes of the refutation which depends upon the consequent to a person's supposing that the relation of consequence is convertible: "For whatever, if this is the case, that necessarily is the case, they then suppose also that if the latter is the case, the former necessarily is the case". Mentioning that this also happens in syllogistic reasoning, he cites Melissus' argument at *SR5* (interestingly, Aristotle remarks on this argument at three places: *SR5*, *6*, and *28*).

Melissus' argument that the universe is infinite, assumes that the universe has not come to be (for from what is not nothing could possibly come to be) and that what has come to be has done so from a first beginning. If, therefore, the universe has not come to be, it has no first beginning, and is therefore infinite. But this does not necessarily follow; for if what has come to be always has a first beginning, it does not follow that what has a first beginning has come to be; any more than it follows that if a man in a fever is hot, a man who is hot must be in a fever. (167b13-20)

We may rewrite this argumentation formally as a deduction as follows.

Argument: *phainomenos-sullogismos*	Argmnt: abbrev term constants	Explanation	Truth value
1.No beginning [N] *belongs to every* ungenerated [U].	1. N*a*U.	1. Premise	T
2.Infinite [I] *belongs to every* ungenerated.	2. I*a*U.	2. Premise	T
3.No beginning *belongs to every* universe [W].	3. N*a*W.	3. Premise	T
? Infinite *belongs to every* universe.	? I*a*W.	? Conclusion	
4.Ungenerated *belongs to every* no beginning.	4. U*a*N.	4. 1 *a*-conversion	T
5.No beginning *belongs to every* universe.	5. N*a*W.	5. 3 repetition	T
6.Ungenerated *belongs to every* universe	6. U*a*W.	6. 4,5 Barbara	T
7.Infinite *belongs to every* ungenerated.	7. I*a*U.	7. 2 repetition	T
8.Ungenerated *belongs to every* universe.	8. U*a*W.	8. 6 repetition	T
9.Infinite *belongs to every* universe.	9. I*a*W.	9. 7,8 Barbara	T

Here we can see that the fault of this apparent deduction is to convert at step 4an *a*-sentence, which does not admit of simple (but of *per accidens*) conversion. We can compare the mistake here and Aristotle's example of the 'man with a fever' to his instruction at *Prior Analytics A2* where he treats conversion.

6. Concluding remarks. We have reviewed Aristotle's metalogical accomplishments at *Prior Analytics A4-7* and seen that he consciously worked with 'syllogistic' argument patterns and that he recognized these patterns to be abstract or formal objects, that is, to be relatively uninterpreted objects. In this respect, then, we can appreciate Aristotle to distinguish a given argument's underlying logical syntax both from its subject matter and its semantics. While it is doubtful that Aristotle held a modern theory of language, it is nevertheless evident that he recognized different argument patterns to *underlie* sentences in arguments involving, for example, ambiguity and equivocation. In just this connection, we can appreciate his logical acumen in recognizing that linguistic expressions (words and phrases) have different meanings; accordingly, the same expression might fall into different semantic domains and thus represent different terms. As we have seen, using Aristotle's 'artificial' categorical syllogistic syntax, ambiguous or equivocal terms disguise different logical relations. Repeatedly Aristotle alerts his readers to the necessity for drawing distinctions. It is this recognition, we believe, that prompted his referring to the faulty reasonings treated in *Sophistical Refutations* as *phainomenoi sullogismoi*, that is, as arguments that appear to fit given *sullogismoi-*given panvalid elemental argument patterns-but which in truth have different underlying logical syntaxes. Indeed, the lessons in *Sophistical Refutations* that we have reviewed are the more intelligible if one understands Aristotle to have worked with a clear notion of an argument's pattern into which fit, for example, ambiguous expressions that give the appearance of correct reasoning. He may even, we suggest, have presupposed in *Sophistical Refutations* the metalogical findings of his logical investigations in *Prior Analytics*, notwithstanding the generally accepted order of his having written these treatises. We may recall what Aristotle says at *SR11*, that "he is a dialectician who examines by the help of a theory of *sullogismos* [deduction]", to indicate his attention to the formal matters of reasoning, which are properly treated as subject matter for the science of logic.

Notes

1. Aristotle defines *sullogismos* at: *Prior Analytics* 24b18-20, *Topics* 100a25-27, *Sophistical Refutations* 164b27-165a2, and *Rhetoric* 1356b16-18. This statement is from *Prior Analytics*. We transliterate '*sullogismos*' rather than translate by "deduction" or even "syllogism" to help objectify its meaning; cf. J. Gasser 1991.

2. J. N. Keynes, for example, typical of the traditionalist interpretation, cites six of the syllogism (1906: 287-291; cf. R. M. Eaton 1959: 95-100). It is interesting to note that, while traditionalists are concerned with correct reasoning in their treatment of syllogisms, they do not understand Aristotle to work with a natural deduction system and they entirely miss Aristotle's concern with the epistemic *process* of deduction.

3. Corcoran's terminology, with its refined determinations, is especially useful for making sense of Aristotle's logical investigations. Moreover, beyond their applicability to studies of Aristotle's logic, they are an important contribution toward improving the intelligibility of discourse on logic and refining matters of logic.

4. This is evident from the nature of his logical investigations themselves and from how Aristotle understands the relationship of the two *Analytics*. Cf. Aristotle's discussion on the relatively topic neutral character of the common notions related to treating quantities at *Metaphysics* 1061b20-21. Consider also in *Prior Analytics A1* where he remarks that demonstrative and dialectical argumentation equally syllogize (*sullogizesthai*) and in *Sophistical Refutations* that didactic, dialectical, examination, and contentious arguments also equally syllogize. Especially see *Sophistical Refutations 9* where he states that the dialectician is not concerned with a particular subject matter of argumentation but with what is common to every art and faculty (170a35-36).

5. With deductionists, then, we take Aristotle to have genuine proof-theoretic interests. On Aristotle's having proof-

theoretic interests, see R. Smith 1984: 594-596, 1986: 55-61, and 1991: 48-50. J. Corcoran (1974, 1994) and R. Smith (1989) have generally made Aristotle's case in this respect.

6. J. Corcoran (1974: 100) has called these "metalinguistic variables"; cf. R. Smith (1984: 590, 595) who refers to them as "syntactic variables for terms". We believe that Aristotle takes his letters to be schematic letters in a way similar to W. Quine's meaning (1970:12; 1982: 33, 145-146, 160-162, 289, 300-301).

7. Note that Aristotle specifically converts the derived sentence patterns in Camestres and Disamis to preserve this syntax.

8. We use, with some modifications, R. Smith's translation of *Prior Analytics* (1989) to cite Aristotle's text in translation.

9. The traditional names of the *sullogismoi* are: First figure-Barbara, Celarent, Darii, Ferio; second figure-Cesare, Camestres, Festino, Baroco; third figure-Darapti, Felapton, Disamis, Datisi, Bocardo, Ferison.

10. Modern logicians refer to the *validity* of an argument. Thus, a given sentence follows logically from other given sentences if it is implied by the other sentences, or if it is a logical consequence of the other sentences, or if all the information in the given sentence is contained in the other sentences, or if there exists no counterargument. An argument is invalid if one or none of the validity conditions holds.

11. While the distinction between "pattern" and "form" may not make a difference to Aristotle studies, it is very important for clearing up some confusion about establishing invalidity. We follow John Corcoran (1993: xxxi-xxxvii) in distinguishing *form* from *pattern* as follows. While a given sentence *has* only one logical form, it may *fit* a number of patterns. An argument, likewise, has only one form but may fit a number of patterns. The difference "pattern" and "form" is important especially for determining a given argument to be invalid by the method of counterargument. Every argument, for example, whatever its number of premises, fits the argument pattern 'premise-set-conclusion' (schematically '*P-c*'), but obviously not every argument has the same logical form. While two arguments in the same logical form are either both valid or both invalid, some arguments in a given pattern may be valid while others are invalid. See also above section 3.1.

12. The method of contrasted instances works for almost all premise-pair patterns, noticeably failing in some instances when the minor premise is a particular, and usually a privative, sentence.

13. Take, for example, the sentence expressing the Barbara and Celarent rules at *A4*, 25b32-35 (cf. 25b37-39 [Darii], 25b40-26a2 [Ferio]). 'Barbara' is used both to denote the rule and to name the argument pattern.

14. We also do not consider fallacies based upon accent (*SR4, 21*), accident (*SR5, 24*), *ignoratio elenchi* (*SR5, 6, 26*), assuming the point (*SR5, 27*) and making several questions into one (*SR5, 30*) for similar reasons.

15. We use, with some modifications, W. A. Pickard-Cambridge's translation of *Sophistical Refutations* (1928) to cite Aristotle's text.

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