CRITICAL STUDY

THE CONTEMPORARY RELEVANCE OF ANCIENT LOGICAL THEORY

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This interesting and imaginative monograph is derived from Lear's doctoral thesis supervised by Saul Kripke. It is influenced by the work of Timothy Smiley, to whom it is dedicated. It is a treatise both on philosophy of logic and on Aristotle's logical system. Core issues in the philosophy of logic are presented by relating them to Aristotle's system and to controversies concerning interpretation of the *Analytics*. No project of this sort has been undertaken before, but the degree of success achieved makes it clear that further contributions can be made by continuing the pattern here set forth.

Although non-specialists can gain much from this work, it bears the stamp of its origin as a doctoral thesis and thus presupposes considerable acquaintance with mathematical and philosophical logic.

Lear shares with mathematically informed logicians the view that very simple logical systems can be used to gain insight into the nature of logic because such systems exemplify the key notions (consequence, deducibility, satisfiability, consistency, truth, proof, etc.) without mathematical and philosophical entanglements. C. I. Lewis, Łukasiewicz, Tarski, Church, Parry, and most others until quite recently have used propositional logic as "the" simple paradigm system, while fully recognising its inherent inadequacies. Logicians rarely *use* a logical system to carry out actual proof but rather they take the systems themselves as objects of study to exemplify various theoretical points (Lear, ix and 13). (Numbers in parentheses henceforth are page numbers in Lear's book).

In addition Lear shares with historically informed logicians the view that Aristotle has much to contribute to perennial (and therefore also contemporary) issues in philosophy of logic. It is no accident that Boole, Whitehead, Łukasiewicz, Beth, Geach, Mates, Smiley and others have studied Aristotle's logic. But Lear is the first to combine these two viewpoints. Indeed, such a combination was scarcely conceivable before the most recent decade.

I. BACKGROUND AND CENTRAL THESIS

Before the 1970s it had not been recognised that Aristotle's *Prior Analytics* contained a logical theory involving a well-developed logical system (in the modern sense) which is *at once* self-contained (not presupposing a prior underlying logic) *and* comparable with standard systems of propositional logic in simplicity, precision, correctness, and comprehensiveness. Until the early 1930s, at least, Aristotle's logic was taken to be largely exhausted by his classification of the 256 two-premise "categorical forms" into valid and invalid. Thus, except for a few points regarded as side issues, Aristotle's logic was, in effect, thought to be codifiable by the "rules of syllogism". This attitude persists to some extent even today, cf. Lemmon [1965: 172]. Modern writers tended to look upon Aristotle's logic with jaundiced eyes, finding fault wherever possible and emphasising differences between what they took to be Aristotle's logic and what they took to be modern logic.

Aristotelian existential import was criticised without notice being taken that virtually the same principles apply in modern many-sorted logics (and indeed are mirrored in the first-order principle that $\forall xPx$ implies $\exists xPx$). Likewise, Aristotle was criticised for failing to give systematic treatment of arguments involving relations, without notice being taken that Aristotle may have been consciously restricting himself to a special case in the same way that Archimedes' study of buoyancy was a special case of mechanics (cf. 13). Until just recently one had to provide an argument for the modest observation that a genuinely Aristotelian syllogism could have an arbitrarily large premise set when in fact there are numerous discussions in the *Analytics* which make this obvious. Lear's second chapter deals with Aristotle's discussion of the possibility of an infinite syllogism (see also 11, 16-17 and Corcoran 1974b: 90).

Dissemination of the idea that Aristotle had a *system* at all stems from the monumental *Aristotle's Syllogistic* of Łukasiewicz published in 1951. The basic ideas had been presented in 1928 and 1929 and published in Polish [Łukasiewicz, 1929]. Remarkably similar work, carried out with a thoroughness beyond that of Łukasiewicz [1929], was done by J. W. Miller in the 1930s and published as *The Structure of Aristotelian Logic*. Miller's excellent work had nothing near the influence of the Łukasiewicz work, although it *is* true that Strawson bases his understanding of the formal structure of traditional logic on Miller [Strawson 1952: 152].

It is ironic in retrospect that neither Miller nor Łukasiewicz actually claim to articulate a logical system originally presented by Aristotle. Neither attempts to use the exact primitive terms, propositions and rules used by Aristotle nor do they attempt to reconstruct the logical structure of Aristotle's own deductions [Miller 1938: 30; Łukasiewicz 1951: 88; and Corcoran 1972: 698, 699]. Moreover, Miller (14) claims only to carry ". . . to its completion an undertaking which Aristotle himself began" and Łukasiewicz [1929: 106 and 1951: 47-51] claims that the actual Aristotelian system presupposes, but does *not* explicitly include, both the propositional logic and a bit of the logic of free variables (or suppressed universal quantifiers).

Dissonance between the Łukasiewicz view and the text of the *Analytics* did not go unnoticed in the intervening years. J. L. Austin in his review pointed out difficulties [Austin 1952] as did W. T. Parry and his students [see, e.g., Iverson 1964]. Nevertheless, the Łukasiewicz view dominated the field for the next twenty years, being adopted *in toto* by respected logicians [e.g., Mates 1964] and *in spiritu*, with minor variations, by others [e.g., Patzig 1968].

It was not until the early 1970s that Smiley and Corcoran, working independently, discovered the system presented by Lear (ch. 1, esp. pp. 2-3) as the Aristotelian system. As one logician put it, "to get the Smiley-Corcoran system from the Łukasiewicz system you simply replace all of the variables with constants and throw away the propositional logic." This is, of course, not precise. The language of the new system is a syntactic analogue of the class of categorical propositions, i.e., the set of sentences of the four types, *Aab*, *Eab*, *Iab*, *Oab* where *a* and *b* are "term constants". The semantic interpretations are simply assignments of non-empty sets to the term constants. "Truth in an interpretation" is defined in the obvious way (Lear, x). The deductions are the direct and indirect deductions constructed by using the four perfect syllogisms and the three conversions as rules of inference. In Corcoran [1974b] the system is described precisely. There it is referred to as System *I*, with language *L*, deductive system *D*, and semantics *S*.

Lear's book provides a demonstration that System *I* is an apt vehicle for the discussion of core issues in philosophy of logic. System *I* is apparently the first logical system and thus has independent historical importance. The argument is aided by the fact that Aristotle used System *I* as the vehicle for presentation of much of his own logical theory, the contemporary relevance of which is another part of Lear's central concern.

At this point it is worthwhile to exercise a little healthy scepticism and ask: if System *I* is so important historically and so useful in illustrating the nature of logic, then why did it take so long for modern logicians to become aware of it? This question suggests that were System *I* so philosophically revealing then it would have been discovered long before.

The answer is that philosophy of logic had been dominated by a viewpoint alien to that represented by System *I*. According to the alien view, the central concept in logic is the monadic *property* "logical truth" rather than the dyadic *relation* "logical consequence". The logical-truth viewpoint, which apparently originated with Frege and was adopted by Russell (who influenced Łukasiewicz), Lewis (who influenced Miller), Łukasiewicz, Miller, Quine and others, suggests that the true form of a logical system includes, *not* a system of *deductions* of consequences from arbitrary (and therefore sometimes false) premises, as in System *I*, but rather a system of *proofs* of logical truths based on logical axioms and rules. Given that there are no logical truths expressible as categorical sentences (or only trivial ones if *Axx* and *Ixx* are so regarded), from the logical-truth viewpoint the most natural system capable of "reconciliation" with the *Prior Analytics* is one of the Miller-Łukasiewicz sort.

However, once one shifts to the consequence viewpoint it is easy to see that a system like System *I* is implicit in the *Prior Analytics*.

Lear's book will seem confused and wrong to those who still subscribe to the logical-truth viewpoint. For example, he writes,

> Frege's formalization of logic as an axiomatized system with a minimum number of rules of inference (*sic*) and a relatively large number of axioms, taken to be logical truths, has deeply coloured the vision of logic held by philosophers and logicians in this century. Twentieth century interpreters of Aristotelian logic are not out of Frege's shadow: an extreme example is Łukasiewicz's formalization of the syllogistic as an axiomatic system — and the temptation to assimilate all common principles to Fregean logical truths must be resisted.

As another example of a logician whose vision of logic is coloured by Fregean ideas, Lear tacitly uses Quine. (See, e.g., Quine's *Philosophy of Logic* [1970] where logic is defined as "the systematic study of logical truth".) On p. ix, Lear quotes Quine's famous remark (tracing the origin of logic to antiquity but its greatness to Frege) only to contradict it.

It would be important, however, to establish that Aristotle subscribed to the consequence viewpoint and that this viewpoint is correct. Lear has contributed in almost every chapter to these goals.

II. Validity and Invalidity

From now on more precision is appropriate. An *argument* is a two-part system composed of a set of propositions, called its *premises* and a single proposition called its *conclusion*. If the conclusion is a *logical consequence* of the premises then the argument is *valid*, and otherwise *invalid*. It is assumed that each argument is valid or invalid in itself without regard to whether anyone believes or knows which, that logical activity consists (in part) of the human processes of determining, given an argument, whether it is valid or invalid, and that logic, the discipline, is concerned (in part) with methods for determining validity and determining invalidity.

Some valid arguments, mostly having only one or two premises, are *obviously* valid in the sense that each of them can be seen to be so without considering any other arguments already known to be valid. For example, from 'Socrates is a human' and 'Socrates is not a logician' it obviously follows that not every human is a logician. Of course, most valid arguments are not obviously valid. But in *some* of these cases the validity can be seen by chaining together obviously valid arguments.

Just because a certain valid argument is not obvious it does not *follow* that its validity can be seen by considering other valid arguments. (If an electron cannot be seen without glasses it does not follow that it can be seen with glasses.) To give a more sophisticated example, just because a certain true arithmetic proposition cannot be seen to be true without a proof it does not follow that it can be seen to be true with a proof; perhaps it cannot be seen to be true at all.

The procedure for establishing validity contains a familiar "*Kernel+ Process*" structure. There is a *Kernel* of valid arguments whose validity is seen *ab initio* and there is a *Process* which produces knowledge of validity from knowledge of validity.

If the premises are known to be true and the conclusion is known to be false *then* the argument can be known to be invalid. But this method applies to a very limited class of arguments. Some of the other invalid arguments are known to be invalid through a process involving arguments already known to be invalid. For example, Aristotle seems to establish that 'some pleasure is not good' does not follow from 'some good is not pleasure' (even though both are true) by observing that 'some man is not an animal' (false) does not follow from 'some animal is not a man' (true). Thus, the procedure of establishment of invalidity *also* contains a familiar "*Kernel+Process*" structure. There is a *Kernel* of invalid arguments whose invalidity is established *ab initio* and there is a *Process* which produces knowledge of invalidity from knowledge of invalidity.

Throughout the book, especially in Chs. 1 and 4, Lear agrees with the substance of the above and takes Aristotle to agree with it as well.

III. Validity and Deduction

A person (correctly) *inferring* a conclusion from premises is engaged in the process of *deducing* by which he gains knowledge that a conclusion follows from premises. (The verb 'to infer' is used in such a way that incorrect inference is not inference at all. In certain contexts, 'to deduce' and 'to infer' are interchangeable but sometimes one is used for constituent steps of the other, either way.) A chain of reasoning (including the endpoints) is often called a *deduction* of the conclusion from the premises and it is by means of a deduction that one comes to see (for oneself) or to show (to another) that the argument is valid (cf. 10). A deduction is often also called an argument but there should be no confusion because the deduction includes a chain of reasoning over and above the premises and the conclusion and it is by means of a deduction that one comes to see that the (included) argument is valid.

Every deduction contains a valid argument but no argument contains a deduction. One might be inclined to say that an obviously valid argument is a trivial deduction, and perhaps no harm would be done thereby, but it would be better to keep deductions separate from valid arguments and to say in such cases that it would be *trivial to construct* a deduction.

A deduction whose premises are known to be true is a *proof* of its conclusion. Anyone who knows the premises can gain knowledge of the conclusion by following the deduction. Likewise, anyone who knows the conclusion to be false can come to know that one of the premises is false by following the deduction. According to Lear (37)

> . . . in the course of a direct deduction of . . . Q from . . . X, it does not matter . . . whether or not the premises . . . are actually being asserted. Only after the deduction is completed do we need to consider whether we have actually proved Q or simply deduced Q from X.

Every proof is a deduction but not every deduction is a proof.

Lear seems to agree with the above ideas throughout his book and to take Aristotle to agree with them. To some extent he even goes along with the terminology. Aristotle is quoted on p. 1: "Every proof is a syllogism but not every syllogism is a proof". On p. 10, Lear says: "A proof, for Aristotle, is a syllogism, which enables one, simply by grasping it, to gain knowledge of the conclusion. . . . The premises of a proof must be . . . known." Further on: ". . . a syllogism should thus be thought of as a deduction . . .". What emerges is that *the class of syllogisms includes the valid arguments and the* (*correct*) *deductions*. The imperfect syllogisms are the valid arguments that are not obviously valid. "A syllogism is *imperfect* if it needs additional propositions set out, which are necessary consequences of the premises, in order *to make it evident* that the conclusion follows from the premises . . ." (5, italics added). The *perfect syllogisms* include the valid arguments that are obviously valid *and* the deductions; in both cases we have syllogisms to which nothing need be added to make evident the fact that the conclusion follows from the premises. Imperfect syllogisms are made perfect (or are perfected) by chaining together (simple) perfect syllogisms. Thus Aristotle's process of *perfecting* imperfect syllogisms is identified with our process of *deducing*.

Despite the fact that these ideas can be attributed to Lear by judicious intermixture of his words with one's own, it is by no means clear what Lear is really saying. He has not taken the trouble to establish his own terminology. He never defines argument. Sometimes he expresses the notion by 'inference'. Sometimes "deductions" include valid arguments. Sometimes "proofs" are proofs and sometimes "proofs" are deductions.

Important points Lear makes seem to get out of focus. He takes deductions to have genuine and essential epistemic status: a deduction makes *evident* that the conclusion follows from the premises (4, 5). It follows then that a deduction cannot be reduced to a mere string of uninterpreted symbols (2). But on the same page he writes as if what is lost in abstracting from the meanings of the lines in a deduction is merely semantic rather than semantic and epistemic.

There is another confusion which pervades the book although it by no means vitiates the work as a whole. Consider the following passage:

> A syllogism is *imperfect* if it needs additional propositions set out, which are necessary consequences of the premises, in order to make it evident that the conclusion follows from the premises . . . . Patzig

> has noted that this definition presupposes that all imperfect syllogisms can be perfected. Aristotle does not admit a category of unobvious syllogisms *per se*; syllogisms are divided exhaustively into those that are obvious and those that can be made obvious. (5)

The definition does *not* presuppose that all imperfect syllogisms can be perfected. This is the fallacy of thinking that because an argument can *not* be seen to be valid without considering other arguments it follows that the argument *can* be seen to be valid by such consideration. Aristotle might have thought that the definition carried this presupposition but if he did then *he* was making a mistake, in fact the mistake of incorrectly inferring the *completeness* of his own system of deductions from a mere definition. It requires intricate argumentation to establish that every valid argument is deducible. But Lear attributes this incorrect inference to Aristotle without criticism. The third sentence quoted above suggests that Lear himself makes the same inference. Further evidence for this is his statement on p. 10: "Any imperfect syllogism already has a structure such that it is possible to interpolate deductive steps designed to make evident that the conclusion is a consequence of the premises."

IV. Invalidity and Counter-instances

Ch. 4, "Invalid Inferences", is ostensibly about how to determine that a given "invalid inference" is not valid. But given the ambiguity of Lear's use of 'inference' one must distinguish two questions here. First, if an inference is a *concrete* argument composed of *actual* propositions or interpreted sentences then the question is how to determine of a given invalid argument that its conclusion does not "follow of necessity" from its premises. This question broadly taken is *not* trivial, although it does have trivial special cases. Let p be the true proposition that every human is an animal and let q be the false proposition that every animal is a human. Since having all true premises and a false conclusion is a sufficient condition for invalidity one can easily determine that p does not imply q. But complications arise, e.g., in connection with the converse argument which has a false premise and a true conclusion. Determining that q does not imply p *is* determining that it is logically possible that every animal is human but some human is not an animal. That is, we must determine the *logical possibility of the truth* of a proposition which is actually false.

Secondly, if an inference is an argument *form* then the question is how to determine of a given form that it is invalid. This question broadly taken *is* trivial, although it does have non-trivial special cases. To determine the invalidity of a form it is sufficient to exhibit a *counter-instance*, an instance having true premises and false conclusion. Lear never does define invalid form. He does make it clear (57) both that having a concrete counter-instance is sufficient for a form to be invalid and that some invalid forms have some valid instances. For example, 'Every human is a human' / 'Every human is a human' is an instance of Axy/Ayx.

There is a long discussion (56-70) dealing with the commonplace observation that our belief in the truth of the premises and the falsity of the conclusion might not be genuine knowledge. On the whole, in this passage Lear shows sound judgement and good sense. But on p. 68 he deals with oppositely motivated objections and when dealing with one he slips into the fallacy which motivated the other, despite the fact that neither represents his own view. Some philosophers suspicious of *a priori* belief take observationally derived belief to be a touchstone of certainty and some philosophers suspicious of *a posteriori* beliefs take rationally derived beliefs to be a touchstone of certainty. But each is overlooking the trivial observations that may have motivated the other, *viz.*, in one case that we are apt to err in forming *a priori* beliefs (e.g., we make mistakes in calculations and deductions) and in the other that we are apt to err in forming *a posteriori* beliefs (e.g., we make errors in perception and our inductions are incomplete). Lear does recognise the fact that our determinations of invalidity of forms are not infallible. But he fails to point out that our judgements of validity are equally subject to error. For Lear the danger is misjudging a valid form to be invalid. This is especially curious because traditional logic books ignore this type of fallacy, concentrating instead on fallacies involved in misjudging invalid forms to be valid (e.g., "affirming the consequent", "denying the antecedent", etc.)

In the entire book there is no mention of how one determines the invalidity of a concrete argument except for the case where the premises are true and the conclusion false. If someone wanted to know what ground Aristotle (or anyone else) would give for claiming that 'Every animal is a human' does not imply 'Every human is an animal' he or she could not find out by reading this book.

Lear uses 'form' in the broad sense in which (1) each argument is an instance of several different forms and (2) a valid form has only valid instances but a non-valid form (called *invalid*) has an invalid instance (but not necessarily *only* such). In this sense of 'form' it is improper to speak of *the* form of a given concrete argument, although one can properly say "this argument has the form . . ." (where a name of a form follows). "Sharing a form" is a very weak equivalence relation because any two arguments having the same number of premises share a form. (3) The following two propositions are both false; every argument sharing a form with a valid argument is valid, every argument sharing a form with an invalid argument is invalid. Thus there is no way to establish validity of a given argument by showing that there is a valid argument sharing one of its forms and there is no way to establish invalidity of a given argument by showing that there is an invalid argument sharing one of its forms. In this sense of form, validity is *not* a matter of form.

But there is a narrow sense of form for which (1) each actual argument has a unique form (so we may properly speak of *the form* of an argument), (2) "sharing form" is a strong equivalence relation, and (3) the following two propositions are both true: every argument in the form of a valid argument is valid; every argument in the form of an invalid argument is invalid. In this narrow sense of form validity *is* determined by form and one can show that an argument is invalid by showing that its narrow form has a concrete instance having true premises and a false conclusion. For arguments of Aristotle's system the definition of narrow form is straightforward: two arguments are in *the same narrow form* if there is a one-one correspondence between their respective sets of terms which transforms the one argument into the other.

It is by tacit use of the narrow concept of form that we see that the argument, 'Every animal is a human' / 'Every human is an animal' is invalid. There are two important points to be made here. The first is that Lear intends to discuss the first question raised above which we have just seen to involve the narrow sense of form when in fact his actual prose focuses on the second question which involves the broad sense of form (and is trivial).

The second point is that Aristotle's method of establishing invalidity involves the narrow sense of form and not the broad sense as Lear claims. The nature of the Aristotelian method can be seen from virtually any of Aristotle's applications of it provided that one takes account of a sufficient context (e.g., see *Pr. An.* 25b30-26a10); "When three terms are so related that . . . the first term applies to all the middle and the middle to none of the last . . . no conclusion follows . . .". Aristotle is claiming, in particular, that *all* of the actual instances of *Amp*, *Esm*/*Asp* are *invalid*. And his ground is the fact that taking 'animal', 'human' and 'stone' for *p*, *m* and *s* yields an argument with actually true premises and an actually false conclusion.

It is clear then that Aristotle's invalidity determinations involve proof, *via* the narrow concept of form, from the actual truth of one proposition *p* to the logical possibility of the truth of *another q* (which may *in fact* be false). It is important to notice that this is *not* the triviality of proof from the actual truth of one proposition to the logical possibility of the truth of *the very same proposition*. But Lear characterises Aristotle's invalidity determinations as involving the principle: "Actual states of affairs are *a fortiori* possible ones" (55-6). And he dwells on the fact that there is no problem with a proof from the actuality of *p* to the logical possibility of *p*. (These are almost his exact words, p. 67).

In this discussion, Lear thinks that someone will be puzzled by the fact that such proofs produce *a posteriori* knowledge of *necessary* propositions. He responds with what appears to be the point that just because a proposition is necessary does not mean that knowledge of it must be *a priori* (68, 69). But instead of keeping with this sensible point (which has become a commonplace of contemporary philosophy) he manoeuvres himself into suggesting the opposite of his own view which is that some necessary propositions can only be known *a posteriori*. His discussion would have been clarified by noting explicitly that '*a priori*' and '*a posteriori*' are epistemic terms but that 'necessary' and 'possible' are non-epistemic.

Once Lear's usage of 'inference' is disambiguated and the narrow and broad senses of 'form' are distinguished, much of the Lear discussion proves to be sensible, non-trivial, and fascinating. But the loss for Lear is that it then becomes clear that he has a mistaken view of Aristotle's method of establishing invalidity.

V. The Aristotelian System

One of Lear's original contributions is the observation that Aristotle took "following of necessity" (logical consequence, implication, validity of arguments) as a "primitive" concept (2, 7, 8). [Cf. Corcoran 1975.] In order to take a concept as primitive it is neither necessary nor sufficient to refrain from defining it. That it is not necessary to refrain from defining it is already obvious enough, but it is to the point to mention the fact that Tarski [1936], cited by Lear, is widely regarded as a successful attempt to define (or, as Lear would put it, "capture") the primitive concept of logical consequence. That it is not sufficient simply to refrain from attempts at definition is clear from the fact that to "have" a concept is not merely to be able to utter words. Rather it is necessary to be able to make positive and negative determinations involving the concept. In more modern terms, it is necessary to be able to make correct assertions (that it holds, where it does) and to make correct denials (that it does not hold, where it does not). Assertion and denial require respectively knowing *of* a positive criterion P_1 and knowing *of* a negative criterion N_1 [Łukasiewicz 1951: 94-5]. Normally, use of a concept C_1 presupposes that P_1 is sufficient for C_1 and that N_1 is sufficient for *not*-C_1 (not-having-C_1). Some philosophers tend to identify a concept with a criterion for its use. Lear's view, which agrees with Aristotle's writings, is that Aristotle neither defined 'following of necessity' nor did he identify it with one of its criteria.

Let A_1 be the range of applicability of the concept C_1, i.e., the class of objects that C_1 applies to (positively or negatively). Once A_1, P_1 and N_1 are settled the natural question is whether P_1 and N_1 are exhaustive of A_1, in other words whether every object in A_1 exhibits P_1 or exhibits N_1. Since P_1 entails C_1 and C_1 entails *not*-N_1, it follows that P_1 entails *not*-N_1, so that no object in A_1 exhibits both.

Thus the *exclusiveness* of P_1 and N_1 is presupposed. But this, of course, does not entail exhaustiveness. Notice that since exclusiveness of P_1 and N_1 is presupposed, exhaustiveness would entail that P_1 and *not*-N_1 are coextensive relative to A_1. (Compare *Pr. An.*, II.22.)

In discussing the primitive concept C, "validity," the first thing to settle is its range of applicability A. In Ch. 1 Lear seems to be clear that validity applies to actual arguments (composed of propositions or interpreted sentences) rather than to complexes of uninterpreted strings (p. 2). It is then necessary to explain how the *word* is *used* in connection with argument forms or "patterns" (p. 4) to block the mistake of thinking that one concept has two ranges of applicability. Lear never does this. Moreover, *if* one takes validity to apply primarily to forms and derivatively to actual arguments [cf. Quine 1970] *then* one gets a different philosophy of logic from that of Aristotle.

Aristotle's logical system is taken to consist of his primitive concept C of "following of necessity" together with its range of applicability A, his positive criterion P and his negative criterion N. As far as is known to the reviewers this acceptation of the terms "Aristotle's logical system" has not previously been stated explicitly but it certainly accords not only with writings of Smiley and Corcoran but also with those of Łukasiewicz.

Without using these terms Lear is clear that Aristotle took *perfectibility* to be *the* mark P of validity (2, 3, 4, 5, 6, *et al*). The "primary" mark of validity is being a "perfect" syllogism (*and/or* being a "conversion"). The perfect syllogisms and conversions are trivially perfectible. Being perfectible using chains of perfect syllogisms and conversions is the "secondary" mark of validity.

Lear also seems to notice that there is something illegitimate or confused about asking for a justification of *this* criterial procedure (p. 2). The idea seems to be that a request for a justification of criterion P for the concept C seems to presuppose *another* independent (and established) criterion for the same concept. *If* use of the concept is manifest *only* through the criterion P then a request for justification is an improper question (involving a false presupposition). This point is discussed further below.

Lear (5, 54, *et al*) does not seem fully to realise that Aristotle took having true premises and a false conclusion to be the primary mark of invalidity and having the same (narrow) form as a "primarily invalid" argument to be the secondary mark of invalidity. *If* we say that a *counter-argument for* a given argument is an argument having true premises and false conclusion and having the same form as the given argument, *then* Aristotle's criterion for invalidity, N, *is* having a counter-argument. A primarily invalid argument is trivially a counter-argument for itself.

Lear does not notice that the impropriety of asking for a justification of a criterial procedure applies equally to the case of negative criteria. *If* the use of the concept *not-C* (not-being-valid) is manifest *only* through the criterion N, then a request for justification here is likewise an improper question. He does, however, repeatedly emphasise that *other* criteria for invalidity are in fact felt to be correct because, and only in so far as, they accord with the counter-argument criterion N (59, 61, taking 'inference' as 'actual argument').

Let A be the class of actual arguments. As mentioned above, once the criteria P and N for validity C are clear the obvious question is that of the exhaustiveness of P and N, i.e., whether every argument either is perfectible or has a counter-argument. One way to begin to deal with this question is to delimit a manageable subclass B of A and inquire whether P and N are exhaustive of B.

This is what Lear says Aristotle does with a certain class of two-premise arguments he calls "syllogistic inferences" (5 and esp. 72). Lear says twice (54, 72) that this is a test of the adequacy of the means of perfection, the procedure of the positive criterion. But it is just as much a test of the procedure of the negative criterion. "Every B which is not N is P" is logically equivalent to "Every B which is not P is N". The fact of the matter is that it is a partial test of the exhaustiveness of P and N (together): it is a test of the *system*, not a test of a component in isolation.

Moreover, *if* Lear was correct in his assertion on pp. 5 and 6 (quoted in III above) that Aristotle thought that his definition of imperfect syllogism carried the presupposition that every valid argument is either perfect in itself or perfectible by perfect syllogisms *then* the above test could have been regarded by Aristotle *only* as a test of the negative criterion.

Once a subclass of the domain has been used to test the exhaustiveness of P and N the natural next step is to expand the subclass aiming at the general result that every argument either is perfectible or else has a counter-argument. Lear is well aware that this question is the Aristotelian analogue of modern completeness questions regardless of which way it is stated. (This, of course, presupposes, in the modern context, that soundness holds.) Lear says (15), ". . . from the perspective of modern logic, the point of a completeness theorem is to establish the extensional equivalence of two distinct . . . relations". The two relations are, of course, deducibility and having no counter-interpretations. But Lear fails to see that the possibility of this *kind* of question transcends the peculiar artifacts of modern logic and can be raised in any situation involving a positive and a negative criterion. He seems to think that the possibility of raising a question of exhaustiveness (or completeness) depends on the syntactical character of deducibility and the model-theoretic character of "no counter-interpretations".

Thus Lear has two arguments why Aristotle could not have raised the question of completeness, neither of which have true premises. It seems to be clear that Aristotle *could* have raised the question. Whether he did is another matter.

In modern logic there have been tendencies to "identify" the concept of consequence with one of its criteria. For example, the so-called "strict formalists" tend to identify consequence with the positive criterion (deducibility) and the so-called "model-theorists", following Tarski [1936], tend to identify consequence with the non-holding of the negative criterion (i.e., to identify consequence with "no counter-arguments" or, in fancier terminology, "no counter-interpretations"). Without getting into the issue of whether these two identifications are correct [Corcoran 1972a: 43], it is to the point to wonder whether Aristotle made either or both. Lear seems to argue (11) that Aristotle does *not* identify "following of necessity" with perfectibility and (7, 8) he suggests that Aristotle did *not* identify "following of necessity" with not-having-a-counter-argument. However, if Lear were correct in thinking that Aristotle's definition of imperfect syllogism carried the presupposition that every valid argument is perfectible, this would have amounted to a kind of identification of validity and perfectibility.

There are many other interesting logical issues raised in this book. On the whole this is a valuable and provocative work. Despite technical flaws and inconsistencies, it makes original and worthwhile contributions to the growing understanding and appreciation of Aristotle's logical theory and it provides a new map for exploration of the *Analytics*.[1]

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REFERENCES

Austin, J. L. [1952], Review of Łukasiewicz [1951], *Mind*, 61 (1952), 395-404.

Corcoran, John [1972], "Completeness of an ancient logic", *Journal of Symbolic Logic*, 37 (1972), 696-702.

Corcoran, John [1972a], "Conceptual Structure of Classical Logic", *Philosophy and Phenomenological Research*, 33 (1972), 25-47.

Corcoran, John [1973], "A mathematical model of Aristotle's syllogistic", *Archiv für Geschichte der Philosophie*, 55 (1973), 191-219.

Corcoran, John [1974a], "Aristotelian syllogisms: valid arguments or true universalized conditionals?", *Mind*, 83 (1974), 278-81.

Corcoran, John [1974b], "Aristotle's natural deduction system" in Corcoran [1974c], 85-131.

Corcoran, John [1974c] (ed.), *Ancient Logic and Its Modern Interpretations*, Dordrecht.

Corcoran, John [1975], "Aristotle on the Underlying Logic of Sciences", *Proceedings of the Fifth International Congress of Logic*, Section xii, 11-12, London, Ontario.

Iverson, S. L. [1964], *Reduction of the Aristotelian Syllogism*, M.A. Thesis in Philosophy, SUNY/Buffalo.

Lemmon, E. J. [1965], *Beginning Logic*, London, 1965; revised editions, ed. George Berry, Indianapolis, 1978, 1980.

Łukasiewicz, Jan [1929], *Elements of Mathematical Logic*, ed. M. Presburger (mimeographed), Association of Students of Mathematics and Physics in Warsaw University, Warsaw; English translation by O. Wojtasiewicz, ed. with footnotes and bibliography by J. Słupecki, New York, 1963.

Łukasiewicz, Jan [1951], *Aristotle's Syllogistic*, second edition (enlarged), London, 1957.

Mates, B. [1964], *Elementary Logic*, New York.

Miller, J. W. [1938], *The Structure of Aristotelian Logic*, London.

Patzig, G. [1968], *Aristotle's Theory of the Syllogism* (tr. J. Barnes), Dordrecht.

Quine, W. V. [1970], *Philosophy of Logic*, Englewood Cliffs, N.J.

Smiley, Timothy [1973], "What is a syllogism?", *Journal of Philosophical Logic*, 2 (1973), 136-154.

Strawson, P. F. [1952], *Introduction to Logical Theory*, London.

Tarski, A. [1936], "On the concept of logical consequence", in Tarski [1956], 409-21.

Tarski, A. [1956], *Logic, Semantics, Metamathematics*, Oxford; revised edition: Indianapolis, forthcoming.

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