

History of Logic from Aristotle to Gödel by Raul Corazzon | e-mail: [rc@ontology.co](mailto:rc@ontology.co)

## Peripatetic Logic: Eudemus of Rhodes and Theophrastus of Eresus

### EUDEMUS OF RHODES AND THEOPHRASTUS OF ERESUS CONTRIBUTIONS ON LOGIC

“Aristotle's successor as director of the Lyceum was Theophrastus, his friend and disciple; Eudemus, another of the Stagirite's important disciples should also be mentioned. Other philosophers belonging to the Peripatetic school were: Aristoxenus, Dikaiarchos, Phantias, Straton, Duris, Chamaeleon, Lycon, Hieronymus, Ariston, Critolaus, Phormio, Sotion, Hermippus, Satyrus and others. Straton even succeeded Theophrastus as director of the Lyceum but his name and those of the other Peripatetics of Aristotle's old school should not be considered in a history of logic as they were mainly concerned with history and the natural sciences.

Theophrastus rejoiced in an enormous prestige at this time and for long afterwards. Diogenes Laertius attributes a tremendous number of works to him. Of them a significant proportion are writings on logic: *Analytica Priora* (3 books); *Analytica Posteriora* (7 books); *Analysis of Syllogisms* (1 book); *Summary of the Analytics* (1 book); *Polemic on the Theory of Euristic Arguments. On Definition* (1 book); *The First Premises* (18 books); *The Sophisms* (2 books); *On the Solution of Syllogisms* (1 book); *Topics* (2 books); *On Artless Demonstrations* (1 book); *On Negation* (1 book); *On Intellect* (1 book); *Classifications* (2 books); *On Entymemes* (1 book); *On the Appreciation of Syllogism* (1 book); *On Lies and Truth* (1 book); *Argumentations* (2 books); *Theses* (3 books); *On Definition* (2 books); *On the Data of Problems* (1 book); *On the Liar* (3 books); *Preface to the Topics* (1 book); *On Arguments proper* (1 book); *Specifications on The Texts of Syllogisms* (1 book).

Eudemus also wrote some treatises on logic, concerning which some information has come down to us; Ammonius, in his Commentary On Aristotle's Categories attributes to him a writing on The Analytics -- '*Analitika*', and another On Expressions -- *Peri lexeos*, in which he deals with the grammatical and logical functions of the sentence. The commentator David in Prolegomena to Isagoge by Porphyry also mentions these works. The latter work is also known to us from the commentaries of Galen.

Theophrastus and Eudemus were concerned with the relationship between judgements in the mechanism of the syllogism, rather than the relationship of the concepts they are made of. In other words, as Prantl remarks (*Geschichte der Logik im Abendlande*, I, p. 351), the logical function of the proposition is gradually replaced by the grammatical function.

To Theophrastus we owe the distinction made between significant judgement -- apophansis -- and premise protasis. Aristotle had used the term protasis -- premise -- but by it he had meant apophantic judgement. Theophrastus retained the term apophantic for the true and false judgements; the same judgement becomes a premise if affirmative or negative. Theophrastus' interest turned, therefore, to the grammatical form and construction of the judgement whose function in the syllogism was, in his opinion, more important than the truth or falsity of a judgement.

This and many other examples illustrate that Aristotle's disciples were no longer in quest of truth but of the syllogistic mechanism independent of truth, and therefore independent of ontology.

These were also Eudemus' concerns. He made an interesting contribution to the theory of existential sentences. Aristotle had replaced all the verbs that could occur in judgements by the copula "is" -- *esti* -- or "is not" *ouk esti*. Eudemus studied the existential sentences and demonstrated that the copula 'is' is a real term that can itself have a predicative determination. This conception, centered mainly, as we see from the examples above, on

the structure of the grammatical form of judgements, explains why their logical investigations focused on another aspect of logic in which the expression of thinking was of prime importance.” (pp. 207-208)

From: Anton Dumitriu, *History of Logic*, Tunbridge Wells: Abacus Press 1977, Vol. I.

### EUDEMUS OF RHODES (c. 350 BC - 290 BC)

"Eudemus (2nd half of 4th cent. B.C.E.), of Rhodes. A student of Aristotle, often mentioned in conjunction with Theophrastus. In a charm story in Aulus Gellius (13.5), when Aristotle was dying, he chose Theophrastus over Eudemus as his successor in the Lyceum. Eudemus apparently returned to Rhodes on Aristotle's death and founded his own school; Simplicius (*In Phys.* 923.9-15) mentions an exchange of letters between him and Theophrastus on a textual question in Aristotle *Physics*. Simplicius also (924.13) mentions a biography of Eudemus by one Damas, of whom nothing else is known.

There are ascribed to Eudemus in various places (see Wehrli) two books of *Analytics*, a *Categories*, *On Expression (Peri Lexeôs)*, *On the Angle*, *Physics*, and histories of geometry, arithmetic, and astronomy. Simplicius refers to Eudemus as "the most genuine of Aristotle's comrades" (*In Phys.* 411.15-16) and says that he "follows Aristotle in all things" (133.22). Though not entirely true, this appears not far off.

In logic, Eudemus and Theophrastus (who are always mentioned together in this connection) made various modifications to Aristotle's logic; Alexander, in his commentary on the *Prior Analytics*, cites the following (Alexander is echoed by the other commentators on most of these points): (i) Theophrastus and Eudemus devised a direct proof the convertibility of universal negative propositions (Alexander 31.4-10; contrast Ar. *APri.* 1.2, 25a14-17). (ii) They adopted the *peiores* rule in modal logic: "that the conclusion is always assimilated to the lesser and weaker of the premises" (Alexander 124.13-14; by contrast Aristotle allowed certain combinations of necessary and assertoric premises to yield necessary conclusions, as in *APri.* 1.9). (iii) They defended the convertibility of universal negative problematic propositions (Alexander 220.9-16, against Ar. *APri.* 1.17, 36b35-37a31). (iv) They also did extensive work on hypothetical syllogisms (Alexander 389.31-390.3; Philoponus *In APri.* 242.18-19, speaks of "treatises of many lines" on the subject).

Eudemus is said to have claimed in *On Expression* (Alexander *In APri.* 16.15-17, scholium in *APri.* ed. Brandis [in *Aristotelis Opera* 4] 146a24-27) that "is" in "Socrates is" is a predicate term; he may thus have been the first to have contradicted Kant's claim that existence is not a predicate. Alexander's notice of this is phrased in a way that make it appear to contradict Aristotle (at least under Alexander's interpretation of Aristotle: 15.14-22)." (p. 234)

From: *Eudemus of Rhodes* by Russell M. Dancy, in: Donald J. Zeyl (ed.), *Encyclopedia of Classical Philosophy*, London: Fitzroy Dearborn Publishers 1997.

"Those works of Eudemus of which we have any real knowledge fall into two groups: systematic and historical. The second group, containing the histories of arithmetic, geometry, astronomy and perhaps theology, is generally assumed to have been conceived as part of a greater project, initiated by Aristotle himself: a series of surveys covering all the philosophically interesting fields of knowledge, which included Theophrastus' *Physikai Doxai* and Menon's *Iatrika*, as well as those of Eudemus. They will have been compiled during Aristotle's lifetime at Athens, the only place where

Eudemus could easily have got hold of the necessary research materials. This raises the question whether, or to what extent, his reading of his sources was affected by Aristotelian preconceptions, a question which has long bedevilled our understanding of Theophrastus' historical works. But it looms less large in connection with the history of mathematics, since in most respects Aristotle's teaching was in accord with the assumptions of mainstream mathematicians, e.g., in accepting the "Euclidean" notion of space, if you will allow the anachronism. The only point on which there was a fundamental disagreement between him and any major group of mathematicians was the existence of indivisible lines, and here Eudemus adopted the Peripatetic position. Thus he agreed with Aristotle in rejecting Antiphon's attempt to square the circle as contravening a basic principle of geometry, the infinite divisibility of magnitudes.(8) In general, however, these works seem to have contained more straight reporting, and less criticism, than the *Physikai Doxai*. In particular, many of the extant fragments make a point of determining who first discovered a phenomenon or theorem, but then such observations are easier to make and more illuminating in connection with the special sciences than the history of philosophy. When we turn to Eudemus' systematic writings, the situation is more complicated. We have fairly extensive fragments of three: the *Analytika* (fr. 9-24W), the *Peri lexeos* (fr. 25-9) and the *Physika* (fr. 31-123). Like the corresponding works of Aristotle and Theophrastus, they reflect Eudemus' lectures closely (see in particular fr. 88), even if they were more than lecture notes in the ordinary sense. Yet there are differences between them which are not only due to the differences of their subject-matter. The *Physika*, of which we have by far the fullest reports, was based on a course of lectures covering the same subjects as Aristotle's *Physics* in the same order (see especially fr. 98), except that it contained nothing corresponding to Book 7 of our version. The extant fragments contain no doctrinal innovations and Eudemus' contribution seems to have been limited to changes of presentation and emphasis (more on this later). Our reports of his *Analytika* are more sporadic, but this work brought some important modifications of Aristotle's doctrine: a new method of proving the convertibility of certain kinds of proposition; the recognition of five kinds of syllogism, which Aristotle treated as variants of other moods, as independent moods of the first figure; the introduction of the *in peiorem* rule in modal syllogistic; and some advances in the theory of "hypothetical" syllogisms. If this were all we knew about the work, Eudemus would count as a considerable logician in his own right, but now comes the rub: all of these doctrines are attributed to him and Theophrastus jointly. The only major fragment ascribed to Eudemus alone (fr. 23W) contains a detailed discussion of the meanings of "hypothetical" which might have been useful for elementary students, but makes no advance in logical theory. (9)

The *Peri lexeos* shows rather more independence. Unlike the books with the same title written by Aristotle and Theophrastus (Diogenes Laërtius 5.24 = Aristoteles *Rhet.* 3; 5.47), it was not concerned with the stylistic, but the logical aspects of language. Of the four certain surviving fragments (fr. 25-8),(10) one asks in what circumstances questions count as "propositions" (*protasis*), two show Eudemus differing from Aristotle as to whether the "is," in sentences of the form "A is B," is part of the predicate or only a link between the subject-term and the predicate-term, while the fourth informs us that Eudemus gave an account of the "third man" argument similar in all essentials to the one found in Aristotle's *Peri ideon*.(11) One wonders how this came to be included in a treatise on language; perhaps the theory of Forms was brought into a discussion of meaning. While these fragments do not allow us to reconstruct the *Peri lexeos* even in outline, they are enough to indicate its subject matter. An almost pedantic concern with verbal expression and verbal distinctions can also be observed in some of the fragments of Eudemus' *Physika*, e.g., fr. 61, 83, 92, 94-6, 102.

Finally there is one series of fragments which is entirely different from all the others: half a dozen stories about animal behaviour preserved by Aelian (fr. 127-32)." (pp. 29-31, some notes omitted)

## Notes

- (8) Fr. 140W. But the sentence near the beginning of the extract printed by Wehrli (1969, 57.271.) which contains a verbal echo of Aristotle (Phys. 185a18), is the work of Simplicius; he only refers to Eudemus later, at 59.11.
- (9) The last fragment printed under this head by Wehrli (fr. 24) is also attributed to Eudemus alone, but consists of a historical note about Speusippus' views on definition which may have come from a different work.
- (10) 29W, from Galen's *De captionibus in dictione*, refers to a certain source of examples of fallacies; in the older editions, its name is given as (the book of) Eudemus, but the unique MS may read *eudumou* rather than *eudemou* and Ebbesen has printed *Euthudemou* in his edition [*Commentators and commentaries on Aristotle's Sophistici elenchi*,] (1981, 2:18; cf. 1:14-16). He cites Alcinoos *Didasc.* p. 159.39 H in support of his conjecture and further confirmation is offered by Simplicius *In Cat.* 22.11ff. This passage can no longer be safely attributed to Eudemus, and it is now doubtful whether his *Peri lexeos* included a treatment of fallacies. See Fortenbaugh in this volume.
- (11) Alexander of Aphrodisias *In Metaph.* 83.34ff. = Aristotelis *Fragmenta* pp. 125-6 Ross; 380a36 - 381a32 Gigon. Wehrli (1969) only prints a very short extract as Eudemus fr. 28.

From: Hans B. Gottschalk, "Eudemus and the Peripatos", in: István Bodnár and William W. Fortenbaugh (eds.), *Eudemus of Rhodes*, New Brunswick: Transaction Publishers 2002, pp. 25-37.

### THEOPHRASTUS OF ERESUS (371 BC - c. 287 BC)

"Theophrastus continued Aristotle's work on logic, making improvements, but also important modifications. Regarding statements, he distinguished between those that are singular and those that are particular, maintaining that the former are definite and the latter indefinite. Affirmations with a privative predicate he called *ek metatheseō*. In regard to the categorical syllogism, Theophrastus added five moods to the canonical four of the first figure. The five are those of the indirect first figure, which is equivalent to the later fourth figure. They are neither perfect nor undemonstrated and are mentioned by Aristotle only in passing. Theophrastus also held that the first mood of the third figure has two different forms. In the same figure he proposed another order of the moods based on the directness of their proofs. In modal logic, Theophrastus maintained against Aristotle that the universal negative problematic premise (that of one-sided possibility) converts just as do the assertoric universal negative and the necessary. In the case of syllogisms constructed from premises of different modalities, he held that the conclusion in every case follows the weaker premise (*peiores*-rule), while according to Aristotle it follows the major premise. In connection with the Academic search for *eide*, Theophrastus developed a special logical form, the proleptic syllogism, which cannot be reduced to a categorical syllogism. One proposition contains potentially a third term, which is made explicit in a second proposition; and the two propositions together yield a conclusion. Theophrastus also did more systematic research in hypothetical syllogistic than Aristotle, and almost certainly influenced the Stoics. But he remained an Aristotelian, concerning himself mainly with the logic of terms and not that of propositions."

From: William W. Fortenbaugh and Josip Talanga, *Theophrastus*, in: Donald J. Zeyl (ed.), *Encyclopedia of Classical Philosophy*, London: Fitzroy Dearborn Publishers 1997, pp. 552-553.

## THEOPHRASTUS ON QUANTIFICATION

Boethius reports concerning Theophrastus (*floruit* 322-388 BC), student, friend, and first successor to Aristotle as Director of the Lyceum, that "those points which Aristotle expounded in this book on the proposition, he recapitulated lightly, but those items which his teacher failed to publish, he added as a supplement, and executed indeed with a rather sharp type of analysis." (29) And on other and independent grounds there is no doubt that Theophrastus prolonged the lines of Aristotle's own later development and thus stands forth as his most authentic interpreter. It is of crucial importance for the history of traditional logic to disengage the elements of this development from the fragments of Theophrastus. Many significant advances emerge. Of them the following three seem most relevant to our present purposes.

Among the disjointed references to Theophrastus one finds for example the very significant remark that:

On the other hand Theophrastus maintains that there are certain cases of statements in which, if there is no quantitative determination of the predicate also, their respective contradictories will be true. This is the example that he gives: if we say 'Phanias possesses knowledge'; 'Phanias does not possess knowledge,' it is possible for both statements to be true simultaneously. (30)

For Phanias could indeed be an expert in musical theory, but know nothing, for example, of astronomy. If one is to avoid the possibility of simultaneously valid contradictories that such unresolved ambiguity grounds, then it is necessary to add to the term: 'knowledge,' some quantitative specification. For one does quantify differently, for example, the following statements: (1) All men are mortal, and (2) Some men are married. In such quantification revision of the present case there would result: (1) Phanias possesses all knowledge, and (2) Phanias does not possess all knowledge. Both of these latter formulations preclude the possibility of simultaneous truth.

The instance of Theophrastus is profoundly interesting. But its true significance is not cleanly and clearly disengaged from his vague but correct feeling for the problem. The focus would have been sharpened by two alterations in its formulation: (1) quantify the subject of the pertinent and illustrative sentences and (2) distinguish and divide the separate elements in the complex predicate: 'possess.' For in the present case 'knowledge' is not really the predicate. The true predicate is 'possesses' and 'knowledge' belongs in one of its two places, as one of its arguments or relata. For 'someone possesses something' comes far closer to the genuine analysis than 'someone is something-that-possesses-something'. Theophrastus is not clear. But his instinct is sound. Like most pioneers in theoretical advances, his grasp on the discovery is clumsy and heavy, even if sure and firm. And the point is of paramount importance. For the main character of difference between the conventional logic of analysis of propositions and that of modern logic is precisely this: conventional logic arbitrarily restricts its analysis to functions involving a *single* generalization (of 'S' in the 'S is P' formula), whereas the modern analysis of statements concerns itself with the further analysis of functions involving many coordinate generalizations, wherever possible and wherever logically important or relevant. The conventional expression: 'All a's are b's', is no more nor less than a function constructed on the matrix pattern: 'if anything is an a, then it is a b,' by means of *the single generalization of the subject* to the level of 'anything.' And this level is the actual upper limit and maximum ceiling of conventional analysis. Consider however such a statement as: 'Every man has a father,' which even in its grammatical formulation is doubly generalized ('every' and 'a'). Such a sentence can undergo partial analysis and resolution by conventional procedures. One may let 'a' stand for the class of men, and 'b' represent the class of 'beings-that-have-fathers,' and write accordingly: 'Everything that is an a, is also a b.' But this technique achieves an analysis of the statement only with regard to its first generalization to the level of 'any man whatever.' If one is to secure an equally valid and necessary analysis of the *doubly* general statement, there is no alternative but to proceed as follows: 'For every entity x there exists at least some one y or other, such that if x is a man, then y is the father of x' (31) This is in fact that technique of double generalization or quantification which Theophrastus glimpsed, but darkly.

Alexander (32) furthermore informs us that Theophrastus labeled 'propositions *kata prolepsin*' statements which were formed by appropriate substitution in the generalized matrix formula: 'to that whatsoever to which B universally belongs, A belongs universally also.' And Alexander

proceeds to explain that the label is etymologically derived from the fact that over and beyond the two determinate terms: 'A' and 'B,' one also employs [ a third most generalized and indeterminate element, i. e. that object whatsoever it be to which both A and B jointly apply. The sense of the passage is clear and the meaning it suggests may be expressed in the following formulation of a universal affirmative statement: 'no matter what entity one may care to mention, if it is a B, then it is also an A.' Alexander further reports that in the opinion of Theophrastus himself such statements *kata prolepsin* and those which are called categorical and are formed by appropriate substitutions in the generalized schema : 'A is B,' are logically equivalent. It would thus appear that the primitive notions of a quantification theory and of resolution of categorical assertions into formal implications are not altogether foreign to the traditional development of Aristotle's logic." (pp. 19-20)

From: Joseph T. Clark, *Conventional Logic and Modern Logic: A Prelude to Transition*, Woodstock, Maryland: Woodstock College Press, 1952.

### THEOPHRASTUS AND HYPOTHETICAL SYLLOGISMS

Boethius furthermore gives this reply to a persistent inquirer whose logical interests appear to have coincided with our own present ones: ... You frequently ask me about hypothetical syllogisms. Aristotle composed no treatise on them. Theophrastus, however, although gifted with a most versatile competence, only touches on their high points. Eudemus undertakes to impart a broader view of the subject, but goes about the execution of the project in such a way that to all appearances he reaped no harvest from the germinal ideas that he scattered about. (33) What then were these high points to which Boethius alludes? Alexander (34) reports for the record a set of rules which seem to pertain to the type of hypothetical syllogisms in question. These are the syllogisms *kata analoghian* also called 'completely hypothetical syllogisms', or again 'triply hypothetical syllogisms'. And we are instructed that Theophrastus reduced these formulae to three figures:

1. If the A proposition [to A], then the B; if the B, then the C; hence if the A, then the C.
2. If the A, then the B; if not the A, then the C; hence if not the B, then the C.
3. If the A, then the C; if the B, then not the C; hence if the A, then not the B.

These formulations are of profound logical interest. At first blush they may be hastily identified with comparable laws of the modern sentential calculus in which the alphabet symbols represent unanalyzed statements, regarded as unit block wholes. But it is more than likely that Theophrastus construes what he imparts in the familiar context of an Aristotelian logic of terms. The paradox is characteristic of pioneers. While laying the groundwork in point of fact for a primitive calculus of statements, Theophrastus apparently interprets his own advances as a prolongation into unexplored areas of the Aristotelian syllogism. But they are without doubt genuine advances."

(29) Migne, *Patrologiae Cursus Completus, Series Latina* 64; Boethius, *De Interpretatione* 12.16: ". . . quae Aristoteles Imo libro de enuntiatione tractavit, leviter ab eo transcurra sunt; quae vero magister eius tacuit, ipse subtiliore modo considerationis adiecit." I take it that one does not 'keep silent' on matters of which one is completely ignorant.

(30) Theodorus Waitz, *Aristotelis Organon Graece* (Lipsiae: 1844-1846) I. 40 ad 17b16.

(31) And in symbolic formulation:

(x) (Ey) (Mx  $\supset$  Fyx).

And on this important point see C. H. Langford in Clarence I. Lewis and C. H. Langford, *Symbolic Logic* (New York: The Century Co., 1932), pp. 286-287." (pp. 22-23)

### Notes

(32) Alexandri in *Aristotelis Analyticorum Priorum Librum Primum Commentarium* (ed. M. Wallies, Berolini: 1883) 378. 12-20 ad 49b27

(33) "J. P. Migne, *Patrologiae Cursus Completus*, Series Latina 64; Boethius, *De Syllogismo Hypothetico* 831C: ". . . de hypotheticis syllogismis saepe quaerebas, in quibus ab Aristotele nihil est conscriptum. Theophrastus vero, vir omnis doctrinae capax, rerum tantum summas exsequitur. Eudemus latiore docendi graditur viam, sed ita, ut veluti quaedam seminaria sparsisse, nullum tamen frugis videatur extulisse proventum."

(34) Alexandri in *Aristotelis Analyticorum Priorum Librum Primum Commentarium* (ed. M. Wallies, Berolini: 1883) 326.8-327.18

From: Joseph T. Clark, *Conventional Logic and Modern Logic. A Prelude to Transition*, Woodstock: Woodstock College Press 1952.

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