

## Bibliography of Ancient Logic in the Hellenistic Period

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8. ———. 1990. "Logical Form and Logical Matter." In *Logica, Mente E Persona. Studi Sulla Filosofia Antica*, edited by Alberti, Antonina, 7-119. Firenze: Leo S. Olschki Editore.
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14. Bobzien, Susanne. 2000. "Wholly Hypothetical Syllogisms." *Phronesis. A Journal for Ancient Philosophy*:87-137.  
"In antiquity we encounter a distinction of two types of hypothetical syllogisms. One type are the 'mixed hypothetical syllogisms'. The other type is the one to which the present paper is devoted. These arguments went by the name of 'wholly hypothetical syllogisms'. They were thought to make up a self-contained system of valid arguments. Their paradigm case consists of two conditionals as premisses, and a third as conclusion. Their presentation, either schematically or by example, varies in different authors. For instance, we find 'If (it is) A, (it is) B; if (it is) B, (it is) C; therefore, if (it is) A, (it is) C'. The main contentious point about these arguments is what the ancients thought their logical form was. Are A, B, C schematic letters for terms or propositions? Is 'is', where it occurs, predicative, existential, or veridical? That is, should '*A esti*' be translated as 'it is an A', 'A exists', 'As exist' or 'It is true/the case that A'? If A, B, C are term letters, and 'is' is predicative, are the conditionals quantified propositions or do they contain designators? If one cannot answer these questions, one can hardly claim to know what sort of arguments the wholly hypothetical syllogisms were. In fact, all the above-mentioned possibilities have been taken to describe them correctly. In this paper I argue that it would be mistaken to assume that in antiquity there was one prevalent understanding of the logical form of these arguments even if the ancients thought they were all talking about the same kind of argument. Rather, there was a complex development in their understanding, starting from a term-logical conception and leading to a propositional-logical one. I trace this development from Aristotle to Philoponus and set out the deductive system on which the logic of the wholly hypothetical syllogisms was grounded."
15. ———. 2000. "Why the Order of the Figures of the Hypothetical Syllogisms Was Changed." *Classical Quarterly* no. 50:247-251.
16. ———. 2002. "The Development of *Modus Ponens* in Antiquity: From Aristotle to the 2nd Century Ad." *Phronesis. A Journal for Ancient Philosophy* no. 47:359-394.  
"*Aristotelian logic*, as it was taught from late antiquity until the 20th century, commonly included a short presentation of the argument forms *modus (ponendo) ponens*, *modus (tollendo) tollens*, *modus ponendo tollens*, and *modus tollendo ponens*. In late antiquity, arguments of these forms were generally classified as 'hypothetical syllogisms'. However, Aristotle did not discuss such arguments, nor did he call any arguments 'hypothetical syllogisms'. The Stoic indemonstrables resemble the *modus ponens/tollens* arguments. But the Stoics never called them 'hypothetical syllogisms'; nor did they describe them as *ponendo ponens*, etc. The tradition of the

four argument forms and the classification of the arguments as hypothetical syllogisms hence need some explaining. In this paper, I offer some explanations by tracing the development of certain elements of Aristotle's logic via the early Peripatetics to the logic of later antiquity. I consider the questions: How did the four argument forms arise? Why were there four of them? Why were arguments of these forms called 'hypothetical syllogisms'? On what grounds were they considered valid? I argue that such arguments were neither part of Aristotle's dialectic, nor simply the result of an adoption of elements of Stoic logic, but the outcome of a long, gradual development that begins with Aristotle's logic as preserved in his *Topics* and *Prior Analytics*; and that, as a result, we have a Peripatetic logic of hypothetical inferences which is a far cry both from Stoic logic and from classical propositional logic, but which sports a number of interesting characteristics, some of which bear a cunning resemblance to some 20th century theories."

17. ———. 2002. "Some Elements of Propositional Logic in Ammonius." In *Interpretation Und Argument*, 103-119. Würzburg: Königshausen & Neumann.
18. ———. 2002. "Pre-Stoics Hypothetical Syllogistic in Galen's *Institutio Logica*." In *The Unknown Galen*, edited by Nutton, Vivian. London: Institute of Classical Studies, University of London.  
 "The text of the *Institutio logica* is not found in Kühn (\*) because its sole surviving MS was first published, not long after its discovery, in 1844, and thus too late for inclusion. The reasons for once considering it spurious are unconvincing. Galen's *Institutio* is one of our main witnesses for a hypothetical syllogistic which predates Stoic propositional logic. Galen draws from a number of different sources and theories including the "ancient philosophers" (*hoi palαιοi ton philosophon*), including Chrysippus; and the "more recent" (*hoi neoteroi*), post-Chrysippean Stoics or logicians of other schools who adopted Stoic terminology and theory."  
 [\* Karl Gottlob Kühn, *Claudii Galeni Opera Omnia*. Leipzig: C. Knobloch, 1821-1833, 19 volumes, reprinted Hildesheim, Georg Olms, 1964-1997].
19. Bochenski, Joseph. 1937. "Notes Historiques Sur Les Propositions Modales." *Revue de Sciences Philosophiques et Théologiques* no. 26:673-692.
20. ———. 1951. *Ancient Formal Logic*. Amsterdam: North-Holland.  
 Contents: I. Prolegomena 1; II. The Forerunners 14; III. Aristotle 19; IV. The Old Peripateticians 72; V. The Stoic-Megaric School 77; VI. The last period 103; Bibliography 110; Index of Greek terms 118; Index of names 121.  
 "The present book is intended to supply mathematical logicians with a synthetic outline of the main aspects of ancient formal logic which are known in the present state of research. In order to avoid misunderstandings, each of the above terms has to be explained.  
 The reader is supposed to be a *mathematical* logician, i.e., to know both the symbolisms and the (English) language of contemporary mathematical logic; those who are not acquainted with it must be warned that several terms used in that language have a particular meaning, different from the meaning attributed to the terms of the same form in other contexts.  
 The subject of the book is *formal* Logic; by this we understand a science such as was developed by Aristotle in his *Prior Analytics*, i.e., essentially the theory of syllogisms as defined in *An. Pr. A 1*, 24b 18-20. Along with the syllogisms proper, the structure of the sentences and semiotics will be studied; contrariwise, not only all ontological, psychological and epistemological problems, but even methodological topics will be omitted in so far as possible. This is perhaps regrettable; but there are

several good books on those subjects while there is *none* on ancient formal logic as a whole - and the limitation of space forced us to omit everything which was not strictly formal.

By ancient formal logic, Greek logic from the beginning of Greek Philosophy until the end of Antiquity is meant. We have, it is true, some Latin textbooks of formal logic - but they all seem based on, or even copied from, Greek sources. It is perhaps worthwhile mentioning that there is also an ancient *Indian* Logic; this lies, however, outside our present scope.

What is offered here is an *outline*, moreover a very fragmentary one. A complete account of ancient formal logic cannot be written at the present date because of the lack of scientific monographs on individual logicians and topics. The initial aim of the author was to limit himself to a reassessment of monographs already published; in the course of the work he was compelled, however, to use some of his own unpublished researches on Aristotle and had the exceptional fortune of reading the manuscript of Dr Benson Mates' book on Stoic logic. He also collected some new data on other topics. In spite of this, considerable parts of ancient logic have hardly been touched upon - e.g. the logic of the Commentators - while others, Aristotle included, have been treated in a way which is far from being complete. On the whole, what the book contains may be considered as a kind of starting point for future research. Yet, it is hoped that even this will supply logicians with some information difficult to be found elsewhere and give a general idea of what the ancient logic was and how it developed." pp. 1-2

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"Après avoir rappelé les principales concordances et divergences entre la terminologie logique latine avant et après Boèce, on examine deux choix propres soit à l'auteur du *Peri hermeneias* (PH) transmis sous le nom d'Apulée, soit à la première tradition logique de langue latine: celui de "pars" ("particula") et celui de "formula" ("forma" chez Martianus Capella), choix auxquels Boèce substituera "terminus" et "figura", pour rendre le notion de "terme" (*horos* chez Aristote) et celle de "figure (du syllogisme)" (*skhema* chez Aristote). Dans chaque cas, on passe en revue la distribution des emplois dans le PH et chez Martianus, en signalant les attestations antérieures ou postérieures à ces traités. On s'interroge enfin sur les raisons possibles du choix effectué par l'auteur du PH et maintenu ou modifié par Martianus Capella.
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Contents: Preface IX; Part One: Ancient semantics; Norman Kretzmann: Aristotle on spoken sound significant by convention 3; Ronald Zirin: Inarticulate noises 23; Newton Garver: Notes for a linguistic reading of the *Categories* 27; Part Two: Modern research in ancient logic; Ian Mueller: Greek mathematics and Greek logic 35; John Mulhern: Modern notations and ancient logic 71; Part Three: Aristotle's logic; John Corcoran: Aristotle's natural deduction system 85; Mary Mulhern: Corcoran on Aristotle's logical theory 133; Part Four: Stoic logic; Josiah Gould: Deduction in Stoic logic 151; John Corcoran: Remarks on Stoic deduction 169; Part Five: Final session of the Symposium; John Corcoran: Future research on ancient theories of communication and reasoning 185; A panel discussion on future research in ancient logical theory 189; Index of names 209-211.  
"During the last half century there has been revolutionary progress in logic and in logic-related areas such as linguistics. Historical knowledge of the origins of these subjects has also increased significantly. Thus, it would seem that the problem of determining the extent to which ancient logical and linguistic theories admit of accurate interpretation in modern terms is now ripe for investigation.  
The purpose of the symposium was to gather logicians, philosophers, linguists, mathematicians and philologists to present research results bearing on the above problem with emphasis on logic. Presentations and discussions at the symposium focused themselves into five areas : ancient semantics, modern research in ancient logic, Aristotle's logic, Stoic logic, and directions for future research in ancient logic and logic-related areas.  
Seven of the papers which appear below were originally presented at the symposium. In every case, discussion at the symposium led to revisions, in some cases to extensive revisions. The editor suggested still further revisions, but in every case the author was the final judge of the work that appears under his name.  
In addition to the seven presented papers, there are four other items included here. Two of them are papers which originated in discussions following presentations. Zirin's contribution is based on comments he made following Kretzmann's

presentation. My 'Remarks on Stoic Deduction' is based on the discussion which followed Gould's paper. A third item contains remarks that I prepared in advance and read at the opening of the panel discussion which was held at the end of the symposium. The panel discussion was tape-recorded and the transcript proved of sufficient quality to merit inclusion in these proceedings with a minimum of editing." (From the Preface)

30. ———. 2006. "Schemata: The Concept of Schema in the History of Logic." *Bulletin of Symbolic Logic* no. 12:219-240.  
 "Schemata have played important roles in logic since Aristotle's *Prior Analytics*. The syllogistic figures and moods can be taken to be argument schemata as can the rules of the Stoic propositional logic. Sentence schemata have been used in axiomatizations of logic only since the landmark 1927 von Neumann paper [31]. Modern philosophers know the role of schemata in explications of the semantic conception of truth through Tarski's 1933 Convention T [42]. Mathematical logicians recognize the role of schemata in first-order number theory where Peano's second-order Induction Axiom is approximated by Herbrand's Induction-Axiom Schema [23]. Similarly, in first-order set theory, Zermelo's second-order Separation Axiom is approximated by Fraenkel's first-order Separation Schema [17]. In some of several closely related senses, a schema is a complex system having multiple components one of which is a *template-text* or *scheme-template*, a syntactic string composed of one or more "blanks" and also possibly significant words and/or symbols. In accordance with a *side condition* the template-text of a schema is used as a "template" to specify a multitude, often infinite, of linguistic expressions such as phrases, sentences, or argument-texts, called *instances* of the schema. The side condition is a second component. The collection of instances may but need not be regarded as a third component. The instances are almost always considered to come from a previously identified language (whether formal or natural), which is often considered to be another component. This article reviews the often-conflicting uses of the expressions 'schema' and 'scheme' in the literature of logic. It discusses the different definitions presupposed by those uses. And it examines the ontological and epistemic presuppositions circumvented or mooted by the use of schemata, as well as the ontological and epistemic presuppositions engendered by their use. In short, this paper is an introduction to the history and philosophy of schemata."  
 [17] Abraham Fraenkel - *Part I. Historical introduction* - to Paul Bernays - *Axiomatic set theory* (1958) - Reprint Dover 1991 pp. 3-35.  
 [23] Jacques Herbrand, *Logical Writings*, (W. Goldfarb, Tr. Goldfarb, and van J. Heijenoort, editors), Harvard University Press, Cambridge, MA, 1971  
 [31] Johann von Neumann, *Zur Hilbertschen Beweistheorie, Mathematische Zeitschrift*, vol. 26 (1927), pp. 1-46.  
 [42] Adam Tarski, *The concept of truth in the languages of the deductive sciences, Prace Towarzystwa Naukowego Warszawskiego, Wydział III Nauk Matematyczno-Fizycznych*, vol. 34 (1933), reprinted in [50], pp. 13-172; expanded English translation in [48], pp. 152-278.  
 [48] Adam Tarski, *Logic, Semantics, Metamathematics, papers from 1923 to 1938*, 2nd ed., Hackett, Indianapolis, 1983, edited with introduction and analytic index by J. Corcoran (first edition 1956)  
 [50] Jan Zygmunt (editor), *Alfred Tarski, Pisma Logiczno-Filozoficzne, 1 Prawda*, Wydawnictwo Naukowe PWN, Warsaw, 1995
31. De Lacy, Phillip H. 1937. "Contributions of the Herculanean Papyri to Our Knowledge of Epicurean Logic." *Transactions and Proceedings of the American*

*Philological Association* no. 68:318-325.

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34. Ebbesen, Sten. 2005. "Theories of Language in the Hellenistic Age and in the Twelfth and Thirteenth Centuries." In *Language and Learning. Philosophy of Language in the Hellenistic Age. Proceedings of the Ninth Symposium Hellenisticum*, edited by Frede, Dorothea and Inwood, Brad, 299-319. Cambridge: Cambridge University Press.

"It is a generally accepted view that 'philosophy of language' as well as 'grammar' as a philosophical discipline were invented in antiquity by the Stoics or by grammarians inspired by them. It is also the accepted view that these achievements were passed on to the Latin West in the Middle Ages through authors like Priscian and Boethius, to be augmented and refined by the schoolmen from the beginning of the twelfth century on. But though the general route of the tradition that indirectly relates to the beginning of linguistic philosophy in Hellenistic times is uncontested, there is little knowledge about any direct influence of the Hellenistic philosophers on that period. Sten Ebbesen takes his readers into the relatively uncharted waters of the influence of Hellenistic philosophy on the Middle Ages by tracing Stoic influence on certain issues. Ebbesen focuses on three points. First he points out how the question of 'imposition', i.e. the assignment of phonemes to natural things was taken up by the members of the Porretan school in order to show how moral and rational vocabulary arose through a transformation of the natural vocabulary, so as to allow discussion of non-natural phenomena in the sphere of culture, reason, and even theology. Second he shows that Boethius of Dacia and other members of the 'modist school' in the late thirteenth century developed a theory of formal grammar and logic, a theory that showed how the 'modes' of signifying, supplemented by a theory of representing logical relationships, is based on modes of understanding and ultimately related to the modes of being. Though among the modists the conviction prevailed that language is based on convention they did not hold that expressions are introduced at random; hence etymology, as first adumbrated in Plato's *Cratylus*, has its role to play in linguistic theory. Finally Ebbesen shows that the static conception of the modists that assumed invariable rules of language was changed into a dynamic theory of language by Roger Bacon, whose theory allowed for changing rules of language without loss of intelligibility.

Thus we find in the Middle Ages ghost-like replicas of the controversies among the ancient philosophers of language, whether it concerns the 'imposition of words' inspired by Plato's *Cratylus*, the quest to account for the relation between language and the objects in the world that was a main concern of the Stoics, and the controversy between analogist and anomalist accounts of language. Ebbesen does not claim that those medieval discussions were based on any direct knowledge of the Hellenistic philosophers or on that of Plato's *Cratylus*. He holds, however, that these medieval positions could not have been developed had there not been the rich tradition of the Hellenistic age, passed on to them in the reflections of Boethius and Priscian." From the *Introduction* by Dorothea Frede and Brad Inwood, pp. 12-13

35. Everson, Stephen, ed. 1994. *Language*. Cambridge: Cambridge University Press.

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Reprinted in: A. Graeser - *Issues in the philosophy of language past and present* - Bern, Peter Lang, 1999, pp. 9-41
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"Formal education in elementary logic began in Plato's Academy and can be traced into the Middle Ages. Evidence from Aristotle, *Prior analytics*, Apuleius, *De interpretatione*, Galen, *Institutio logica*, and anonymous sources suggests that many works may have been written to be memorized by students. The views of the Peripatetics and Stoics, originally different, coalesced, and later handbooks covered both at an elementary level. The origin of a concept of a syllogistic mood is obscure; it may have existed for some time before appearing first in Apuleius."
41. Hurst, Martha. 1935. "Implication in the Fourth Century B.C." *Mind* no. 44:484-495.  
"Modern analyses of the nature of necessary connection have given rise to more paradoxes than they have solved. A familiarity with the controversy between Diodorus and Philo which took place in the Fourth Century B.C. might perhaps have made unnecessary the anguish which modern logicians have suffered. (1)  
The dispute is mentioned in passing by Cicero (2) and is discussed in two places by Sextus Empiricus (3). The persons concerned in the dispute are named Diodorus and Philo, and are, I think, to be identified as the Megarians, Diodorus Cronus and his pupil Philo."  
(1) My attention was first called to this dispute by a notice in C. S. Peirce, *Collected Papers* 3, 441. In being aware of this dispute Peirce is an exception among modern logicians. But he failed to grasp its full significance; so that his knowledge did not save him from the mistakes which they have made.  
(2) *Academica Priora*, II, 143.  
(3) *Pyrrhoneion Hypotyposeon* II, 110, *Adversus Mathematicos* VIII, 113 ff.
42. Ildefonse, Frédérique. 1997. *La Naissance De La Grammaire Dans L'antiquité Grecque*. Paris: Vrin.
43. Jedan, Christoph, and Strobach, Niko. 2002. *Modalities by Perspective. Aristotle, the Stoics and a Modern Reconstruction*. Sankt Augustin: Academia Verlag.

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Contents: Preface V-VIII; I. The origin of logic as a science 5; II. Concepts, terms, definitions, ideas, categories 20; III. Judgments, subject and predicate 43; IV. Syllogisms 60; V. Induction: ancient and modern logic 75; Books cited 89; Index 91-95.  
"The five chapter of this little book represent the manuscript of a series of five special lectures which I gave at Columbia University by invitation of the Department of Philosophy and the Department of Greek and Latin." (Preface, V).
45. Klein, Jacob. 1968. *Greek Mathematics Thought and the Origin of Algebra*. Massachusetts: The M.I.T. Press.  
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50. ———. 1971. "Neoplatonists's Account of Predication and Mediaeval Logic." In *Le Néo-Platonisme. Actes Du Colloque De Royaumont, 9-13 Juin 1969*, 357-364. Paris: Éditions du CNRS.
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"The paper is a study of the logic of existence, negation, and order in the Neoplatonic tradition. The central idea is that Neoplatonists assume a logic in which the existence predicate is a comparative adjective and in which monadic predicates function as scalar adjectives that nest the background order. Various scalar predicate negations are then identifiable with various Neoplatonic negations, including a privative negation appropriate for the lower orders of reality and a hyper-negation appropriate for the higher. Reversion to the One can then be explained as the logical inference of hyper-negations from mundane knowledge. Part I develops the relevant linguistic and logical theory, and Part II defends Wolfson and the scalar interpretation against the more traditional Aristotelian understanding of Whittaker and others of reversion as intensional abstraction."
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"By 'logic' I mean 'the analysis of argument or proof in terms of form'. The two main examples of Greek logic are, then, Aristotle's syllogistic developed in the first twenty-two chapters of the *Prior Analytics* and Stoic propositional logic as reconstructed in the twentieth century. The topic I shall consider in this paper is the relation between Greek logic in this sense and Greek mathematics. I have resolved the topic into two questions: (1) To what extent do the principles of Greek logic derive from the forms of proof characteristic of Greek mathematics? and (2) To what extent do the Greek mathematicians show an awareness of Greek logic?

Before answering these questions it is necessary to clear up two preliminaries. The first is chronological. The *Prior Analytics* probably predates any surviving Greek mathematical text. There is, therefore, no possibility of checking Aristotle's syllogistic against the actual mathematics which he knew. On the other hand, there is no reason to suppose that the mathematics which he knew differs in any essential way, at least with respect to proof techniques, from the mathematics which has come down to us." p. 35

"The paper which follows has three main sections. In the first I discuss the character of Euclidean reasoning and its relation to Aristotle's syllogistic. In the second I consider the passages in the *Prior Analytics* in which Aristotle refers to mathematics; my purpose here is to determine whether reflection on mathematics influenced his formulation of syllogistic. In both sections my conclusions are mainly negative. Euclid shows no awareness of syllogistic or even of the basic idea of logic, that validity of an argument depends on its form. And Aristotle's references to mathematics seem to be either supportive of general points about deductive reasoning or, when they relate specifically to syllogistic, false because based on syllogistic itself rather than on an independent analysis of mathematical proof. In the third main section of the paper I consider the influence of mathematics on Stoic logic. As far as Chrysippean propositional logic is concerned, my conclusions are again negative. However, it is clear that at some time logicians, probably Stoic, began to consider mathematical proof on its own terms. Although they never developed what I would call a logic to cover mathematical proof, they at least realized the difference between it and the logical rules formulated in antiquity. Much of the third section is devoted to an attempt to reconstruct in outline the history of logical reflections on mathematics in the last two centuries B.C. In conclusion I recapitulate briefly my conclusions about the relation between Greek mathematics and logic." p. 37

65. Mulhern, John. 1974. "Modern Notations and Ancient Logic." In *Ancient Logic and Its Modern Interpretations*, edited by Corcoran, John, 71-82. Dordrecht: Reidel. "To what extent does ancient logic admit of accurate interpretation in modern terms? Blanché [3] and Dürr [14] published general surveys of research on ancient logic in the mid-1950's. My aim in the present paper is to identify studies made available during the quarter-century 1945-1970 that illustrate the influence modern notations have had on our understanding of ancient logical texts. Accepting Bochenski's division of ancient logic into four temporally distinct stages, I mention research on the Prearistotelian, Aristotelian, Stoic and Commentatorial logics in Sections 1-4. In Section 5, I offer some generalizations on the utility of modern notations in writing the history of ancient logic." p. 71

"At the beginning of this paper, I asked to what extent ancient logic admits of accurate interpretation in modern terms. While no final answer to this question will be available until research in the field has gone a good deal further than it has so far, still the progress since 1945 has been remarkable, and it is not too early to consider its causes. In his history of the history of logic, Bochenski wrote as follows:

The rise of modern history of logic concerning all periods save the mathematical was made possible by the work of historians of philosophy and philologists in the 19th century. These published for the first time a series of correct texts edited with reference to their context in the history of literature. But the majority of ancient philologists, medievalists and Sanskrit scholars had only slight understanding of and little interest in formal logic. History of logic could not be established on the sole basis of their great and laborious work.

For its appearance we have to thank the fact that formal logic took on a new lease of life and was reborn as mathematical. *Nearly all* the more recent researches in this history were carried out by mathematical logicians or by historians trained in mathematical logic. ([5e], pp. 9-10.)

The trained researchers who have worked on the ancient materials have had to do much more than merely transcribe into modern notations logical treatises originally written in ancient natural languages. Just finding suitable transcriptions has had to wait on considerable analysis of the ancient texts. Transcription into modern notations presupposes some community of understanding and purpose with the ancient logicians, and this community is something that needs to be argued for. In general, a department of ancient logic lends itself to being dealt with in notation if and only if its corresponding department of modern logic lends itself to being dealt with in notation. Logistic systems and their interpretations lend themselves to this to a great extent, theoretical syntax and especially semantics to a much lesser extent. Where a modern notation follows or reproduces or elucidates the logical form of a sentence or inference or schema that interests an ancient logician, then its use is in order. The studies discussed in Sections 1-4 of this paper point to the conclusion that the judicious use of modern notations has been one cause of progress -- over the last two decades and a half -- in our understanding of ancient logic." (pp. 81-82)

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[4] Bochenski, I. M., *Ancient Formal Logic*, Amsterdam 1951

[5e] Bochenski, I. M., *A History of Formal Logic* (trans. by I. Thomas), Notre Dame 1961

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- "This book is intended as the first part of a history of those problems and theories in the domain of philosophical semantics which nowadays are commonly referred to as problems and theories about the nature and the status of propositions. Although the conceptual apparatus and the terminology by means of which questions concerning

propositions were asked and answered have considerably varied from period to period, the main types of disputes and solutions have remained remarkably constant. One of the aims of this study is precisely to trace the vicissitudes of the vocabulary in which this refractory topic was treated in the remote past. As is evident from the Bibliography, many parts of the field have been explored by predecessors. Guided by their results, I have tried to fill in more details and to design a provisional map of the area as a whole." (from the Preface)

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77. Tracy, Kevin. 2006. *The Development of Dialectic from Aristotle to Chrysippus*. Dissertation presented to the University of Pennsylvania (available on ProQuest). "From Aristotle onward, formal logic was an element of ancient Greek dialectic (*dialektiké*). Aristotle's *Prior Analytics* (4th century BCE) is the earliest evidence of a formal logic in antiquity. The evidence for the formal logic of the Stoic philosopher Chrysippus (3rd century BCE) is fragmentary; nonetheless it makes clear that not more than a century or so after *Prior Analytics*, Chrysippus revolutionized formal logic. The scholarship on Stoic logic has not yet presented the history of dialectic from Aristotle to Chrysippus as an intelligible narrative. Without such a narrative, one cannot explain what, in general, motivated the innovations of Chrysippus, what made Stoic logic coherent as a unified project, or what relationship that project had to earlier work in logic. This dissertation approaches the problem through the presentation and interpretation of the ancient source material. First it describes the logical doctrines of Aristotle, Theophrastus, and the 'Megarics' in such a way as to make clear what questions these predecessors left for Chrysippus. It then describes how Chrysippus addressed these questions. Finally, it uses the resulting narrative to

give a detailed account of Stoic formal logic. The dissertation yields five principal conclusions. First, neither the Peripatetics or the 'Megarics' described logical forms of propositional logic; Chrysippus was the first to do so. Second, the guiding aim of Chrysippus' logic was to avoid adopting a semantic stance in describing logical forms and explaining logical relationships. Third, the Stoics distinguished 'valid' (*hugies*) from 'true' (*aléthes*), so that *sunartésis* is a standard for the validity rather than the truth of the Stoic conditional (*sunhémmenon*). Fourth, the Stoics produced derivations for categorical arguments in their deduction system. Fifth, the Stoic deduction system is roughly analogous to the first-order fragment of Frege's system, except on two points: it most likely was not designed to accommodate the use of polyadic predicates with multiple quantifiers, although the possibility for doing so inheres in its approach to the analysis of propositions, and it uses the 'natural' approach rather than the 'axiomatic' approach of Frege."

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"This paper offers a logical analysis of Scepticism. It is shown that Dogmatism, Academism and Scepticism as characterized by Sextus Empiricus in *Outlines of Pyrronism* form a variety of views which can be ordered by an interpretation of the classical logical square. In particular, Scepticism appears as a conjunction of the negations of Dogmatism and Academism. The next problem concerns the logic proper for Scepticism. Logic based on a dual of the consequence operation is proposed as satisfying intuitive requirements associated with doubting. Finally, the attitude of the sceptic toward logic is discussed. In particular, it is argued that the principle of isosteny trivializes scepticism if it is applied to logic."

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