

From Existential Import in Syllogistics to Translations between Modal Logics

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The aim of this paper is to illustrate how age-old issues in Aristotelian syllogistics continue to inspire new research in contemporary, mathematical logic. In particular, we start by considering the topic of existential import in syllogistics. Very roughly, existential import is the idea that certain subject-predicate sentences somehow require that their subject be ‘non-empty’, i.e., there should exist at least one entity satisfying the subject term. This informal idea can be made formally precise in at least two ways: existential import as (i) a property of individual formulas or (ii) as a property of logical systems. In this debate we often find people drawing analogies between first-order logic/syllogistics and the modal logics K/KD . This analogy inspires us to define four modal translations S , W , S' and W' . When considered within K , these translations yield two layers of strengthenings/weakenings of a given formula φ , i.e., $S(\varphi) \vdash_K S'(\varphi) \vdash_K \varphi \vdash_K W'(\varphi) \vdash_K W(\varphi)$. Furthermore, when considered within KD , this entire sequence collapses: $S(\varphi) \equiv_{KD} S'(\varphi) \equiv_{KD} \varphi \equiv_{KD} W'(\varphi) \equiv_{KD} W(\varphi)$. Finally, using some basic tools from finite model theory (esp. n -bisimulations), it can be shown that W is a faithful embedding of KD into K , i.e., $\vdash_{KD} \varphi$ iff $\vdash_K W(\varphi)$. Throughout the paper we show how the translations also yield various new perspectives on the modal square of opposition.

Christine Ladd-Franklin and the Syllogistic Problem She Solved

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Christine Ladd-Franklin, a student of C.S. Peirce, was the first one to complete the requirements for a PhD in logic in America. In her dissertation on algebraic logic, she, according to many modern commentators, solved a logical problem "which had plagued the field of syllogisms since Aristotle." In this talk, we revisit this claim, identifying specifically the problem that she set out to solve, and her solution to the problem. This solution, the "antilogism", while it turns out not to be a solution to an Aristotelian problem, is worthy of note in its own right as it went on to be highly influential on later logicians and is what cemented her in the ranks of foremost logicians of the 19th century.

Aristotle's Unified Method of Inquiry

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Aristotle distinguishes dialectical and demonstrative arguments based on the content of their premises (*Pr. An. A, 1*; *Top. A, 1*). A dialectical argument starts from ἔνδοξα and scholars have debated whether it is an extrinsic feature of propositions to be ἔνδοξα inasmuch as it happens to them to be held by many (De Pater 1965; Brunschwig 1967 and 2007) or whether there are propositions that are intrinsically ἔνδοξα inasmuch as they resist objections (Fait 1999; Reinhardt 2015). In this paper, I will argue that the issue can be tackled from a different angle. Let us begin by assuming that Aristotle had an essentially dialogical method of inquiry that is regimented in *Top. VIII* but is ubiquitous in his writings. This method presupposes the presence of dialectical games whereby an ideal questioner questions an ideal opponent in front of a public. If a proposition can resist objections and counterexamples, this should be understood within the framework of the ideal debate that shapes Aristotle's understanding of argumentation. In a nutshell, an ἔνδοξον will be a proposition that resists counterexamples and objections raised by an ideal opponent in front of a competent audience. This unified understanding of the ἔνδοξα allows us to look at demonstrative premises as displaying an additional specification on top of their being ἔνδοξα, since also true premises should resist counterexamples and objections, and we can better understand why Aristotle uses at times the adjective ἔνδοξον in its comparative form. This unification of the method will become more apparent in the context of the *Prior Analytics*. We can look at the pons asinorum as a dialectical enterprise since it involves an ideal game (cf. Crubellier 2017 for a similar take on *Pr. An. A, 28-29*). Decisive evidence for this interpretation is offered in *Pr. An. A, 38*, where Aristotle argues that the relations of predications should be distinguished according to the categories, that is, according to a series of distinctions raised in dialectical contexts (cf. Menn 1995). It will be argued that it is philosophically worthwhile to distinguish between a dialogical method, that is ubiquitous in Aristotle's texts and that has been regimented in *Top. VIII*, from a dialectical argument *stricto sensu* that displays not only the procedural structure of an ideal game, but also that has premises that are ἔνδοξα and do not display any additional qualification.

Minimal and maximal arguments

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This conference paper returns to Cicero's discussion in *De Inventione I, 61*; Alexander of Aphrodisias in his commentary on Aristotle's *Prior Analytics* (p. 263, 11-25; p. 388, pp. 17-20) and Boethius' *De hypotheticis syllogismis, II, 1*, where the number of parts that a syllogism has is questioned if three or four or even five if the proofs of one or both premises are added. This old discussion is associated with the hypothetical syllogism and is directly related to dialectical and rhetorical procedures, but in my presentation, I will try to show that this issue involves a doubt about what a syllogism is and what the nature of logic is. To develop my proposal, I will distinguish the different types of arguments, not by matter and form, as traditional, but as maximal and minimal arguments, defining the logical argument as a minimal argument, that is, whose parts are essential to obtain a conclusion. A maximal argument is one that incorporates one or more proofs of the premises(s). Accordingly, I do not make the distinction between hypothetical and categorical arguments, and the distinction between dialectic and scientific arguments is based solely on the fact that the demonstrative syllogism provides evidence for the truth of the premises, through truer, prior, and better-known propositions or arguments than the premises. And the dialectical syllogism in more probable or accepted propositions or arguments. Granted this, I will go on to define the current Theory of Argumentation as a theory with many auxiliary sciences, but with a fuzzy object, suggesting that its object should be the study of the truth or probability of the premises of a syllogism, as opposed to the logic that studies the indispensable parts of deductive reasoning. Another important consequence of the view of this paper is that we can now enter belief in logic without feeling uncomfortable about the presence of matter in logic.