

Figure 2: Paris, BnF, lat. 14716, f. 17v. The logical relations between different modal propositions according to John Buridan

roduction are not meant to be an exhaustive or thorough representation of contemporary research in the history of logic and logical reasoning. Far from it, in fact. I only wished to highlight some trends and new perspectives that I believe could be of interest to non-historians and non-specialists of this discipline. I suppose that many readers of *The Reasoner*, engaged as they are in contemporary debates on reasoning in its many forms, may not be entirely familiar with the historical theories on logical reasoning that will be presented in the articles of this issue. If this is indeed the case, I hope that reading these will provide them an occasion to transgress the usual disciplinary boundaries.

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Theories of Reasoning from Late Antiquity to the Medieval Arabic Tradition: the Syllogistic Arts

From what premises does human reasoning stem, and along which lines does it obtain new knowledge? Most philosophers and commentators from Antiquity to the Middle Ages regarded the demonstrative syllogism described in Aristotle's *Prior* and *Posterior Analytics* as the most powerful device to attain true and certain knowledge. Not all the premises that the human mind ordinarily uses are necessary, however, nor do all lines of reasoning yield conclusions as solid and reliable as demonstrative syllogism. Indeed, reasoning often starts from common beliefs and reaches probable conclusions. By the 6th century CE,

the Greek commentators active in the Neoplatonic school of Alexandria developed a classification of syllogistic arguments that included these different methods of reasoning. In his commentary on Aristotle's *Categories*, the Neoplatonic philosopher Elias identified five types of syllogism, which he arranged hierarchically in decreasing order of epistemic strength on the basis of the truth-values of their premises, as shown in Figure 3.

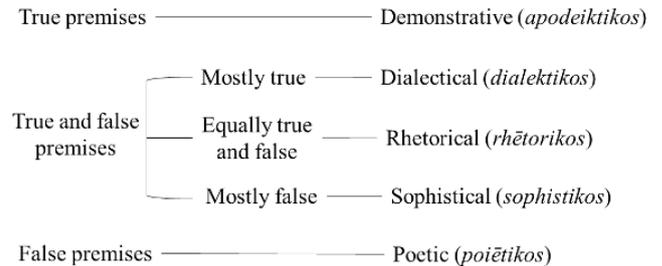


Figure 3: Elias' classification of the syllogisms based on their premises

Besides broadening the horizons of theory concerning the forms of argumentation, the classification in Fig. 3 paved the way for the formation of the so-called 'long *Organon*', that is, a new arrangement of Aristotelian writings according to which *Rhetoric* and *Poetics* became part of Aristotle's logical corpus.

This view would later become prevalent in the Arabic logical tradition. By "Arabic logical tradition," I refer here to the Hellenising philosophical trend named *falsafa* that, from the 8th century CE onwards, received and reworked the Aristotelian corpus in Arabic. This logico-philosophical tradition was not alone in developing a theory of argumentation in Arabo-Islamic contexts: jurists and theologians had also been using argumentative devices (such as analogy) to address the problems of interpreting the Coran and the *ḥadīth*. This latter tradition, however, is not considered here.

The Arabic tradition also individuated five types of syllogism. In contrast to the Greek tradition, however, the five arguments were categorised not so much according to the truth-values of their premises as the strength of the audience's assertion (*taṣdīq*) to their conclusions.

Key figures in the elaboration of a systematic theory of the types of syllogisms were al-Fārābī (d. ca. 950), the "second master" after Aristotle, and Ibn Sīnā (better known in the west as Avicenna, d. 1037). The most detailed account of the fivefold classification of syllogisms emerges from the major philosophical *summae* authored by Ibn Sīnā. The following reconstruction (Fig. 4) is based on the *Book of Healing* (especially *Madkhal* I.3 and *Burhān* I.1); the *Elements of Philosophy* ('*Uyūn al-Ḥikma*); the *Deliverance* (*Naḡāt*); and the *Pointers and Reminders* (*Iṣārāt wa-Tanbīhāt*).

The syllogistic arts employ qualitatively different premises. Their cognitive outcomes vary accordingly, ranging from the highest degree of demonstrative certainty to the lowest degree of imagination.



Syllogism	Premises	Cognitive Outcomes	
Demonstrative	Primary (<i>awwalīyyāt</i>)	Certainty	Assertion
	Empirical (<i>taḡribīyyāt</i>)		
	Sensible (<i>maḥsīās</i>)		
Dialectical	Generally accepted (<i>mašhūrāt</i>)	Assertion close to certainty	Assertion
Rhetorical	Received (<i>maqbulāt</i>)	Strong opinion, persuasion	
	Presumed (<i>maznūnāt</i>)		
Sophistical	Generally accepted (<i>mašhūrāt</i>)		No Assertion
	Specious (<i>mušabbīha</i>), resembling other premises	Fallacious assertion resembling certainty	
Poetic	Imaginative (or: figurative) statements (<i>mukhayyilāt</i> , lit.: 'image-eliciting')	Imagination (<i>takhyīl</i>)	No Assertion

Figure 4: Ibn Sīnā's classification of syllogisms

(1) Demonstrative syllogism (*al-qiyās al-burhānī*) yields certain conclusions. It is the method par excellence, in relation to which the other syllogisms play an auxiliary role. Its premises are self-evident first principles as well as sensible, empirically evident propositions. (2) Dialectical syllogism (*al-qiyās al-ḡadalī*) results in an endoxic assertion that is close to certitude. It proceeds from generally accepted premises (*al-mašhūrāt*), equivalent to the *endoxa* of Aristotle's *Topics*; these are beliefs that are either universally accepted by all people, or by a number of people perceived as authoritative. (3) Rhetorical syllogism (*al-qiyās al-khiṭābī*, Aristotle's *enthymēma*) is also based on generally accepted opinions. Its premises include statements of varying degree of trustworthiness: received propositions (*al-maqbūlāt*) are generally deemed to be trustworthy, as they come from an authoritative person (e.g., the *imām*), while presumed propositions (*al-maznūnāt*) do not result in a firm assertion. (4) Sophistical syllogism (*al-qiyās al-sūfistā'ī*), also called 'fallacious' (*al-muḡāliṭī*), moves from premises that are misleading on account of their apparent similarity to demonstrative or dialectical premises. (5) Poetic syllogism (*al-qiyās al-šī'rī*) includes as its premises and conclusion figurative statements. Its purpose is not to deceive the listener (as in sophistical syllogism), but to evoke an image in their mind. Its premises provoke a motion in the faculty of imagination (*al-takhyīl*) which affects the human soul in a way that is similar to certain assertion. This motion of the imagination can make the soul feel attraction or repulsion for a given thing. A classic example is that of honey, which can be erroneously taken for vomited bile due to their similarity in colour and complexion. The erroneous equation of honey and bile arguably derives from an argument with figurative statements as major premise and conclusion:

Honey is yellow;
 Everything yellow is vomited bile;
 Therefore, honey is vomited bile.

Poetic syllogism has been variably understood in the Arabic tradition. Al-Fārābī and, in his wake, Ibn Rušd (Averroes, d. 1198) considered it to be unproductive. As opposed to the Greek tradition, Avicenna did not entirely rule out the possibility that the premises and conclusions of poetic syllogisms may be true: in his last major work, the *Pointers*, he appears to criticise a classification of syllogisms similar to the one in Fig. 3, which left no room for such a possibility.

As argued by Black (1990: *Logic and Aristotle's Rhetoric and Poetics in Medieval Arabic Philosophy*, Brill), a theory of syllogisms including rhetorical and poetic arguments might have served in the Arabic tradition to account for the methods of reasoning employed in the arts that fall outside the domain of

theoretical and practical philosophical sciences. The developments and implications of this comprehensive theory of reasoning in the Arabic logical tradition are largely yet to be explored. The post-Avicennian logical tradition, which extends well into the 19th century CE, consists of a wealth of original texts, commentaries, and marginal annotations whose intellectual interest has only recently been acknowledged, and which await editing and study (for an overview, see El-Rouayheb 2019: *The Development of Arabic Logic, 1200-1800*, Schwabe Verlag). Historical and theoretical work on these materials promises to reveal in the near future an entirely new picture of the history of Arabic logic, and of the history of reasoning more generally.

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13th-14th Century Theories of Inference

In medieval logic, *consequence* refers to a relation between two parts of a hypothetical proposition, respectively called the *antecedent* and *consequent*, according to which what is stated in the consequent follows from what is stated in the antecedent, e.g. 'If Socrates is running, then he is moving'.

Consequence is arguably the core notion studied in formal logic today, where it has stood since Alfred Tarski's groundbreaking work on the topic in the 1930s, and also plays a major role in adjacent fields including computing and the philosophy of science. When compared to the intuitive notion of consequence that they aim to capture, however, the most widely-known theories of consequence today suffer from several deficiencies:



- Classical theories of consequence validate inference rules that are highly unintuitive. The best-known of these is *explosion*, which allows anything to be inferred from a contradiction.
- Natural language inference is *semantically closed*. making it possible for statements to refer, directly or indirectly, to themselves. The artificial languages studied in formal logic today, by contrast, tend to employ various devices to prevent semantic closure, leaving them less expressive than their natural counterparts.
- The inference schemata studied in modern logical systems tend, by design, to be indifferent to whatever content might be expressed in actual natural language inferences whose formalizations they capture. Particularly for novices, this can leave the use of these systems opaque.

Several essential aspects of the theory of consequence as we understand it today first arose during the later medieval period: the earliest extant treatises directly devoted to consequence, translated in Archambault (2017: *The development of the medieval Parisian account of formal consequence*, PhD thesis, Fordham University), were written at the turn of the 14th century, and the notion of *formal* consequence became a primary locus of attention shortly thereafter (Dutilh Novaes, 2020: