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Fārābī's logic

For general information on al-Fārābī (c. 870-c. 950) see Druart (SEP). We describe al-Fārābī's logic under five heads:

1. Al-Fārābī as author.

When al-Fārābī began his career, logic in the Islamic Empire could be said to consist of the logical writings of Aristotle in Arabic translation, together with the writings of some commentators on Aristotle's texts. These commentators included Roman Empire scholars (such as Alexander of Aphrodisias) who wrote in Greek—some of Alexander's writings are lost in the original but were apparently available to al-Fārābī and survive in Arabic translations. There were also commentators writing in Arabic, though little was composed in Arabic before al-Fārābī himself. The logical works of Aristotle were understood to be *Categories*, *De Interpretatione*, the *Prior and Posterior Analytics*, *Topics*, *Sophistical Refutations*, *Rhetoric* and *Poetics*, with Porphyry's *Eisagoge* attached as an introduction. In modern scholarship this collection of nine texts is sometimes referred to as the 'Arabic Organon'. Al-Fārābī had access to all the works of the Arabic Organon in highly professional Arabic translations that made use of earlier Syriac translations. (See the Introduction to Zimmermann (1981) on what was available to al-Fārābī of earlier logical writers.)

Al-Fārābī's logical writings are all in some sense expositions of parts of the Arabic Organon. They fall into three kinds. The first kind is the 'commentary' (*sharḥ*) which comments on a work line by line, or sometimes even word by word; it can run to several hundred pages, and it may copy or discuss material from earlier commentaries. The only commentary of al-Fārābī that we have in full is [*Commentary on De Interpretatione*], though we have parts of [*Commentary on Prior Analytics*] and some fragments of [*Commentary on Categories*]. The second kind is the summary or epitome (*talkhīṣ*), which is briefer but gives the author more freedom to express his own views; we have al-Fārābī's summaries for all of the Arabic Organon, in fact at least two ([*Jadal*] and [*Analysis*], cf. also Zonta (2011)) for different parts of the *Topics*. The third kind is the essay or monograph (*risāla*), which serves some special purpose and can range in length from half a dozen pages to some hundred pages; several of al-Fārābī's logical essays survive.

Modern commentators have often noticed al-Fārābī's tendency to say apparently incompatible things in different places, even sometimes within the same work. Galston (1990 pp. 39-43) has suggested that this may be partly deliberate: al-Fārābī sees himself as a teacher presenting dialectical goals to his readers for them to formulate their own responses (see section 2.3.2 below). Galston has in mind al-Fārābī's political writings; but the problem

applies equally to his logical works, though it has been less investigated in these. A fairly typical example which might support Galston's suggestion appears in his [*Commentary on De Interpretatione*] pp. 168-170 (Zimmermann 1981 pp. 162-164, commenting on *De Interpretatione* 21b10-24), where he presents an argument why the negation of 'possibly the case' is 'possibly not the case', and then an argument why the negation is 'not possibly the case', without saying anything to show how one of these arguments is wrong. But (again typically) the passage could also be explained as heavy-handed exposition of Aristotle's text.

2. The aims and structure of logic.

2.1 Discrimination

In the closing sections of his [*Indication*] al-Fārābī argues that human happiness depends on our ability to make discriminations (*tamyīz*). In theoretical matters we need to be able to discriminate true from false, and in practical matters we need to be able to discriminate what to choose from what to avoid. The various arts teach us to make discriminations of particular kinds, but philosophy needs to call on an art which teaches us correct discrimination in general—and this art is logic.

He goes on to say that since discrimination is needed for any art, study of at least some logic must precede study of any other art. But also logic is impossible to pursue without some knowledge of language. So the art of language has to be counted as the first art, followed by logic and then followed by the other arts. This is precisely the ordering of sciences that al-Fārābī adopts in his [*Catalogue*]. The ordering raises the question how the arts of logic and language are related. In [*Catalogue*] 54.2-5 he gives his famous answer: 'The relation of the art of logic to the intellect and concepts is like the relation of the art of grammar to language and expressions. For everything that the science of grammar gives us about the laws of expressions, the science of logic gives us analogous things about concepts.' (Al-Fārābī makes no systematic distinction between 'sciences' and 'theoretical arts'; logic counts as both.)

Discrimination involves forming concepts of the things discriminated. Hence al-Fārābī gives great importance to 'conceptualisation' (*taṣawwūr*) and the associated logical notion of 'definition'. In [*Demonstration*] 52.13-57.18 he studies systematic procedures for finding definitions; one of them is Plato's procedure of 'division' as described in the dialogue *Sophist*. Discrimination also includes forming opinions about what is the case, an act that al-Fārābī calls 'assent' (*taṣdīq*). Al-Fārābī stresses that we can't assent to a proposition until we understand it; so conceptualisation comes before assent. But it has to be said that al-Fārābī himself often runs the risk of blurring the distinction by treating definition and demonstration as in some sense equivalent processes REF.

The pair conceptualisation and assent came to be hugely important in later Arabic thinking about logic and language. Lameer (2006) discusses their use by Mulla Sadra in the 17th century, and his first two chapters examine al-Fārābī's Aristotelian sources for the pair. Black (1990 p. 71ff) argues that the pair are 'quite central' for understanding how the Arabic

logicians saw logic as a whole, and in particular why *Rhetorics* and *Poetics* were taken to be parts of the *Organon*. (The inclusion of these two books in the *Organon* is sometimes known as the 'context theory'.)

The claim that logic has a distinctive role to play in discriminating true from false and good from bad was inherited by early Arabic logicians from propaganda used by the 5th-6th century school of logicians in Alexandria. (Gutas (1983) traces the influence of the Alexandrians on Al-Fārābī through the Syrian scholar Paul the Persian.) The claim caused intense irritation to some Arabic thinkers in other fields. Al-Fārābī's colleague Mattā bin Yūnus took the flak for this in a public debate; see Street *Arabic and Islamic Philosophy of Language and Logic* and Elamrani-Jamal (1983). But al-Fārābī's own statements in [*Indication*] are stronger and more articulate than those of Mattā in the debate.

2.2 Historical origins of logic

Since logic is the art of discrimination, al-Fārābī puts great emphasis on distinguishing between the different parts of logic. In several works he bases the distinctions on how the various parts of logic arose in response to different human needs. An overall need was to have ways of persuading ourselves or other people of the truth of universally quantified propositions. After all, sentences without universal quantification can be established simply looking at the relevant part of the world.

Political and religious leaders need to persuade their followers of political or religious claims, and it was found that certain kinds of argument are helpful for this; thus arises the art of rhetoric. At the same time, poets showed that persuasion can be through verbal images; so by analogy with rhetoric, the art of poetry came into being as a part of logic. When it became clear that there are arts of argument, early scientists hoped to recruit arguments to support their speculations; but the arguments that they used were incompetent, and thus there arose the art of sophistry.

It came to people's attention that different leaders used different arguments to persuade their respective followers of incompatible propositions. Hence there was a need for a way of setting rival views against each other, so as to assess their strength. Thus there arose the art of debate or dialectics, where two people would argue for contrary propositions, but also they would criticise each other's arguments (or 'syllogisms'), so that there was pressure to improve the cogency of syllogisms.

But scientists might point out that the person who wins a debate would often be the person better at arguing, not the person with the better case. So one could never be certain of the truth of the proposition established by the debate. 'Methods of certainty' were needed. The part of logic which uses syllogisms to give us certainty of universally quantified truths is the art of demonstration. Thus there came into being the five 'syllogistic arts', namely rhetoric, poetry, sophistry, debate and demonstration. It seems clear that al-Fārābī's division of logic into these five parts is derived from the contents of the five books of the Arabic

Organon after the syllogisms in *Prior Analytics*, taking *Posterior Analytics* to describe demonstration and *Topics* to discuss debate.

2.3 Intellectual conversation

Being an incorrigible classifier, al-Fārābī draws many other lines to distinguish one part of logic from another, and they often cut across the classification into five syllogistic arts. For example in [*Debate*] 58.17-62.10 he discusses various situations where practical or strategic considerations lead a person to use a mixture of methods from different syllogistic arts. (Thus a person wants to prove something, but the premises he needs are some of them certainties and some just general knowhow.) A feature of these situations is that they all involve at least two people and some passage of information between them. In various works al-Fārābī identifies types of 'conversation' (*mukhāṭaba*) which serve a particular logical purpose. It is not clear that he has a systematic catalogue of these types, but we can note some that he clearly regarded as central.

2.3.1. One kind is called simply 'debate' (*jadal*), and it serves as a template for the other kinds. There are two participants, a questioner and a responder. A 'goal' or 'quaesitum' (*maṭlūb*) is presented, perhaps by the questioner; it consists of two closely related but incompatible propositions, for example a subject-predicate sentence and its contradictory negation (see BELOW). The responder is invited to 'concede' one of the two sentences, which then becomes the responder's 'posit'. For the remainder of the debate, the questioner seeks to persuade the responder to accept other propositions which entail the falsehood of the posit. The responder can accept the propositions but point out flaws in the argument that they refute the posit. Alternatively he can offer reasons why the propositions are not acceptable.

2.3.2. A second kind of conversation is between a teacher and a student. The teacher invites the student to agree to statements or give reasons for refusing. This style of teaching forces the student to become an active learner, and it also gives the student practice in finding arguments to support cases.

2.3.3. A third kind is what al-Fārābī calls 'examination' or 'test' (*imtiḥān*, probably translating Greek *peirastike*). The aim of examination is 'to achieve the utmost humanly possible perfection in the knowledge that we believe' ([*Demonstration*] 94.17f). This kind is distinguished by the facts that the questioner can put a single proposition to the responder rather than a two-part goal, and that the syllogisms used can be compound (see section 4.4 below) so that the responder may be required to challenge premises that are remote from the conclusion. Al-Fārābī presents examination as a form of research (unlike Aristotle's *peirastike*, whose function is to show up the ignorance of the responder, *Sophistical Refutations* 169b23). Possibly the main interest of examination is that Avicenna took it up as a paradigm of how original advances can be made in parts of logic that are still under development.

2.3.4. A fourth kind of conversation plays a major role in metaphysics, and al-Fārābī expounds it in [*Letters*]. The questioner puts questions to the responder about the identification of ideas. The ideas can be either 'universal' concepts such as the meanings of common nouns, or they can be 'individuals' (though al-Fārābī may intend the meanings or essences of the individuals rather than the real-world objects themselves). The questioner begins with the broad question 'What is it?', and narrows down to more specific questions 'Which such-and-such is it?', and so on. This kind of conversation is of cardinal importance in al-Fārābī's metaphysics, because he constantly relies on the 'What is it?' question when he defines ontological notions such as 'genus' and 'species'.

3. Preliminaries for logic.

3.1 Construction of language

Names.

Subject-predicate sentences. SP versus PS expressions of subject-predicate sentences. Does he assume the subject is nonempty in affirmative SP sentences?

Hypothetical sentences, refer to 4.3 below.

3.2 Categories

Insists that for purposes of inference the difference between one category and another is irrelevant. Then what is the role of the categories in logic? For example at [*Debate*] 94.19f, 'the subjects of dialectic are the ten categories and what is below them'.

3.3 Ontology

Shay', constitutive, genus, species, accident, proprium, differentia, definition.

3.4 The nature of inference

Definition of qiyas.

Topics as abstract argument forms.

The logical status of conversions and contradictory negations.

4. Logical systems.

Like Aristotle, al-Fārābī concentrates his interest on two-premise inferences in a natural language. A pair of sentences with a term in common constitute a 'premise-pair'. If the pair yields a logical conclusion it is said to be 'productive'. A 'syllogism' is (usually) either a productive premise-pair or a productive premise-pair together with its conclusion. Following Aristotle, al-Fārābī classifies productive premise-pairs into 'moods' according to how their terms are placed (but see 4.1.3 below); and like Aristotle he classifies the moods into 'figures'. He describes moods as (for example) 'the first mood of the third figure' (which is *Darapti* in the later Latin terminology). A mood is unproductive if there are unproductive premise-pairs in the mood. He also makes a broader classification according to the forms of the sentences involved (thus 'categorical', 'hypothetical' etc. as below).

4.1 Categorical logic

For al-Fārābī, categorical logic is the common tool of all forms of logical art. He discusses it in [*Qiyas*], [*Short Qiyas*] and presumably also in the missing part of [*Commentary on Prior Analytics*]. His discussion follows Aristotle's *Prior Analytics* i.4-6 so closely that it will be simplest to concentrate on the places where he differs from Aristotle. He follows Aristotle in regarding first-figure categorical syllogisms as 'perfect', i.e. self-evidently yielding the stated conclusions, and in using a range of devices to 'reduce' other syllogisms to the first-figure ones.

4.1.1. Aristotle made systematic use of a technique for proving that a mood is unproductive, by finding terms to show that there is no affirmative conclusion and terms to show that there is no negative conclusion. Al-Fārābī never uses this technique, and it is not clear that he understood it at all. He does list unproductive moods; but in order to do this, he collects some statements by Aristotle about productive moods, and shows that each unproductive mood violates ones of these statements. Later Arabic logicians referred to statements about productive moods used in this way as 'conditions of productivity', though this term is not found in al-Fārābī himself. His use of conditions of productivity is a definite fall in rigour compared with Aristotle's logic, since al-Fārābī makes no attempt to justify the conditions.

4.1.2. Al-Fārābī repeats nearly all of Aristotle's justifications of second- and third-figure moods by reduction to first figure. But for *Baroco* in second figure he gives (in three places, REF) a justification by ecthesis, although earlier writers such as Philoponus REF had concluded that no such justification is possible. His ecthetic argument seems to have been taken from Aristotle's justification of a modal *Baroco* at *Prior Analytics* 30a5-11. The argument as he presents it is not formally valid, since he gives it for some specific natural language sentences and relies on real-world knowledge about the terms involved. Again this is a fall in rigour.

4.1.3. Aristotle distinguished the syllogistic figures by the placing of the terms in the premise-pair. Commentators were worried that Aristotle's definition of the figures was not uniform, since it involved different criteria in different cases. So, following Alexander, they

found a definition that depended on the placing of the terms in the conclusion or the goal. But that is strictly impossible, since the goal is not given by the premise-pair. Al-Fārābī quietly remedies this by introducing a convention: if the sentences are written in SP form, the major premise is written second, while if the sentences are written in PS form, the major premise is written first. Since the major premise contains the major term, and by the Alexander-Philoponus convention this term must be the predicate of the goal, the result is that one can read off the figure from the premise-pair itself, as Aristotle had intended.

4.1.4. Al-Fārābī claims that a kind of argument by cases (which he calls 'complete induction') can be seen as an inference in mood *Barbara*. His idea is that the argument takes the form

Every C is a B1 or a B2 or ... a Bn.

Every B1 or B2 or ... or Bn is an A.

Therefore every C is an A.

This is certainly an argument in the mood *Barbara*. But the disjunctive term 'B1 or ... or Bn' is unexplained (and al-Fārābī hides this fact by writing 'or' here as 'and'). More seriously, his informal explanation makes clear that the second premise is reached from several earlier premises each established separately: 'Every B1 is an A', 'Every B2 is an A' etc. He gives no hint of the rule needed to go from these separate premises to the combined second premise. This is not so much a fall in standards of rigour as a total absence of rigour.

4.2 Demonstrative logic

In order to show how a syllogism whose premises are certain can generate a conclusion that is certain, al-Fārābī begins by collecting from Aristotle's *Posterior Analytics* six statements about propositions that are certain truths (in the Arabic Aristotle they appear as statements about 'knowledge' ('*ilm*', translating *episteme*). Since one of these conditions is that we know the proposition to be true, al-Fārābī needs to establish that if we know the premises of a syllogism to be true, we also know the conclusion to be true. But he ignores this point, surprisingly since elsewhere he often comments on errors resulting from lack of awareness. Instead he concentrates on the sixth condition, which is that our knowledge of the truth of the proposition must be 'essential' and not 'accidental'.

Since the main propositions of science are affirmative and universally quantified, al-Fārābī concentrates on syllogisms whose conclusions are affirmative and universally quantified, i.e. syllogisms in *Barbara*. One of his main results is that if in both premises the predicate is constitutive for the subject, then the same holds also for the conclusion. Since having its predicate constitutive for its conclusion is one way of being an essential truth, this establishes

that syllogisms in *Barbara* lead from this kind of essential truth to this kind of essential truth. (He breaks down the argument into more specific cases: for example that the predicate is the genus of the subject, or the differentia of the subject.)

It would have made sense for al-Fārābī to adopt 'B is constitutive for A' as a new sentence form. An essentialist logic could be built around this form, with an essentialist version of *Barbara*:

C is constitutive for B.

B is constitutive for A.

Therefore C is constitutive for A.

It is quite possible that some later logicians read al-Fārābī in this spirit, but we should note that it is not how he himself speaks. For him the logic is categorical, but categorical *Barbara* preserves this kind of essentiality.

Al-Fārābī also considers cases where the subject B is constitutive for the predicate A. In such cases there is no general guarantee that 'Every B is an A'; for example animal is constitutive for human, but not every animal is a human. So in such cases the essentialist properties of the premises have no logical connection with the categorical form, and it is unclear why al-Fārābī considers these cases at all, except perhaps to make loyal use of some suggestions in the *Posterior Analytics*.

Chase (2007) quotes Albertus Magnus attributing some views to al-Fārābī, and notes that these views go in the direction of giving a Neoplatonic and emanationist colour to al-Fārābī's treatment of essence. It would follow that al-Fārābī wrote more about essentialist logic than we have, possibly in a *Commentary on the Posterior Analytics*. This is an interesting prospect, but for the moment it is only speculation. Albertus's references to al-Fārābī could simply be tendentious reports of remarks in the surviving work [*Demonstration*], FOR EXAMPLE.

4.3 Hypothetical logic

Hypothetical sentences consist of two shorter sentences joined by some 'particle' (such as 'and' or 'if ... then'); let us write such a sentence as (p * q), where * stands for the particle. Al-Fārābī classifies these compound sentences according to the kinds of inference that they allow. Thus if the inference

(p * q), p. Therefore q.

is allowed, the sentence (p * q) is said to be 'continuous'. (Example: (p*q) is 'If p then q'.) If the inferences

(p * q), p. Therefore not q.

$(p * q), q$. Therefore not p .

are allowed, the sentence $(p * q)$ is said to be 'separated'; if also we have the inferences

$(p * q), \text{not } p$. Therefore q .

$(p * q), \text{not } q$. Therefore p .

the separation is said to be 'perfect'. (Example of a perfect separated sentence: $(p * q)$ is 'Either p or q '.) It seems that al-Fārābī's hypothetical logic has no further inference rules beyond these and similar ones that are immediate from the classification.

In the separated case the second premise is said to be 'excepted'. This appears to be al-Fārābī's own terminology derived from Arabic linguistics. If I have two brothers Ahmed and Hasan, the inference

My brothers were there, except for Hasan. Therefore Ahmed was there.

is justified, and one sees the formal similarity to the second of the 'separated' inferences above.

Al-Fārābī has further classifications of hypothetical sentences, according to the evidence on which they are based. Some are described as *ittifāqī*, which could mean any of 'random', 'expressing agreement with the facts' and 'the result of an agreement between the people involved'. The examples that al-Fārābī gives fail to rule out any of these three readings. This could indicate that al-Fārābī is trying to make sense of earlier ideas that have reached him in a confused form. The strong similarities to the contents of Boethius' *De Hypothesis* also imply some earlier common source. There is room for research here. (See the further details in Chatti and Hodges under [*Syllogism*].)

Al-Fārābī suggests in several places that hypothetical syllogisms are reducible to categorical syllogisms. His examples are nonsensical as formal logic; FOR EXAMPLE:

Presumably when he says 'reducible', what he means is rather that in concrete situations an inference that can be formalised as hypothetical can generally be reformalised (for example by taking different parts of the context into the premises) as a categorical inference. This is vague but undoubtedly true; see for example Peirce's proof—many years after his discovery of first-order logic—that every inference can be formalised as an inference in *Barbara* (Peirce (1992) pp. 131f).

4.4 Compound syllogisms

A section on 'compound syllogisms' (i.e. arguments consisting of more than one syllogism arranged so that the conclusions of some syllogisms are premises of others) appears in [*Syllogism*], and a curtailed version of the same text is in [*Short Syllogism*]. The expression

'compound syllogism' seems not to be found before al-Fārābī, either in Arabic or in Greek. (The expression appears in manuscripts of the standard Arabic translation of the *Prior Analytics* in the heading of chapter i.42, but this heading could have been added after al-Fārābī.) The contents of this section of [*Syllogism*] read as a meditation on *Prior Analytics* i.25, where Aristotle claims to show that every argument can be analysed down to a combination of two-premise syllogisms. It hardly amounts to a general theory of compound syllogisms.

In [*Syllogism*] al-Fārābī includes a curious example of a syllogism compounded with an induction. We want to prove that bees are reproduced sexually. So we aim for the syllogism

All bees are animals.

All animals are reproduced sexually.

Therefore all bees are reproduced sexually.

Induction is needed to prove the second premise; so we subdivide 'animals' into the various kinds of animal and check that each kind is reproduced sexually. But if bees are included as a kind, the argument is circular; if they are not, 'no conclusion follows necessarily'. The example is intriguing, but the reader's guess at al-Fārābī's purpose in including it will be as good as anyone's.

Al-Fārābī does handle some arguments that involve more than one step of reasoning, without regarding them as compound syllogisms. One such case is proof by absurdity. He takes this to be a form of proof where a conclusion r that is known to be impossible is deduced from a premise p that is known to be true and another premise q . Given such a proof, we observe that since impossible conclusions never follow from possibly true premises, the premise q must be impossible and hence its contradictory negation is true. Al-Farabi gives no indication whether he regards this observation as a separate inference step or syllogism.

4.5 Modal logic

From a quotation by Ibn Usaybia from a lost work of al-Fārābī, we know that al-Fārābī regarded himself as the heir to a tradition in which for several hundred years nobody had studied Aristotle's modal syllogisms, and that he felt that he and his teacher Ibn Ḥaylān had turned a corner by studying the whole of the *Prior Analytics*. (See Watt (2008) for a deconstruction of al-Fārābī's account of this history. In any case the part of Aristotle that al-Fārābī did think had been studied continuously is relevant to conversion and contradiction of modal sentences.) Believing what he did, one would expect al-Fārābī to advertise his views on modal syllogisms. But there is almost no mention of modal syllogisms in any of his surviving works. (The author of [*Harmony*] says that Aristotle was right to accept *Barbara* with categorical minor premise and possibility major premise as productive; but arguments of Lameer (1994) and Rashed (2009) make it very unsafe to assume that this author is al-Fārābī.)

To learn something of his treatment of modal syllogisms in the missing part of his *Commentary on Prior Analytics* we must rely on comments in Avicenna, Averroes and Maimonides. These comments do not indicate any single modal syllogistic mood that al-Fārābī either accepted or rejected.

From REF and Maimonides cited in REF, we know that al-Fārābī criticised Galen for having suggested that possibility syllogisms are useless for science. On the contrary, al-Fārābī said, we know that possibility syllogisms are valuable for sciences where prognosis of the outcome is significant. This comment is bewildering at first: how can a conclusion that something is 'possibly' the case give any help for predicting actual outcomes? But then we realise that al-Fārābī must be assuming that 'possible' in modal syllogisms is a stand-in for a range of other notions, for example 'likely' or even 'probable'.

Once we realise that, some other material cited by Avicenna and Averroes falls into place, namely where al-Fārābī considers syllogistic premises of the form 'Every B is, insofar as it is a B, an A'. Al-Fārābī is very likely experimenting with this form as a possible reading of 'Every B is necessarily an A'. Unfortunately the trail quickly runs cold. We know from both Avicenna and Averroes that al-Fārābī asked whether 'insofar as it is a B' should be taken as a part of the subject or the predicate, and what the answer would imply for conversion. But we have only the questions, not al-Fārābī's answers.

We know a little more about al-Fārābī's use of the Dictum De Omni (refer to Pietrowski's article on Logical Form?) in modal syllogisms. According to quotations in Averroes, al-Fārābī regarded the Dictum De Omni as a 'condition' for the productivity of first-figure premise-pairs. Also he regarded the Dictum De Omni as something that should apply equally to syllogisms with categorical, necessity or probability premises, since Aristotle had said that the same rules apply regardless of the 'matter'. There is plenty to puzzle us here too. If the Dictum De Omni applies also to categorical logic, why does al-Fārābī never mention it in his surviving works on categorical logic? And how can 'possibly' and 'necessarily' be regarded as matter?

From Averroes we know that al-Fārābī observed that to get a valid syllogism

Every C is a possible B.

Every B is a possible A.

Therefore every C is a possible A.

(a form that Aristotle accepted as perfect) we need 'Every B' in the second premise to mean 'Every possible B'; otherwise the Cs might be possible and not actual Bs, and we would have a failure of 'enfolding' between the two premises. Because of the point above about 'matter', it follows that 'Every B' in categorical premises has to be read as 'Every possible B' too. In short al-Fārābī proposed ampliating to the possible in all premises, not just modal ones. Later Arabic logicians attributed this view to him, though they may have had the same difficulty as we do in distinguishing between what he said as his own view and what he thought Aristotle meant.

Note that 'Some possible B is an actual A' fails to convert to 'Some possible A is an actual B'; so that if al-Fārābī did amplify in all cases, he would have had problems maintaining his view that 'Some B is an A' converts to 'Some A is a B'. (The expression 'enfolding' in this context seems to be al-Fārābī's own invention, and it might indicate a growing interest in the set-theoretic underpinning of logic.)

5. The wider context.

5.1 Relation to other Islamic sciences

Al-Fārābī brought a number of terms into logic from surrounding disciplines. One is *yufīdu*, a word said of something that gives us what we wanted, usually either information or money. The term became frequent in linguistics of the generation before al-Fārābī, and he may have been the first person to use it within logic. Another is 'exception' (*istithnā*). As we saw in section 4.5 above, he may have been the first person to ask for the logical properties of 'insofar as'—though similar locutions are found in Aristotle's metaphysics.

There has been considerable debate about how far al-Fārābī meant to relate his logic to the study of reasoning in the Islamic jurisprudence (*fiqh*) of his time. Reference Gyekye (1989), Lameer (1994), Mallet (1994, 1996).

Influence in the other direction?

5.2 Influence on later logicians

List influences on Avicenna.

Note Avicenna's habit of using Farabian language in non-Farabian senses.

Can we trace Farabian influence on the post-Avicennan logicians? Mention also resistance to Farabi's innovations, e.g. in Abū al-Barakāt; and the Pourjavady-Schmidtke paper.

Averroes as a channel for Farabian influence on the scholastics.

5.3 Informal logic

A number of points mentioned above suggest that it is wrong to see al-Fārābī as a formal logician. Aristotle's categorical logic cries out to be regarded as formal, in the sense that it is the study of a set of argument forms every instance of which is valid. But even here al-Fārābī sidesteps, or perhaps fails to notice, the notion of valid argument form. His treatment of *Baroco* (4.1.2) illustrates this; we get a similar message from his carelessness about the exact forms of sentences in 4.1.4 and the reduction of hypothetical to categorical

sylogisms. His attempt (if that is what it is) to define formal logic in terms of topics goes nowhere.

Al-Fārābī's frequent references to the 'rules' (*qawānīn*, from Greek *kanōn*) of logic are not an indication that he regarded logic as operating by formal rules. For example his [*Canons*] consists of 'rules' for the logical art of poetry; but the 'rules' in question are definitions of technical terms, largely for describing forms of poems. They serve more as heuristics, directing our attention to useful concepts when thinking about poetry. According to the analysis of Aouad and Schoeler (2002), al-Fārābī claims that the paradigm syllogisms of poetry are nonproductive second figure syllogisms; which raises the natural question how poetry differs from sophistry.

But one can make a good case that al-Fārābī was the first major practitioner of the discipline that we know today as 'informal logic and critical thinking'. (Cf. Hitchcock (2017) and Walton (1989); like Walton, al-Fārābī gives a pivotal role to dialogue.) In many examples where al-Fārābī claims that a certain argument has a certain syllogistic form, the form is trivial (it is often *Barbara*), but writing down the premises has the effect of identifying the claims that need to be justified in the argument.

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