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Fārābī on logic and language

For general information on al-Fārābī (c. 870-c. 950) see Druart 'Al-Fārābī' (SEP).

## 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. Around the fifth century translations of Aristotle and commentaries in Syriac started to appear, and some of these were later translated into Arabic.<sup>1</sup>

In the Arabic-speaking world 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. There were also commentators writing in Arabic, though little was composed in Arabic before al-Fārābī himself.<sup>2</sup>

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' (*taṣawwur*) 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 (e.g. [*Expressions*] 87.17f). But al-Fārābī himself sometimes runs the risk of blurring the distinction by treating definition and demonstration as in some sense equivalent processes.<sup>3</sup>

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.<sup>4</sup> 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' (SEP) 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' (*jadāl*), 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 3.3 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 it fed into Avicenna's view 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 [*Expressions*] and [*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. Theory of language

#### 3.1. Compositionality

Al-Fārābī is the earliest known proponent of the thesis of compositionality of meanings. He expresses it in different words in different places (chiefly in [*Letters*], [*Expressions*] and [*Commentary on De Interpretatione*]), but in all these places the same message comes through: the meaning of a compound phrase is a compound of meanings, and its component meanings are those of the corresponding syntactic components of the phrase.<sup>5</sup> One statement reads as follows:

... the act of combining expressions is similar to the combination of composite meanings, which are indicated by these composite expressions. Composite expressions are given things enabling them to connect with one another when these expressions indicate composite meanings that connect to one another. Care is taken that the arrangement of expressions is equivalent to the arrangement of meanings in the soul. ([*Letters*] (126), trans. Khalidi.)

Al-Fārābī has a tendency to think of natural languages as artefacts that were put together deliberately, rather like law codes. So for him, compositionality describes the intentions of the language creators. He sometimes speaks of the expressions of a language as 'copies' of their meanings; in this sense, the meanings came first.

Since Frege, modern discussion of compositionality has often focussed on failures of compositionality, in particular places where the syntactic context of a phrase seems to alter the meaning of the phrase. Al-Fārābī shows some awareness of this phenomenon: at [*Sophistical*] 136.5 that the same expression can have one signification in one compound, but an 'altered' signification in another compound. He has in mind the Aristotelian example of the person who is perceptive and a doctor (Aristotle has 'cobbler') but not a perceptive doctor. But his discussions of this example are aimed more at explaining Aristotle than in developing a theory of compositionality. In fact for al-Fārābī the main role of compositionality seems to be to allow him to jump freely between expressions and their meanings. (In this he follows the habit of his predecessors, except that he offers a valid reason for this habit.) He does often speak about how the gap between expression and meaning can lead to mistakes in reasoning, but his point normally is that people can make mistakes in working out the meaning from the expression.

Compositionality entered Latin thinking through Abelard in the 12th century. Since no line of communication from al-Fārābī to Abelard is known, one asks if there is a common ancestor. But none is known.<sup>6</sup>

Examples of various kinds of linguistic compound are scattered through al-Fārābī's writings, but he offers a theoretical account only of three kinds (all of them discussed in his [*Interpretation*]). The first he calls simply 'compound', namely where two descriptive words or phrases are combined to form a simple sentence as in section 3.3 below. The second is the 'compound of restriction', which takes the form 'X that is a Y' (or 'X that is a Y and a Z' etc.). The third is where two sentences are combined, as in section 5.3 below.

### 3.2. Classification of meanings

One consequence of compositionality, as al-Fārābī understands it, is that a large part of the description of languages can be referred back to a description of meanings. For al-Fārābī the central question about meanings must be how we classify and distinguish them. He bases his answer to this question on an analysis of question words, beginning with the word 'what' (Arabic *mā*).

Al-Fārābī defines a 'thing' (Arabic *shay'*) to be an entity for which there is an acceptable answer to the question 'What is it?'. The collection of acceptable answers to this question forms the 'whatness' (Arabic *māhiyya*, cf. the Latin *quidditas*) of the thing. Al-Fārābī identifies the whatness with the Aristotelian essence (in Aristotle's Greek, *to ti ēn einai*). For example I can point at a date-palm and ask you 'What is it?', and you can truthfully and relevantly answer 'It's a tree'. So the date-palm is a thing, and 'tree' is a part of its whatness or essence. But also I can ask you 'What is a horse?' and you can answer 'It's an animal'. This time the question is not about an identifiable individual in the world; rather it's about the meaning of the common noun 'horse'. So al-Fārābī takes this meaning to be a thing with a whatness. Since the meaning is true of many different individuals, al-Fārābī (following Aristotle) calls it a 'universal'.

Sometimes al-Fārābī suggests that there are two main kinds of thing, namely universals and identifiable individuals. But at other times he seems to forget the individuals and concentrate on meanings. He has a reason for this. For purposes of classification, a thing and its whatness are interchangeable; bringing a thing into your mind is the same as bringing its whatness into your mind. In this sense 'the whatness of a thing is the thing itself' ([*Letters*] 195.21). For universal meanings this is a plausible view; one might well argue that a universal meaning consists of the ideas that we can use to explain or define it. But identifiable individuals are clearly not the same thing as their whatnesses, because the whatnesses are made up of meanings and so are mental entities, unlike the date-palm in the external world. The whatnesses of individuals are not universals, because two different individuals have different whatnesses; al-Fārābī again follows Aristotle in calling these whatnesses 'particulars' (or 'individuals'). So often al-Fārābī's world of things consists of two kinds of whatness: universals and particulars.

The idea of defining classificatory notions in terms of the answer to questions is not new with al-Fārābī. The Syriac introduction to logic by Paul the Persian in the 6th century, in its definition of 'genus', contains the remark 'If we are asked "What is a horse?" we answer "It's an animal", and so "animal" is predicated of it as part of its essence'. (Trans. from Land's Latin translation 7.5-7, cf. 7.14f.) But al-Fārābī's version contains a radical innovation. Notoriously the appropriate answers to a question depend on the context and intention behind the question; this makes explanations like that of Paul the Persian unhelpful, because the context has to be that the questioner is looking for the essence, so that the explanation is circular. In his [*Letters*], al-Fārābī aims to break out of the circle by beginning with a study of how questions are used in everyday speech. He presents a rich array of material, which merits study for the problems that it raises as much as the solutions it offers. He seems not to realise how odd some of his questions and answers are. For example when would we ask 'Which is the plant in Egypt?'? And when would we accept the answer 'It's a body' to the question 'What is it?' asked of a date-palm? ([*Letters*] 188.10, 166.16)<sup>7</sup>.

Al-Fārābī uses this theory of questions in order to show how a universal, say U, can be defined. The first question will be 'What is U?' If an appropriate answer is 'It's an X', then X is a 'genus' (*jins*) of U. U may have several genera, but we look for one that is as close as possible to U without being equivalent to U. In the general case there is a unique such X, called the 'proximate genus' of U. Since X is not equivalent to U, we can ask a second question 'Which X is U?' An appropriate answer to this will give us Y, which selects from those things which are Xs the ones that are also Us; it is known as a 'differentia' (*faṣl*) of U. Then we can define U as the restrictive compound 'X which is Y'; this is a definition (*ḥadd*) by genus and differentia. For example we can define 'human' as 'animal which is rational', taking 'animal' as the genus and 'rational' as the differentia.

Al-Fārābī notes that 'animal' in turn can be defined as 'body which digests and perceives', so that this definition of human can be unpacked to 'body which digests and perceives and is rational'; and similarly with other definitions. At every stage of the unpacking process, the resulting phrase will be a restrictive compound with at least two components. The components that can occur are the 'constitutives' (*muqawwim*) of the whatness of the universal being defined. This looks like a definition of 'constitutive', but really it is not, because being a constitutive is one of the criteria that al-Fārābī applies in order to determine whether an answer to a question is appropriate for purposes of discriminating. For example the question 'Which animal is the human?' might be answered by 'He is the animal that sells and buys'; but al-Fārābī excludes this as a definition since selling and buying are not constitutive for human. The truth seems to be that 'constitutive' is one of al-Fārābī's primitive and undefined notions; which is frustrating, since we will see that it plays a crucial role in his demonstrative logic.

Although al-Fārābī's explanations and examples are often original and interesting, the kinds of classification that he offers were already well-known in the Peripatetic tradition. Genus and differentia are two of the five notions which Porphyry in his *Eisagoge* used for classifying universals. Al-Fārābī also uses the remaining three notions: species, accident, proprium. Alongside these al-Fārābī uses the separate classification scheme given by

Aristotle's *Categories*: substance, quality, quantity, time, place, etc.; in fact several of the categories have names derived from question words (e.g. 'quantity' *kamiyya* from 'how many' *kam*), so they play to al-Fārābī's tune.<sup>8</sup>

There is a problem why al-Fārābī considers the categories relevant to a logical study of language, since he himself goes to some length to show that the categories are irrelevant to the rules of reasoning. (In the next century Avicenna would argue that the categories are not needed for logic, using arguments like those already in al-Fārābī.) The easiest answer might be the truth: that al-Fārābī found the categories included as part of logic in the curricula of his predecessors. Another answer that might occur to one is that the categories are needed for ensuring that propositions are well-formed and don't contain 'category mistakes'. But this is unlikely; although al-Fārābī often talks about meanings 'fitting together', he seems to have no interest in discussing semantic misfits. For him the sentence 'Every heat is curvilinear' is acceptable but false ([*Categories*] 125.8).<sup>9</sup>

### 3.3. Simple propositions

Al-Fārābī describes the simplest propositions as being built up from two 'things', say X and Y. There are two kinds of simple proposition: affirmative and negative. An affirmative simple sentence expresses that Y (say) is 'found for' (*mawjūd li*) X or 'predicated of' (*mahmūl 'alā*) X; a negative simple sentence expresses that Y is 'not found for' X or 'not predicated of' X. Thanks to the influence of Avicenna and other Peripatetic philosophers in Islamic culture, these usages have come to be accepted both in Arabic and in Persian (for example *mawjūd* now commonly means 'existing' in both languages). But when al-Fārābī wrote, these were both technical terms transmitted from Greek through Syriac; see Zimmermann REF for details. So they need an explanation. One line of explanation is to say that 'Y is found for X' means that some sentence of the form 'Every/some/the X is a Y' is true; and likewise 'Y is not found for X' means that some sentence of the form 'No X is a Y' or 'Not every X is a Y' or 'The X is not a Y' is true. For a modern logician it would be outrageous to give a basic definition as rough-hewn as this; but al-Fārābī is following the tradition, and we have to accept it.

In the examples above, X is said to be the 'subject' and Y the 'predicate', and together they form the 'terms' of the proposition. We notice that in the technical formulations the predicate Y is stated first, whereas in the explanatory sentences (at least in Arabic, Latin and English) the subject is stated first. Al-Fārābī exploits this difference (see 5.1.3 below), so it will be helpful to name it. We describe the predicate-first form as PS, and the subject-first form as SP. While Aristotle generally used the technical PS form, Arabic logicians from earliest days preferred the SP form. This is why the Arabic logicians generally run the variables backwards: for example 'Every B is an A' rather than 'Every A is a B'.

The simple sentence forms can be tightened up by adding a quantifier (Arabic *sur*), so that we have the following four sentences in the SP form:



1. Every B is an A. ('Affirmative universal')
2. No B is an A. ('Negative universal')
3. Some B is an A. ('Affirmative particular')
4. Not every B is an A; or, Some B is not an A. ('Negative particular')

Al-Fārābī explains in [*Categories*] 124.10-19 that 1 and 4 are contradictory negations of each other, in the sense that they 'partition truth and falsity'; he presumably means that in any situation exactly one of 1 and 4 (with the same A and B in both cases) is true and the other one is false. In the same sense, 2 and 3 are contradictory negations of each other. This is all standard Aristotelian fare: but al-Fārābī adds two novel items. First, he says that a pair of the form 1, 4 or 2, 3 partitions truth and falsity 'whether or not there are any Bs'; and second, he says that when there are no Bs, the affirmative sentence of the pair is false. As Saloua Chatti has noted (unpublished), this makes al-Fārābī the first logician known to have explicitly stated the existential import of affirmative universal sentences.

But we have to add a reservation. In some places where he surely would have mentioned the existential import if he had believed it, he fails to do so. One such place is [*Commentary on De Interpretatione*] 133.1-137.20 distinguishing simple negation from metathetic negation (see footnote 11 below). The omission here is so odd that it might be evidence that the *Commentary* was written before al-Fārābī had formulated the theory presented in [*Categories*]. (Almost nothing is known about the order in which al-Fārābī's works were written.) In fact [*Categories*] may turn out to be the only book in which al-Fārābī mentions the existential import.<sup>10</sup>

Al-Fārābī also uses some variants of the simple sentence forms above, all of them taken from the Aristotelian tradition. Thus the predicate can be negated, as for example 'not-human'; this form is called 'indefinite', and the sentence 'Every B is a not-A' is a 'metathetic negation' as opposed to the 'simple negation' 'No B is an A'. See Thom (2008) for al-Fārābī's treatment of indefinite and privative terms.<sup>11</sup>

### 3.4. Development of language

Al-Fārābī makes frequent references to ways in which one feature of languages is 'prior to' another. In some cases he is talking about the historical development within a single language; elsewhere he is talking about relationships between languages. Sometimes he is probably talking about a conceptual priority, not a temporal one.

For example Porphyry had distinguished between words of 'first imposition', which are used to name or classify things in the world, and words of 'second imposition' which are used to name or classify words of first imposition. It makes sense to apply a similar distinction to meanings rather than words; Dexippus (4th century) took this step, and al-Fārābī followed him, speaking of 'primary intellecteds' and 'secondary intellecteds'. (An intellected, *ma 'qūl*, is the same as a meaning; to describe it as 'intellected' just means that it has been passed through

the intellect to bring it to a form suitable for thinking. The corresponding Latin is *intelligibile*.) Two features of al-Fārābī's use of this distinction are worth mention.

First, al-Fārābī points out that there are also intellecteds that classify second intellecteds 'and so on to infinity'. But he also says that the higher levels of this hierarchy don't introduce new phenomena; for example some of the secondary intellecteds can already serve to classify second and higher intellecteds too.

Second, he uses the notion to specify the 'primary subjects' of logic. Namely, the primary subjects of logic are the first intellecteds 'insofar as' they are predicates, or subjects, or defined in terms of each other, etc. A thing is only a predicate or a subject in the context of some compound meaning, and so al-Fārābī goes on to explain that logic is concerned with 'features of compounded things' (*aḥwāl al-murakkabāt*). These brief remarks form a crucial intermediate step between Paul the Persian's statement that 'Logic arises from the composition of speech' and Avicenna's much more detailed and sophisticated account of the 'subject' of logic.<sup>12</sup>

Another form of language development that interests al-Fārābī is the derivation of new words from old ones. For example he claims that the way in which inflections are added to roots is a copy of the way in which accidents are attached to and removed from meanings. He uses this relationship to explain why there are no finite Arabic verbs meaning 'is an X' (as opposed to 'becomes an X', for example); this is interesting as a semantic explanation of an observed linguistic fact.

Yet another form of language development is the introduction of new vocabulary for new sciences or crafts. Al-Fārābī lays out criteria for choosing the new words, either as derivatives of existing words in the existing language, or as already existing words of the language but with a new meaning, or as borrowings from other languages. He also notes situations (particularly in logical procedures) where it is appropriate to introduce new words rather than expressing the same meaning by compound phrases.

### 3.5. Al-Fārābī's knowledge of languages and linguistics

Al-Fārābī's Arabic is fluent, and at its best quite eloquent. It is not certain that al-Fārābī could read or speak any language other than Arabic. His name suggests family origins in a Turkic-speaking area, but he never calls on any knowledge of Turkic languages. The languages that he does invoke, apart from Arabic, are Greek, Persian, Syriac and Sogdian. Elementary errors in his explanation of Greek words make it probable that he had no working knowledge of the language (Zimmermann (1981) p. xlvi), and the same has been claimed for his knowledge of Persian (Zimmermann (1981) p. 38 note 6). There is a better chance he knew some Sogdian (at that date the chief language of the Silk Road, though soon to be replaced by Turkic languages), since there seems no other reason for him to mention it; but the information that he gives us about it is purely lexicographic. He had a number of Syriac-speaking associates, which increases the chances that he knew some of the language; but it

also means that the small amount of information (again purely lexicographic) that he gives us about this language could be based on remarks of his friends and teachers.

Further evidence comes from his claim that the distinction between fixed substance and changing accidents is copied in languages by the distinction between fixed and variable letters. He is clearly describing the Semitic system of radicals; Greek, Persian, Sogdian and Turkic languages all resist this kind of description.

We know from al-Fārābī's [*Catalogue*] that he knew his way round the main components of Arabic linguistics, at least to the extent that might be expected of a well-informed intellectual. There is a tradition that his study of linguistics went further than this: Ibn abī-Uṣaybi'a (1965) 606.8f reported a story that 'al-Fārābī used to meet with Abū Bakr bin al-Sarrāj to learn from him the art of grammar, while Ibn al-Sarrāj would learn from al-Fārābī the art of logic'. Ibn al-Sarrāj (c. 875-929) was the author of the influential book *Foundations in Grammar*, described by Suleiman (1999) p. 12 as 'as a descriptive treatise on Arabic grammar'. Versteegh accepts this tradition, and points to al-Fārābī's criticism of Arabic linguists' definition of parts of speech in [*Expressions*], adding that 'It must have been a humiliating conclusion for the Arabic grammarians that their classification was judged to be insufficient for the analysis of Arabic, since the arguments and examples al-Fārābī used were derived from their own language ...' (Versteegh (1997) p. 84, in his Ch. 6 'The relationship between speech and thought: Al-Fārābī on language'). Zimmermann (1981) cxviii-cxxii reviews the same evidence and is much more cautious. It is possible that the tradition reflects only a later perception that al-Fārābī was friendly to the study of grammar.

#### 4. The nature of truth and inference

##### 4.1. Truth

What al-Fārābī tells us about truth and falsehood is not easy to understand, and consists largely of isolated flashes of insight. So the summary below has to be regarded as provisional.

Al-Fārābī tells us that truth consists in a relation between things that we conceptualise and things in the external world. For example 'The meaning of truth is that what is conceptualised in the soul is the same as outside the soul' ([*Letters*] 214.1f, cf. 117.24-118.1). To clarify what 'the same' means here, al-Fārābī passes to affirmative simple propositions; for these truth means that the subject is the same in the external world as it is stated to be in the proposition. In other words, for these sentences we can take the correspondence to be between our conceptualisation of the subject and the subject itself in the external world.

At this point al-Fārābī is in danger of being trapped by his habit of identifying 'things' with their whatnesses. To say that the whatness of the subject is the same in our souls as it is in the world is to say that the subject has the same *essential* properties in our souls as in the world; and this can only serve to explain what it is for an essential or necessary proposition to be true. In fact at [*Interpretation*] 140.18 he tells us that 'the declarative sentence is true or

false through its construction and essence, and not by accident'. But elsewhere he realises the trap and warns us that 'things' can be *mawjūd* as such-and-such either by essence or by accident ([*Letters*] 216.3). This is a rescue that doesn't help to build up a general account. However, it does serve to remind us that further analysis will depend on explaining the relationship between the technical notion of *mawjūd* and truth. In fact al-Fārābī sometimes treats *mawjūd* and 'true' as synonyms. As a result, al-Fārābī's theory of truth and his theory of existence slide into one another.<sup>13</sup>

In his discussions of induction, al-Fārābī reminds us that the truth of a universal statement can be reduced to the truth of each of the corresponding judgments about all the individuals below the subject term ([*Expressions*] 93.11-14). Al-Fārābī says little or nothing about the relationship between the truth-value of a sentential compound and the truth-values of its subclauses; instead he explains these compounds in terms of how they appear in arguments (see 5.3 below).

Al-Fārābī has a very distinctive view about the excluded middle. If P and Q are two statements that are the contradictory negations of each other, then at least one of the two is true. He tells us that for statements that are necessarily true or necessarily false, this implies that either P specifically is true or Q specifically is true. But for statements of possibilities there is no such implication. For these statements, just as we can know that 'Either P or Q' without knowing that P or knowing that Q, so it can be true 'in itself' that 'Either P or Q' without its being true 'in itself' that P or its being true 'in itself' that Q. Al-Fārābī offers this as a solution of Aristotle's puzzle about the sea battle. ([*Commentary on De Interpretatione*] 97, p. 92 in Zimmermann (1981)).

#### 4.2. Definition of inference

Al-Fārābī's general term for inference is 'syllogism', *qiyās*. He offers two definitions of this term, one narrow and one broad. The narrow definition reads:

A syllogism is a discourse in which things are posited, more than one of them, such that when they are composed, something different from them follows from them, essentially and not by accident, and necessarily. ([*Syllogism*] 19.8-11.)

He takes this definition from the Arabic translation of *Prior Analytics* 24b19f, with two main adjustments. The first is that while Aristotle says that the conclusion (the 'something different') follows when things are posited, al-Fārābī requires that the things should also be 'composed'. His point presumably is that no deduction occurs until the connection between the premises (the things posited) is recognised. The second is that the Arabic Aristotle says that the conclusion follows from the premises *bi-dhātihā*, which can mean either (1) 'by their essences' as opposed to accidentally, or (2) by themselves without relying on anything else. In the definition quoted above, al-Fārābī resolves this ambiguity in favour of (1).

Curiously the very similar definition in [*Short Syllogism*] 75.12f resolves the ambiguity in favour of (2). Al-Fārābī's practice doesn't clarify whether he really means (1) or

(2). For example in [*Sophistical*] he condemns some putative syllogisms because their conclusion follows only accidentally; but elsewhere he makes following essentially a mark of demonstrative syllogisms rather than syllogisms in general.

The broader definition of 'syllogism' in [*Expressions*] 100.3-5 is that a syllogism is things that are arranged in the mind in an order such that when the things have been put in this order, the mind as a result finds itself unavoidably looking down at something else of which it was ignorant before, so that it knows it now, and thus the mind is equipped to submit to the thing it looked down at, just as if it [already] knew that thing.

He goes on to explain that these 'things ordered in the mind' have to be intellected meanings, not verbal expressions. This definition probably owes something to Aristotle's remark that in a dialogue, the questioner can sometimes hide from the responder the fact that the responder is accepting the premises of a syllogism, by presenting those premises to the responder in the wrong order.<sup>14</sup>

#### 4.3. Conversions and contradictions

Following the *Organon*, al-Fārābī treats logical relationships between two sentences separately from syllogisms in general. These logical relationships include contradictory negation, as in 3.3 above. They also include conversions, where the second sentence follows from the first but is in some sense the other way round from the first. For simple sentences al-Fārābī's account of conversion is not significantly different from Aristotle's.

There is one novelty: al-Fārābī recognises some conversions using metathetic subjects, for example:

If every human is an animal, then every non-animal is a non-human.

Since al-Fārābī's categorical logic never makes any use of metathetic subjects, this conversion never connects with categorical logic. In fact al-Fārābī introduces it as a topic rather than a logical rule. (On conversions in al-Fārābī involving negations, see Fallahi (in preparation).)

We know from remarks of Avicenna that al-Fārābī was also interested in conversions between modal propositions. But as with his modal logic in general, we know almost nothing about what modal conversions he accepted or rejected. Since he argued that Aristotle should have read 'Every B is possibly an A' as quantifying over all things that are possibly Bs, it seems highly likely that he accepted the inference from 'Every B is possibly an A' to 'Every A is possibly a B'. (See further 5.5 below.)

#### 4.4. Is al-Fārābī's logic formal?

The question is whether al-Fārābī identifies argument forms which have the property that every argument of such a form is valid. Zimmermann (1981) xxxviii has argued that al-Fārābī does exactly this when he distinguishes between the 'matter' of the sentences in the premises of a syllogism, and the 'composition' of the syllogism; the composition is the form. This view has been accepted by a number of recent writers, and allows them to speak of al-Fārābī's 'formalism'.<sup>15</sup> But some serious reservations need to be put.

First, al-Fārābī's distinction between matter and composition works only for categorical logic, which is well recognised as being a formal logic. Al-Fārābī may have no sensible extension of the notion to other logics. For example in modal logic, Averroes quotes al-Fārābī as saying that the distinction between 'Every B is an A with necessity' and 'Every B is an A with possibility' is a distinction of matter (Ibn Rushd (1983) 133.1-3); this suggests a shallow understanding.<sup>16</sup>

Second, al-Fārābī's notion of when two arguments have 'the same composition' is much looser than most formal logicians would allow; see 5.1.4 below on induction and 5.34 on *reductio ad absurdum*.

Third, within categorical logic itself, al-Fārābī thinks it is satisfactory to justify one of the valid forms by using a particular example and a real-world feature of that example; see 5.1.2 below on *Baroco*.

It may well be true that al-Fārābī took some steps towards formal logic and away from the informality of the Syriac tradition. But the steps were limited and unsteady. In any case one should not underestimate the major contribution that al-Fārābī made towards creating a theory of what we know today as 'informal logic and critical thinking'.<sup>17</sup> 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. This illustrates how logic can serve as a tool for organising our reasoning at quite an informal level.

## 5. 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 5.1.3 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).

## 5.1 Categorical logic

For al-Fārābī, categorical logic is the common tool of all forms of logical art. He discusses it in [*Syllogism*], [*Short Syllogism*] 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.

5.1.1. 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.

5.1.2. 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) a justification by ecthesis, although earlier writers such as Philoponus 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.<sup>18</sup> Again this is a fall in rigour.

5.1.3. 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. In [*Syllogism*] al-Fārābī quietly and perhaps unintentionally remedies this, at least for first-figure syllogisms, 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 definition of Alexander and his successors 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.<sup>19</sup>

5.1.4. 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.

## 5.2 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*.<sup>20</sup>

### 5.3 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 for perfect separated:  $(p * q)$  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.<sup>21</sup>

#### 5.4 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.<sup>22</sup> 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-Fārābī gives no indication whether he regards this observation as a separate inference step or syllogism.

#### 5.5 Modal logic

From a quotation by Ibn Abī Usaybi'a (1965) 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*.<sup>23</sup> 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 [*Commentary on De Interpretatione*] (193.3-19, Zimmermann (1981) p. 186f) and quotations in Maimonides, we know that al-Fārābī criticised Galen for having suggested that possibility syllogisms are useless for science. On the contrary, al-Fārābī said, syllogisms that mix possibility statements and absolute ones are extremely useful

because all the practical sciences make use of [them], especially in establishing whether the single phenomena which are expected, are going to occur or not, in medicine, in agriculture, in navigation, in politics, in rhetoric, in general premises and in all the activities in which one is in need of prognostics. (Quoted by Maimonides, trans. Schacht and Meyerhof (1937) p. 67.)

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 (cf. Street (2001)) 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 of modal sentences. 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* (see Pietroski 'Logical form' (SEP) for this notion) 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. For example, if the *Dictum De Omni* applies also to categorical logic, why does al-Fārābī never mention it in his surviving works on categorical logic?

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.<sup>24</sup> 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'.

## 6. The wider context.

### 6.1 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 (Giolfo and Hodges (2018)). 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). Lameer (1994) p. 235-239 points out that some of al-Fārābī's references to jurisprudential logic are the result of a curious glitch in the standard Arabic version of the *Prior Analytics* at ii.23, 6b9-12. Aristotle spoke of 'rhetorical syllogisms', but this is expanded in the Arabic to 'rhetorical, jurisprudential and advisory syllogisms'. It seems that al-Fārābī took the text as evidence that Aristotle himself had jurisprudential logic in mind in his *Prior Analytics*.

### 6.2 Influence on later logicians

Ibn Bajja (Avempace). Avicenna. Al-Ghazali. Averroes.

Pourjavady and Schmidtke (2015) report that al-Fārābī's works were relatively neglected from the late 12th to the late 15th century, though some logical specialists in this period (such as Naṣīr al-Dīn al-Ṭūsī) were still able to cite him. Interest started to grow in the late 15th century, but it was not until the 17th century that his longer logical works began to be copied regularly.

The Latins knew al-Fārābī as Alfarabius. The channels by which his logic reached them—apart from the *Quaesita* of Averroes—are still uncertain. He can probably be held responsible for the spread of the notion of ampliation, and his speculations in [Demonstration] may have influenced writings on per se predication. EXPAND.

### Footnotes

<sup>1</sup> For the Syriac logical tradition see Brock (1993) and Hugonnard-Roche (2004).

<sup>2</sup> See Zimmermann (1981) lxviii-xcviii and Lameer (1994) Chapter 1 on what was available to al-Fārābī of earlier logical writers.

<sup>3</sup> For example at [Demonstration] 47.21-24 he presents what he sees as the same material, first as a demonstration and then as a definition. The demonstration:

The cloud contains a wind that ripples;

so there is a sound in it,

so therefore the cloud contains a sound.

He continues: 'When we want to take these same parts as a definition, we alter the order and say:

Thunder is a sound in a cloud caused by the rippling of wind in it.'

<sup>4</sup> Gutas (1983) traces the influence of the Alexandrian logicians on Al-Fārābī through the Syrian scholar Paul the Persian. For the influence of the Alexandrian school on al-Fārābī more generally, see Vallat (2004).

<sup>5</sup> This kind of compositionality can be called Aristotelian compositionality, to distinguish it from late twentieth-century versions, for example by Partee and Davidson, which make no use of the notion of 'components of meanings'. See Hodges (2012b) and Szabó 'Compositionality' (SEP).

<sup>6</sup> It has been suggested that al-Fārābī himself created his notion of compositionality, relying on an informal view which he shared with some Arabic linguists of his time, that the meaning of an utterance is the intention of the speaker in making that utterance. If the speaker intends all parts of a compound statement, then one might assume that the speaker's intention in the whole statement is built up from her intentions in the separate parts. (Giolfo and Hodges (2013).) One fact pointing to independent Arabic and Latin discoveries is that al-Fārābī and his successors seem to have expressed compositionality in terms of building compounds from their parts, whereas Abelard and his successors Leibniz and Frege all expressed it in terms of how the meaning of the whole phrase is affected if one part is replaced by a phrase with the same meaning. On Abelard see Rosier-Catach (1999), and on Leibniz see Ishiguro (1990).

<sup>7</sup> The problems raised by al-Fārābī's theory of questions are still very much alive. See Cross and Roelofsen 'Questions' (SEP). For example compare the answer 'It's a body' (about the date-palm) with the answer '[He] is a person who is over three inches tall' discussed in 'Questions' 4.4.

<sup>8</sup> Chapters III and IV in Rescher (1968) are helpful for comparing al-Fārābī's questions with Aristotle's ontology, including the categories. Rescher published too early to take advantage of the publication of [*Letters*] in 1968, which is why these two chapters address the later writers Yahyā bin 'Adī and Avicenna instead of al-Fārābī. Rescher conjectures that the use of questions to organise the categories was originally a Stoic innovation, noting that Chrysippus wrote a treatise 'On questions'.

<sup>9</sup> Commentaries often began with an explanation of the reasons for studying the material (Hasnawi (1985)); but al-Fārābī's surviving summary of Aristotle's *Categories* gives no such explanation. In the fragmentary [*Commentary on Categories*] p. 202, al-Fārābī says 'Under the conditions we have mentioned, the contents of the *Categories* turn out to be a specific part of logic', but it is not easy to see what the conditions in question amount to. The introduction to [*Commentary on De Interpretatione*] (22.14, Zimmermann p. 7) tells us that *Categories* contains 'logical descriptions' of the categories, showing how they appear in compositions; but it is not clear what al-Fārābī means by 'logical' here, beyond the fact that the descriptions are not restricted to a particular language. Gutas (2014) pp. 300-303 discusses Avicenna's separation of the categories from logic.

<sup>10</sup> Either this existential import or something close it is needed to justify a rule of Aristotelian logic: that from 'Every B is an A' we can infer 'Some A is a B'. Avicenna accepted al-Fārābī's account of existential import, adding that in his view all sane logicians before him had

believed it (Hodges (2012a)). Read (2015) argues that Aristotle himself believed in the existential import of universal affirmative propositions.

<sup>11</sup> Al-Fārābī's treatment of these variants is generally not deep. For example he never asks how the question 'What is a non-human?' can have a sensible answer, i.e. how 'non-human' can have a whatness. Also a universal metathetic negation counts as affirmative, because the sign of negation is hidden inside the predicate; but it doesn't occur to al-Fārābī to note the consequence that the universal metathetic negation has existential import while the universal simple negation doesn't.

<sup>12</sup> Cf. Street 'Arabic and Islamic philosophy of logic and language' (SEP). Much of the recent discussion of these notions in al-Fārābī and Avicenna confuses the subject individuals of logic with the 'features' which they have in compounds. This confusion is more damaging for understanding Avicenna than it is for al-Fārābī.

<sup>13</sup> For further discussion of these difficult issues, see Menn (2008) and Abed (1991) 111-115.

<sup>14</sup> On all of this paragraph, see further Hodges (to appear).

<sup>15</sup> 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 invalid second figure categorical syllogisms; which raises the natural question how poetry differs from sophistry.

<sup>16</sup> There is an interesting passage in [*Analysis*] 95.5-8 pointed out by Mallet (1994). Al-Fārābī describes 'topics' as 'the universally quantified premises whose particular cases are used as major premises in the syllogism and in each separate art'. When he says 'particular cases', we at first expect him to be talking about applications of premises to individuals. The difficulty with this reading is that in categorical logic, major premises are almost always universally quantified. A possible alternative reading is that a topic might have the form 'Every Y is an X' with letters, and a particular case might be the sentence 'Every horse is an animal'. So the topic is the sentence form. This alternative reading is interesting because it

brings al-Fārābī into line with the early 20th century logician David Hilbert. In his lectures on first-order logic, Hilbert introduced predicate logic by taking one of the standard medieval topics and showing that it can be expressed as a valid argument form in predicate logic, very much as in this alternative reading. See Hilbert and Ackermann (1928) section iii.3 and the discussion in Hodges (2004). Unfortunately in [*Analysis*] al-Fārābī goes nowhere with this idea, and we may well be reading too much into him.

<sup>17</sup> Cf. Hitchcock (2017) and Walton (1989). Like Walton, al-Fārābī gives a pivotal role to dialogue.

<sup>18</sup> The form of *Baroco*, in SP style, is:

Not every C is a B.

Every A is a B.

Therefore not every C is an A.

At [*Syllogism*] 27.8-12 he justifies the following instance of this form:

Every horse neighs.

Not every animal neighs.

Therefore some animal is not a horse.

by taking human as an example of an animal that doesn't neigh, and observing that it is true that humans are not horses. Ecthesis is the device of taking a term to witness 'C that is not B'. Strictly the device needs some backup in this case, because if there are no Cs then by existential import the premise 'Not every C is a B' is true but we can't take a term to witness this. But in any case al-Fārābī's justification rests on the real-world fact that humans are not horses, not on the form of the syllogism.

<sup>19</sup> Like Aristotle, al-Fārābī recognises three figures of categorical syllogisms, but his convention has the effect of excluding from the first figure the 'indirect' syllogisms such as

Every C is a B.

Every B is an A.

Therefore some A is a C.

If these indirect syllogisms are to be recognised, their premises will need to be taken in the opposite order, in effect forming a new 'fourth' figure. Avicenna made this point later, but



there is no reliable evidence that it occurred to al-Fārābī. In the 12th century Ibn al-Ṣalāh, who seems to have been the first logician to do serious work on the fourth figure, reported that he had heard about a book of al-Fārābī on the fourth figure, but he added that he had never seen it (Rescher (1966) p. 53). There is no such book in the standard Arabic lists of al-Fārābī's works, and though he is not easily type-cast, it seems out of character for him. (In passing, note that the second figure example in the previous footnote violates the ordering convention, which might be evidence that al-Fārābī didn't consciously intend the convention.)

<sup>20</sup> 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. Albertus's remarks could suggest 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*].

<sup>21</sup> Some further details will appear in Chatti and Hodges (see under [*Syllogism*]).

<sup>22</sup> The expression 'compound syllogism' 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.

<sup>23</sup> See Lameer (1997) and Watt (2008) for deconstructions 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.

<sup>24</sup> The expression 'enfolding' (*inṭiwā'*) in this context seems to be al-Fārābī's own invention, and it might indicate a growing interest in the set-theoretic or extensional underpinning of logic.

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