

## Ibn Sīnā: analysis with modal syllogisms

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Dedicated to my grandson

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born

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Tony Street asked me to speak on Ibn Sīnā's modal syllogisms.

I think this was because he knows I view them differently from him.

I will formulate three problems about them, and suggest some answers.

A general view has to be based on lots of textual details. I relegate most of this to the handout, with apologies for mistakes.



### Problem 0 (not for solution)

For depth and originality, Ibn Sīnā is hard to beat in logic. My own favourite is his treatment of temporal quantifiers. The first comparable breakthrough in Western logic (in Peirce's group at Johns Hopkins around 1880) led very quickly to the invention of first-order logic.

Ibn Sīnā's treatment of temporal quantifiers is part of his theory of 'additions' (*ziyādāt*), which in turn is part of his theory of composition of meanings.

More on these below.



Cameron and Marenbon, *Vivarium* 48 (2010) 3:

[Avicenna's] modal syllogistic is one of the most brilliant and innovative parts of his work.

I don't see this at all.

To my eye Ibn Sīnā's modal logic, though certainly original and influential — and well worth studying for both reasons, contributes no significant logical innovations (techniques, principles or insights).

### Problem 1

Why does Ibn Sīnā have no expression meaning 'modal syllogism'?

Contrast

'predicative syllogism', 'propositional syllogism', 'recombinant (*iqtirānī*) syllogism', 'duplicative syllogism', 'syllogism of absurdity', 'meet-like (*muttaṣil*) syllogism', 'difference-like (*munfaṣil*) syllogism', 'demonstrative syllogism', 'dialectical syllogism', ...

### Problem 2

Why do we have no examples of modal syllogistic moods being applied by Ibn Sīnā to validate or criticise natural language arguments?

### Problem 3

Why does Ibn Sīnā maintain the distinction between modal and absolute, after he has demolished its basis?

(Evidence on both below.)

My comments will be based mainly on Chapters iii, iv of *Qiyās* in the *Šifā'*, and Method 7 of *Išārāt*. (No time or space to include *Najāt*.)

Tony Street (*Arch. Gesch. Philos.* 84 (2002)) has suggested several differences between the accounts of modal syllogisms in *Qiyās* and *Išārāt*. Uncontroversially:

- (1) *Qiyās* is longer and fuller (103 pages vs. 17 pages).
- (2) In *Qiyās* but not in *Išārāt*, the modal syllogisms are treated after the absolute ones. (May be important.)
- (3) In *Išārāt* but not in *Qiyās*, Ibn Sīnā emphasises how properties of the conclusion 'follow' one or another premise. (Probably irrelevant below.)

More controversially:

- (4) The exposition in *Iṣārāt*, but not in *Qiyās*, 'is given as a critique of the rule of the weaker'.
- (5) *Iṣārāt*, unlike *Qiyās*, 'devotes a substantial portion of its treatment to' the descriptive readings.

In both these cases it seems to me the opposite is true, though the difference is slight.  
Some details are in the handout.

(2) is an important difference of *presentation*, but to my eye the differences of *content* between *Qiyās* and *Iṣārāt* are slight and mainly the result of brevity in *Iṣārāt*.

### We begin with Problem 2,

the absence of applications of modal syllogistic moods to validate arguments.

Distinguish between *syllogisms*, which are arguments in Arabic, and *moods*, which are argument forms.

In aristotelian logic we validate an argument by showing that it *has the form* of some valid mood.

This commonly involves paraphrasing and tidying up to expose the form.

Ibn Sīnā calls this tidying procedure *analysis (tahlīl)*, and believes that it's the reason why Aristotle called his book *Prior Analytics*.

*Qiyās* ix sections 6–9 forms a short treatise on analysis.

One of its examples (*Qiyās* 472.5–476.1) contains modal notions, but they are inside predicates, so no modal mood is required.

The same holds for two syllogisms analysed in Ibn Sīnā's *Letter to the Vizir Abu Sa' d* p. 37f.

Cf. a modal principle used by Galen to analyse a medical syllogism, discussed in Barnes in *Galen's Method of Healing* (1991). The syllogism contains no modal notions, so Galen's purpose is obscure.

*Qiyās* Chs. iii, iv contains a number of sample modal syllogisms.

But they all seem to be given in order to argue for or against modal principles, not as applications of established valid modal moods.

See the examples in the handout.

Are there any valid ones where we would be convinced of the conclusion *because of* the modal argument?

### Possible conclusion so far

Perhaps Ibn Sīnā's study of modal syllogisms is not for validating arguments at all, but in order to suss out properties of possibility and necessity?

Know that most of what Aristotle says about mixtures (of modalities) is for testing, not genuine fatwas. (*Qiyās* 204.11)

There may be truth here, but for Ibn Sīnā as opposed to Aristotle it's a very incomplete picture.



Ibn Sīnā *Autobiography*, trans. Gutas but my italics:

The next year and a half I devoted myself entirely to reading Philosophy: I read Logic and all the parts of philosophy once again. ... I compiled a set of files for myself, and for each argument that I examined, I recorded the syllogistic premisses it contained, the way in which they were composed, and the conclusions which they might yield, and *I would also take into account the conditions of its premises [i.e. their modalities]* until I had Ascertained that particular problem.



This is clearly about analysis.

And here, if Gutas is right,

Ibn Sīnā says he includes modalities in the analysis.

Unfortunately Gutas is not right, though his mistake is inspired. See the Arabic:

I would also take into account the conditions of its premises [i.e. their modalities]

وأراعي شروط مقدماتها



This phrase, *murā'ā al-šurūt*, 'taking into account the conditions', is one of the most important in Ibn Sīnā's logic. (But neither Goichon nor Jabre is aware of it.)

The powers of drugs are recognised by two routes. One is the route of experiment, and the other is the route of syllogism. Let us go first to experiment. We say that experiment leads us reliably to recognition of the powers of drugs only after *murā'ā al-šurūt*. (Types of experiment follow. *Qānūn* ii 2)



Maginnis, 'Scientific methodologies in medieval Islam', *J. Hist. Philos.* 41 (2003), is helpful for seeing the analogy with logical analysis.

Experiment provides the conditions that need to be added to 'Scammony purges the bile' in order to make pharmacology a deductive science.

So one ingredient of *murāʿā* is finding things that were supposed to be added to premises to make an argument sound (strictly, to make the premises true).

What sort of things?

On conditions (*šurūṭ*) of propositions.

One should keep an eye out for (*yurāʿay*) ... the status of relations, for example when it is said that 'C is a father' one should look out for (*li-yurāʿa*) the question 'whose'? The same goes for time and place and condition (*šarṭ*). For example when it is said that 'Everything that moves changes', one should look out for (*li-yurāʿa*) the question 'Is that while it stays moving?'. (*Išārāt* iii 10, Inati p. 89)

### Short course on composition of meanings

Every declarative meaning contains a *main relation* of attachment between two *main component meanings*.

The two main meanings are descriptive.

If they are both of noun type, the attachment relation is predication.

If they are both of sentence type, the attachment relation is consequence.

(Here I ignore for simplicity, as Ibn Sīnā often does, the negative case where the attachment is a relation of conflict.

Also one of the meanings may have a quantifier attached.)

The two main meanings are black boxes for purposes of deduction.

The logical properties of the declarative meaning depend on a comparison of them as unanalysed wholes, plus the main relation.

(Ibn Sīnā often emphasises this.)

In speech and thought we normally attach 'additions' (*ziyādāt*), 'conditions' (*šurūṭ*) and 'relationships' (*iḍāfāt*) to the two main meanings and their relation.

**Examples:**

- (1) [OF ZAYD] added to the meaning [FATHER] is a relationship.
- (2) [NECESSARILY] is a kind of condition. (Thus far Gutas was right!)
- (3) [SO LONG AS IT FITS THE DESCRIPTION C] is a condition.

As in the third example above, these additions are often tacit.

Hence the need for *murācā* to uncover them.



As a rule of thumb, adding conditions consistently through a syllogism doesn't affect the validity of the syllogism.

Ibn Sīnā knew this and used it (brilliantly) in the case where the condition consists of a clause 'If  $\phi$ ' added at the beginning of a premise and at the beginning of the conclusion.

Of course this is not a syllogistic rule.

And of course Ibn Sīnā would not have been either able or willing to state it in the following form, though it's a perfectly sound fatwa.



**Fact** (in any standard natural deduction system):

Let  $T$  be a set of formulas and  $\phi, \psi$  formulas. Let  $\delta(p)$  be a formula in which  $p$  occurs only positively, and  $p$  is not in the scope of any quantifier on a variable free in some formula of  $T$ . Suppose

$$T, \phi \vdash \psi.$$

Then

$$T, \delta(\phi) \vdash \delta(\psi).$$

Since Ibn Sīnā certainly used this in some form, but not as a metatheorem or a syllogistic rule, we need to know where it fits into his notion of logic.

**Ibn Sīnā's demolition of the absolute/modal distinction**

Ibn Sīnā worked with an Arabic translation of the *Prior Analytics* which divided syllogistic sentences into three disjoint sets by what notions occur in them: absolute, necessary, possible.

According to some of [the commentators], the condition for being absolute is that [the proposition] contains no modality, either in the expression or in the conceptualisation. (*Qiyās* 28.4f)



In *Qiyās* i 3,4 Ibn Sīnā gave examples of sentences from various branches of science, illustrating a number of patterns of temporal quantification.

None of these examples contain modal notions, so by above they should be absolute.

Problem: Some of these example sentences contain quantification over 'all times'.

Truth at 'all times' could be reckoned a kind of necessity, in a tradition going back to Diodorus Cronus.

So these sentences come out syntactically absolute but semantically necessary.

This wrecks Aristotle's classification.

The First Teacher unequivocally forbids us to think of the absolute in this way, and his instruction implies some evasions that we will mention. (*Qiyās* 30.5f)

Ibn Sīnā attempts to reconstruct the three-way division, in either of two ways.

### Way one: divide in terms of time, not modality

What the meaning [*B* is a *C*] itself determines is called an 'absolute' proposition. If a condition is added to it mentally — not including the condition of genuine necessity that we will mention, but including those cases where the content holds ... at some time or under some condition and some case, [it is called] *wujūdī*. When the meaning is that *B* is a *C* while its essence continues to be satisfied, [the proposition is said to be] 'necessary'. When the meaning is [that it is a *C*] so long as it fits the description *B*, [the proposition is said to be] *lāzīm*. (*Easterners* 65.2–6)

Note the phrase

'at some time or under some condition and some case' (*waqtan mā 'aw bi-šarṭin wa-ḥālin*)

This is one of several passages that strongly suggest Ibn Sīnā has in mind quantification not just over times, but over (actual) *situations*.

Nevertheless his classification here seems to ignore 'definitional' necessity.

## Way two

Stick with Aristotle's 'necessary' and 'possible', but enlarge them to include any notions that have similar logical behaviour.

Anything not necessary or possible counts as absolute.

This leads to a bad classification because there is no unifying principle behind the concept 'necessary', and a fortiori no unifying principle behind 'absolute'. (But Ibn Sīnā has other classifications that are bad this way — like *munfaṣil* propositions.)

Here is a problem common to both ways, which Ibn Sīnā himself points out.

Ibn Sīnā quotes a scientific statement involving time, which would have to be absolute by either way, but whose distinctive role in reasoning has nothing to do with this classification.

Since this [proposition] isn't a necessary or possible proposition in the sense we are concerned with, it's clear that it [has to be counted as] absolute, though it won't be absolute according to our approach. (*Qiyās* 30.4f)

The example very probably comes from Sosigenes 'On moving spheres'.

## Drawing some threads together

Tony Street (2002):

Avicenna does not have an assertoric syllogistic.

As before, we need to distinguish between syllogisms and syllogistic moods.

I think Tony is referring to the latter.

**Fact.** In one sense, Ibn Sīnā has *only assertoric syllogistic moods*, no others.

This is the message of *Qiyās* ix 2, seven pages in which Ibn Sīnā tries (not very successfully) to infer the possible forms of simple (non-compound) argument from the theory of composition of meanings.

He shows that every such argument is either a predicative syllogism or a recombinant propositional syllogism or a duplicative proposition syllogism.

In short its form must be one of the assertoric moods he recognises in *Qiyās*.

But now we need to know: when does an argument have a given mood as its form?

By *Qiyās* ix 2, the mood is determined by the two main meanings and their relation (plus negation and quantifier), ignoring all additions.

After identifying the assertoric mood, we need to apply *murācā al-šurūṭ* (as in Ibn Sīnā's Autobiography), not just to find what the additions are, but also to see whether they damage the validity of the argument.

Ibn Sīnā has no formal tools for this. Essentially he has to look at each individual case and think.



But of course he can cluster similar cases together. For example he can lump together any kinds of addition that can reasonably be thought of as 'necessity'.

This accounts for his subdivision of assertoric moods into different moods according to modalities.

Ibn Sīnā lists a modal mood if he can find valid examples within the relevant cluster.

The kinds of 'necessary' or 'absolute' chosen for different modal moods need not match.

In this sense the modal moods are parasitic on the assertoric ones; they catalogue what can survive after *murācā al-šurūṭ*.



**Example:** Conversion of E-propositions 'No C is a B'

When he sets out the syllogistic forms in *Qiyās* ii 4, Ibn Sīnā uses conversion of E-propositions exactly as Aristotle did.

But since for Ibn Sīnā an 'absolute' proposition can contain additions, he also has to examine what kinds of addition could block the conversion. This he does in *Qiyās* ii 1, explaining that the version without additions is the one normally used in scientific writing. (*Qiyās* 75.10f)

There is no difference of opinion from Aristotle, just a difference of terminology.



In spite of his clustering, there is no reason why all the forms of 'necessary' should behave the same way. Sometimes the discrepancies show up.

(1) Some modal arguments are valid only because of some metaphysical principle that we can call on for the relevant kind of necessity.

It's plausible that it is not correct to say that something which is contingent for each individual could fail to be true of any of them ever. . . . It is not for the logician as a logician to know the truth about this. (*Qiyās* 48.10–17)

Cf. *Išārāt* iv 5, Inati p. 99 for a parallel.



(2) Sometimes Ibn Sīnā uses arguments which work for mathematical modalities but perhaps no others.

Otherwise it is possible that some  $C$  is not an  $A$ .

Then let us posit this possible thing as existing.

(*Qiyās* 202.5)

Compare this with the quotations in the handout from Al-Nayrizī's text of Euclid *Elements* 1,

where exactly the same argument move occurs.

As Tony Street has pointed out, it is not sound as general modal logic.

In this framework, a modal argument is analysed by first uncovering the underlying *assertoric* argument, then using possibly ad hoc arguments for the extra modal material.

This helps to explain the absence of examples of modal analyses, Problem 2.

There remains Problem 3. Why did he continue with the old separation of modal and absolute?

The rearrangement in *Iṣārāt*, with all forms of addition considered together under each figure, might be a move towards abandoning that separation.

Does simple reverence for Aristotle explain why he moved no further?