The architecture of Ibn Sīnā's logic (2)

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SOAS, June 2014

`http://wilfridhodges.co.uk/arabic40.pdf`

Ibn Sīnā's logic splits down into distinct 'logics'.
Each 'logic' has broadly the same components,
which it's convenient to classify as:

1.	propositions	*qaḍāyā*
2.	listing of valid inference forms	*taᶜdīd*
3.	criteria of validity	*qawānīn*
4.	explanation	*bayān*
5.	analysis of arguments	*taḥlīl*

(See part (1) of this talk.)

The 'logics' are distinguished by their sentence forms:

- assertoric   *mašhūr*
- predicative 2D   *ḥamlī*
  (narrow time-scope)
- predicative   *ᶜalā l-sūr*
  (wide time-scope)
- meet-like   *muttaṣil*
- difference-like   *munfaṣil*
  ⋮   ⋮

We will discuss the assertoric, 2D and *muttaṣil* sentences.

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1. Assertoric (*mašhūr*)

These sentences are virtually the same as Aristotle's four main quantified forms

(a) Every *B* is an *A*.

(e) No *B* is an *A*.

(i) Some *B* is an *A*.

(o) Not every *B* is an *A*.

Ibn Sīnā completely accepts Aristotle's logic of these sentences,
and he copies Aristotle's *Prior Analytics* i.4–6 closely.

Ibn Sīnā is the earliest logician known to have said explicitly that when there are no *B*s,

- forms (a) and (i) (the 'affirmatives') are false and
- forms (e) and (o) (the 'negatives') are true.

Call this the *existential assumption*.

But Ibn Sīnā says this is not his own idea;
all earlier logicians—at least the sane ones—assumed it.
He is probably right for logicians after 2nd century AD.

2. Two-dimensional (2D)

This is my shorthand for the tidiest part of Ibn Sīnā's 'predicative' sentences.
The name is from Oscar Mitchell 1883 (more on him below).

Ibn Sīnā introduces these sentences in *Qiyās* ('Syllogism') i.3 and in the surviving part of *Mašriqiyyūn* ('Easterners'). The account in *Mašriqiyyūn* is very valuable, repeating what's in *Qiyās* without Aristotelian irrelevances.

If anybody here can get a properly edited text of *Mašriqiyyūn* into print, please do! Logicians will bless you.

Ibn Sīna notices (like Mitchell much later) that in assertoric sentences the predicate *A* often expresses a temporary property:

- Every human breathes in.
- Some people write.
- Zayd is in the house.
- Not every horse is asleep.

So the predicate contains a time reference, often implicit. Ibn Sīnā says Aristotle should have noticed this—it matters for logic.

So Ibn Sīnā introduces several possible ways the time reference can occur in the predicate. Examples:

(a-d) Every *B* is an *A* all the time it exists.
(a-ℓ) Every *B* is an *A* all the time it's a *B*.
(a-m) Every *B* is an *A* sometime while it's a *B*.
(a-t) Every *B* is an *A* sometime while it exists.
(e-d) Every *B* is throughout its existence not an *A*.
(i-ℓ) Some *B* is an *A* all the time it's a *B*.
(o-t) Some *B* is sometime in its existence not an *A*.

'd', 'ℓ' etc. are based on names suggested in *Mašriqiyyūn*.
E.g. d = *ḍarūrī*, ℓ = *lāzim*.

Mitchell reckoned that the subject term B ('human', 'Zayd', 'horse' etc.) doesn't depend on time.

Ibn Sīnā disagrees. The notion 'accident' is irrelevant to logic:

> ' 'Accident' belongs to the vocabulary of metaphysics, not of logic' (* Taʿlīqāt* 168.28)

So the fact that subject terms often don't express accidents has no logical significance.
In any case horses die, so there is still a time reference.
But Ibn Sīnā minimises it: B is read as 'sometimes B'.

With these 2D sentences, Ibn Sīnā presented for the first time a workable logic of multiple quantification.
Not achieved in the West until 19th century.

He started to develop this logic,
partly as a tool for studying Aristotelian modalities.
(Recall he uses *ḍarūrī* to mean 'throughout its existence'.)

It was potentially a major breakthrough.
Should we blame Bahmanyār for the fact that it didn't get much beyond potential?

Example: Ibn Sīnā verifies *Barbara* with possibility minor premise and necessity major premise and conclusion.
He does this by translating 'necessity' as (d) as above. Thus:

(a-t) Every sometimes-C is sometimes a B.
(a-d) Every sometimes-B is always an A.
(a-d) Therefore every sometimes-C is always an A.
VALID.

(See part (1) of this talk for further facts that he got this way.)

Khūnajī's counterexample, assuming Zayd could ride horses but in fact rides only donkeys:

Every horse is possibly ridden by Zayd.
Everything ever ridden by Zayd is necessarily a donkey.
Therefore every horse is necessarily a donkey.

Every sometimes-horse is sometimes ridden by Zayd.
Everything sometimes ridden by Zayd is always a donkey.
Therefore every sometimes-horse is always a donkey.

Every sometimes-horse is sometimes ridden by Zayd.
Everything sometimes ridden by Zayd is always a donkey.
Therefore every sometimes-horse is always a donkey.

VALID, BUT: If the times are actual, first premise is false.
If the times are potential, second premise is false.

Khūnajī's counterexample depends on reading the
modalities in different ways in the two premises.
For Ibn Sīnā this would be a kind of fallacy of many terms.
But logicians from Khūnajī onwards wanted a logic of two
different modalities.

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3. Propositional sentences (*šartī*)

We consider just the *muttaṣil* sentences. They come in four
forms corresponding to (a), (e), (i) and (o):

    (a) *kullamā kāna ϕ fa-ψ.*
    (e) *laysa albatta iḏā ϕ ψ.*
    (i) *qad yakūnu iḏā kāna ϕ fa-ψ.*
    (o) *laysa kullamā ϕ ψ.*

where ϕ, ψ stand for assertoric sentences.

Using these four forms as the (a), (e), (i), (o) sentences,
Ibn Sīnā gives *exactly the same* valid syllogisms as for the
assertoric sentences,
and with *exactly the same* justifications.

Simplest explanation: The *muttaṣil* are a special case of the
assertorics.
Adopted by some commentators, later Arabic and modern.

    'In the science of meanings, the *šarṭī* sentence is
    a special case of the predicative sentence.'
    (Al-Sakkākī, *ᶜIlm al-maᶜānī* 208.3)

So for example we read

- *kullamā kāna ϕ fa-ψ*
  as:
- There is a time-when-ϕ-holds, and
  every such time is a time-when-ψ-holds.

- *laysa albatta iḏā ϕ ψ*
  as:
- No time-when-ϕ-holds is a time-when-ψ-holds.

The same as Wallis 1702 and Boole 1854
(except that they ignored the existential assumption).

Main problems for this explanation (there are others):

1. Ibn Sīnā himself never makes this reduction to assertorics.
Instead he treats the *muttaṣil* sentences as an adaptation of the 2D sentences.

2. Ibn Sīnā describes several readings of *muttaṣil* sentences, but all obeying the same logical rules.
This strongly suggests that the different readings come from different choices of parameter within the same formalism.

In one reading (important for reductio ad absurdum), we assume hypotheses that couldn't ever be true, apparently breaking the existential assumption.

Note how the pieces in a 2D sentence can be rearranged to make other kinds of sentence:

- ▸ Every writer sometimes makes a mistake while writing.
- ▸ There is a time when everybody writing at that time is making a mistake.
- ▸ There is a time when everybody is writing and everybody is making a mistake.

The first is 2D.
The second is what Ibn Sīnā calls *ᶜalā l-sūr*.
The third is his *qad yakūnu iḏā kāna ϕ fa-ψ* (a *muttaṣil*).

In second and third case, so presumably in first case too, Ibn Sīnā makes a big distinction between the time quantifier and the other ('Aristotelian') quantifier.

For him, the Aristotelian quantifier ranges only over things that *actually* fit the subject description.
Ibn Sīnā is very insistent about this, even for modal sentences. He never ampliates to possibles with this quantifier.

But often Ibn Sīnā uses 'times' that are not actual times.

- ▸ He uses 'times' when nothing is coloured white, or when all animals are human.
- ▸ He uses 'times' when a pronoun refers to a certain object.
- ▸ He sometimes uses other expressions besides 'times': for example 'situations' or (once) 'possible posits'.

These generalised times are important.
They must be analysed both logically and metaphysically.
The remarks below are very provisional.

(I) We get different applications of logic by using different kinds of 'time'. (This seems to be the choice of parameter.)

For example literal 'times' give temporal or *ittifāqī* logic, 'situations' give logic of necessary entailment or *luzūm*.

The logical rules are the same in both cases but the application is different.

Recall our discussion of Khūnajī mixing up the applications.

(II) By allowing 'situations' where impossible things are true, we can neutralise the existential assumption on (a) sentences.

Ibn Sīnā never says this.
But I see no other explanation of how he allows impossible assumptions without ever dropping the existential assumption.

In both (I) and (II), Ibn Sīnā writes as a logician, not as a metaphysician.
He provides a machinery for solving logical problems, but in his logical writings he says almost nothing about the metaphysical requirements of this machinery.

Many modern logicians take a similar position.
But in Ibn Sīnā it's a surprising gap.
No wonder some leading logicians in the Avicennan tradition chose a different path.

References

El-Rouayheb's edition of Khūnajī *Kashf al-asrār* (Tehran 2010)
gives Khūnajī's counterexample on page 170,
and a good discussion of the issues around *muttaṣil*s in his Introduction at page *xxxiii* ff.
I may disagree with El-Rouayheb about what the issues were that divide Ibn Sīnā from Khūnajī.

My talk 'The architecture of Ibn Sīnā's logic (1)' is on the web at http://wilfridhodges.co.uk/arabic38.pdf, with some backup material.