A Day of Indian Logic

The following document is a collection of slides and a short paper arising from the meeting "A Day of Indian Logic" at the Institute for Logic, Language, and Computation, University of Amsterdam, on November 2, 2009. The speakers at this workshop included Nicolas Clerbout (Université Lille 3), Marie-Hélène Gorisse (Université Lille 3), Laurent Keiff (Université Lille 3), Sara L. Uckelman (University of Amsterdam), and Peter van Ormondt (University of Amsterdam).

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Epistemic contextualism and Jain theory of knowledge assertions

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Jain Logic as Semantic Pluralism

Jain logic can be characterized as a kind of **semantic pluralism with regard to epistemic concepts** in the sense that:

- Multiplicity of sets of epistemic standards
- For a given proposition there are contexts in which we can truly assert it is a knowledge statement, whereas there are others from which we can not.

We draw a parallelism with this meta-theory and a contemporaneous trend in philosophy of knowledge, namely the one of epistemic contextualism.

Aims

What we aim to do in drawing such a parallelism is the following:

- Specify the notion of 'context' involved in the Jain literature
- Try to figure out the technical and philosophical implications of it
- Make the first step toward a formalization of the Jain theory of knowledge statements behavior (syādvāda)

But first of all, we are going to characterize some specificities of the Jain system.

A Soteriology

Jain pluralism is, as every other theories of knowledge in India, part of a soteriological path.

- There is a *de facto* plurality of attested ways for one to obtain liberation (the way of Buddha, the way of Mahāvīra, etc.)
- Inside these different ways, an individual is not under the same material circumstances than another individual and different things have to be done by both of them to progress.

Our acts always have at the same time a conventional character (*vyavahāra*) and an ultimate one (*paramārtha*).
So even the strong philosophical use of the term 'knowable' is here endowed with the same properties than in a type of knowledge that deals with some utility principles.

A meta-theory of knowledge

Jain pluralism is not a theory of knowledge, but a meta-theory of knowledge.

- The Jainas define seven types of theories of knowledge
- Under which every theory existent in history can be classified as either:
  - A good theory (called a '*naya*', viewpoint),
  - A defective one (called a '*nayābhasa*', illusion of a viewpoint)

Our parallelism with different modern conceptions of epistemic contextualism should therefore be developed in relation with each different types of theory of knowledge classified by the Jainas, rather than in relation with the Jain system as a whole.

A pluralism in relation with the object

Jainas are realist philosophers:

- Their pluralism relies on the observation that the object of knowledge itself is multiple (characterized by an infinity of aspects).
- From this observation and because a human knowing agent is not endowed with infinite capacities, they develop their theory of viewpoints stating that when we know, we are focusing on one given aspect.
- And complete knowledge about something is the sum of every aspect (the possibility of an omniscient people is not prohibited in the Jain theory).

Definition

The Jain contribution is to say that:

- The choice of the aspect is not a material choice, but a theoretical one. There are precisely seven viewpoints, i.e. seven ways of choosing an aspect for a knower when she apprehends an object of knowledge.
- Each viewpoint has a given ontology, i.e. a given classification of the infinite aspects of the object.
- Therefore the choice of the aspect determines the type of set of individuals that fits the knowledge statement at stake.

To see the point in more details, let us introduce the seven viewpoints (taken from Prabhācandra's eleventh century Jain treatise ([6]) and commented for example by Balcerowicz in [1]).

The seven viewpoints(1)

- **The viewpoint of plurivocity** (*naigama*)
  This viewpoint is a broad inclusive one. It reflects the fact that there are several ways from which we can say for an object c 'this is a pot'. Here, we can truly say for something viewed as a pot, used as pot, intended as a pot, etc. that this is a pot. And if different cultures defines other functions to fulfill for being a pot, then we can call a pot the thing that fulfill these functions. And a fictional pot, the pot Pegasus uses, is still a pot.

Hence this viewpoint might be seen as the determination of the set of all the sets of what can be a 'pot'.

The seven viewpoints(2)

- **The viewpoint of genus** (*saṃgraha*)
  This viewpoint has not as large a scope. It only deals with existent objects. It reflects the fact that the word 'pot' is used for the set of all the occurrences of pots, 'past, present and future' (the Indian way of saying 'universally'). What can be truly be called a pot is any instance of this set.

Hence this viewpoint might be seen as the determination of the set of what can be a 'pot'.

The seven viewpoints(3)

- **The viewpoint of the particular** (*vyavahāra*)
  The scope of this viewpoint is again narrowed. It concerns not the set of all pots, but individual instances of pot. This particular pot considered as a enduring substance is what can be truly be called a pot.

Hence this viewpoint might be seen as the determination of the particular 'pot'.

The seven viewpoints(4)

- **The viewpoint of the manifestation in temporal structure** (*ṛju-sūtra*)
  Here, the theories become sensitive to the temporal structure. What might be called a pot is the particular pot considered as a isolated manifestation at a given point of time.

Hence this viewpoint might be seen as the determination of the actual manifestation of the particular 'pot'.

The seven viewpoints(5)

- **The viewpoint of the syntactical structure** (*śabda*)
  Here, the theory becomes sensitive to grammatical distinctions, such as tenses, number, gender, function in the sentence, and so on.

Hence this viewpoint might be seen as the determination of the particular 'pot' as being uttered and endowed with a grammatical structure.

The seven viewpoints(6)

- **The viewpoint of the etymological structure** (*samabhirūḍha*)
  Here, the theory becomes sensitive to the etymology of the word that is used.

Hence this viewpoint might be seen as the determination of the particular 'pot' as being uttered and endowed with an etymological structure, i.e. a justifiable grammatical structure.

The seven viewpoints(7)

- **The viewpoint of the manifestation in etymological structure** (*evaṃbhūta*)
  Here, the theory becomes sensitive to the etymology of the word that is used and to the actual use of this word in relation or not with its etymology.

Hence this viewpoint might be seen as the determination of the particular 'pot' as being uttered and *presently* endowed with an etymological structure.

Which contextualism for the theory of viewpoints?

What we will keep in mind for our purpose for the moment is that the Jainas are saying that:

- One context is characterized by the theoretical intention (choice of focus) of the knowing agent.
- The move from a context to another context is changing the meaning of the words we use.

But along with the meaning, this moves is changing too:

- The ontology of my theory (set of sets, sets, individuals, etc.) We will have a closer look to this problem in the second talk.
- Whether a statement is a knowledge statement or not. We will see how in the next slides.

A modal theory for knowledge assertions

- From this, the question becomes: how within such a theory is one to express a knowledge statement in a philosophical debate, that is to say in a debate in which a statement must be defended in every context to become a (valid) knowledge statement?
- The syādvāda (theory of the 'syāt') is an attempt to answer such a question.
- Very briefly, the point is here to introduce an operator 'syāt' ('arguably', 'in some given circumstances') that functions in a very straightforward way like the diamond in nowadays modal logic. For more on this, see Gorisse in [4].

Seven ways to assert a knowledge modal statement

Inside the scope of this modal operator, the Jainas define seven different behaviors for a knowledge statement within a game. The three primary behaviors are the following ones:

- Arguably it holds.
- Arguably it does not hold.
- Arguably it is non assertable.

And the four others are but a combination of these three (hence excluding the case where non of them hold)

By the way, holding a kind of modal structure with an operator handling contextual features of a knowledge assertion is what is permitting to rule out some apparent contradictions between the theses of the different Indian schools of thought.

A fine grained approach to context

We will now introduce some features of a current trend in formal epistemology, named epistemic contextualism. Afterwards we will draw some parallels in the last section:

- Most broadly stated, it is the claim that a knowledge statement is relative to the context in which it is uttered. Up to a point quite harmless. Nobody will deny that 'I know that BO is the president of the US' is true now and one year ago it was not.
- What makes epistemic contextualism interesting is that not only more structure is attributed to contexts, i.e. contexts refer to more then just some temporal structure. It could be a whole set of different factors what makes up a context. But also there is the view that it is not the context of the 'subject of knowledge' which should be taken into account, but the context of the 'attributor of knowledge. See for example DeRose's work in [2] and Lewis in [5].

Subjective and Attributive Epistemic Contextualism

There are two broad divisions one can make within the field of epistemic contextualism (more on this in Pritchard's paper, [8]). One division is the difference in how we perceive contexts:

- On one view contexts refer to facts pertaining to the subject of knowledge. Context could then be the social configuration an agent finds himself in. One could focus on the justification or evidence one would need to support a knowledge claim. Obviously, these different parameters induce epistemic settings which can alter from one context to another.
- Contexts are explained in terms of the situation of the subject of knowledge.
- Another view is that contexts have more to do with the facts of the person who is ascribing the knowledge, the knowledge attributer, or modeler. The intentions of the ascriber become the relevant factors to consider when one evaluates a knowledge claim. For instance when one is modelling a dialogue.

Substantive or Semantic Contextualism

Another pair of opposing views is on the issue of 'what we can use contexts for'. After having accepted these entities in our ontologies what exactly do they do?

- There are some who use contexts for making substantive claims about knowledge, mostly in response to other such claims about knowledge, e.g. foundationalism, coherentism etc.
- Others will just use contexts as linguistic items used for modeling the semantics of expressions in which knowledge claims are made. This could be labeled the semantic stance in opposition to the aforementioned substantive stance.

Intentional theoretical structure of contexts

- Now, we saw that in Jainism, there are hidden parameters in assertion referring to some kind of intentional theoretical structure.
- The aim of this last section is to draw a parallelism between the conceptions of what a context is in Jain philosophy and in some approaches of nowadays epistemic contextualisms so as to see (foregoing work) some formal and philosophical consequences of some Jain definitions.

Against Epistemological Skepticism

As with many forms of epistemic contextualism, Jain view seems to have been developed in a reaction to Buddhist epistemology and logic, considered as leading to epistemological skepticism.

- **More precisely,** the core of the Buddhist position (according to the Jainas!) lies in the rejection of the universal validity of the third excluded: if there are reasons both for asserting and rejecting a given proposition then there is no epistemological justification for doing either and this lacking of justification for an assertion applies to all propositions.
- **Foregoing work:** What do the Buddhist skeptical arguments look like and in what way is the Jain approach a solution to some skeptical paradoxes. Are there similarities with the contextualist development here?

Example of a dialogue

The more interesting view is to see how the knowledge ascribing view would look at the Jain tradition. To see this in more details, let us develop an example:

- Let us assume Leonard, a traditional Jain logician, who is still well-schooled in the old ways.
- Let us further assume that Leonard is in fact adhering to objects according to the first viewpoint explained above.
- Now we could imagine a knowledge attributer, named David in conversation with Catherine about the knowledge of Leonard. *What David and Catherine think they know that Leonard knows depends on the context 'syāt' is referring to, hence on the meaning of the words of the statement at stake and of the underlying ontology.*
- So when they hear Leonard say 'syāt', it exists', they would have to make a claim as to which viewpoint 'syāt' now refers.

Example of a dialogue(2)

- As we said, we assumed Leonard's 'syāt' to refer to the first viewpoint.
- But now, Rafaello joins the discussion and says to David and Catherine: 'haven't you heard? Leonard converted to the second viewpoint, yesterday'.
- Because of this additional information, 'syāt' refers to another context and this might effect the knowledge David and Catherine wish to ascribe to Leonard.
- More precisely, if we now have 'it is unassertable', it means that the predicate at stake is not relevant in the second viewpoint, and no knowledge has been gained.

The semantic stance

From this example and according to the distinctions drawn above, we can ask: why has the notion of context been introduced?

- The Jain answer seems to have been that it changes the meaning of my knowledge assertions in such a way that several apparently contradictory theses can be successfully defended from different contexts.
- This seems to correspond to a semantical view of contexts, where we are interested in elucidating the semantics of the verb 'to know'.
- Here, the different epistemic standards of the contexts, which may be thought of in terms of truth conditions, render different meanings of 'to know'. Viz. Ganeri's [3] or Priest's [7].

Subject or ascriber?

Secondly, to the question: what is a context referring to?

- The Jain answer seems to have been that a context is thought in relation with the theoretical context of the person who is ascribing the knowledge (theory of knowledge considering, concepts, particulars, etc.)

Given the distinctions we have drawn above we can ask our selves if these distinctions would influence a formalisation of Jain logic

- Would a substantive contextualist interpretation of Jain logic change the way I would represent it formally?
- Hybrid logic, justification logic?
- And what if we think about Jain logic in terms of a semantical interpretation?
- Dialogical semantics, update logics?

Some more features and conclusive remarks

- Jainism is not concerned with how an agent knows an object. It is a meta-theory in this respect that is is concerned more with when something is known.
- If one views Jain logic from the perspective of semantic epistemic contextualism it would be interesting to investigate how 'Syāt' would behave viewed like an indexical. This may well be presented in update style logics where dialogues are modeled.
- This last point is what we are going to investigate and develop in further works.

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Jaina Logic: A dialogical perspective

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From the 7 viewpoints to the 7 knowledge statement behaviors within a language game

We saw in the previous talk that the Jainas had to face the following question: **How is a Jain to express a knowledge statement in a philosophical debate?**

- Given the context-dependent approach of Jain theory of viewpoints
- And given the fact that asserting within a philosophical debate is in India conceived as being able to defend one's own thesis against all possible attacks coming from all possible viewpoints

The syādvāda (theory of the 'syāt') is precisely the attempt to answer such a question: it is meant to be a framework in which the accurate tools of knowledge can be used while taking the viewpoint into account.

From the 7 viewpoints to the 7 knowledge statement behaviors within a language game (2)

In Prabhācandra's terms:

कथं पुनर्नयसप्तभण्ग्याः प्रवृत्तिरिति चेत् ।
प्रतिपर्यायं वस्तुन्येकत्राविरोधेन विधिप्रतिषेधकल्पनायाः' इति ब्रूमः ॥

Katham punar-naya-saptabhaṅgyāḥ pravṛttir-iti cet ?
'Pratiparyāyam vastuni ekatra avirodhena vidhipratiṣedha-kalpa-nāyāḥ' iti brūmaḥ

And if someone objects 'But how does the saptabhaṅgī work in relation with the viewpoints?'
We will answer that the saptabhaṅgī consists in asserting and denying [something about] a object conceived as one *without contradiction*.

Prameyakamalamārtaṇḍa, [6] p.687.

From the 7 viewpoints to the 7 knowledge statement behaviors within a language game (3)

What has to be kept in mind here are the following:

- The saptabhaṅgī is a theory of assertion: what is at stake is the way one can 'assert' or 'deny'
- 'The object conceived as one' here means the object taken from one of his several aspects. We therefore have to know that our assertion is a partial one.
  We will see that thanks to the introduction of the operator 'syāt' that resembles the diamond operator in nowadays modal logic, we can express the contextual character of our expressions.
- With the expression 'without contradiction', the Jainas want to bring the focus on the fact that apparent contradictions between the theses of the different schools of thought are solved.
  Because their method allows one to make explicit some hidden parameters in assertion.

Aims

Before getting in details in the exposition of this framework, let us indicate our main direction:

- This framework can be formalized with benefits within a dialogical approach, i.e. as a language combined with a set of rules.
- Today we only sketch:
  - The reasons why we want to do so.
  - The problems to be solved for the one who wants to handle a dialogical (local) reading of the saptabhaṅgī.

A modal knowledge-statement

- First of all, the different ways to express a knowledge statement are formalized within the scope of a kind of modal operator: the operator 'syāt'.
- 'Syāt' is the optative mood of the verb *'asti-'* ('to be'), and could be translated 'arguably', 'in some given circumstances', 'let...'.
- Our thesis is that it functions in a very straightforward way like the diamond in nowadays modal logic ([2]).

Seven ways to assert a modal knowledge-statement

Now inside this operator, three primary behaviors are defined:

- Assertion
- Denial
- Unassertablity

And the four others are but a combination of these three (hence excluding the case where non of them hold)
Let us examine them all in more details.

The first manner

The first way of defending a modal knowledge statement (let us call it a 'thesis') pertains to a modal assertion with 'syāt' as its modal operator:

स्यादस्त्येव ।
Syāt asti eva
Arguably it holds

- From a theory that is considering particulars, and in the case that one is considering a particular pot, 'this is a pot' holds.
- In the same way, from the first viewpoint, the viewpoint of the plurivocity, i.e. a theory that is considering the intentions, when considering a piece of clay, one is perfectly justified to assert 'this is a pot'.
- And so on for each of the seven viewpoints.

The second manner

The second way of defending a thesis pertains to a modal denial:

स्यान्नास्त्येव ।
Syāt na asti eva
Arguably it does not hold

- If a propounder belonging to the third viewpoint, the theory dealing with particulars, takes as the subject of his assertions the object 'piece of clay' intended as being the intention of a pot, then the thesis 'this is a pot' does not hold.
- But keep in mind that a viewpoint does not rule out other viewpoints. For example, in the case of a piece of clay already shaped and used but not yet cooked, a propounder of the particular viewpoint and a propounder of the viewpoint of the intentions would be both truly justified to assert 'this is a pot'.
- And so on for the seven viewpoints.

The third manner

The third way of defending a thesis is a combination of the first two ways:

स्यादस्त्येव स्यान्नास्त्येव।
Syāt asti eva, syāt na asti eva
Arguably it holds, arguably it does not hold

- From a theory that is considering particulars, and in the case that one is considering a particular pot, 'this is a pot' holds even if this particular pot is not '*potizing*' **and** from a theory that is dealing with the actual use of the word at stake in relation with its etymology, 'this is a pot' does not hold in this situation.
- And so on for the seven viewpoints.

The fourth manner

The fourth way of defending a thesis pertains to the third and last argumentative attitude: a modal unassertability.

स्यादवक्तव्यमेव ।
Syāt avaktavyam eva
Arguably it is non assertable

- In the case, for example, of presupposition failures:
  - If we can't find neither a particular pot to validate the assertion 'this is a pot' in the viewpoint of the particular,
  - Neither the absence of a pot to validate the denial 'this is not a pot' in the viewpoint of the particular,
  - Then we can not say anything about the statement 'this is a pot' in the viewpoint of the particular.
- And so on for the seven viewpoints.

Interpreting the fourth manner

There have been great controversies among Jain scholars so as to see whether this value should be considered as a gap or as an over-lapping. Ganeri in [1] put this problem forward and quoted this passage of our text of Prabhācandra:

Opponent: Just as the values 'true' and 'false', taken successively, form a new truth-value 'true-false', so do the values 'true' and 'true-false'. Therefore, the claim that there are seven truth values is wrong.

Reply: No: the successive combination of 'true' and 'true-false' does not form a new truth-value, because it is impossible to have 'true' twice. In the same way, the successive combination of 'false' and 'true-false' does not form a new truth-value.

The fourth manner, again

Opponent: How then does the combination of the first and the fourth, or the second and the forth, or the third and the fourth, form a new value?
Reply: It is because, in the fourth value 'non-assertible', there is no grasp of truth or falsity. In fact, the word 'non-assertible' does not denote the simultaneous combination of truth and falsity. What then? **What is meant by the truth-value 'non-assertible' is that it is impossible to say which of 'true' and 'false' it is.** [PKM, p.689].

The fourth manner, a last time

- This interpretation is the one we are going to follow in our reading, since it deals with the limits of the excluded-middle, which are interesting limits to study from a dialogical perspective.
- Against Prabhācandra, we do not think that the other interpretation would produce the collapsing of the other values.
- But following Ganeri, and against Priest (in [7]), we do think that the Jain thinkers wanted to avoid a para consistent issue.

Combining the three attitudes

Now, the three last ways are very straightforward:
The fifth:

स्यादस्त्येव स्यादवक्तव्यमेव।

Syāt asti eva, syāt avaktavyam eva

Arguably it holds, arguably it is non assertable

The sixth:

स्यान्नास्त्येव स्यादवक्तव्यमेव।

Syāt na asti eva, syāt avaktavyam eva

Arguably it does not hold, arguably it is non assertable

And the seventh:

स्यादस्त्येव स्यान्नास्त्येव स्यादवक्तव्यमेव।

Syāt asti eva, syāt na asti eva, syāt avaktavyam eva

Arguably it holds, arguably it does not hold, arguably it is non assertable

A Dialogical reading

To sum up, what we want to keep in mind in the Jain theory is the following:

- According to the theory of viewpoints, a change of context is a theoretical one and might change both the underlying ontology and the meaning of the predicates of a given knowledge statement.
- From this, a theory of the behavior of knowledge statement has been developed, according to which there are seven ways of defending a thesis, each of them being contextualized within the scope of a modal operator.

So far so good. What we aim at doing now is to show that a dialogical reading of this theory might be develop with benefits.

- This is the aim of the following section.

Preliminary remarks

- The dialogical tradition takes it that speech acts are best understood as forms of interaction.
  To briefly sketch this central idea, we say that dialogues are games in which what is at stake is a formula.
- In other words: speech acts are forms of interaction submitted to rules.
- With a modal dialogical approach, we are able to make explicit the contexts in which speech acts are made.
  Furthermore, changes of contexts are understood as occurring after some choice.

Particle rules: the level at which choices are made

Assertion	$\langle \mathbf{X} \text{ - } A \wedge B \text{ - } \eta \rangle$	$\langle \mathbf{X} \text{ - } A \vee B \text{ - } \eta \rangle$	$\langle \mathbf{X} \text{ - } A \rightarrow B \text{ - } \eta \rangle$
Attack	$\langle \mathbf{Y} \text{ - } ?_L \text{ - } \eta \rangle$ or $\langle \mathbf{Y} \text{ - } ?_R \text{ - } \eta \rangle$	$\langle \mathbf{Y} \text{ - } ?_\vee \text{ - } \eta \rangle$	$\langle \mathbf{Y} \text{ - } A \text{ - } \eta \rangle$
Defence	$\langle \mathbf{X} \text{ - } A \text{ - } \eta \rangle$ or $\langle \mathbf{X} \text{ - } B \text{ - } \eta \rangle$	$\langle \mathbf{X} \text{ - } A \text{ - } \eta \rangle$ or $\langle \mathbf{X} \text{ - } B \text{ - } \eta \rangle$	$\langle \mathbf{X} \text{ - } B \text{ - } \eta \rangle$

Assertion	$\langle \mathbf{X} \text{ - } \neg A \text{ - } \eta \rangle$	$\langle \mathbf{X} \text{ - } \Diamond A \text{ - } \eta \rangle$
Attack	$\langle \mathbf{Y} \text{ - } A \text{ - } \eta \rangle$	$\langle \mathbf{Y} \text{ - } ?_\Diamond \text{ - } \eta \rangle$
Defence	–	$\langle \mathbf{X} \text{ - } A \text{ - } \eta' \rangle$

Structural rules: the level at which strategies are constrained

Structural rules describe the general way an argumentation game is built. They rule the global running of a game, and put constraints on the allowed choices for players in given circumstances.

- How the game begins
- Which moves are authorized or forbidden

- How the game ends
- The conditions for winning

Usually, they are designed such that the existence of a winning strategy for the player who proposed the thesis matches the validity of the thesis. For more on this, see [3], [8] or [9].

Structural rules: the level at which strategies are constrained

Structural rules describe the general way an argumentation game is built. They rule the global running of a game, and put constraints on the allowed choices for players in given circumstances.

- How the game begins
- Which moves are authorized or forbidden
  - The formal use of atomic assertions
  - The proper way to change dialogical contexts
- How the game ends
- The conditions for winning

Usually, they are designed such that the existence of a winning strategy for the player who proposed the thesis matches the validity of the thesis. For more on this, see [3], [8] or [9].

The syāt operator

- For the syādvāda, the set of dialogical context is easily fixed as a set of 7 elements standing for the 7 viewpoints. Since these seven contexts are given, the Proponent is allowed to choose any of them even if it has not been previously introduced by the Opponent.
- The syāt operator is read as an S5 possibility operator so, from any context, the Proponent is allowed to choose any context when he has to defend an assertion of the form $\Diamond\phi$

An atomic game

The first two predication modes can be read as

1. $\Diamond Pk$
2. $\Diamond \neg Pk$

An atomic game

The first two predication modes can be read as

1. $\Diamond Pk$
2. $\Diamond \neg Pk$

The problem is that sooner or later, the Proponent will have to assert an atomic formula, a kind of move which is under strong constraints because of the formal rule.

- There are ways to implement a model in a dialogical game (see for example [10]). Since the saptabhaṅgī relates to truth in a context, and not to validity, it seems a must be.
- Still, there may be some alternatives we should investigate. For example, to see how Lorenz deals with atomic games ([5] and [4]).

A standard modal first-order language does not seem to match the purpose

In addition to the previous challenge, we must not forget that the syādvāda is meant to integrate the viewpoints, each with its own ontology and its own definition of what a predicate is.

- Our dialogical games will have to give an account for the inclusive relation holding between the domains of the viewpoints.
- Whatever our solution to run atomic games is, it will have to come with another language allowing us to capture the different definitions of a predicate.

Unassertable?

Another crucial point for a dialogical approach for the syādvāda is the way we interpret the fourth predication mode, (*avaktavyam*).

- It doesn't seem to be $\Diamond(\phi \wedge \neg\phi)$
- Another possibility is to read it as $\Diamond\neg(\phi \vee \neg\phi)$.

Unassertable?

Another crucial point for a dialogical approach for the syādvāda is the way we interpret the fourth predication mode, (*avaktavyam*).

- It doesn't seem to be $\Diamond(\phi \wedge \neg\phi)$
- Another possibility is to read it as $\Diamond\neg(\phi \vee \neg\phi)$.
  But then some questions arise:
  - Can we assume that the Jain underlying logic is intuitionnistic?
  - If not, are we ready to consider that the logic may change with respect to the context? (and would Jainas agree with that?)

Conclusion

- Dealing with the syādvāda by means of a modal dialogical framework, we would be able to give an account of the Jain logic in terms of choices of context. This seems to match their conception as well as their purpose.
- There are lots of questions that need answers before we are able to give a dialogical approach. We exposed some challenges together with some of the technical and philosophical issue they are linked with.

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Ultimately and Conventionally

Some remarks on Nāgārjuna's logic

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1 Introduction

2 Modal readings

3 Negation-centered readings

4 From a dialogical point of view

Catuṣkoṭi

In the first verse of the *Mūlamadhyamaka-kārikā*, one finds the following four pairs of questions and answers (Matilal's translation):

1. Does a thing or being come out itself? – No.
2. Does a thing or being come out of the other? – No.
3. Does it come out of both, itself and the other? – No.
4. Does it come out of neither? – No.

Catuṣkoṭi

Taken as an argument pattern, *Catuṣkoṭi* seems to be used in general to show the vacuity of debating certain considerations concerning metaphysical entities such as causality, the soul or the world.
Witness this example, taken from *Mūlamadhyamaka-kārikā* (22:11) and quoted by Westerhoff:

> *'Empty' should not be asserted, 'Non-empty' should not be asserted, both or neither should not be asserted, as these are only names.*

Emptyness thesis

- The *Catuṣkoṭi* should be understood in the context of the defense of a specific doctrine
- The main doctrinal point of Mahdyamaka Buddhists can be stated thus:

Emptyness Doctrine (*Śūnyavāda* (SV))

Everything is devoid of intrinsic nature and therefore empty (*śūnya*).

The two truths

- (**SV**) is strongly correlated with a double distinction:
  1. **Ontological** There are two kind of beings: (i) Those which are dependent on something else lack intrinsic nature, and exist only *conventionally*. (ii) Those which are endowed with independent origination and intrisic nature exist *ultimately*.
  2. **Epistemological** There are two kind of truths: (i) *conventional* truths (*saṃvṛti-satya*) are those that essentially depend on a context – perceptual, social or linguistic; as opposed to (ii) *ultimate* truths (*paramārthasatya*) which are independent from context.

Debates

- Nāgārjuna's *Vigrahavyāvartanī* is dedicated to present and refute objections against (**SV**). Let us see an example.
- One may argue that an empty (or nonexistent) statement like (**SV**) itself cannot perform a negation (*pratiṣedha*), hence cannot show the emptyness of everything. Call that argument (3).
- Nāgārjuna's adversary is thus claiming that the very meaning of (**SV**) prevents it to operate as it should, i.e. as a denegation of the claim that some things have an intrinsic nature (*sasvabhāva*).

Debates

- Then, Nāgārjuna's adversary considers a possible defense against (3). The very same (3) may be applied to (3) itself, which therefore would also fail to deny (**SV**). But such a defense of (**SV**) is not admissible, and the reason is inherent to the rules of a dialectical debate:

  > *Why [is this defense inadmissible]? – Because the objection [(3)] applies [only] to the specific character of your proposition, not to that of mine. It is you who say that all things are void, not I. The initial thesis (pūrvakaḥ pakṣaḥ) is not mine.*

Debates

- To understand properly what happens here one needs to consider the dynamics of the debate.
- What decides the admissibility of arguments faced with couter-arguments is the burden of the proof, which lies on the side of the proponent of the initial claim, together with the situation produced by the last effective argument.

Debates

- Assume that the initial claim in the dialogue is (**SV**), i.e. a denegation of the existence of *sasvabhāva*. Either this denegation is ineffective or effective.
- In the first case, the existence of *sasvabhāva* is not even questionned.
- Assume the denegation succeeds. Such an act yields a dialogue situation where (**SV**) is grounded, and therefore in which (3) is admissible. After (3) is performed, though, (**SV**) no longuer can be assumed to hold, blocking a rebuttal of (3) using (3) itself, which is precisely the content of the objection in § IV of the *Vigrahavyāvartanī*.

Debates

§ XXIX of the *Vigrahavyāvartanī* contains Nāgārjuna's crucial defense on the justifiability of (**SV**).

> *If I had any proposition (pratijñā), then this defect would be mine. I have, however, no proposition.*

This is (**SV**) self-applied.

Summing up

1. Everything (including (1)) is empty
2. Refutation is not (straightforward, truthfunctionnal) negation
3. Ultimate truths should be distinguished from conventional ones

The Tibetan reading

According to a tibetan tradition, the *Catuṣkoṭi* should be modally decorated thus:

- $[\mathbf{U}]\phi$
- $\langle \mathbf{C} \rangle \neg \phi$
- $[\mathbf{U}]\phi \wedge \langle \mathbf{C} \rangle \neg \phi$
- $\neg [\mathbf{U}]\phi \vee \neg \langle \mathbf{C} \rangle \neg \phi$

Now one may argue that (i) decoration is arbitrary and (ii) on that reading Nāgārjuna is still endorsing the rejection of both ϕ and $\neg \phi$

Ultimately and Conventionally as operators

- "Conventionally" and "ultimately" have obvious modal features.
  - "Conventionally ϕ" (notation $\langle \mathbf{C} \rangle \phi$) should be true whenever there is a set of conventions that makes ϕ true.
  - Dually, "Ultimately ϕ" (notation $[\mathbf{U}]\phi$) should be true iff any conventional context makes ϕ true.
- The question is then: what is a context?

Madhyamaka Contexts

A context is defined by a set (contingent) of perceptual evidence together with social and linguistic *conventions*.

Ultimately and Conventionally as operators

- It would thus be tempting to give [**U**] and $\langle \mathbf{C} \rangle$ the usual box and diamond semantics.
- Now one should beware here. When discussing the objections against (**SV**) in the *Vigrahavyāvartanī*, Nāgārjuna explicitely rejects the idea that there are undisputable means of correct cognition (*pramāṇa*)
- Consequently Nāgārjuna will reject the idea that some statements are true in virtue of their meaning.
- Furthermore, the main reason for (**SV**) is that objects that are dealt with in one conventional context won't necessarily survive context change. So [**U**] should force a *de re* reading while $\langle \mathbf{C} \rangle$ should always be *de dicto*.

Ultimately and Conventionally as operators

- So at the very least, some contexts will behave non-normally with respect to closure under consequence (see *impossible* and *open* worlds in Priest's semantics).
- We may find an interesting lead in Rahman's understanding of non-normal modal logics, where chosing a context is also chosing a semantic for the non-modal logical constants.

Two negations

1. *prasajya*-negation: the usual truth-functional operator ($\neg$)
2. *paryudāsa*-negation: predicate modifier ($\bar{\text{P}}$)
3. The *Catuṣkoṭi* would then look like:
   - $\neg$ A is B
   - $\neg$ A is $\bar{\text{B}}$
   - $\neg$ A is B $\wedge$ A is $\bar{\text{B}}$
   - But how one should understand the fourth?
     - $\neg\ \neg$(A is B $\vee$ A is $\bar{\text{B}}$) ?

Three negations

1. *prasajya*-negation: the usual truth-functional operator ($\neg$)
2. *paryudāsa*-negation: predicate modifier ($\bar{\text{P}}$)
3. *illocutionary*-negation: pragmatic force ($\nvdash$)
4. The *Catuṣkoṭi* would then look like (Westerhoff take):
   - $\nvdash$ A is B
   - $\nvdash$ A is $\bar{\text{B}}$
   - $\nvdash$ A is B $\wedge$ A is $\bar{\text{B}}$
   - $\nvdash \neg$(A is B $\vee$ A is $\bar{\text{B}}$)

Questions for Westerhoff account

1. How does it relate with the two truths doctrine?
   - Is it ultimately or conventionally true that Nāgārjuna is not asserting the Lemmas?
2. How does it relate with the (**SV**) doctrine?
   - The reason for rejecting the lemmas built in Westerhoff account is that all lemmas presuppose existence of the objects refered to by the sentences. But argumentation for the rejection of any of the lemmas will not enter into the reasons why Nāgārjuna thinks there is no objects (namely because objects do not (necessarily) survive context switch.

What we want of our dialogue system

- From the Tibetan we take that the *Catuṣkoṭi* should be read with respect to the $[\mathbf{U}]/\langle\mathbf{C}\rangle$ distinction.
- But clearly no statement should be allowed to be formulated outside the scope of $[\mathbf{U}]/\langle\mathbf{C}\rangle$ operators.
- Consequently $[\mathbf{U}]/\langle\mathbf{C}\rangle$ should not be defined at the object level. This is where we agree with Westerhoff (and Matilal and others): some part of the *Catuṣkoṭi* should be understood at the level of forces definitions, not at the level of logical constants.

What we want of our dialogue system

- Hence "Conventionally" and "Ultimately" are types of assertion, i.e. types of games, distinguished by who choses the context of debate.
- "... should not be asserted" is a kind of operator, but the definition of which includes reference to structural rules. Actually $\nvdash \phi$ means "there is a winning strategy against ϕ".
- So every lemma should read : "there is a context where I have a winning strategy against ... "

A presentation of Jonardon Ganeri's formalisation of the Navya-Nyāya technical language

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Navya-Nyāya

- An Indian system of philosophical analysis
- Developed from 12th century AD to 17th century AD
- A technical language to clarify technical debate

Ambiguities in Sanskrit

- Homonomy
- No (systematic and obligatory use of) articles or quantifier expressions
- Noun phrase occurring by itself can be a definite description: *e.g.* 'Pot [is] blue'
- Existential or universal force of noun: '[The] doctor is coming'
- 'Scope' ambiguity can render 11 readings of a sentence: 'Fire is cause of smoke'
- Semantic ambiguity of relational expressions: *e.g.* inherence vs. containment

Navya-Nyāya is a technical language designed to clarify philosophical debate by elimanating ambiguities occurring in ordinary language.

Contents

- The language
- Negation
- Examples
- Inference
- Abstraction

Symbols

The alphabet of the language $\mathcal{N}$ consists of the following symbols:

- A set $\mathcal{C}$ of individual constants. We will denote the constants with lower case Roman letters "$\dot{a}$", "$\dot{b}$", *etc.* Sometimes we will use subscripts as follows "$\dot{a}_1$", "$\dot{a}_2$", "$\dot{a}_3$" and so on, where we will drop the dots if no confusion can arise;
- We have abstract terms, "α", "β" *etc.* given by an *abstraction functor* if applied to a individual constant a. For instance *pot*, gives us the abstract term *pothood* or *potness*;
- A set of *primitive relations*. These relations will be denoted by uppercase Roman letters "P", "R", "S", *etc.* ;
- A set of *relational abstracts*. These relations will be denoted by bold uppercase Roman letters "$\mathbf{P}$", "$\mathbf{R}$", "$\mathbf{S}$", *etc.* ;

Symbols *(Continued)*

- The symbol "=" will denote our identity relation;
- A set $\mathcal{C}^-$ of absential counterparts of the elements of $\mathcal{C}$, which will be denoted by $\bar{a}, \bar{b}$, *etc.* ;
- A set of *absential* relations: "$\bar{P}$", "$\bar{R}$", "$\bar{S}$", *etc.* ;
- **N**a, which means 'absenthood-conditioned-by-a, which by definition is the same as a is absent.
- A set $\mathcal{L}$ of logical constants containing "[]", "." and ":";

Terms

The set $\texttt{TERM}^+$ is the smallest set X with the properties

1. All primitive terms are in X: $\dot{a} \in X$, $\dot{b} \in X$, *etc.* ;
2. All abstract terms are in X: $\alpha \in X$, $\beta \in X$, *etc.* ;
3. If $t \in X$, then $\mathbf{R}[t] \in X$.

Terms *(Continued)*

The set $\texttt{TERM}^-$ is the smallest set Y with the properties

1. All absential terms are in Y: $\dot{a} \in Y$, $\dot{b} \in Y$, *etc.*.
2. If $t \in Y$, then $\bar{R}[t] \in Y$.

The set $\texttt{TERM}$ is defined by $X \cup Y$. If x is not in X or Y, x is not a term.

Sentences

$\texttt{SENT}$ is the smallest set X with the properties

1. $s, t \in \texttt{TERM} \Rightarrow s.\mathbf{R}t \in X$;
2. $\alpha \in \texttt{TERM} \Rightarrow \alpha : \mathbf{R}[s] \in X$.

Nothing else is a sentence then on basis of the above.

Domain

Let $W = W^+ \cup W^-$ be the domain of discourse, where W^+ contains all *positive* objects of discourse and W^- contains the *absential* or *negative* counterparts of W^+.

Set theoretic notation. Let B be a set. We write $B \times B$ to denote the cartesian product of this set. A binary relation R on B is a set of ordered pairs, hence $R \subseteq B \times B$. We write $[a]R$ to be the *image* of a under R, *i.e.* $[a]R := \{b \in B \mid aRb\}$. We write $R[b]$ to be the *preimage* of b under R, *i.e.* $R[b] := \{a \in B \mid aRb\}$.

An interpretation of the terms $t \in \texttt{TERM}$ of the language $\mathcal{N}$ is a function $I : \texttt{TERM} \to W$ satisfying:

1. $I(\dot{a}) = a$;
2. $I(\alpha) = A \subseteq W^+$;
3. $I(\mathbf{a}) = \{a\}$;
4. $I(\dot{\bar{p}}) = \bar{p}$
5. $I(\mathbf{R}[b]) = \{a \in W \mid aRb\}$
6. $I(\mathbf{R}[\beta]) = \{a \in W \mid aRb \;\&\; b \in I(\beta)\}$

A valuation is a function $[\![.]\!] : \texttt{SENT} \rightarrow \{0, 1\}$ such that

1. $[\![\dot{a}.\mathbf{R}[t]]\!] = 1 \Leftrightarrow I(\dot{a}) \in \mathbf{R}[t]$
2. $[\![\alpha.\mathbf{R}[t]]\!] = 1 \Leftrightarrow I(\alpha) \subseteq \mathbf{R}[t]$
3. $[\![\alpha : R[t]]\!] = 1 \Leftrightarrow I(\alpha) \cap \mathbf{R}[t] \neq \emptyset$

11 senses of pot and table

-
  - ‘A particular table t is the locus of a particular pot p’
  - ‘The pot is on the table’
  - $t.\mathbf{L}[p]$
-
  - ‘The table is the locus of some pot’
  - ‘Some pot is on the table’
  - $t.\mathbf{L}[\pi]$
-
  - ‘The table is the locus of pothood’
  - ‘All pots are on the table’
  - $\pi.\mathbf{L}^{-1}[t]$
-
  - ‘Some table is the locus of the pot’
  - ‘The pot is on a table’
  - $p.\mathbf{L}^{-1}\tau$

11 senses of pot and table *(continued)*

-
  - ‘Every table is the locus of the pot’
  - ‘The pot is on every table’
  - $\tau.\mathbf{L}p$
-
  - ‘Some table is the locus of some pot’
  - ‘Some pot is on some table’
  - $\tau : \mathbf{L}\pi$
-
  - ‘Every table is the locus of some pot’
    - ‘Every table has some pot on it’
    - $\tau.\mathbf{L}\pi$
    - ‘There is a pot which is on every table’
    -
-
  - ‘Some table is the locus of every pot’
    - ‘Every pot is on some table’
    - $\pi.\mathbf{L}^{-1}\tau$
    - ‘A particular table is the locus of all pots’
    -
- ‘Every table is the locus of every pot’

Negation

- Every object has an anti-object (*abhāva*). '$\bar{p}$' means the 'absence of p'
- $\mathbf{N}p := \dot{\bar{p}}$
- $\mathbf{N}\beta := \bar{\beta}$

- A Nyayikan will say instead of 'the pot is not on the table' that 'the absent-pot is on the table' or 'the table is the locus of the absenthood conditioned by pot'.
- The pot is not on the table $\approx t.\mathbf{L}(\mathbf{N}p)$

Negation *Continued*

- But it could also mean 'A pot is not on the table'
- 'The table is the locus of the absenthood conditioned by pothood' $= t.\mathbf{L}(\mathbf{N}\pi)$

- What about 'No pot on the table?'
- This would translate into 'The table is the locus of the absence of all pots'. Here the formalisation is a bit more complicated: $\pi.\mathbf{N}^{-1}(\mathbf{L}^{-1}t)$. This reads: 'The set of pots is a subset of the set of objects whose absence is located on t'.

Inference

Classic example of an inference is the following:

The hill has fire because the hill has smoke.

Every inference has three terms:

- Probandum
- Reason/Ground
- Locus

In the above the probandum is ‘fire’, the reason is ‘smoke’ and the locus ‘hill’.

Inference *(Continued)*

In order to arrive at such a conclusion one must follow the 5 steps (*Nyāya*):

- Thesis: The hill has fire.
- Reason: Because the hill has smoke.
- Example: Where ever there is smoke there is fire.
- Application: This hill has smoke.
- Conclusion: This hill has fire.

We would want to investigate if we can now define a consequence relation within the language $\mathcal{N}$ defined above. What would this mean for a 'grammatical' logic like Nyāya?

Abstraction

We have seen that there is frequent use of abstracts. We have primitive terms like 'pot', 'cow' *etc.* and it is guaranteed that every primitive term can induce, or form at least one abstract term. So, 'pot', or p gives you 'pothood' or π. Some Nyayikans also allow for the following abstraction from p. Namely 'that which is the property of being this very pot', denoted by $\{p\}$. What is the relation between objects and concepts in Nyaya therory?

> *Let U be a set of objects, the objects in the domain. Assign to each primitive term "A" an object A_i in the subset $\mathbf{A} \subseteq U$. [...] Assign to "A-hood" or "$\mathbf{A}$" the set $\mathbf{A}$.*[1]

This is sanctioned by the following axiom:

$$\text{Axiom of possession: } A = \mathbf{A}\text{-possessing.}^{2}$$

---

[1] [2], p. 131
[2] [2], p. 128

Conclusions

- We should determine to which fragement of Predicate Logic the language defined by Ganeri is equivalent.
- Given the language a consequence relation should be defined.
- What is the relation between objects and concepts? A modern logical perspective includes a modern *philosophical* perspective.
- Extensions of the language?


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Indian Logic and Medieval Western Logic: Some Comparative Remarks

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Abstract

Many unique features of logic in the Navya-Nyāya tradition which have their origin in features of Sanskrit grammar and usage can also be found in the logical tradition of medieval Western Europe. While the two traditions are wholly distinct, there being no channel of influence in either direction, recently scholars of logic have approached both traditions in a similar fashion, using the tools and techniques of modern mathematical logic in order to understand the formal, regimented, but nevertheless not generally symbolic, systems. It is a commonplace that both medieval logic and Indian logic do not generally resemble modern (Fregean) mathematical logic. Given this divergence, what is interesting is just how similar medieval logic and Indian logic in the Navya-Nyāya tradition are. We discuss four specific similarities, and try to put into context how two such different and separate systems of logic have more in common with each other than, e.g., medieval logic and modern mathematical logic, which one might think would mirror each other more similarly than they do, given that they are a part of the same historical tradition.
Keywords: epistemic clauses, medieval logic, natural language, Navya-Nyāya, negation

1 Introduction

In [Ganeri 2008a, Ganeri 2008b], Jonardon Ganeri discusses the main features of logic and reasoning in the Navya-Nyāya tradition and introduces a symbolic syntax and semantics to formalize the technical language developed in that tradition. His goal in these papers is to clarify the structure of the technical language and to make it more accessible to logicians in the Western tradition, and he does this by providing a symbolic mathematical notation.

The exercise is justified by noting that

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> A careful analysis of the conceptual framework of expressive pwoer of the Navya-Nyāya technical language is therefore of considerable importance in the modern study of the Indian academic literature [Ganeri 2008a, p. 105].

But this is not the only reason that such an exercise may be of interest. Many of the unique features in the Navya-Nyāya tradition, which have their origin in features of Sanskrit grammar and usage, can also be found in the logical tradition of medieval Western Europe, which also has its roots in natural language (in this case, Latin).[1] While the two traditions are wholly distinct, there being no channel of influence in either direction, recently scholars of logic have approached both traditions in a similar fashion, using the tools and techniques of modern mathematical logic in order to understand the formal, regimented, but nevertheless not generally symbolic, systems. It is a commonplace both that medieval logic does not generally resemble modern (Fregean) mathematical logic [Dürr 1951, Moody 1975], and that Indian logic does not generally resemble either medieval or modern Western logic.[2] Given this divergence, what is interesting is just how similar medieval logic and Indian logic in the Navya-Nyāya tradition are. In this paper, we discuss four specific similarities, and try to put into context how two such different and separate systems of logic have more in common with each other than, e.g., medieval logic and modern mathematical logic, which one might think would mirror each other more similarly than they do, given that are a part of the same historical tradition.

2 The comparison

There are a number of interesting ways in which the medieval tradition of logic and Navya-Nyāya are similar. These similarities all stem from a shared approach to logic which grounds it in real-world applications, namely to clarifying specific problematic features of natural languages which make it ambiguous, and hence unsuited for precise reasoning, and to dialogical contexts where the role of the participant is crucial. In this section we discuss four: the role of knowledge (§2.1), features of the system which specifically reflect ambiguities in natural language (§2.2), truth conditions for basic statements (§2.3), and the distinction between term negation and sentence negation (§2.4).

2.1 The role of knowledge

An essential feature of logic and reasoning in Navya-Nyāya is its epistemological character. Two of the three rules which establish the legitimacy of a *hetu* (ground, reason) crucially include epistemological clauses:

2 The ground must be present in at least one locus where the probandum is known to be present.

3 The ground must be absent in all loci where the probandum is known to be absent.

[1] Henceforth, we will use "medieval logic(ian)" to refer to medieval Western logic(ians), despite that the Navya-Nyāya tradition also developed during the medieval period.

[2] For example, Pahi equates pre-modern Western logic with Aristotelian logic, and discusses the "divergent courses" of the two [Pahi 2008, p. 236]. Cf. p. 2.1 below.

In [Matilal 1998, §1.3], Matilal cites the epistemological character of Indian logic as the first of four ways that Indian logic differs from the "'modern' conception of logic" [p. 14] in the Western tradition. Pahi goes even further than that, saying that this difference holds not only of the modern conception of logic, but of Western logic. He seems to be equating "historical Western logic" with "Aristotelian logic" when he says:

> The mainstream of western logic has been primarily concerned with the characterization and systematization of valid modes of deductive inference. It began in Greece as a deduction-centered discipline (*nigamana-kendritaśāstra*) and has basically continued to remain so throughout its history. Logic in India though concerned with the problem of validity of inference (*anumāna pramāṇa*) as a mode of justification of knowledge claims, has focused primarily on the relation of pervasion (*vyāpti-kendrita śāstra*) [Pahi 2008, p. 235].

While Matilal may be correct when he says that "Epistemological questions... are deliberately excluded from the domain of modern logic" [Matilal 1998, p. 14], Pahi's description of logic in the western tradition overgeneralizes. It overlooks developments in the medieval period which, like the Navya-Nyāya, recognize the fundamental importance of *known* truth, as opposed to simple (and potentially unknown) *truth*. Specifically we have in mind medieval theories of *obligationes*, a dialogue-type framework with two participants (the Opponent and the Respondent), where at each step in the dialogue the Opponent puts forward propositions and the Respondent is *obligated* (hence the name) to respond according to certain rules. Early treatise on *obligationes* couch the rules purely in truth-functional terms[3], later treatises recognize that in the context of an actual dialogue between two real participants, the only way that the Respondent can correctly follow the rules is if either he is omniscient, or the rules are modified to reflect the Respondent's state of knowledge (so that he is not penalized for being unaware of, e.g., whether the pope is currently in Rome or not). For example, Richard Brinkley (late 14th C) includes the rules:

> Everything following from the *positum* during the time of its positing and known to be such must be conceded [Brinkley 1995, p. 15 (15)].
>
> Everything repugnant to the *positum* during the time of its positing and known to be such must be denied [Brinkley 1995, p. 15 (16)].

Other examples can be found in the works of William of Ockham, Paul of Venice, Peter of Mantua, and others.[4]

Thus we can see that, in a dialogical context, the role of knowledge was not only recognized but explicitly included in the rules for determining the correctness of an inference.

[3]For example, the early treatise *Obligationes Parisienses* [de Rijk 1975] has rules such as "Everything which is put forward that has the same form of speech as what was first put down [the *positum*], everything following from the *positum* and a thing or things conceded [previously] and everything which is true and not repugnant to these must be conceded" and "the opposite of the *positum* and every false thing not following from the *positum* and a thing or things conceded and the opposite or opposites of a thing or things correctly denied and every true thing repugnant to these must be denied".

[4]Cf. [Ockham 1974, p. 737]; [Venice 1988, pp. 50, 52, 54, 56, 64]; and [Boh 2001, pp. 168–69]. I'm grateful to Catarina Dutilh Novaes for allowing me access to her notes on epistemic clauses in *obligationes* rules.

2.2 Modeling natural language

Both the Navya-Nyāya technical language and the regimented Latin used by medieval logicians were developed as a way to make precise ambiguities in the natural language used by the philosophers, either Sanskrit or Latin. Ambiguous terms occur in both Sanskrit and Latin, but these are generally easy to deal with when they arise. More problematic in both languages is the lack of definite and indefinite articles and, in some cases, quantifiers. For example,

ghaṭo nīlaḥ
pot [is] blue

can mean "the pot is blue", "some pot is blue", or "every pot is blue" (cf. [Ganeri 2008a, p. 105]. Similarly, in Latin,

homo est albus

can be translated as "the man is white", "some man is white", or "man is white", where the latter is understood to mean "every man is white". An even more imprecise statement in Latin is:

homo est animal

can be translated as "the man is animal" (adjectival), "the man is an animal" (nominal), "some man is animal", and so on.

Both medieval logicians and the Naiyāyikas solved the problem of the variety of interpretations of such Latin and Sanskrit sentences in a similar fashion. In Indian philosophy of language, there were two solutions to the interpretation of an unquantified subject in a subject + predicate sentence: Meaning Particularism (*vyaktiśaktivāda*) and Meaning Universalism (*jātiśaktivaāda*). On the former, the unquantified subject of a subject + predicate sentence is understood as being existentially quantified, and has, as Ganeri puts it, "genuine referring use" [Ganeri 2008a, p. 106]. On the latter, the unquantified subject is understood in a universal sense, much like Russell's treatment of definite descriptions. Medieval logicians were similarly faced with the question of how to interpret subject + predicate sentences with unquantified subjects. They identified four types of subject + predicate sentences, on the basis of their quantity: universal, particular, singular, and indefinite. Sentences such as the examples above would count, on most medieval theories, as indefinite. William of Sherwood's definition of indefinite propositions is typical:

> An indefinite statement is one in which the subject is a common term not determinated by any sign. Such statements are called indefinite because they do not determine whether the discourse is about the whole [of the subject] or about a part [Sherwood 1966, p. 29].

The inferential relations that held between universal and particular propositions was well known to the medieval logicians through the square of oppositions described by Aristotle. How indefinite statements were fit into the square of oppositions differed from author to author, with differing levels of success. Sherwood makes the incorrect move of equating indefinite propositions with particular ones [Sherwood 1966, p. 30]. A better approach is taken by Peter Abelard in his *Logica Ingredientibus*. There he argues

> that the simple affirmative statement 'A human being is white' [*homo est albus*] should be analysed as claiming that that which is a human being is the same as that which is white (*idem quod est homo esse id quod album est*) [Knuuttila 2007, p. 192].

I.e., indefinite statements have a universal character.

The interpretation of unquantified subjects in a subject + predicate sentence is closely related to the truth conditions for such sentences, which forms the topic of our second comparison.

2.3 Truth conditions for predications

In [Ganeri 2008a, §6.1], Ganeri introduces what he calls a "translation manual" to move from his formalization of Navya-Nyāya and predicate logic. After presenting the translation manual, he concludes that "every sentence in this language (NN*) has the structure: $(-)(\forall/\exists)(\exists)(-)(\_{}_1 R \_{}_2)$" [Ganeri 2008a, p. 117], where $-$ is negation, and R a binary relation with $\_{}_1$ and $\_{}_2$ being its inputs.

If we restrict our attention to categorical propositions, and replace R with the relation E (for Latin *est*), this formalization exactly matches the truth conditions given by Peter Abelard (cf. above). For an indefinite statement such as *homo est albus*, the most natural way to understand 'that which is a human being' is universally and 'that which is white' is particularly. When an indefinite statement is determined by a sign of quantity, such as *omnis*, *quiddam* or *nullus*, then we can simply replace 'that' with the relevant quantifier (everything, something, nothing). This gives us the following predicate logic notation for the four types of categorical propositions with explicit quantifiers:

A: $\forall x \exists y(xEy)$
E: $\forall x \forall y \neg(xEy)$
I: $\exists x \exists y(xEy)$
O: $\exists x \forall y \neg(xEy)$

We can rewrite the (E) and (O) statements as $\neg\exists x \exists y(xEy)$ and $\neg\forall x \exists y(xEy)$, respectively, to obtain four forms that match the pattern Ganeri gives for (NN*).

Furthermore, in both cases (the Indian and the medieval), we usually use restricted quantifiers, e.g., (in Ganeri's notation):

$$(-)(\forall/\exists : \tau)(\exists : \pi)(-)(\_{}_1 R \_{}_2)$$

to be read "(It is not the case that) for every/some τ there is a π such that the τ-object and the π-object are (not) related by R."

2.4 Term negation vs. sentence negation

Both medieval logic and Navya-Nyāya are term logics (as opposed to predicate or propositional logics), though they can be simulated in predicate logic. One unique feature of term logics is the presence of two types of negation, term negation and sentence negation (also called internal and external negation, respectively). Medieval logicians indicated whether a negatory sign was to be interpreted as internal or external by its placement in the sentence. In the categorical sentence *quidam homo non est albus*, *non*, coming before the copula *est*,

indicates sentence negation and is correspondingly given negative quality. It can be translated as "some man is not white". This is contrasted with *quidam homo est non albus*, where *non* is narrow-scope over *albus* only. This sentence can be translated "some man is non-white", and it is considered to be affirmative, since the property "non-white" is affirmed of the subject *quidam homo*. This same type of term negation, expressed in terms of absence (*atyantābhāva*), is used in Nyāya. In both traditions, "absence of a property is treated as another property" [Matilal 1985, p. 116]. Where the two traditions differ is that in Nyāya, term negation is considered primary. Ganeri notes that "Nyāya avoids sentential negation wherever it can, but it cannot eliminate it altogether". In contrast, both types of negation are found equally, and neither is preferred, in medieval logic.

3 Conclusion

From the preceding it is clear that many of the similarities between Navya-Nyāya and medieval logic arise from their shared focus on the applied, pragmatic aspects of reasoning and rationality, both in the modeling of natural language and in the context of dialogues. Connected to this focus on logic and reasoning as it occurs in natural language and natural-language contexts is the delineation of grammar and logic. In both traditions, the development of the logical side of things is closely connected to a grammatical analysis of the language in question, whether it is Sanskrit or Latin, and this is in turn connected to the distinction between descriptive and prescriptive uses of language. The Indian tradition, Pahi argues, is primarily descriptive. He links the development of the Navya-Nyāya technical language with the programme of developing an adequate deductive model of grammatical knowledge, that is, a system of grammar. He says that

> a system of grammar for a language aims at characterizing the informal notion of grammatical correctness of words and sentences for the language in question... The grammarian is not at liberty to alter the boundary between admissible and inadmissible data. Grammar is descriptive subject only to minimal constraints on the admissibility of data [Pahi 2008, p. 239].

A similar attention to grammar and the grammatical correctness of language can be found in two contexts in medieval logic. The first is the pre-Abelardian logical developments, as exemplified by St. Anselm of Canterbury. He distinguished between the job of the grammarian (which is descriptive) and the job of the logician (which is prescriptive), but notes that the logician should not wholly discount the works of the grammarian, but should instead use his prescriptions to give a foundation for the descriptions of the grammarian. A clear explication of the proper, logical usage of terms can be used to give an explanation for the improper, ordinary usage of terms (cf. [Uckelman 2009, p. 251] for further discussion).

The second context is the speculative grammar of the modist grammarians, in the 13th and 14th centuries. The Modistae developed an "attempt to systematise a universal semantic approach to language, leading to a high degree of sophistication and adequacy in linguistic description" [Pinborg 1982, p.

265]. The approach of the modist grammarians can be described as derivatively prescriptive: Their goal was to isolate the prescriptive rules governing actual linguistic use. When viewed this way, works of speculative grammar fall under much the same light as the axiomatic systems of grammar that Pahi is describing in the passage quoted above.

Thus, we can see that the shared features of Indian and medieval logic stem from a shared concern in the appropriate regimentation of natural language, whether this is done in a descriptive or a prescriptive fashion, and the concomittent attention which must be given to epistemological concerns connected to natural language use.

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