

JAINA LOGIC AND THE ICONIC SCENARIOS

Miguel López-Astorga

Institute of Humanistic Studies “Juan Ignacio Molina”

Talca University, Chile

An important contribution of the so-called ‘Indian logic’ is the set of predications developed by Jain philosophers. However, if assessed based on western classical logic, Jaina logic in general and its predications in particular are clear examples of incorrect or inconsistent frameworks. Against this last idea, in this paper, it is argued that Jaina logic has a great potential to explain the way human beings really make inferences, and that comparing it to modern standard logic can be a mistake. To do that, a current semantic approach about reasoning, the one of the mental models theory, is used.

INTRODUCTION

There is no doubt that a very relevant cultural contribution given by the East is a number of logical frameworks known as ‘Indian logic.’ One of such frameworks is clearly that of Jaina logic and its seven predications, which will be examined in this paper. Jaina logic is important for several reasons, and one of them is its potential to describe the actual way people derive conclusions from sets of premises. However, this potential can be unnoticed if this logic is reviewed in a manner that pays attention only to the criteria of western logic, since, if this is done, it would appear that Jaina logic is an incoherent logic in that it leads to inconsistencies.

But, as has already been said, judging ancient logics on the basis of the requirements and principles of western modern logic can lead one to misinterpret these ancient logics, ancient logics assuming the requirements and principles of western modern logic can lead one to misinterpret the source theory, as it is really hard to separate logics from their formation contexts and circumstances, and from the intentions to which they were built. As far as Greek logic is concerned, a noteworthy case is Stoic logic, which, according to, for example, Susanne Bobzien (1996, 134) and Miguel López-Astorga (2016a, 139-140; 2016b, 21-22), can be thought to be far from calculi akin to that of Gerhard Gentzen (1934, 1935). On the other hand, as regards the concrete case of Indian logic, papers such as, for instance, the one by López-Astorga (2016c) claim that proposals such as that of Stanilaw Schayer (1933), which deems the Hindu Syllogism presented in the book Nyāyasūtra as an evident precursor of basic elements of first-order predicate logic (see also, e.g., Jonardon Ganeri 2004, 327), are not acceptable. In the same way, López-Astorga (2016a) shows how another text usually considered as a part of Indian logic, the Kathāvathu, which is linked by Schayer (1933) and Bimal Krishna Matilal (1998) to the classical logic in the West too (see also, e.g., Ganeri

2004, 314), can be understood as an approach very different from this last logic as well, and more similar to Stoic logic than to a calculus such as the one of Gentzen.

Thus, in this paper, it will be argued that the case of Jaina logic is not really distinct from the aforementioned ones. Indeed, if evaluated from the western standard propositional calculus, it can only be admitted that, at most, it is like a paraconsistent logic more or less related to frameworks such as that of Bernard Bolzano (1837). Nonetheless, if standard calculus is ignored, it can be interpreted that its sense is very different, and that, as said, for example, by López-Astorga (2016c) for the Hindu Syllogism, it is an approach trying to show the true way the human mind comes to conclusions, and not to present a close logical system such as it is understood nowadays. In this way, as in, for instance, López-Astorga (2016c) too, the analysis will be carried out under the hypothesis that a contemporary theory, the mental models theory (from now on, MMT), actually explains human reasoning, which will allow noticing that the machinery of this last theory is able to capture the basic ideas of Jaina logic without finding consistency problems, and that, building the gap, the concepts and basic theses of this last logic are closer to the essential elements and resources of MMT than thought. The key point will be, as indicated below, that both of them appear to refer to possible scenarios.

To do all of this, firstly, the theory of predications of Jaina logic will be explained. Secondly, given that several interpretations of this logic have been given, one of them that of Ganeri (2004), will be commented on in greater detail. The for this is that while my interpretation here will not be exactly the one offered by Ganeri (2004), it will not be absolutely incompatible with it either. Then I will explain general notions of MMT that will be necessary to achieve the aims of this paper. Finally, I will try to show how Jaina logic can be understood based on MMT, and, by means of an example, to argue that they are more similar than it first appears, and that the former can also be used to account for certain intellectual actions often made by human beings. However, before anything else, I would like to elaborate on several points mentioned in this introduction that need further consideration.

STANDARD LOGIC, CONTEXTS, INTENTIONS, AND THE VALIDITY OF REASONING

There is no doubt that one might ask several questions about what has been said above. One of them is, for instance: if logic is about the validity of reasoning, how can it depend on contexts or intentions? Another one can be: why can it be thought that it is necessary to compare logics to each other? Still, another question can be: is it always unjustified to make such comparisons?

This paper can in fact also be considered as a response to questions such as these ones. Maybe the main mistake is to believe that the way western classical logic understands rationality and its validity is the only one there is. As known, that way is very restricted and, for example, only admits results drawn from deductive processes, where the conclusions that can be obtained by means of inductions are usually ignored. That does not seem to be the case in Indian logic, which, as the literature shows, could include inductive processes as absolutely valid processes (see, e.g., López-Astorga, 2016c). It is true that the West has offered inductive logics as well, but we generally assume that western standard logic is, as said, deductive. So, circumstances such as this one make it evident that the concept of

validity of western standard logic is not the only there is, and that there are other concepts of validity as well.

On the other hand, intentions and contexts can be relevant because the different logical systems can have distinct goals and aims. From certain perspective, one might think that standard logic is a normative system that basically tries to capture the way reasoning should be made, and not the way it is habitually really made. We know, and the literature on the mental models theory cited below reveals that that it is, that people sometimes do not infer conclusions following the schemata or the truth tables of standard logic. Therefore, it can be claimed that this last logic is just an idealization of the most correct way to derive conclusions. And this is exactly what enables us to propose that a logic such as the Jaina one has different intentions from those of the classical one, since, as mentioned, the former can be considered simply a descriptive logic that indicates the actual way people reason (and not the way they should do reasoning).

In any case, the following sections will support the ideas that rationality can be understood from different frameworks and cultural contexts, that the logics developed in different parts of the world do not have to coincide with each other (and hence that it is not suitable to judge one of them on the basis of another one), and that, if Jaina logic is analyzed based on the standard one, the former can appear to be inconsistent or, as said, paraconsistent, when it may not be actually be such.

Perhaps, we very quickly assume that the diverse logical proposals around the world must have commonalities, since logic is only one, and this is what leads to the comparisons. However, as argued, this is not necessarily so and this study is intended to serve as an evidence in this direction. Thus, without further delay, I shall describe what Jaina logic is exactly in the following section.

JAINA LOGIC AND ITS SEVEN PREDICATIONS

To describe the seven predications of Jaina logic, I will base, as Ganeri (2004) does, on a 12th century writer, VādidevaSūri, and, in particular, on the account that is to be found in VādidevaSūri (1967, Chapter 4, Verses 15-21). According to this last text, the predications are as follows [I also take here the information given by Ganeri (2004), but my translations are not exactly the same]:

- [I]: Conditionally, certain object is (*syād asty eva*).
- [II]: Conditionally, certain object is not (*syān nāsty eva*).
- [III]: Conditionally, certain object is; conditionally, certain object is not (*syād asty eva syān nāsty eva*).
- [IV]: Conditionally, certain object cannot be asserted (*syād avaktavyam eva*).
- [V]: Conditionally, certain object is; conditionally, certain object cannot be asserted (*syād asty eva syād avaktavyam eva*).
- [VI]: Conditionally, certain object is not; conditionally, certain object cannot be asserted (*syān nāsty eva syād avaktavyam eva*).
- [VII]: Conditionally, certain object is; conditionally, certain object is not; conditionally, certain object cannot be asserted (*syād asty eva syān nāsty eva syād avaktavyam eva*).

As mentioned, there are different interpretations of these predications. Nevertheless, the one that I will mainly analyze here is, as also indicated, that of Ganeri (2004). This does not mean that well-known views such as those of Filita Bharucha and R.V. Kamat (1984) or Matilal (1991) are going to be absolutely ignored in this paper. In fact, discussions between Ganeri (2004) and these last authors will be examined in the next section. What this means is that, although as mentioned I will not take the exact formalization and interpretation given by Ganeri (2004), I will assume those that I consider to be the main ideas of his account, which is described below.

GANERI'S (2004) INTERPRETATION OF THE SEVEN JAINA PREDICATIONS

To explain what the previous predications really express, Ganeri (2004, 358ff) resorts to an operator such as ':', which refers to the fact that something can be argued from a particular perspective. Thus, Ganeri's (2004) idea seems to be that, given a formula such as this one:

P : x

Its meaning is that x can be argued from the perspective P.

In this way, Ganeri's (2004) interpretations of the four first predications are akin to the following:

[I]: There is a perspective P such that P : x

[II]: There is a perspective P such that P : \neg x

Where ' \neg ' stands for negation.

[III]: There is a perspective P such that P : x, and there is a perspective P such that P : \neg x

[IV]: There is a perspective P such that \neg (P : x) and \neg (P : \neg x)

The demonstration until the predication [IV] can be enough here because, given the four first ones, it is very easy to deduce how the other three predications would be under Ganeri's (2004) interpretation. Maybe it is even trivial to indicate them. Nonetheless, what does seem important to take note is that the Ganeri's (2004) analysis of [IV] can be controversial, since it is different from those of Bharucha and Kamat (1984) and Matilal (1991). As argued by Ganeri (2004, 360), Bharucha and Kamat (1984) appear to claim that [IV] refers to a situation in which:

There is a perspective P such that P : (x and \neg x)

On the other hand, according to Ganeri (2004, 360), Matilal's (1991) view is not very different, as it would be similar to the following:

There is a perspective P such that P : x and P : \neg x

Ganeri's (2004) seems to reject these proposals for two reasons. On the one hand, it is

not clear what the difference between [V] and [IV] is under explanations such as these ones, especially under that of Bharucha and Kamat (Ganeri 2004, 360). On the other hand, they appear to lead to the problem pointed out above, that is, the problem of paraconsistency, since they refer to situations in which x and $\neg x$ seem to be possible at the same time. As far as this last point is concerned, in principle, one might think that Ganeri's (2004) interpretation has exactly the same problem, as it can be understood that $\neg(P : x)$ is equivalent to $P : \neg x$, and that $\neg(P : \neg x)$ is equivalent to $P : \neg\neg x$, that is, to $P : x$, which would also raise the aforementioned problem. However, Ganeri (2004, 361) explicitly rejects equivalences such as those under his interpretation, and this makes his account more compatible with a framework such as that of MMT, which, as shown below, supposes that contradictions have no place in human reasoning. Some general theses of this last theory are presented in the next section.

MMT AND THE ICONIC SCENARIOS

As mentioned, MMT is a current theory. Hence some of the works supporting it are very recent (e.g., Hinterecker, Knauff, & Johnson-Laird 2016; Johnson-Laird 2015; Johnson-Laird, Khemlani, & Goodwin 2015; Khemlani, Lotstein, Trafton, & Johnson-Laird 2015; Ragni, Sonntag, & Johnson-Laird 2016). However, the basic theses of it that are interesting for this paper are to be found in most of the studies published by its proponents. One of these theses refers to the concept of possibility. According to MMT, assertions inform about possibilities. Those possibilities constitute mental models and these models are iconic. All of this can be better understood by means of an example. Let us suppose a conditional sentence such as 'if p then q .' At first, the possibilities that can be related to it are the same as those of classical logic, that is, $[p \ \& \ q]$, $[\neg p \ \& \ q]$, and $[\neg p \ \& \ \neg q]$. Nevertheless, there are important differences between MMT and this last logic.

Apart from the fact that we do not always notice that the three mentioned possibilities are those of the conditional (see, e.g., Johnson-Laird et al. 2015, 202), the possibilities capture "... what is common to all the different ways in which the possibility might occur" (Johnson-Laird 2012, 137). This means that the previous possibilities, i.e., $[p \ \& \ q]$, $[\neg p \ \& \ q]$, and $[\neg p \ \& \ \neg q]$, represent exactly the same world, the only difference between them being, obviously, the truth-values of p and q . In this way, for example, the reality is basically the same in the cases $[p \ \& \ q]$ and $[\neg p \ \& \ q]$. The only element that is different is that in $[p \ \& \ q]$ p is true and in $[\neg p \ \& \ q]$ p is false, while the other elements remain without change. Thus, evidently, the distinctive characteristic of $[\neg p \ \& \ \neg q]$ is just that both p and q are false in it. So it can be said that, following MMT, the human mind works with iconic representations because "A mental model has a structure that corresponds to the known structure of what it represents" (Johnson-Laird 2012, 136).

But all of this has interesting consequences, as the content of the clauses, by virtue of modulation phenomena, can transform the models (see, e.g., Johnson-Laird et al. 2015, 202). In fact, if we continue with the case of the conditional, it can be said that, paying attention to their possible models, as what Johnson-Laird and Byrne (2002) have done we can distinguish ten kinds of conditional. One of those types is called by them 'Enabling' and can be represented by means of this example:

If there is water, then there can be fish.

If p represents the fact that there is water and q stands for the fact that there are fish, now the possibilities are not those indicated above, but $[p \ \& \ q]$, $[p \ \& \ \neg q]$, and $[\neg p \ \& \ \neg q]$. As it can be noticed, $[\neg p \ \& \ q]$ cannot be considered because it is not possible that there is no water and there are fish. On the other hand, $[p \ \& \ \neg q]$ must be taken into account because, of course, it is possible that there is water and there are no fish.

Likewise, to take another example, I can refer to another kind of conditional among the ten identified by Johnson-Laird and Byrne (2002). That kind is known in standard logic as ‘Biconditional’ and they keep the same name in their own classification. A clear instance in this regard can be this one:

If you are Italian, then you have Italian nationality.

If, in this case, p denotes the fact that you are Italian and q refers to the fact that you have Italian nationality, it is clear that only two scenarios are possible: $[p \ \& \ q]$ and $[\neg p \ \& \ \neg q]$. Obviously, $[\neg p \ \& \ q]$ has to be eliminated because it is impossible that you are not Italian and you have Italian nationality.

Maybe it is important to mention two more points of the theory as well. On the one hand, the dotted line (...) also plays a role as a symbol in MMT. As said, people do not always consider all of the combinations of possibilities corresponding to sentences, and the theory uses the dotted line to represent that situation (see, e.g., Johnson-Laird 2012, 138, Table 9.2). In this way, if it is indicated that the possibilities of a particular sentence are $[p \ \& \ q]$ and [...], this means that only $[p \ \& \ q]$ has been detected and that, although it is known that there are more possibilities, they are not taken into account.

On the other hand, as it can be derived from the arguments commented on, contradictions are not acceptable in the possibilities because, if there is a contradiction in a possibility, that possibility is removed. Clearly, this means that scenarios such as, for instance, $[p \ \& \ \neg p]$ are immediately rejected in the cognitive activity, and that, therefore, MMT is not a paraconsistent system at all. This aspect of the theory is directly related to modulation, which can easily be checked if the example of water and fish is reviewed again. As said, the sentence ‘if there is water, then there can be fish’ cannot be linked to the possibility $[\neg p \ \& \ q]$, the reason of that being that it is not possible that there are fish (q) without water ($\neg p$). And this is so because, as also explained, the models represent reality in entirety and are iconic, which implies that $[\neg p \ \& \ q]$ is here just an abbreviated representation of a much wider scenario. That scenario includes, among other elements, $\neg q$ (as indicated, there cannot be fish without water), and hence a contradiction, since a more complete way (although, of course, still abbreviated) to represent it could be $[\neg p \ \& \ q \ \& \ \neg q]$, which reveals that a contradiction between q and $\neg q$ exists and that the scenario has to be eliminated.

Obviously, MMT proposes many more theses and analyzes more intellectual processes than those that have been presented in this section. Nevertheless, what has been said about it can be enough to understand Jaina logic as an approach trying to describe human thinking that is compatible with MMT and is not paraconsistent. This last idea is developed below.

JAINA LOGIC AND THE ICONIC POSSIBILITIES OF MMT

As pointed out, there are several interpretations of Jaina logic and its seven

predications. Beyond those mentioned above, it is even possible to find a relationship to Stanisław Jaśkowski's (1969) framework (Ganeri 2004, 364-365). However, as also stated, one more way to consider them can be obtained from the resources and machinery of MMT. Thus, based on the general ideas of this last theory, the seven predications can be understood as follows:

- [I]: [x]
- [II]: [\neg x]
- [III]: [x], [\neg x]
- [IV]: [...]
- [V]: [x], [...]
- [VI]: [\neg x], [...]
- [VII]: [x], [\neg x], [...]

In this way, clearly, [I] represents the situation in which there is a scenario in which x is true. On the other hand, [II] stands for the case in which there is a scenario in which x is false. [III] informs that x is true in a scenario and false in another one. However, [IV] expresses that, as far as it is known, there are not enough data to state whether or not x is true in a particular scenario. In my view, this way to represent [IV], if it is not absolutely coherent with that of Ganeri (2004), at least it is not totally incompatible with it, since, in essence, Ganeri seems to claim that [IV] refers to the circumstance in which neither x nor \neg x can be deduced in a specific scenario. Furthermore, in [V] there is a scenario in which x is true and another one in which it has an unknown truth-value. And something similar happens in [VI], where, while x is false in the first scenario, its value continues to be unknown in the second one. Finally, [VII] indicates three possible scenarios: x is true, x is false, and it can be known whether or not it is true.

So, it appears that, from MMT, the sense that Ganeri (2004) assigns to the predications in Jaina logic can be expressed without difficulties. Nonetheless, another interesting point is that this way of interpreting them also allows them to infer conclusions under the general approach of MMT. For example, given a biconditional such as the one analyzed above (i.e., the one of the Italian nationality), it can be said that, if now x denotes that fact that you are Italian and y stands for the fact that you have Italian nationality, its possibilities are:

- [A]: [x & y]
- [B]: [\neg x & \neg y]

Thus, if the biconditional is true (which, in the case of this example, it is), [I] indicates a situation in which not only x is true, but also y. The reason of this is obvious. If, as provided by [I], x is true, [B] is not an acceptable possibility, since x is false (of, if preferred, \neg x is true) in it. Hence, because only [A] remains and y is true in it as well, it must be admitted that y is also true. Likewise, \neg y is true in [II] too. Now, [A] is the possibility that needs to be ignored and [B] reveals that, when x is false, y is false as well. [III], on the other hand, enables both [A] and [B] (x can be both true and false in it). Accordingly, both y and \neg y can be the case in this predication. As far as [IV] is concerned, given that there is no information about x, nothing can be said about y either, the value of this last clause being indefinite too. Thus, it is easy to note that [V] refers to two possible scenarios: in one of them y is true and

in the other one we do not know its truth-value. And, in the same way, it is not hard either to notice that the only difference between [V] and [VI] is that, in the first scenario of the latter, y is false. Likewise, it is also evident that, in the last predication, that is, in [VII], the possible scenarios are three again. In the first one, y is true, in the second one, what is true is $\neg y$, and, in the third one, it cannot be known whether what really happens is y or $\neg y$.

Therefore, there is no doubt that the framework provided by Jaina logic can be interpreted following the basic theses of MMT. Its predications can be considered as information about possibilities, and, under that interpretation, which does not appear to be, as said, absolutely incompatible with the one given by Ganeri (2004), it can be used to make inferences in a way consistent with the essential principles of MMT. This, obviously, can lead one to interesting conclusions.

CONCLUSIONS

As indicated, MMT tries to explain human reasoning. So, if, as shown, Jaina logic is coherent with it, it can be thought that this logic is a description or an attempt to describe that reasoning as well, and not just a proposal for a logical system such as, for example, western standard calculus. Actually, as far as ancient logic in general is concerned, this is not an absolutely new idea. For instance, López-Astorga (2016c) claims something similar with respect to the Hindu Syllogism, which is linked to MMT by him too. Likewise, as also pointed out, several works have already insisted that certain logics from the past, including, of course, the Indian one, cannot be rightly understood if their contexts are ignored, and that their real intentions were very different from those of classical logic. Undoubtedly, this perspective is also compatible with the hypothesis that those logics tried to give contributions in fields such as that of human cognition (see, e.g., López-Astorga 2016c as well).

In the same way, following the essential theses proposed by López-Astorga (2016a, 2016b, 2016c), another relevant idea that can be supported is that perhaps syntax was not as important in ancient logics as it is in the current logical systems, and that the former were more semantic and pragmatic approaches, that is, its approaches are more similar to frameworks such as the one of MMT. Thus, in accordance with those same theses, although, as it is known, there are contemporary cognitive theories other than MMT and, for this reason, it is possible that this last one is not the best alternative to account for human thought, it is obvious that the links that can be provided between certain ancient logics and MMT can be useful at least to better understand the former. Indeed, such links can lead us to notice that maybe the approaches from the past are not directly related to logical forms and that their basic elements are meaningful if seen as iconic possibilities.

For the particular case of Jaina logic and its seven predications, all of this shows that, as MMT, it holds that, in the human mind, the same element or fact can be both true and false. It depends on the perspective adopted or the scenario considered. Therefore, it can be said that both approaches share the idea that language does not always inform about isolated data that can be true or false, and that it can indicate simple iconic possibilities too. Obviously, this is a meaningful point that deserves to be continuously taken into account and researched. And this applies irrespective of whether what is being studied is just MMT, just Jaina logic, or the relationship between them.

REFERENCES

- Bharucha, Filita F. and R.V. Kamat. 1984. *Syādvāda* theory of Jainism in terms of deviant logic. *Indian Philosophical Quarterly* 9.
- Bobzien, Susanne. 1996. Stoic syllogistic. In *Oxford Studies in Ancient Philosophy*. Edited by Christopher C. W. Taylor. Oxford: Clarendon Press.
- Bolzano, Bernard. 1837. *Wissenschaftslehre*. Sulzbach: Seidel Buchhandlung.
- Ganeri, Jonardon. 2004. Indian logic. In *Handbook of the History of Logic, Volume I. Greek, Indian and Arabic Logic*. Edited by Dov M. Gabbay and John Woods. Amsterdam: Elsevier.
- Gentzen, Gerhard. 1934. Untersuchungen über das logische Schließen I. *Mathematische Zeitschrift* 39 (2).
- Gentzen, Gerhard. 1935. Untersuchungen über das logische Schließen II. *Mathematische Zeitschrift* 39 (3).
- Hinterecker, Thomas, Markus Knauff and Philip N. Johnson-Laird. 2016. Modality, probability, and mental models. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 42 (10).
- Jaśkowski, Stanisław. 1969. Propositional calculus for contradictory deductive systems. *Studia Logica* 24 (translation of the text written in 1948).
- Johnson-Laird, Philip N. 2012. Inference with mental models. In *The Oxford Handbook of Thinking and Reasoning*. Edited by Keith J. Holyoak and Robert G. Morrison. New York: Oxford University Press.
- Johnson-Laird, Philip N. 2015. How to improve thinking. In *The Routledge International Handbook of Research on Teaching Thinking*. Edited by Rupert Wegerif, Li Li, and James C. Kaufman. Abingdon & New York: Routledge.
- Johnson-Laird, Philip N. and Ruth M. J. Byrne. 2002. Conditionals: A theory of meaning, pragmatics, and inference. *Psychological Review* 109 (4).
- Johnson-Laird, Philip N., Sangeet Khemlani, and Geoffrey Goodwin. 2015. Logic, probability, and human reasoning. *Trends in Cognitive Sciences* 19(4).
- Khemlani, Sangeet, Max Lotstein, J. Gregory Trafton, and Philip N. Johnson-Laird. 2015. Immediate inferences from quantified assertions. *The Quarterly Journal of Experimental Psychology* 68 (10).
- López-Astorga, Miguel. 2016a. Some relationships between Indian and Stoic logic. *Problemas* 90.
- López-Astorga, Miguel. 2016b. The first rule of Stoic logic and its relationship with the *indemonstrables*. *Tópicos. Revista de Filosofía* 50.
- López-Astorga, Miguel. 2016c. The Hindu Syllogism, iconic representations, and human thought. *Revue Roumaine de Philosophie* 60 (2).
- Matilal, Bimal Krishna. 1991. *Anekānta*: Both yes and no? *Journal of Indian Council of Philosophical Research* 8.
- Matilal, Bimal Krishna. 1998. *The character of logic in India*. Albany: State University of New York Press.
- Ragni, Marco, Tobias Sonntag, and Philip N. Johnson-Laird. 2016. Spatial conditionals and illusory inferences. *Journal of Cognitive Psychology* 28 (3).

- Schayer, Stanislaw. 1933. Altindische Antizipationen der Aussagenlogik. *Bulletin International de l'Academie Polonaise des Sciences et des Lettres, Classe de Philologies* 90-96.
- Vâdideva Sûri. 1967. *PramâGa-naya-tattvâlokâlaCkâra*. Bombay: Jain Sahitya Vikas Mandal.

Submitted: 8 March 2017; revised: 18 March 2018