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A ONE-VALUED LOGIC FOR NON-ONE-SIDEDNESS

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1. A Constructivist Approach

Does it make sense to employ modern logical tools for ancient philosophy? This well-known debate[2] has been re-launched by the indologist Piotr Balcerowicz, questioning those who want to look at the Eastern school of Jainism with Western glasses. While plainly acknowledging the legitimacy of Balcerowicz's mistrust, the present paper wants to propose a formal reconstruction of one of the well-known parts of the Jaina philosophy, namely: the *saptabhaṅgī*, i.e. the theory of sevenfold predication. Before arguing for this formalist approach to philosophy, let us return to the reasons to be reluctant at it.

For one thing, Balcerowicz (2008) made a clear-cut distinction between a *constructivist* and a *reductionist* method of interpretation. The former is defined by Balcerowicz (2008: 4), where the so-called "constructivist" method is not to be confused with the philosophy of mathematics and merely amounts to the exercise of formal reconstruction:

> "What is called 'constructivist method' is such a strategy of examination that, while trying to meaningfully analyze the theory, makes use of modern tools and epistemology which were not explicitly known in ancient and medieval India, although one can see no objection to their application and one thinks their use helps one illuminate the issue by 'dismembering' its muddled structure or by disambiguating expressions which seem to us either indeterminate, obscure or equivocal precisely because no such disambiguation tools were available at that time."

[1] This paper has been presented as a lecture at a conference on "Jaina logic" (London, SOAS, 21-22 March 2013. I am grateful to the two anonymous referees for their very helpful comments and suggestions.

[2] About the philosophers that clearly argued for the explanatory value of formal logic, see e.g. Barnes 2007 and Fine 2012. Clarity and accuracy are the two central criteria in the debate between constructivists and reductionists.

The latter words recall what has always been presented as one of the main tasks of philosophy (especially its analytical branch), i.e. clarifying or disambiguating any discourse by rephrasing its vocabulary without altering its meaning. But here is precisely the challenge Balcerowicz addresses to the method itself: can ancient texts be reformulated by means of modern words without being altering their meaning? Whoever replies to this question negatively will hardly appreciate the following, thus opting for a so-called "reductionist" approach that advances hermeneutic explanations of ancient texts instead of resorting to their formalization.

Before losing every such reader from these preliminary lines onwards, let me propose something like a genealogical outline of the formal method I propounded thus far. For the reason why any modern philosopher and logician must be attracted by Jainism is related to its surprisingly close connection with some contemporary topics of the so-called "philosophical logics". These have been also mentioned by Balcerowicz (2008: 5):

> "To recapitulate, the constructivist approach explores what respective authors believe are hidden, unexpressed logical structures and logical and philosophical implications of the *syād-vāda*, such as multiple values or paraconsistency of the *syād-vāda*. A real danger of this approach is that it may read modern concepts into an ancient theory, albeit the theory allowed no room for them."

The connection between the Jaina theory of standpoints, or *syād-vāda*, many-valued logics and para-consistency largely accounted for the development of formal reconstructions. At the same time, Balcerowicz (2008: 9) favoured the reductionist approach because of its more cautious interpretation of the ancient texts. In this respect, I have been blamed for formalizing at length while departing from the original sources in an overeager way:

> "As a matter of fact some scholars, e.g. Ganeri (2002), to some extent, and Fabien Schang en masse, no longer offer a genuine interpretation of the *syād-vāda* but use some ideas of the theory in order to develop independent systems of many-valued logic which may be of considerable interest in their own right but of little interest as formalization attempts of the *syād-vāda*."

And yet, three main confusions in the logical vocabulary are such that a formal re-construction is in order to have a clearer understanding of Jainism.

1.1. Contradiction and Consistency

First and foremost, a crucial clarification is to be made about the twin concepts of *contradiction* and *inconsistency*. The aforementioned confusion at hand first occurs between opposite pairs of concepts like affirmation-negation and truth-falsity: affirmation is not truth and negation is not falsity, since an affirmative sentence may be false and a negative sentence may be true. While affirmation and negation essentially relate to the logical concept of contradiction, truth and falsity relate to the meta-logical *Principle of Bivalence* (hereafter: PB), namely: there is a set of two exhaustive and exclusive truth-values in logic, viz. truth and falsity. The notion of contradiction has been introduced by Aristotle's *Metaphysics* long before the logical school of Jainism emerged with its main representatives, including Prabhācandra (9th century C.E.) and Vādideva Sūri (1086-1169).[3] Contradiction was introduced by the Greek philosopher in the form of a logical principle (in Sanskrit: *paribhāṣā*), namely: the *Principle of Non-Contradiction* (hereafter: PNC), according to which a sentence and its negation cannot be true at once. While noting that there may be several plausible formulations of it, PNC is a normative principle: the simultaneous truth of a sentence and its negation is something that *ought* not be the case, insofar, as Łukasiewicz (1910) aptly showed, that PNC cannot be proved but should be imposed to the speakers for extra-logical reasons.

The concept of inconsistency is closely related to contradiction. Inconsistency is a relation between a sentence and its negation, so that inconsistency and contradiction are on a par from the viewpoint of classical logic: if a sentence α is true (or false), then its negation $\sim\alpha$ is false (or true) and both cannot be accepted at once by PB. At the same time, the founder of the para-consistent trend of *dialetheism*, Graham Priest argues for the existence of true contradictions from Priest (1979). The latter phrase is actually an ill-named case of "true inconsistency", given the normative definition of contradiction as that which cannot be accepted within a single logical system. Let us say accordingly that a contradiction expresses any inconsistency that cannot be accepted from a given model; this means that the inconsistent set of sentences α and $\sim\alpha$ is a contradiction in classical logic but not in e.g. Priest's para-consistent logic, where a third truth-value results from the combination of truth and falsity in one and the same truth-value ("both true and false"). We shall return to this non-classical device later on, since it concerns one of the forms of inconsistency usually associated to the Jaina concept of *avaktavyam*.

[3] Some references of these Jaina philosophers are to be found e.g. in Ganeri 2002.

I want to claim in the following that PNC does not essentially concern sentences or truth-values but, rather, speech acts and their related statements; this interpretation is in accordance to the etymological roots of contradiction, from the Greek *antiphasis* meaning the act of asserting and denying a sentence at once. The reason why such an interpretation has been neglected in the literature may be due to a prominently *ontological* reading of non-contradiction, following the distinction by Łukasiewicz (1910) between three versions of PNC (ontological, logical, and psychological).[4] At any rate, I gathered from this relevant detail that the debate about contradiction should not be centered around the semantic properties of sentences, viz. their truth-values, but refer to what speakers do in using these sentences during a discussion. Although some parallel can be made between the pairs truth-falsity and assertion-denial, the next section shall establish a relevant asymmetry between these two pairs of concepts.

Secondly, the general confusion about the meaning of contradiction should be exemplified in the three levels of discourse mentioned by Łukasiewicz (1910): truth and falsity, affirmation and negation, but also yes- and no-answers, these being correlated to two opposite speech acts about the declarative use of sentences. Some are immediately going to say that no difference occurs between both truth and yes-answer, on the one hand, falsity and no-answer on the other hand: just as saying "yes" to the question whether a given sentence is true is to assert its truth, saying "no" to the same question is to deny its truth and, therefore, to assert its falsity. But the latter conclusion is just what fails in a more fine-grained description of speech-acts, and the next section will set forth a logical framework accounting for the different levels of inconsistency in the *saptabhaṅgī*.[5]

Thirdly, some confusion appeared in the Jaina logic about the way to characterize an appropriate model for it, i.e. the set of accepted sentences that are taken to be true. According to the import of viewpoints in the Jaina epistemology (*anekāntavāda*), a special feature of the Jaina model is the occurrence of sentences pertaining to different viewpoints within one and the same set. It follows from this multiplex view of reality that a sentence can be said to be true and false according to the arguments provided for or against it. Here is a clear discrepancy with what Ganeri (2001) called the "doctrinalist" approach of Aristotle's logic, i.e. the one-sided view of truth as a one-one correspondence between true sentences and facts

[4] An exception is e.g. Dultih Novaes 2007, who clearly stressed upon the dialogical import of the concept of contradiction.

[5] The correlation advocated between 'logic' and 'pragmatics' can be related to some authors with different approaches to pragmatics, including Paul Lorenzen's game semantics or John Searle's illocutionary logic. See especially Lorenzen 1955 and Searle 1969.

of the world. Furthermore, the Jaina non-one-sided doctrine entails that some inconsistencies may be accepted inside the same model, whereas contradiction cannot be accepted by definition and should be avoided for sake of consistency or, better, coherence); to account for the difference between accepted and rejected inconsistencies, I proposed in Schang (2009b) a more comprehensive opposition between inconsistency and consistency, in contrast to the opposition between contradiction (banned inconsistency) and *coherence*.

1.2. The Jaina View of Inconsistency

Now that the conceptual framework is clarified, let us return to the case of Jaina logic and its controversial treatment of inconsistency.

As a least defense of my own interpretation, I propose to expose the rationale through which I choose my explanatory method. The following wants to show how my formal reconstruction below evolved since the early papers that were the target of right objections.

A preliminary outline by Schang (2009a) proposed to follow Ganeri (2002) by constructing a many-valued (i.e. 7-valued) existential and quasi-truth-functional view of the Jaina theory of judgments, or *saptabhaṅgī*. That is, each of the seven judgments or predications was given a single logical value by being reworded as the existence of a single viewpoint that makes the corresponding sentence true (hence the generic statement: "there is a standpoint S such that the sentence α is true"); at the same time, the formal semantics at hand could not determine the logical value of complex statements connected by logical constants like conjunction (α and ψ), disjunction (α or ψ), or conditional (if α then ψ). Furthermore, this 7-valued interpretation has been extended to a syncretist, 15-valued variant in which a twofold interpretation of *avaktavyam* is proposed without opting for either (the "glutty" one: both true and false, or the "gappy" one: "neither true nor false")[6]. Admittedly, such a construction is at odds with the ancient texts by introducing logical tools that have nothing to do with the Jaina tradition. For example, no more logical connectives occurred in these texts than in the Aristotelian logic, and nothing suggests the use of more than two truth-values in the *saptabhaṅgī* (as Balcerowicz indicated). If so, then it does not make sense to talk about a 7-valued logic of viewpoints, not to mention the 15-valued one.

[6] "Gappy" refers to the case in which some sentences are "under-determined" in a logical system: there is a gap in their meaning, given that these are *neither* true *nor* false. And conversely, "glutty" means that the sentences are "over-determined" by being *both* true *and* false. This conceptual pair glutty-gappy belongs to the current parlance of many-valued logics, where the logical systems are defined and interpreted in terms of truth-values.

Balcerowicz is thus entirely right to see Schang (2009a) as a purely formal extension that cannot account for the Jaina theory of judgments.

Let us consider again the theory at issue. It consists in a set of seven judgments or predications that are taken to be compatible with each other, contrary to the Aristotelian, exclusivist view of being and not-being. Each of these judgments proceeds as a statement performed by means of *assertions* (truth-claims) or *denials* (falsity-claims) about some object (referred to by "it"):

syād asty eva	arguably, it exists	assertion
syān nāsty eva	arguably, it does not exist	denial
syād asty eva syān nāsty eva	arguably, it exists; arguably, it does not exist	successive assertion and denial
syād asty eva syād avaktavyam eva	arguably, it is unspeakable	simultaneous assertion and denial
syād asty eva syād avaktavyam eva	arguably, it exists; arguably, it is unspeakable	assertion and simultaneous assertion and denial
syān nāsty eva syād avaktavyam eva	arguably, it does not exist; arguably, it is unspeakable	denial and simultaneous assertion and denial
syād asty eva syān nāsty eva syād avaktavyam eva	arguably, it exists; arguably, it does not exist; arguably, it is unspeakable	(assertion and denial and simultaneous assertion and denial)

A formal interpretation of the above statements needs to do justice to their combined consistency, if it wants to make sense of them. Moreover, my formal reconstruction of the Jaina logic purported to give, from Schang (2011a) onwards, a precise role to a set of ancient concepts by relating these into a common framework or philosophical system.

Accordingly, let us reconstruct the whole rationale by calling for a number of ancient concepts. The Jainas argued for a tolerant approach to truth[7]: *anekāntavāda*, which corresponds to a doctrine of non-one-sidedness; the latter was embedded by means of a set of seven plausible statements or predications (*saptabhaṅgī*), each of these statements (*bhaṅgī*) including one, two, or three basic statements (*mūlabhaṅgī*) about whether the corresponding sentence is true, false, or inexpressible (*avaktavyam*). The compatibility of such opposite

[7] 'Tolerance' is to be taken here in the proper sense of the word: it comes from the Latin word '*tolerare*', i.e. accepting the possibility for another view to be true for want of any conclusive evidence against it. Non-one-sidedness results from the Jaina struggle against doctrinalist, one-sided opinions.

statements is due to the Jaina conventional theory of truth (*saṃvṛti-satya*), according to which truth is characterized by its conditionality (*syādvāda*) and leads to a general theory of standpoint (*nayavāda*). This clearly stands in contrast to the Mādhyamaka view of truth as an absolute or one-sided expression of reality (*paramārtha-satya*), all the more that this Buddhist stance assimilates the ultimate substance of reality with emptiness (*sūnyatāvāda*) and is thereby compelled to refuse any of four possible assertions about it (*catuṣkoṭi*). Finally, a crucial way to make sense of the two opposite schools relies upon the logical constant of negation: not only do the Jainas and Mādhyamikas make use of two different expressions of negation, the former being a negative assertion that proceeds as a relational or locutionary negation (*paryudāsapratiṣedha*) whereas the latter amounts to a mere suspension of judgment that occurs as a non-affirming or illocutionary negation (*prasajyapratiṣedha*). Despite the fact that the Indian schools explicitly obeyed general criteria of rationality (*paribhāṣā*) like non-contradiction or inner consistency, I take the reason why the *saptabhaṅgī* and *catuṣkoṭi* have been blamed for violating these criteria to stem from a misleading interpretation of the ancient texts from the view of modern logic, with a special emphasis on the intriguing case of negation[8].

For this purpose, the development of my formal works about Jaina logic has been devoted to a semantic background that assigns a specific role to each of the aforementioned concepts from ancient texts. As a result, the early logical system that has been blamed deservedly by Balcerowicz turned into a more cautious but surprising upshot at the first glance, namely: a one-valued logical system for the Jaina *saptabhaṅgī*.

2. One-Valuedness

In Schang (2011a) and Schang (2013), the 7-valued early system has been replaced by a 1-valued, existential interpretation of *saptabhaṅgī*. While noticing that a similar interpretation has been mentioned by Balcerowicz (2008),[9] a striking difference lies in the fact that the current truth-values are superseded in my works by other sorts of logical values. This difference is largely due to the import of *dialogue* in Indian philosophical schools, which is rendered by a question-answer game in the meta-language. It results in a so-called Question-Answer Semantics (hereafter: **QAS**) for Jaina logic. Admittedly, there already exist logical

[8] On the role of negation in the set of statements in the *saptabhaṅgī* and *catuṣkoṭi*, see especially Flügel 2010 and Clavel 2010.

[9] See e.g. Balcerowicz 2008, section 3: "description of the *syād-vada*".

devices where questions plays a crucial role in a more comprehensive theory of meaning; let us quote among those the cases of dialogical logic in Lorenzen (1955), erotetic logic in Wiśniewski (1995), or the so-called inquisitive semantics in Groenendijk (1999). Now the coming semantics is simpler, in that it uniquely contains yes-no questions and does not alter the classical meaning of the logical constants.

After a preliminary, theoretical discussion about the meaning of a "truth-value" in Schang (2013), my formal reconstruction of Jainism is embedded by a non-Fregean semantics. Roughly speaking, the common point with Frege (1919) is that any information is taken to have both a sense and a reference; and the difference with it is that sense and reference are not defined in the same way. According to the formal semantics I hereby advocate, the *sense* of a sentence is not an extra-linguistic proposition (Frege's *Gedanke*) but an ordered set of questions about this sentence; and its *reference* is not a traditional truth-value including truth and falsity, but a corresponding ordered set of yes-no answers. It follows from this redefinition of meaning that the reference of sentences is still a logical value without being a Fregean truth-value. In the Jaina case of *saptabhaṅgī*, Schang (2009a) claimed that each of the seven *bhaṅgī* stands for logical values if we take these to be about semantic predicates like "being true" and "being false".

Let us consider again the logical structure of the seven statements, in the light of a question-answer game which helps to preserve at the same time the *bivalent* nature of Jaina logic (as urged by Balcerowicz) at the metalinguistic level of questions.

For one thing, every statement is about the truth-value (if any) of a given sentence, whether the predication is about a pot or whatever you want. Every corresponding answer to an initial question about the sentence is either "yes" (symbol: 1) or "no" (symbol: 0), and the logical structure of the *saptabhaṅgī* can be rendered as the result of a set of three basic questions about an arbitrary sentence α: $\mathbf{Q}(\alpha) = \langle \mathbf{q}_1(\alpha), \mathbf{q}_2(\alpha), \mathbf{q}_3(\alpha) \rangle$, where $\mathbf{q}_1(\alpha)$ = "Is α assertible (justifiably true)?", $\mathbf{q}_2(\alpha)$ = "Is α deniable (justifiably false)", $\mathbf{q}_3(\alpha)$ = "Is α inexpressible?". Each positive answer to either of these three questions leads to the acceptance of what has been termed in Gokhale (1991) as a *mūlabhaṅgi*, that is, a basic statement to the effect that the given sentence is either true, or false, or inexpressible. As to the ensuing answers, they amount to statements by affirming or denying either the truth (first question) or the falsity (second question) of the sentence at hand. The whole combination of possibilities relevantly yields seven logical objects, i.e. non-Fregean logical values: (1) $\mathbf{A}(\alpha) = \langle 1,0,0 \rangle$, (2) $\mathbf{A}(\alpha) = \langle 0,1,0 \rangle$, (3) $\mathbf{A}(\alpha) = \langle 1,1,0 \rangle$, (4) $\mathbf{A}(\alpha) = \langle 0,0,1 \rangle$, (5) $\mathbf{A}(\alpha) = \langle 1,0,1 \rangle$, (6) $\mathbf{A}(\alpha) = \langle 0,1,1 \rangle$, (7) $\mathbf{A}(\alpha) = \langle 1,1,1 \rangle$. This odd list of values may seem striking, but it is nothing but logical: given any m initial questions and n resulting answers, it always results in n^m logical values. As we have $m = 3$ questions and $n = 2$ answers in the above reconstruction,

there should be $n^m = 2^3 = 8$ possible answers and, hence, eight logical values in an ill-named *saptabhaṅgī*. It is not so, however, the eighth case (8) = ⟨0,0,0⟩ being merely excluded: at least one yes-answer is given to either of the three questions. Indeed, every sentence is taken to be either true, or false, or inexpressible.

Furthermore, one of Balcerowicz's main objections to the many-valued interpretation of Jaina logic is overcome by the fact that each of the seven predications includes semantic predicates (being true, being false, being non-assertible or inexpressible) that are betrayed with the help of our above three questions and don't go beyond the bivalent values of truth or falsity mentioned in the ancient texts – the third question doesn't contradict the bivalent character of the Jaina *saptabhaṅgī*, as will be shown in the subsequent sections.

Finally, the former combination of answers has been limited to two items – yes, or no – because the seven *saptabhaṅgī* always include at least one yes-answer to the semantic predicates attached to the sentence: for every sentence to be assessed, the former is either claimed to be true, false, or inexpressible. *Quartium non datur*, as would be noted by the non-classical logicians; nevertheless, these three independent questions don't lead to a three-valued system, contrary to a number of such views in the logical literature. Thanks to our non-Fregean definition of logical values, the Jaina theory of sevenfold predication does not result in a non-bivalent system but, rather, a one-valued logic including statements about truth- and falsity-claims.

2.1. From Seven to One

To motivate my progressive reduction from seven to only one value through four intermediary ones, a quick look at the formal translation is in order.

Once again, each *mūlabhaṅgī* is seen a statement about the semantic predicate of a given sentence. Thus the first statement (1), *syād asty eva*, means the same as "the sentence α = 'x is F' is true from some standpoint"; while the second statement (2), *syān nāsty eva*, corresponds to "the sentence $\sim\alpha$ = 'x is not F' is true from some standpoint". Note that the answers to (1) and (2) are *independent* from each other, due to their different standpoints that can be opposed to each other without being expressed with one and the same respect. In other words: a positive answer to the first question (symbols: $\mathbf{a}_1(\alpha) = 1$) does not entail a negative answer to the second question (symbols: $\mathbf{a}_2(\alpha) = 0$), and conversely.

Above all, a crucial point underlying the correlated theory of judgments in the Jaina theory of standpoints (*nayavāda*) is that the multiplexity of reality – or non-one-sidedness (*anekāntavāda*) – means that opposite standpoints are equally accepted (symbols: $\mathbf{a}_1(\alpha) =$

$\mathbf{a}_2(\alpha) = 1$). In a nutshell, these equally hold about the nature of the predicated object and can be safely stated without leading to a forbidden contradiction.

Because of their distinctive standpoints, the two kinds of statement performed by the Jains are assertion and denial[10]. Importantly, every denial (symbols: $\mathbf{a}_2(\alpha) = 1$) is a *negative assertion* in the *saptabhaṅgī*; that is, whoever asserts a given sentence α thereby states "it is the case that α", whereas denying it amounts to state "it is the case that $\sim\alpha$". Echoing the formal reconstruction of Jainism, it turns out that any combination of the aforementioned statements nicely matches with what Belnap (1977) devised in his 4-valued logic of sentences –where semantic predicates are "being told (true, or false)" rather than "being (true, or false)". Indeed, *syādasty eva* means that α is told true from some standpoint (e.g., s_1), while *syān nāsty eva* states that α is told false from some standpoint (e.g., s_2).

To make sense of the multiplex and tolerant view of reality, my view is that a proper way to account for the Jaina non-sidedness leads to a one-valued logic, where a consistent acceptance of the seven *bhaṅgī* means that every assessed sentence can be told true and told false from various standpoints. Here is the unique logical value I advocated for a Jaina one-valued system: $\langle 1,1 \rangle$. This pair of answers clearly differs from the alleged seven values from Schang (2008), where each statement was taken to be a logical value among seven possible triplets of answers; actually, it stems from the four exhaustive combinations of yes- and no-answers about the first two questions, i.e. $\langle 1,1 \rangle$, $\langle 1,0 \rangle$, $\langle 0,1 \rangle$, and $\langle 0,0 \rangle$. Consequently, only one of the last set of reduced questions-answers is sufficient to characterize the Jaina stance in a logical way.

2.2. Making *Avaktavyam* Silent

Let us consider now the most troublesome topic of the Jaina predications, especially in its formal reconstruction, namely: the concept of *avaktavyam*, which corresponds to the third semantic predicate or *mūlabhaṅga*. Almost all the logical literature rendered this concept as a synonym for either the semantic predicate of inconsistency or that of incompleteness, that is: "both true or false" or "neither true nor false". Although there can be some deep reason to argue for the first option – following the current interpretation of *avaktavyam* as a *simultaneous* assertion and denial – its other translation as "inexpressibility" tends to make it

[10] Contrary to a number of non-classical interpretations like Sylvan (1987) or Priest (2011), the following section is going to show that the stance of silence is not on a par with assertion and denial. This distinctive treatment will crucially lead to one-valuedness, because silence does not contribute to the construction of logical values in **QAS**.

closer to that which cannot be true or false. I rejected both options in Schang (2011a), echoing another similar view about the Christian Trinity in Schang (2011b). Admittedly, it may seem even more irrational to claim that a sentence that is not plainly true or plainly false cannot be said to be "both-true-and-false" or "neither-true-nor-false" either.

To defend this awkward stance, I argued that a sentence is said to be *avaktavyam* whenever its subject cannot be predicated at all because of its *transcendental* nature – like *ātman*, *brahman*, or whatever extramundane entity going beyond the realm of conceivable properties and resorting to what is called an *ultimate class* in set theory. Such a semantic predicate is attached to the sentence elliptically, in the sense that it is primarily the subject to which the notion of inexpressibility is attached.

If I am right, then no predicate can be said to be "both-true-and- false" of it because no property is out of its scope. In other words, such a transcendental object should be said to be true of absolutely everything, including any given pair of a predicate and its negation. But to say so is meaningless, assuming that any meaningful sentence should make a clear-cut dichotomy between the properties that pertain to the subject and those which do not; this last precondition refers to Spinoza's statement about relevant informativeness: *determinatio negatio est*, which means that a sentence can make sense only by excluding some properties from the range of its subject.

At the same time, the latter negative result does not imply that every property should be said to be "neither true nor false" of a transcendental subject. Although *avaktavyam* has been frequently rendered as "non-assertible", I take the latter expression to be misleading in that it misses the real point of a transcendental sentence, viz. that being inexpressible is being *beyond* the categories of truth and falsity. In contrast, to support this "gappy" position is to say that nothing can be truly said of the subject, while it has just been argued that everything is true of it. To escape from this circular situation requires some words about the principle of *subsumption*, according to which any sentence consists in putting a subject under the scope of a higher-order concept. This cannot be done with whatever is true of anything.

The result of such a situation is, according to me, that *avaktavyam* can make sense in the Jaina *saptabhaṅgī* only by equating with the stance of *silence*. It does not collapse any more to the first *bhaṅgī* (true only) than the second (false only), or the third (true and false successively, i.e. from different standpoints). It does not amount to a double denial about whether the sentence is true and false, either (symbols: $\mathbf{a}_1(\alpha) = \mathbf{a}_2(\alpha) = 0$), recalling that a subject that relates to everything cannot fail to have any of the available predicates. It has to be distinguished from the trivial silence symbolized by the forbidden eighth logical value (8) $\langle 0,0,0 \rangle$: the latter means that nothing is answered about the three *mūlabhaṅgī* including inexpressibility, while *avaktavyam* stands for the stance of inexpressibility itself and amounts

to a lack of logical value. Furthermore, this result squares with the relative view of truth in Jainism (*saṃvṛtisatya*): a sentence is true only from a partial perspective, while any absolute sense of truth is prohibited. This is an additional reason not to say anything about transcendence, i.e. whatever goes beyond the cognitive capacities of human beings.

2.2.1. Neither a Logical Value …

A first corollary of what has just been said is that *avaktavyam* cannot be part and parcel of a logical value in **QAS**; for given that any logical value consists of ordered answers, how can *avaktavyam* be taken as such once it is equated with the stance of silence? Unless you consider silence as a sort of answer, the last section entails a cancellation of the third *mūlabhaṅga* from the ordered answers and a reduction of the structure of a Jaina logical value from three to two elements, viz. only explicit yes- or no-answers to questions about the truth-value of a sentence. That is: for every sentence α, its logical value is $\mathbf{A}(\alpha) = \langle \mathbf{a}_1(\alpha), \mathbf{a}_2(\alpha) \rangle$ rather than $\mathbf{A}(\alpha) = \langle \mathbf{a}_1(\alpha), \mathbf{a}_2(\alpha), \mathbf{a}_3(\alpha) \rangle$. Furthermore, such a reduction matches with what Balcerowicz and other scholars said about bivalence: only truth and falsity were mentioned in the Jaina texts, and it hardly makes sense to consider inexpressibility as a semantic predicate on a par with the two Fregean truth-values. All of this should lead one to reject the third question from the Jaina logic and to ignore the third *mūlabhaṅgī*.

Now three objections may be raised against my reductive strategy.

To the first objection that nothing justifies such a cancellation of the third question, I claim again that inexpressibility is not a semantic predicate assigned to a sentence but, rather, the view that nothing can be said about the sentence. Accordingly, *avaktavyam* results in a lack of answer about whether the sentence is either-true-or-false and cannot be treated as a proper logical value. In one sense, the transcendental subject both falls under any given predicate (*asty*) and lies outside its scope (*nāsty*) as an *infinite* entity. In another sense, this special subject neither falls under the predicate nor lies outside its scope insofar as any such specification cannot be duly attributed to an *ubiquitous* entity. Therefore, any predicate is both both-true-and-false of a transcendental subject and neither-true-nor-false of it. This hardly makes sense for whoever does not adhere to the so-called "impossible values" of Priest (1984) and Shramko and Wansing (2006). Instead of advocating such a hyperinflation of non-classical truth-values, I opted in Schang (2011a,b) for the view that inexpressibility refers to whatever cannot be expressed within the limits of language, i.e. its set-theoretical way of predicating by subsumption, and results in no logical value.

To the second objection that silence should occur a logical value on its own, my reply is that a similar debate already took place in the realm of philosophical logic: to the question

whether the expression "neither-true-nor-false" should be considered as a third proper truth-value in addition to the classical values of truth and falsity, it has been variously replied that the "gappy" value is just an algebraic object that serves as a dummy truth-value; now such a reply assumes a *metaphysical* view of bivalence, without being able to refute the introduction of a supplementary value on the very ground of logic. As to my proposed dialogical semantics, it clearly appears that silence cannot be seriously treated there as the component of a logical value whenever the latter corresponds to explicit answers in a dialogue. No metaphysics supports this first corollary of my interpretation of *avaktavyam*, accordingly; it follows from it a restricted range of four logical values in the resulting Jaina logic, as will be seen in the next section.

To the third objection that the seven *bhaṅgī* cannot be all formulated if the third question is cancelled, a difference is to be made between two meanings of a "standpoint". On the one hand, a sentence can be said to be true or false in accordance to what the Jaina theory of standpoints (*nayavāda*) proposes in its range of justifications. On the other hand, the capacity for a speaker to give an answer relies upon his capacity to give evidence for or against the truth of the sentence. This means that normal, cognitive-bounded agents cannot answer to questions once they are not able to find any evidence for the truth-value of so-called "transcendental" sentences. Only transcendental agents can do that, i.e. God himself or a blessed Jina. Accordingly, I view the fifth, sixth and seventh predications of the *saptabhaṅgī* as a combination from statements that can be justified only by transcendental agents while making the other ones silent: a sentence is said to be both true (and/or false) and inexpressible if its truth (and/or falsity) can be justified by one agent and can never be so by another one, respectively.[11]

2.2.2. … Nor a Case of Inconsistency

A second corollary of the preceding paragraph is that *avaktavyam* crucially differs from inconsistency, whether in a successive or simultaneous interpretation of being true and false. If so, then para-consistency does not take in the Jaina predications through this third basic predication; neither does it occur in the sense of what Priest calls *dialetheism*, i.e. the simultaneous reading of being "both" true and false (from one and the same standpoint).

The formal machinery of **QAS** helps to make a distinction between three grades of inconsistent answers, expressing these in the meta-language of questions-answers while keeping *avaktavyam* strictly apart from these. The first grade is a *light* inconsistency, or

[11] About this point, see e.g. Flügel 2010.

inconsistency from two different standpoints: a sentence is asserted from one standpoint and denied from another one, which does perfectly make sense from a classical view of logic and is totally harmless for Aristotle's Principle of Non-Contradiction (i.e. it is impossible to attribute a property and its negation to one and the same subject at once, with respect to the same subject and the same standpoint). In symbols: $\mathbf{a}_i(\alpha) = \mathbf{a}_j(\sim\alpha) = 1$ (where *i* and *j* are two different standpoints). The second grade is a *mild* inconsistency, i.e. inconsistency from one and the same standpoint: $\mathbf{a}_i(\alpha) = \mathbf{a}_i(\sim\alpha) = 1$. This second case of locutionary contradiction has been assimilated to *avaktavyam* in e.g. Priest (2008); I just argued for my rejection of such an option. The third and last grade of inconsistency is a *strong* inconsistency, or inconsistency in one and the same answer; although this case of illocutionary contradiction has been mentioned by Matilal (1991), it hasn't been observed in the various statements thus far and equates with a simultaneous yes- and no-answer by the same agent to one and the same question: $\mathbf{a}_i(\alpha) = \mathbf{a}_i(\sim\alpha) = \{1,0\}$. Actually, such an incoherent pair of answer seems to match with the previous case of *avaktavyam*: an inexpressible sentence has been viewed above as something equally true-and-not-true (rather than true-and-false) and false-and-not-false (rather than false-and-true). However, I take this interpretation to make no sense in that it introduces answers while rejecting them at once. This illocutionary form of contradiction should be reduced to silence, for want of intelligibility.

For those who would object that doing so is just the same as the mild version of inconsistency, i.e. making a simultaneous assertion and denial, I would reply again that a subtle difference still lies in these two levels of contradiction: a dialetheist can find reasons to assert the truth of a sentence while asserting its falsity; however, this consists in accepting – saying "yes" to the question about– the first two statements (about the sentence's being true and false, respectively) rather than both accepting – saying "yes" to the question about – and rejecting – saying "no" to the question about – one and the same statement. This ultimate grade of inconsistency I take to be a plain incoherence, by contrast to the dialetheist stance of mild *inconsistency*.[12] Given my interpretation of *avaktavyam* as entailing a silence without logical value, this third semantic predicate is not concerned with para-consistency after all and also differs from its usual interpretation as a simultaneous assertion and denial (mild contradiction). Rather, the Jaina theory of predication is depicted in Schang (2011a) as a para-consistent theory in the harmless sense of inconsistency, i.e. obeying a logic of light inconsistency while departing from a genuine acceptance of contradictions – the second grade of inconsistency.

[12] Unless Priest 1979 takes his analysis of the Liar Paradox to be a genuine counterpart of strong inconsistency? I postpone this hermeneutic difficulty for a later note, independently of our present concern with Jainism.

3. An Ancient Dual Logic

Why to opt for a one-valued logic for non-one-sidedness? There may be several reasons to do so, as will be displayed in a couple of coming sentences.

Now there is one main reason not to do so, given the blatant inconvenience of such a decision: opting for a one-valued logic thereby nullifies the crucial relation of *consequence* in a logic. The reason for this is obvious, due to the nature of logic itself: given that logic aims at making a difference between valid and invalid arguments (i.e. structured connections between sentences), a usual characterization of logic consists in saying that an argument is valid whenever the truth of sentences is preserved from its premise(s) to its conclusion(s). Now the criterion of truth-preservation cannot be but made trivial by a logical system where only one logical value obtains; for how to invalidate an argument where only true sentences occur, indeed? Assuming that modern logic is a theory of consequence between sets of sentences, I hardly see how the Jaina "logic" really deserves its name as it stands in a mere theory of predication.

As a reply to this serious objection, I would say that logical consequence, because of its formal feature of connecting abstract truth-values, is not a relevant concept in the Jaina theory of sevenfold predication[13]; rather, inference has to do with the cognitive capacity of human agents to make causal connections between different available phenomena. This entails that the role of epistemic faculties (perception, deduction, kinesthesis, and the like) differs from the logical properties of consequence in a modern formal logic. Instead of a logic of consequence between sentences, the question-answer game I suggested with the framework of **QAS** insists upon some special *speech acts* (assertion, denial)[14] expressed by each of the seven *bhaṅgī*. Hence the Jaina *saptabhaṅgī* concerns "logic" only in the ancient sense of a theory of concepts, i.e. set of rules for the formation of judgments; in this respect, it matches with what Aristotle did in his *Categories*, rather than his *Analytics*. It is *a fortiori* not a properly para-consistent logic, the latter encompassing all the logical systems that violate the so-called Principle of Explosion according to which everything follows from contradictory premises. Inconsistency and contradiction (mild inconsistency) have to do with Jainism but don't affect Explosion, accordingly.

[13] The *saptabhaṅgī* is said to be a 'theory' not as a theory of consequence, accordingly, but as a generalized or exhaustive classification of feasible statements. It is a proper logic in the ancient sense of the word, i.e. as a theory of judgment or predication (compare with Aristotle's *Categories*).

[14] **QAS** does justice to the bivalent nature of the *saptabhaṅgī*: there are only speech acts at hand in it, because any speech act stands for an answer to a given question. Once again, silence is not a speech act since remaining silent is giving no answer at all.

Another reason to question a one-valued logic of non-one-sidedness is due to the prominent role of contradiction among the logical principles (*paribhāṣā*) required by the ancient Jaina texts: how can contradiction occur in a logic with only one logical value? A simple reply to this objection is that contradiction uniquely expresses a relation between the truth-values of truth and falsity. It is not the purpose of my one-valued system to render contradiction as a relation between non-Fregean logical values but, rather, to explain how the Jaina theory of judgment came to accept allegedly contradictory sentences by means of several standpoints. An alternative, stronger sort of contradiction that could occur in a question-answer semantics is that between the answers themselves, namely: answering both yes and no to the one and the same question. Such a contradiction is an illocutionary one, in the sense that it defeats the rational behavior of a speaker; it relates to the third grade of strong inconsistency and stands for a grade of inconsistency that infringes the criterion of coherence. Light inconsistency does not violate contradiction, however.

Turning to the advantages of one-valuedness, the latter makes sense of light para-consistency without introducing further *truth-values* beyond truth and falsity. Again, the question-answer game at hand constitutes a plea for bivalence (of semantic predicates) while combining four logical values by means of the first two *bhaṅgī* – the third one related to *avaktavyam* is kept apart from the current predications about empirical or non-transcendental subjects.

A second reason is that the formal semantics in use brings out the role of *dialogue* in Indian schools in general, through the various question-answers games that make the resulting judgments meaningful; unlike the metaphysical reference to general truth-values, the very value of dialogues is provided by answers that essentially rely upon the context of questioning and leads to one and the same ordered pair of answers. The positive philosophy of tolerance and open-mindedness that characterizes the Jains is betrayed by the twofold yes-answers of Schang (2011a), these being expressed by one positive assertion and one denial corresponding to a negative assertion. Assertion is a linguistic mark of positivity whether it is about an affirmative or a negative sentence, viz. a positive attitude of commitment.

Thirdly, the semantics I proposed helps to overcome the pitfall of *avaktavyam* by distinguishing the latter from the unique value ⟨1,1⟩: *avaktavyam* refers to the inexpressibility (or indescribability) of an object and, elliptically, that of the corresponding sentence where the latter occurs as a subject. Importantly, the various grades of inconsistency couldn't be expressed within the mainstream bivalent logic of truth-values and essentially relies upon the question-answer game. Indeed, being both true and false does not mean the same as answering both yes and no: the former corresponds to the grade of mild inconsistency, whereas the latter is a case of strong inconsistency.

And finally, this formal reconstruction of the theory of sevenfold predication brings some light upon a dual connection that could not be emphasized within a usual bivalent logic and its truth-values. The duality stands between the Jaina *saptabhaṅgī* and another logical device from the Buddhist tradition, namely: the *catuṣkoṭi*. Just as Bahm (1958) wondered if the first logic was a "reversal" of the second, i.e. its polar contrary, let us see how my formal machinery confirms this viewpoint in a more precise way.

Roughly speaking, *saptabhaṅgī* and *catuṣkoṭi* appear to be twin logics that are alike in several respects. It has been recalled in Schang (2013) that both are *soteriological* discourses: they represent a quest for peace of mind, prior to truth. Despite of their common purpose, they remain opposite to each other in their methods to reach salvation through opposite "middle ways": the Jains express their goal by means of combined sorts of assertion while the so-called Mādhyamikas do it through combined denials, where denial essentially differs from that of the Jains. Matilal (1998: 129) illuminated this Janus-faced impression by the following words:

> "The difference between Buddhism and Jainism in this respect lies in the fact that the former avoids by rejecting the extremes altogether, while the latter does it by accepting both with qualifications and also by reconciling them."

In both cases, the many-valuedness I advocated in the beginning turned into opposite one-valued systems. To account for this common treatment, a common background for these two logics has been devised in Schang (2011a) within the conceptual framework of **QAS**: a four-valued logic of acceptance and rejection, $\mathbf{AR_4}$, where the logical values amount to ordered pairs of answers $\langle \mathbf{a}_1(\alpha), \mathbf{a}_2(\alpha) \rangle$. These are on a par with Belnap's epistemic states of information in his system of First-Degree Entailment (**FDE**) and rephrased into question-answers just as they were formulated in the preceding section –two basic questions, four subsequent answers. These are the following ones and their Belnapian counterparts, in accordance to the Jaina expression of logical values from a reductive question-answer approach without inexpressibility:

Values in $\mathbf{AR_4}$	Values in **FDE**	Interpretation
$\mathbf{A}(\alpha) = \langle 1,0 \rangle$	$v(\alpha) = \mathrm{T}$ (true only)	α is true from some standpoint, false from no standpoint

$\mathbf{A}(\alpha) = \langle 1,1 \rangle$	$v(\alpha)$ = B (both true and false)	α is true from some standpoint, false from some standpoint
$\mathbf{A}(\alpha) = \langle 0,0 \rangle$	$v(\alpha)$ = N (neither true nor false)	α is true from no standpoint, false from no standpoint
$\mathbf{A}(\alpha) = \langle 0,1 \rangle$	$v(\alpha)$ = F (false only)	α is true from no standpoint, false from some standpoint

It is worthwhile to recall why only four logical values matter instead of seven: according to my reductive treatment of *avaktavyam*, the third question should be cancelled and reinterpreted as a mere absence of answer. For given that inexpressibility amounts to silence, there are only two yes-no answers at hand corresponding to the first two questions; this also explains why no yes-no answer can be given to the question whether a sentence is inexpressible: the latter is not on a par with truth and falsity, insofar as it is *not* a semantic predicate. Rather, *avaktavyam* is the expression of a lack of answer to the two classical questions.

A natural ensuing question should be this: how to obtain one-valued systems with a four-valued one? The answer is that: each of the two Indian logics are considered as sub-algebras included into $\mathbf{AR_4}$ in the sense that their domain of valuation is "saturated", i.e. restricted to only one value among the four available ones. It is clear by now that the unique value for the *saptabhaṅgī* is $\langle 1,1 \rangle$. What of the *catuṣkoṭi*?

The answer lies in the way in which the following *tetralemma* can be answered both negatively and consistently. Unlike the Jaina seven statements made of three *mūlabhaṅgī*, there are four statements (*koṭi*) made of two basic views (*dṛṣṭi*) (a positive and a negative) in the *catuṣkoṭi*. One of the prominent Mādhyamikas, Nāgārjuna (150-250), was said to express the ultimate view of denial by rejecting each of the four combined sentences:

(a) A being comes out itself.	(assertion)
(b) A being comes out the other.	(denial)
(c) A being comes out of both itself and the other.	(assertion and denial)
(d) A being comes out neither.	(non-assertion and non-denial)

The problem is the following: how to deny each of the preceding sentences without falling into a plain inconsistency? My proposal is the use of the third logical value in $\mathbf{AR_4}$, including only no-answers, to make sense of Nāgārjuna's stance. While being reminiscent of what the Jains called by "*avaktavyam*", the attitude of the Mādhyamikas differs from the latter by

using negative predications rather than being merely silent about them. Besides, an epistemological motivation for this negative stance comes from the Buddhist absolute view of truth (*paramārtha-satya*) that departs from the Jaina relative and more tolerant approach: given that such a truth cannot be known, the Mādhyamikas withdraw from any commitment in their statements by avoiding any assertion –any truth-claim[15] about sentences. Now the logical difficulty with such a negativist stance comes from its formal translation in classical logic, where each denial is rendered by the constant of negation in front of every lemma.

(a') $\sim(\alpha)$
(b') $\sim(\sim\alpha)$
(c') $\sim(\alpha \wedge \sim\alpha)$
(d') $\sim(\sim(\alpha \vee \sim\alpha))$

It is well-known that the above set of sentences cannot be accepted from a classical point of view: according to the law of double negation, (a') and (b') are contradictory to each other while (d') collapses into (c') after reduction. A many-valued way out has been proposed by Priest (2011) on the basis of Belnap (1977), where the four "truth-values" refer to states of information. Just as the seven *bhaṅgī* of the Jains have been often viewed as seven truth-values, the four lemma may be equated with the four truth-values to be found in Belnap's system. Let α be the sentence "A being comes out itself":

(a) α	$v(\alpha) = \mathrm{T}$
(b) $\sim\alpha$	$v(\alpha) = \mathrm{F}$
(c) $\alpha\wedge\sim\alpha$	$v(\alpha) = \mathrm{B}$
(d) $\sim(\alpha\vee\sim\alpha)$	$v(\alpha) = \mathrm{N}$

According to Priest (2011: 15), an appropriate way to make sense of denying each statement of the *catuṣkoṭi* is to resort to five-valuedness:

[15] Assertion is depicted as a truth-claim throughout the present paper, taking it to be a psychological attitude above all. It could be objected to this definition that an assertion is successful if and only if it is about a sentence that turns out to be true irrespective of the speaker's attitude. I don't subscribe to this objective-minded approach, however, assuming that assertion essentially expresses a conversational attitude that does not depend upon how the state of the world is actually.

> "The most obvious way to proceed is now to take this possibility as a fifth semantic value, and construct a five-valued logic. Thus, we add a new value, E, to our existing four (T, B, F, and N)."

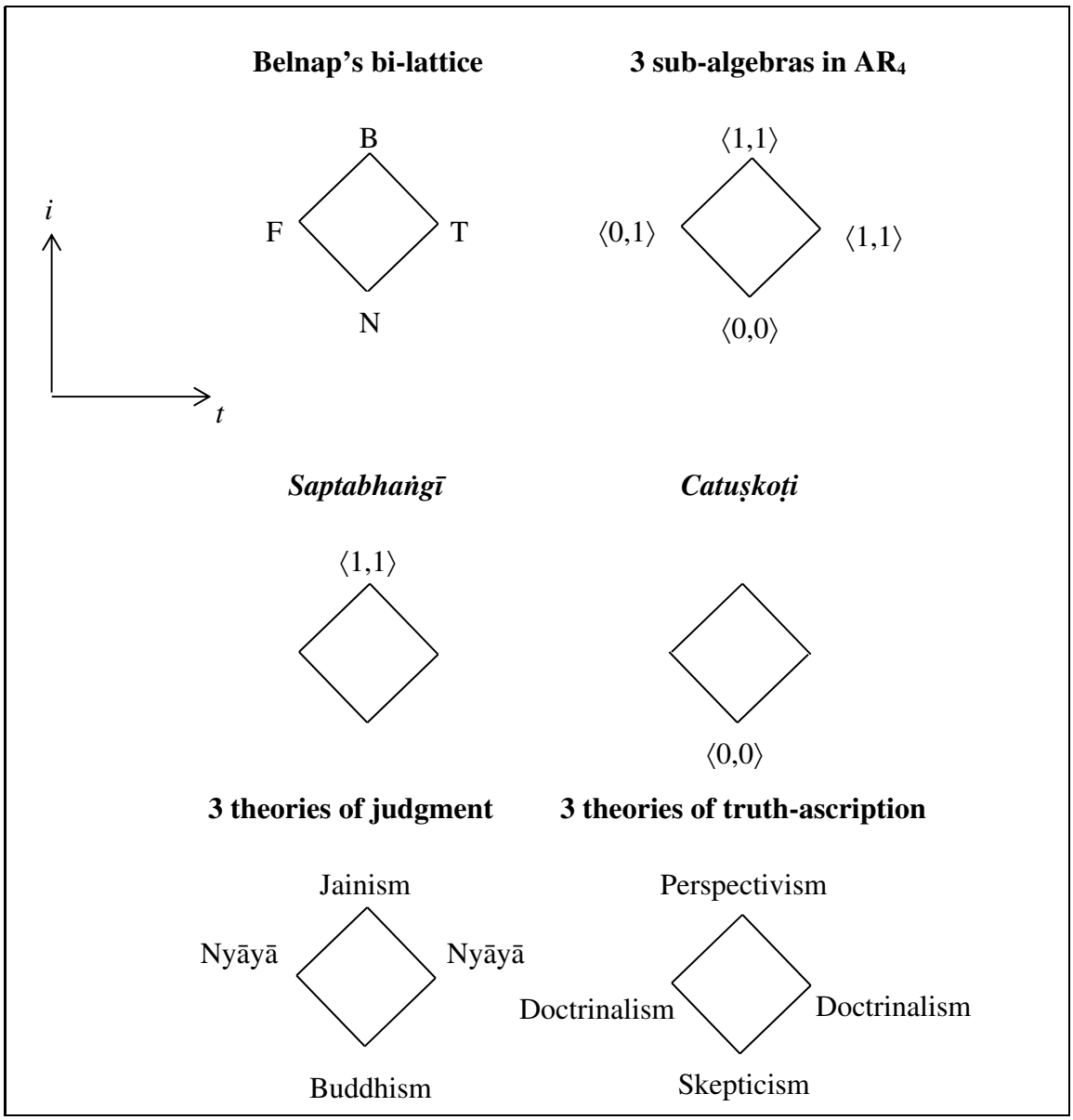
Nevertheless, exactly the same objection can be made here as with Jaina logic: why should any denial of a given *koṭi* express a proper truth-value? Just as nothing justified Ganeri (2002), Priest (2008) or Schang (2009a) to identify the seven *bhaṅgī* with independent logical values (whether Fregean or non-Fregean), there is no ancient Mādhyamika source where such a reference to five values can be found.

An alternative way out has been elaborated in Schang (2011a), where the question-answer game restricts the number of truth-values to the two classical items while constructing two sorts of unique logical values for the Jaina and Mādhyamikas theories. It also relies upon an *illocutionary* interpretation of denial in the *catuṣkoṭi*, as well as a related distinction between two negations: the Jains used a relational, locutionary negation of the realists (*paryudāsapratiṣedha*); the second *mūlabhaṅgi* amounts to an act of negative assertion or falsity-claim (symbols: $\mathbf{a}_2(\alpha) = \mathbf{a}_1(\sim\alpha) = 1$) and stands for a commitment of the speaker about how the world is not. By contrast, the Mādhyamikas resorted to a non-relational, illocutionary negation (*prasajyapratiṣedha*) that stands for their systematic denial and typically endorses an attitude of non-commitment – to be compared with the skeptical attitude of withdraw (symbols: $\mathbf{a}_1(\alpha) = \mathbf{a}_2(\alpha) = 0$). In addition, Nāgārjuna's following stance is the key to his allegedly radical skepticism:

> "If I had a thesis, I would be wrong. But I have no thesis. Therefore there is nothing wrong with me."[16]

In the vein of my formal reconstruction, a proper logical value for this non-commitment is the twofold no-answer $\langle 0,0\rangle$ such that $\mathbf{a}_1(\alpha) = \mathbf{a}_2(\alpha) = 0$. Consequently, the alleged duality between Jains and Buddhists lies in the opposition between their unique valuation $\langle 1,1\rangle$ and $\langle 0,0\rangle$ for any given sentence (while making an exception for the inexpressible sentences having to do with transcendental entities, in the Jaina case). Borrowing from the algebraic bi-lattice of Belnap's four-valued logic, where each edge refers to a Fregean logical value that is classified according to its amount of truth (t) and informativity (i), a similar structure can be used to explain the relation between several philosophical stances with respect to truth.

[16] See Nāgārjuna's *Mulamadhyamakakārikā*, verse 29: "To keep one away from the vain discussions".



Unlike the Belnapian truth-values, it has to be noticed again that the four logical values of **AR4** are not truth-values but answers expressing an attitude of acceptance ($\mathbf{a}_i(\alpha) = 1$) or rejection ($\mathbf{a}_i(\alpha) = 0$). This crucial difference helps the non-Fregean values to include the illocutionary attitude of withdraw by means of no-answers, whereas the Fregean truth-values always lead the speaker to commit in the truth of a sentence or its negation.

Conclusion: The Logic of "Philosophical Logics"

To summarize the general rationale of the Jaina doctrine, let me advance the following sketchy combination of its epistemological and logical components while stressing upon the

theoretical primacy of epistemology over logic (no *saptabhaṅgī* could come to be without a prior reference to cognitive viewpoints):

anekāntavāda = *nayavāda* + *syād-vāda* (*saptabhaṅgī*)
non-one-sidedness = theory of standpoint (epistemology) + theory of judgment (logic)

Let us also notice that the borderline between ontology and epistemology is not so clearly marked in Jainism than in the Nyāyā school, for instance. This is due to their multiplex view of reality and their correlated rejection of the so-called correspondence theory of truth, according to which that a sentence is true if and only if it expresses one objective state of affairs. Although this point concerns the metaphysical roots of epistemology, it cannot be left aside by whoever strives to make sense of the consistent set of the seven *bhaṅgī*.
A formal reconstruction of Indian logics has been described in the present paper, both relying upon the quotations of scholars and the explanations of ancient concepts. It has to be repeated that such a formalisation does not pretend to catch the entire rationale of Eastern philosophies, not any more than any scientific model in general. The point of such a formal methodology is to emphasize the salient features of a theory, recalling these words from Russell (1914: 68) about the import of logic in philosophy:

"The old logic put thought in fetters, while new logic gives it wings."

Even the modern classical logic was retained by its own fetters, when trying to make sense of the consistent sets of *bhaṅgī* or *koṭi*. I hope to have shown that a formal reconstruction of these theories of judgment by means of contemporary methods rightly overcomes the objections that usually beset the works of modern logicians in philosophical logics. Without claiming to catch the genuine essence (if any) of Indian thought, may this paper fulfill the requirements of some scholars like Balcerowicz, Matilal, or whoever is able to go through the ancient texts at hand. Wings may lead logicians astray in their formal reconstructions, admittedly; it is up to the scholars to assess how far my proposal of a Question-Answer Semantics departs from the ancient texts as they stand.

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