

Looking for Oriental fundamentals Fuzzy Logic

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Abstract: For quite some time we have been trying to trace the river of Non-Classical Logics, and especially, Fuzzy Logic, trying to find the sources of this today flowing quite mighty river. Following from Lotfi A. Zadeh, we have traced his inspiring, the Polish logician Jan Lukasiewicz, who in turn was inspired by Aristotle's *Peri Hermeneias (De Interpretatione)*. Also, Lukasiewicz occupies a central position in the Lvov-Warsaw School, who founded Kazimierz Twardowski, a student of Franz Brentano, and this in turn disciple of Bernard Bolzano. The connection with Leibniz and Bolzano come through medieval scholastic thinkers, especially John Duns Scotus and William of Ockham and the problem of future contingents, they had collected from the Aristotelian tradition. But there was to trace the “eastern (oriental) track, which leads to the ancient Chinese and Indian philosophy. Here we will treat it as a first and necessary approach.

Keywords: History of Logic; Mathematical Logic; Non-Classical Logics; Fuzzy Logic; Oriental Thought.

1. Introduction

At the beginning of its expansion, the ideas published by Lotfi A. Zadeh was not well received in the West, even in many cases were bitterly dismissed by the more conservative elements of the scientific community. However, over time began to gain enough supporters, which led to these theories were being extended again and again, settling firmly among the most innovative scientists, and especially among the best professionals, more than anywhere else, initially in Japan and then South Korea, China and India. Europe and the States have been incorporated into this new math, but more slowly.

As a matter picturesque, if you will, but true, we can tell that the now recognized by many as “the father of Fuzzy Logic”, Lotfi A. Zadeh, in his time met with executives from IBM, which told him that his “discovery” had no interest or no utility. Of course, it will be considered a very clear model of intelligence and vision. Were it not so, you probably have developed the United States and other Western countries many of the remarkable technological advances arising from the new science.

Zadeh’s intention was to create a formalism to handle more efficiently the imprecision of human reasoning. It was in 1971 when he published his “Quantitative Fuzzy Semantics”, in which appeared the formal elements that led to the methodology of fuzzy logic and its applications, as known today.

From the above it follows that you may need a radical rethink of our classical concepts of truth and falsehood, replacing the concept of fuzziness (vagueness or fuzziness) as a result of which the truth or falsity are only extreme cases¹. By fuzziness understand the fact that a proposition may be partially true and partially false simultaneously. A person is not just high or low, but partially may participate in both features, so that only above and below certain heights necessarily called it higher or lower bound, while in the intermediate zone of both heights exist as a graduation which is

ceasing to be high. It seems intuitively clear that the concept of fuzziness is rooted in most of our ways of thinking and speaking. Another separate issue is the valuation that each individual granted such a fuzzy character (the glass half full or half empty), which depend on subjective psychological issues and difficult to evaluate.

The fuzzy principle states that everything is a matter of degree. It will be its more famous "leitmotiv". All propositions acquire a truth value between one (true) and zero (false), inclusive. The allocation of these extreme values will only be given in the case of logical truths or falsehoods or strong inductions: "All men are mortal" can be an example of strong induction, since there is no counterexample.

American Professor Bart Kosko² highlighted the differences between Eastern and Western philosophies regarding the concept of truth, summing up in opposition against Aristotle Buddha. In fact, Kosko said that Western philosophy, Aristotle's successor, has accepted uncritically the bivalent as the system that is useful, but overly simplifying complex reality. Put simply: what has won in simplicity is lost in accuracy. By contrast, Eastern philosophies: Buddha, Lao Tse, Confucius, etc. Always have accepted the strict unity of opposites, of what they call (as we know) the yin and yang.

On the other hand, if it is true that Aristotle was the great introducer of bivalence absolute⁵, we should not ignore that he was not spent entirely overlooked aspects could be fuzzy propositions, as when he commented that: "In any case, what is said according to these (qualities) supports arguably the most and least", or when we talk about that we can come to knowledge, but without the certainty of it. If Aristotle did not study this concept, it may have been lacking the necessary mathematical knowledge for development. It was not until the appearance of a Calculus increasingly systematic and operational, combinatorics and probability theory, or the new theory, now known as 'Crisp', or Classic, Sets, initiated by Cantor, as well as modern statistics and matrix calculations.

Aristotle did not have the mathematical apparatus for developing a fuzzy logic [1,5]. The gestation of this construct starts with Newton and Leibniz, who developed calculus in the seventeenth century. Despite the obsession with accuracy in mathematics has made them perfectly applicable sentence Einstein: "To the extent that mathematics refer to reality, not true. And to the extent they are true, not refer to reality". But does not say Einstein is undoubtedly the deductive apparatus developed by mathematics facilitates the understanding of reality. The explanation given by Aristotle movement is replaced by the most innovative in Newton, but thanks to a sharp appoggiatura in calculus, without which it would not have been possible. However, the infinitesimal calculus in depth was only used for the study of physics in the following centuries, experiencing spectacular growth with Euler, Laplace, Lagrange, Fourier, and so on. Today permeates all sciences, both social and human and natural. This Calculus Mathematics introduced the question of degree: to what degree is modified by changing seamlessly B, where A is a dependent variable B?

Classical Aristotelian logic has been shown, therefore, and for a long time, quite effective in science so-called "hard", such as math or physics. But it is insufficient when the predicates contain imprecision, uncertainty or vagueness, on the other hand, is how the brain actually works and human reasoning, and in general, is how systems behave around us. Fuzzy logic has also helped that the software can interpret judgments of this kind.

Sifting through old Eastern doctrines [7], we can find some Buddhist beliefs closely related to what we understand as degrees of truth, and with the doctrine of the two truths.

2. Indian logical tradition

Nagarjuna (150-250 BC) was the founder of Indian Madhyamaka school of Mahayana Buddhism. The term Madhyamaka means "Middle Path or Middle Way." He was the foremost philosopher in the tradition of Indian thought.

Nagarjuna was also a notable practitioner of traditional Indian Ayurvedic medicine. Among its conceptualizations, we can find some descriptions of the circulatory system and blood tissue.

In Western medicine, at least so far, Ayurvedic medicine is considered alternative because it is only offered as a complementary treatment, which does not replace or traditional diagnosis nor “pharmacopoeia” the Western expert. Balance is emphasized; says that suppress natural urges is seen to be unhealthy, and that if you do one, you can almost certainly lead to illness. Therefore, people are advised to stay within the limits of reasonable balance and measure of fair or average.

Its main contribution is in the use of the concept of “emptiness” (in Spanish, “vacuidad”), which brings together other key Buddhist doctrines, thereby seeking to refute the metaphysics. For Nagarjuna, as for the Buddha from ancient texts, it is not merely sentient beings that are “selfless” or non-substantial, all phenomena are empty of any “self-nature”, and thus without any underlying essence. Are independently be existing gaps. This is so because all things arise always dependently: not by their own power, but in terms of the conditions that lead to its passage into existence, as opposed to being.

Nagarjuna was also instrumental in the development of the doctrine of the two truths⁵, which states that there are two levels of truth, a truth which is directly, and one which is only conventionally or instrumentally true. Thus Nagarjuna⁶ says that “...this world is supported by a polarity, that of existence and non-existence... Everything exists: That is one extreme. Everything doesn’t exist: That is a second extreme. Avoiding these two extremes, the Tathagata teaches the Dhamma via the middle...”

Nāgārjuna differentiates between the teachings conventionally true and ultimately true, but never stated that any conceptually formulated doctrine come to fall into the latter category. This was made famous in his “tetralemma”, composed of the following logical propositions: X (affirmation); non-X (negation); X and non-X (both); neither X nor non-X (neither).

Therefore, we can establish at least three original traditions within the logic: the traditions of the Greek thinkers, China and India. The latter continued until very modern times, through Navya-Nyaya school of logic, because the Rig Veda contains certain speculative considerations in terms of logical divisions. More precisely, “A”, “nor A”, “A and nor A”, and “neither A and nor not-A”, which coincides with the aforementioned tetralemma.

Another Indian thinker, Panini, V century BC, will develop a logic that bears some interesting similarities with Boolean logic.

The Navya-Nyaya school also developed a conceptual scheme that solves problems of logic, based on a very similar development theories to ideas which will then expose Gottlob Frege [4].

All these schools were discovered by British researchers in the eighteenth century [8]. Mentioned especially the work in this respect, H. T. Colebrooke. An analysis of their inferences, establishing a comparison with Aristotelian logic, resulting in the Aristotelian syllogism could not explain the Indian syllogism.

The German mathematician Hermann Weyl (1885-1955), in 1924, wrote that “Occident mathematics has in the past centuries broken away from the Greek view, and followed a course which seems to have originated in India, and which has been transmitted, with additions, to us by the Arabs; in it the concept of number appears as logically prior to the concepts of geometry”. In fact, it is clear that the logic of India has profoundly influenced many Western modern logicians, such as Charles Babbage, George Boole, Augustus De Morgan or, impressed by the news which reached them. They all belonged to the nineteenth century, which can be called “modern” in many ways. The same Augustus De Morgan said that: “The two races which founded mathematics, languages of Sanskrit and Greek, were the two that have formed independently logic systems”.

Therefore, it is time that we are aware of mathematicians remarkable influence on all of us have had Indian mathematics. In fact, these are some of the fundamental roots of thought and Western science.

3. Chinese logical tradition

Even then try a line of thought that even if it was truncated at the time, it shall nevertheless be a precursor honorable Formal Logic: is the current in the history of thought in ancient China was called the “Mohism”, or “Moism”. So, we now turn to such announced line of Chinese thinking.

This is a Chinese philosophical school founded by Mo Tzu late V century BC. In morals, proposed an egalitarian society and had to seek mutual love between all people. Mo Tzu said, better known as “Master Mo”, was a contemporary of Confucius.

For even when the first Chinese philosopher Kong news is that we have Di, who founded the school called the lawyers, very fond of the ceremonies and traditions, the second most notable was this Mo Di.

After assimilating the ideas of Kong's subjected to sharp criticism up to found his own “School of Master Mo”. This school was more than an educational group, getting to be a quasi-religious and military group. It is like the closer to what was in the West the Knights Templar or other warrior-monks. They were disciplined and well organized, leading a frugal life and practicing martial arts. It might also remind the “samurai” of Japan, across distances of space and time.

While fans of another school teacher, Kong, tended to come from noble castes and circles of the Court, in Mo were integrated especially popular classes. It would, therefore, warriors own half. Let us also note that Mo Di despised and criticized all protocols and labels both abused by then the Chinese Court.

His writings and those of his disciples are contained in the book Mozi, which is composed of seventy-one chapters, preserved only fifty-three. Of these, the first nine defensive war try and build walls, others speak of moral and political philosophy in recent addresses epistemological issues, specifically scientific and logical.

Mosterin says³ that: “Kong respected the tradition and despised maximum profit. Mo despised tradition and made the profit, individual utility and social touchstone of all institutions. In fact, the morale of Mo Di was teleological, and even utilitarian versus deontologism of Kong.”

In the Mozi find a constant methodological concern because: “Not only claims and suggests, but tries to prove and convince.” Hence the importance attached by the Mozi to the criteria or standards: “...It is necessary to establish some criterion or standard of judgment. Affirm a proposition without stating under what criteria or what standard we rely to establish it is like trying to set the address of departure and sunset on the rotating potter around”. [3]

The question in this text: “How to check that a standard is appropriate? We can see this by applying the triple test:

- 1) the test of the foundation, which show that the standard is well founded, and is compatible with the best knowledge we already possess;
- 2) the test of verifiability, which uses what people can see with their eyes and hear with their ears;
- 3) the test the applicability, showing that its adoption leads to greater well-being and enjoyment. The test of the applicability is based on its implementation produces beneficial results for the people.

But how do we know that the results are beneficial for the people?

For the quadruple test, it produces:

- 1) enrichment of the poor;
- 2) increase in population;
- 3) reduction of hazards;
- 4) decrease clutter and increase enforcement.

This methodological concern is new in Chinese thought, and lead, in the subsequent evolution of the Mohist school, a remarkable development of logic and epistemology.”

Mosterin concludes that: “During the fourth century BC., and third century BC, Mohist school, so-called the Mojia, was remarkably successful. That late third century a. C., disappears, and the second a. C. there was no trace of him”. [3]

In regard to actual logical issues are particularly interested in the problems of valid inference and the conditions necessary to reach the right conclusions reached. The approach “Mohist” to Logic and Argumentation Theory potentiated rhetorical analogies, mathematical reasoning

superimposing himself. It was based on a method called “three fa”, which served to make distinctions between types of things.

There in the mainstream a sort of three tributaries, one of which was precisely the school “logicians”. This is what we want to mention here, because according to experts, would be the most arcane precursor of Formal Logic.

But the rigid legal rules imposed by the Qin dynasty ended with all this power, leaving many contributions transmitted in a direct or otherwise, although it has tried to reconstruct indirect ways. In conclusion, it was subjected to direct repression, leading to its abandonment.

Would, therefore, everything plunged into a long silence from the distant Chinese soil, until Buddhism with Indian philosophy begins to reach them, which, however, failed to take root as it should, by the lack of a suitable base to absorb it. [6,7]

4. Conclusions

The initial purpose of this work was to put ourselves in the path of knowledge of both traditions of thought, China and India, in order to go deeper and further into the “prehistory” of logical thinking related to the idea of vagueness and the idea uncertainty that currently are key science and philosophy. We have gotten at least arouse interest for it.

Acknowledgments

This paper was prepared within the Research Project Spanish MICINN, FF 2011-29623, “El papel de las Controversias en la producción de las prácticas teóricas y en el fortalecimiento de la sociedad civil”, which now directs Cristina de Peretti.

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