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Fuzzy epistemology: Decolonizing the social sciences

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Abstract

This article first argues that the social sciences need to be decolonized, as the current epistemologies and research methodologies are too narrowly based on the European and North American experiences and hence unable to adequately capture non-European experiences and realities. I then argue that decolonizing dominant social science epistemology means freeing it from its Aristotelian foundation. The next step undertaken is to discuss five non-Western epistemologies from West Africa, China, Melanesia, India, and South America. Building on the work of Jimi Adesina (2002), I find that all five share a fuzzy perception of reality, allowing for statements that are non-exclusive, non-discrete, and hence fuzzy. I propose an operationalization of these fuzzy epistemologies by applying Charles Ragin's Fuzzy Set Qualitative Comparative Analysis (fscqa).

KEYWORDS

Coloniality, decolonization, fuzzy logic, social science epistemology

1 | INTRODUCTION

The main argument I advance in this article is that the Western scientific tradition is a tradition constructed on colonial conquest, exploitation, and slavery – and that philosophy and the social sciences need to be decolonized, because the Western epistemological tradition does not contain the necessary tools to capture, understand and analyze the whole world. Concretely, I argue that Western colonial powers imposed an Aristotelian logic of hard and discrete differences and exclusive attributes onto the world, suffocating the many non-binary, non-discrete, and non-

exclusive epistemologies that existed before the conquest and, at times, continued to exist in resistance to it. My analysis thus follows the arguments advanced by such authors as Anibal Quijano (2000), Enrique Dussel (2002), Immanuel Wallerstein (1999), Walter Mignolo (2008), and Ramón Grosfoguel (2008) on the theme of 'coloniality at large.'

The contribution I seek to make to this debate is to zoom in on the precise nature of coloniality and the "epistemicide" accused by Boaventua Sousa Santos (2014) by focusing on the epistemology contained in and hidden within it. Concretely, I argue that colonialism has forced the Aristotelian logic of binaries, of yes or no, being or non-being, onto the whole world. Most of the world, however, did not, and to some extent, still does not rely on such a binary logic to explain reality. Mignolo (2008) has captured this phenomenon when arguing that the universalisms exported to the world in the belly of the beast of universal capitalism were never able to completely erase pre-colonial ontologies, epistemologies, and ways of knowing and explaining the world. I also agree with Mignolo when he argues that

> Decolonizing the social sciences and philosophy means to produce, transform, and disseminate knowledge that is not dependent on the epistemology of North Atlantic modernity – the norms of the disciplines and the problems of the North Atlantic – but that, on the contrary, responds to the need of the colonial difference. (Mignolo, 2008, p. 247)

The Western scientific tradition, after all, is itself a composite of different influences and traditions, absorbing many Eastern and Southern ontologies, epistemologies, and methodologies. As was the case with classical Athens (Bernal, 1993), however, Western chauvinism has often denied its non-Western influences and found ways to "purify" the Western tradition by reducing it to Western thought.

With colonization, Western powers narrowly focused on a sanitized version of the Western tradition, focusing exclusively on classical Athens stripped from its north African and Semitic roots and spreading a narrow version of Aristotle's ontology and epistemology, which then provided the foundations for all of the sciences and academias constructed since. Aristotle's binary and exclusive logic indeed became the basis of computing and, with the advent of the computer age and Artificial Intelligence, the logic of 0 and 1 became ingrained even further into the dominant ways of explaining and perceiving the world, and, as a consequence, of fashioning a world that follows the processing rhythm of computers. By stripping ancient and classical Greece from its non-Western elements and focusing exclusively on Aristotle's logic, a one-dimensional version of the "Western tradition" became the foundation of European imperialism.

The purpose of this article then is to propose an epistemology liberated from Aristotelian foundations. The unearthing and discussion of pre-colonial and non-European epistemologies is a process of freeing the world from universal claims of Western epistemology, dressed as superior knowledge. Such an unearthing must necessarily lead to the substitution of Western, Aristotelian epistemology by more place-bound and limited epistemologies, created from specific locations and territories of knowledge and knowledge-production (Deloria, 2003), because as Jimi Adesina (2002) has rightly claimed, all knowledge production is ultimately ideographic. This endeavor also has the potential of highlighting the non-Western elements hidden in the Western scientific tradition. This seems important as it avoids a falling into an overly rigid binary of West vs. Non-West. It is, after all, precisely against the exaltation and reification of epistemological, ontological, and methodological binaries that his article is written.

What I am able to achieve in this article is, however, not an elaboration of different, place-bound epistemologies. Rather, I detect an overarching theme present in many of those place-bound epistemologies suffocated by Aristotelian logic – the theme of fuzziness. Most societies, either before European conquest or in resistance to it since rely on a "fuzzy logic," which is not binary, not exclusionary, and not discrete, allowing for "this *and* that," instead of Aristotle's exclusive "this *or* that." In this article, I thus highlight a rather astonishing overlap of non-Aristotelian epistemologies and ontologies, present among South American highland cultures, in India, China, Melanesia, and in West Africa. Given this overlap, it appears that most peoples of the world thought of the world in fuzzy, non-binary terms and categories. Aristotelian logic, which conquered the world and defined modernity in exclusive, binary categories, must thus be seen as a provincial and particular logic, informing a particular ontology and epistemology, which makes its conquest even more astonishing and violent. Once 'provinzialized' and cut back to its actual heuristic scope, Aristotelian logic appears neither universal nor Western, as fuzzy logics always competed and still compete, with Aristotelian logic – even in "the West."

Unveiling a broad epistemological and ontological theme of fuzziness also sheds some light on the idea of the much bemoaned 'disenchantment' of the world that, to some Western authors, seems the inevitable price for modernity. It now appears that it is Aristotelian modernity, based on an extreme reductionism of the world so it can fit within the narrow confines of discrete and mutually exclusive categories, that leads to such disenchantment. Other, non-Aristotelian modernities seem possible, based on less rigid epistemologies and ontologies, able to capture more of the fuzzy realities of life and the world, and hence less instrumentalized and utilitarian.

Given the history of Western colonization, which imposed Aristotelian logic on the world, my endeavor necessarily is one of decolonization. To get there, I start with a reflection on the relation linking ontology to epistemology and methodology. This relationship is anything but clear but of an entangled nature, thus threatening to complicate a straightforward treatment of epistemology in isolation. The first step I propose to take in this article is to clarify, as much as possible, this relation and disentangle it analytically to clear the path for a treatment of epistemology. The next step consists of a critique of Aristotelian epistemology. I advance this potentially endless endeavor by focusing narrowly on Aristotle's Organon.

The next step consists of elaborating the fuzzy logics contained in Jain, Yoruba, Melanesian, Chinese, and Aymara cultures and highlighting their perception of the world in non-exclusive and non-binary terms. The last step, finally, consists of an attempt to operationalize these fuzzy ontologies and epistemologies so they can become research programs and methodologies. This final step seems necessary if the goal of decolonization is to use and apply non-Western thought in different knowledge productions. I am aware, however, that operationalizing non-Western thought bears the risk of forcing such thought into the narrow framework of Western scientific procedure and language, potentially transforming it into a narrow utilitarian application by instrumentalizing it. This is a real risk and potentially dangerous if our collective goal is to free the world not just from Aristotelian thought dominance but also from utilitarianism and instrumental rationalism. Many non-Aristotelian ontologies and epistemologies will remain place-bound and local – and unintelligible to external, non-emic analysts. At the same time, science and the quest for truths go on so that the decolonization of philosophies and social sciences are an urgent task of all those who seek to free themselves from coloniality in their research practice. To truly value the thought of others, Sandra Harding (2008) has explained, their thoughts have to be intelligible on our terms, not theirs.

My elaboration of a relational, non-discrete and hence fuzzy epistemology explicitly builds on the pioneering work of Jimi Adesina (2002), who, in turn, proposed such an epistemology based on his reading of the Nigerian sociologist Akinsola Akiwowo. I aim to expand Adesina's proposal beyond the "Akiwowo Project" toward a more general non-Aristotelian epistemology.

2 | ONTOLOGY, EPISTEMOLOGY, METHODOLOGY

Ontology ought to form the base upon which an epistemology is constructed, as we first have to agree what we accept as real before we can think about how to know this reality. Maybe ironically, however, this relationship of ontology first, epistemology later gets turned on its head in many cases. We end up accepting as real that which we are able to perceive, so that our epistemology, and sometimes even our methodology, determines our reality and what we accept as real. This reversed order seems to work in both directions: we might deny the reality of something real simply because we do not perceive, or comprehend it; and we might attribute reality, or ontological status, to something we have created through our own research. A narrowly constructed "Western" scientific tradition uses Aristotle's logic as a core building block to make sense of the world, to describe and explain it, actively denying and pushing into the shadows the Southern and Eastern components without which no such thing as a "Western scientific tradition" could have ever emerged. (Senghor, 1971) As Aristotle's epistemology has so strongly influenced Western epistemology, given the feedback loop described above, it is also a central element of Western ontology, thus centrally forming a Western worldview.

Given the colonization of the world by Western powers from 1500 to the late 1990s, when Hong Kong and Macau finally gained independence from Britain and Portugal respectively, Aristotelian epistemology, and with it Aristotelian ontology, conquered the world along with the conquering of people, resources, and territory, dressed as "Western science" and "Western tradition." A sanitized version of Western science, western aesthetics, western worldviews and ideologies, and western value systems thus became the way to perceive, comprehend, categorize, and explain the world, pushing into the realm of superstition, pseudo science, folklore, and tradition any and all of the previously existing ontologies, epistemologies, and methodologies. This process has been called a worldwide "epistemicide" by such authors as Boaventura Sousa Santos (2014). Of what, then, consist the western ontology, epistemology, and methodology that conquered the world?

3 | ARISTOTELIAN LOGIC

The core of Aristotle's logic, as summed up and taught over generations in the *Organon*, (Aristotle, 2012) consists of its exclusive and discrete attributions to statements and phenomena. The very last sentence of Aristotle's *On Interpretation*, one of the books that constitute the *Organon*, sums up this core:

> It is evident, also, that neither true judgments nor true propositions can be contrary the one to the other. For whereas, when two propositions are true, a man may state both at the same time without inconsistency, contrary propositions are those which state contrary conditions, and contrary conditions cannot subsist at one and the same time in the same subject. (*On Interpretation*, p.194)

In his *Prior Analytics*, also part of the *Organon*, Aristotle further explains:

"First then take a universal negative with the terms A and B. If no B is A, neither can any A be B." (*Prior Analytics*, p.56) From there, a whole edifice of logical, inductive, inference is constructed, called, by Aristotle, the syllogistic method. The basis of this is given prior, in *Categories*, another book of the *Organon*: "For every assertion must, as is admitted, be either true or false, whereas expressions which are not in any way composite such as 'man', 'white', 'runs', 'wins', cannot be either true or false. (*Categories*, p.15) Here, then, is the crux of the matter: statements, or propositions, must be either true or false.

Aristotle offers more detail on the matter:

> Substance, again, does not appear to admit of variation of degree. I do not mean by this that one substance cannot be more or less truly substance than another, for it has already been stated that this is the case; but that no single substance admits of varying degrees within itself. For instance, one particular substance, 'man', cannot be more or less man either than himself at some or other time or than some other man ... Substance, then, does not admit of variation of degree." (Categories, p.20)

This, then, is the ontological foundation of Aristotelian logic: one thing cannot be one and another at the same time and no degree of being one thing and another can exist.

From the *Categories*, Aristotle develops this core theme in his *Prior Analytics* and *Posterior Analytics* and his *Interpretations*, moving out from a binary, discrete, and exclusive ontology of things into statements and propositions that follow the same logic: a statement, or proposition, must be true or false. It cannot be both. His epistemology and methodology thus follow coherently from his ontology. Things and statements about things are clear and discrete, not fuzzy. They follow a binary logic of yes or no, 1 or 0. This is how the world is and this is how we need to explain it, following a rigorous logic that justifies its methods with its epistemology and its epistemology with its ontology. It is a well-ordered world, neatly categorizable and explainable with 0 s and 1 s. From this ontology a coherent epistemology is presented, which, in turn, provides the basis for a methodology. The world is binarily ordered – and so is our comprehension of the world and, as a result, our methodology to understand, explain, and measure the world must also follow this binary logic.

4 | CONQUEST AND CATEGORIZATION

The Aristotelian logic provided the mental blueprint for a Western ontology, epistemology, and methodology stripped of its other constitutive components, which conquered the world alongside European expansion and submission, as it provided the necessary tools to impose a rational, well-ordered, and easy-to-manipulate roster on the world. It facilitated conquest and control through the imposition of clear, and value-laden, binary propositions: good /bad; modern /traditional; beautiful/ugly; deserving/not-deserving; industrious/lazy; gifted/dumb; European/colonial; white/black; man/woman; civilized/primitive; etc. It is also an epistemology that facilitated two developments that crucially built on this binary system: statistics and computing.

Correlational statistical analysis, it should be remembered, was developed first by Francis Galton to account for population variety. From its very beginning, it was linked to Eugenics, the science of "racial improvement," by first categorizing people into neat types and then using

this categorization to strategically influence human reproduction and classifying people into those whose reproduction is desirable for "progress" and those whose reproduction stands in the way of "progress" and who were consequently targeted by forced sterilizations and, under Nazi Germany, mass killings. Statistical regression relies on discrete attributions of characteristics as one of its basics assumptions. Overlapping variables undermine the very possibility of regression analysis and the discreteness of variables, even if they are continuous, requires that clear, mutually –exclusive attributes are associated with each variable to be tested. Statistical analysis thus represents an application of Aristotelian logic par excellence. It also represents an important step in the gradual disenchantment of the world, as it demands reducing ontological complexity into discrete 0 s and 1 s for the sake of operationalization. The risk inherent in assessing the world through statistical correlation is to forget that such a method, like any other, can only capture a small slither of reality and produce a very simplified version of a complex and inter-related ontology. Many statisticians, Galton included, mistook their statistical findings for reality, thus falling prey to the trap of reification. As already highlighted above, statistical methodology runs the risk of informing epistemology and ultimately ontology. We believe only that to be real which we are able to account and capture with our 0 s and 1 s.

In this regard, it is worth noting that such authors as Ifi Amadiume (1987) and Oyeronke Oyewumi (1997) have pervasively shown how European colonizers imposed neat and mutually exclusive gender ascriptions onto a West African reality where such discrete assignments and ascriptions were hitherto unknown. European colonizers, argues Oyewumi (1997), literally *invented* women in West Africa – which is the title of her book. By imposing the binary categories male/female and associating specific and different gender roles to each one, European colonizers did away with more nuanced and less mutually exclusive pre-colonial gender roles. These West African feminist researchers clearly demonstrate in their path-breaking work that while male – female categorizations existed outside of conquering Europe, theses categories were nowhere as discrete and separate as they were among the European conquerors – particularly those enforcing their own Victorian gender roles and their sexual practices among those they classified as "primitive." Marilyn Strathern (2005) made a similar point when discussing gender roles in Melanesia.

The same can be said about the spread of the category "race," which at one point reduced the complex identities of the world to white/black/yellow/red/brown. These categories, it is important to recognize, are still informing most censuses of the world today – even if the labels have changed in, thus substituting black with African Descendant, white with Caucasian, yellow with Asian, red with Native American, and brown with Latino or Hispanic. While the labels have changed, most censuses of the world still sort their people into a few neat and mutually exclusive categories, despite the knowledge that more is shared across them than within them. The categorization of the world into discrete racial categories must be seen as an integral part of conquest and colonization. (Gilroy, 2002).

Benedict Anderson (2006), in his acclaimed book on conquest, colonization, and nation building, describes the tools used by Dutch colonizers in Indonesia: "The real innovation of the census-takers of the 1870s was, therefore, not in the construction of ethnic-racial classifications, but rather in their systematic quantification." (Anderson, 2006:168) And furthermore: "But after 1850 colonial authorities were using increasingly sophisticated administrative means to enumerate populations, including the women and children (...), according to a maze of grids which had no immediate financial or military purpose." (Anderson, 2006, p.169).

The purpose of doing so was, as Anderson reveals, control. Once a population is sorted and categorized, specific measures can be applied to some of them – favoring some while exposing

others, categorized as not deserving, not gifted, not civilized, not white, and not male, to different treatments and control measures. Categorization, a method of counting and accounting for perceived difference, creates these very differences through its own practice and it provides the basis for separation, discrimination, and comparison, along the same lines Galton pioneered this exercise. Once categorized as "inferior," "primitive," or "savage" by those who categorized themselves as "civilized," "progressive," "modern," and "white" the colonizers used these arbitrary categorizations to justify genocide and enslavement, forced sterilization and abuse.

Alfred Crosby (1996) has even argued that the adoption of discrete measurements during the European Middle Ages have paved the way for Europe's world hegemony. He argues that a revolution of sorts occurred in Europe between 1250 and 1600, pushing Europe away from a qualitative perception of reality towards a quantitative one. According to Crosby, it was this shift in perception that allowed for the development of double-entry bookkeeping, a tool that allowed for a rational accounting of money and assets. Crosby attributes advanced in economics, science, technology, and even music to this gradual expansion of quantitative thinking in Europe.

We must assume, with Max Weber (1968), that this process indeed constituted a "disenchantment" of the world – and we can add specificity to Weber's general pessimism about the Enlightenment process: the disenchantment of the world was carried out by quantifying it and by imposing a concrete and binary categorical system onto a world that did not neatly fit into it. Forcing reality into discrete and binary categories will cut off and kill anything that does not fit – all the edges, overlaps, curves, and fuzzy realities out there. And here we encounter it again - the devastating bleeding back from epistemology to ontology, or even worse: from methodology to ontology. What we cannot count does not exist; what does not fit into our discrete and binary categorical system does not exist. What gradually emerged in Europe between 1250 and 1600, killing off life that does not fit into neat categories and binaries, was then forced upon the rest of the world through colonization. European colonization went hand in hand with epistemicide and this epistemicide consisted of analytically quantifying reality and then giving epistemological and then ontological status to the realities so "treated." Seen from this angle, the disenchantment of the world is a Western colonial disease.

Computing, on the other hand, also relies on neat, binary, attributes and we can only wonder how much of the binary computer logic, to which we are all exposed on a daily basis, has bled into our perception of the world and into our lifeworlds. Here, the equivalent of "if I cannot count it then it does not exist" might be "if I cannot process it then it does not exist." As with the imposition of discrete categorical systems described above, a world perceived and processed through computers will necessarily sidestep all those realities that do not fit the informational requirements of discrete data processors. If sidestepping were the only problem, we would end up in a world where overly complex and fuzzy realities remain unprocessed and unexplained. That is, however, not how computing has evolved and expanded. It is much more likely to assume that the outcome of a computerization of the world is to kill off those realities that cannot be processed. Here, as in the general quantification and statistification of the world, the risk is that a restricted and restrictive methodology leads from an impoverished methodology to an impoverished epistemology and ultimately to an impoverished ontology. We end up living in a world fashioned after our own limited and limiting methodologies of capturing and explaining it – a world of neat and discrete categories and binaries.

If the quantification of the world was indeed a medieval European process that later was imposed to the rest of the world through European conquest and colonization, as I

have tried to argue here, then it makes sense to search for other, non-discrete epistemologies in the hope that colonization has not totally destroyed everything that existed before it. From the onset, it is clear that such non-discrete and hence "fuzzy" epistemologies must exist both within the non-Aristotelian components of the Western traditions and among Southern and Eastern epistemologies.

5 | THE WORLD AGAINST ARISTOTLE

Jimi Adesina, in his article on the work of Yoruba philosopher Akinsola Akiwowo (2002), forwards a fundamental claim, namely that any knowledge production is ideographic. He argues: "The nomothetic design [...] is one that has advanced not because of its universality but as an ideographic narrative of (a section of) the West, often part of the imperial agenda that has been called 'triumph of the West'. (Adesina, 2002, p. 94) The verdict reached by Adesina is simple: "western sociology is deeply ideographic in its discourse and origin. We cannot understand Weber or Durkheim outside of the particular social context in which they wrote." (Adesina, 2002, p.91).

Adesina's work resonates strongly with the efforts of other African philosophers and social scientists engaged in creating an African Philosophy and sociology proper, such as Fabien Eboussi Boulaga (2014), Paulin Hountondji (1997), Valerie Yves Mudimbe (1988), and Archie Mafeje (2002) all of whom have constructed African philosophies and social sciences that grow out of their particular historical situation as Africans.

If we accept Adesina's assessment, then we are facing the need to move beyond universalistic explanations of the world toward manifold, pluriversal explanations, each one partial, limited, and conditioned by the time, the place, and the situatedness of the author. Adesina's project thus resonates strongly and clearly with Feminist Standpoint Theory, as advanced, for example, by Sandra Harding (2008). It is also in line with the more recent efforts among some decolonization scholars to advance *Designs for the Pluriverse* – the title of Arturo Escobar's, 2018 book and the project of *Constructing the Pluriverse* (Reiter, 2018).

The call to construct the pluriverse, advanced by these authors, is thus an invitation to elaborate different, non-hegemonic epistemologies that are consciously place bound and limited and to operationalize these different epistemologies so they can translate into research programs. This is, as the same Jimi Adesina explained in another article (2005), not an easy feat, given the predominance of colonial design everywhere (see also Dipesh Chakrabarty on the difficulty to escape colonial mental and academic structures). However, he advances a 'provisional' step toward epistemic decolonization by developing the fuzzy logic aspect of Akiwowo's work (2002).

It is only at a time when this Aristotelian logical edifice is in crisis that the possibility of other ontologies, epistemologies, and methodologies are being given a second look. Hand in hand with this crisis goes the gradual recovery of precolonial worldviews and systems of thought and analyses the world is witnessing in the 21st century. The crisis of Western hegemony and supremacy, which is a crisis of its legitimacy and its actual dominance in the face of successful Asian contenders of power, is thus accompanied and reinforced by a rescuing of precolonial knowledge, made possible by decolonization and the slow emergence of and non-Western universities, the instruction of non-Western thought within Western universities, and the systematization of indigenous thought outside of formal universities.

From the historical vantage point of the 21st century, a new history of thought seems to emerge – one much more diverse than the universal claims of the Western tradition. Aristotle's way of explaining the world, it turns out, was but one of many and the claims formulated by him and his successors were and are not universal. To the contrary, they seem limited and exceptional.

"The world," it turns out, did not perceive and explain its surroundings in discrete, binary terms. Whereas for Aristotle, a thing could only be one *or* the other, in many other cultures, things could be one *and* the other. For example in the world of Yoruba philosopher Akinsola Akiwowo (1922–2014). Concretely, Jimi Adesina (2002) points out that, "Akiwowo notes that bivalent logic contrasts with what is found in many non-western faiths. The latter is a world of multivalence, not mutual exclusivity. The sky is not either blue or not blue, but *it is* [emphasis in the original] in fact both at the same time." (Adesina, 2002, p.105).

For Adesina, then, "The displacement of Aristotelian binary logic and the affirmation of contingent co-existence of opposites in the narratives of Orunmila provide the basis for a distinct sociological paradigm. This is one in which the coexistence of opposites and the open-ended outcome of social interaction or contending social forces provide an analytical framework devoid of teleological discourse." (Adesina, 2002, p.106).

Similarly to the claims advanced by Amadiume (1987), Oyewumi (1997), Nzegwu (2006), and Amoo-Adare (2013) about West- and Central African epistemologies, Adesina (2002) suggests that pre-colonial West Africa was home to a multivalent and fuzzy epistemology that did not seek to force reality into discrete and often binary categorical systems. By implication his assessment suggests that African modernization bears the potential of producing less disenchantment, as it cuts off less of actual reality in its attempts to explain and manipulate reality. That is if such a thing as African modernity existed – as opposed to the kind of modernization that most of Africa was forced into: a European modernization, defined by the North, forced upon Africa through colonization and imperialism, and later sold to them by Western and Northern development experts – all committed to a quantitative world view.

It further appears that Africa was not the only continent where European conquest and colonization led to epistemizide. The Jain philosopher Jehta Lal. S. Zaveri argues that, "The law of anekānta affirms that there is no opposition between the unity of being and plurality of attributes. A thing is one and many at the same time—a singularity and a plurality rolled into one" (Zaveri, 2009, p. 6–7)." Jainism, as Venu Mehta explains, "significantly contributed to Indian philosophy and logic." (Mehta, 2018, p. 259) India thus can also count on pre-colonial epistemologies that run contrary to the Western binary worldview and it further appears that this non-Western, non-discrete, and non-binary epistemology is still preserved within certain religious doctrines.

Marylin Strathern (2005) and Roy Wagner (2001) have both stressed that discrete and neatly categorizable subjectivities do not exist among many Melanesian societies, where subjectivities and their constitutive relations to groups are constructed in a more composite and indeed fuzzy way and perceptions and conceptions of personhood are more overlapping with groups than the Aristotelian logic allows for. For Strathern (2005), personhood in Melanesia is neither singular nor plural. Wagner, in turn, argues that, "at least for some Melanesians, the part/whole distinction and its systematic entailment is inapplicable." (Wagner, 2001, p.160) He refers to such a conception of personhood as "fractal."

In Chinese philosophy, the principle of Yin and Yang work together, complementing each other instead of being separate principles or entities. According to acclaimed Sinologist Joseph Needham (1956), the Yin-Yang school goes back to Tsou Yen, a Chinese philosopher of the 3rd

century BC. According to Needham, "There can be little doubt that the philosophical use of the terms began about the beginning of the -4th century, and that the passages in older texts which mention this use are interpolations made later than that time." (Needham, 1956, p.273) The principles of Yin and Yang are also mentioned in the Book of Changes, *I Ching*, which first appeared in China around 1000 BC. Needham himself seems unable to fully capture the foundational difference separating classic Chinese from classic Western thought, as he is all too eager to find similarities and parallels between Tsou Yen and Aristotle. He still concludes: "In general, one may say that while there are certain similarities between the Greek and Chinese theories of the elements, the divergences are still more striking, and it seems unnecessary to assume any transmission." (Needham, 1956, p.246).

Fung Yu-Lan, in his classic *History of Chinese Philosophy* (1983) writes:

> During the Warring States period these religious ideas were developed and transformed into a unified system of cosmology, and all sorts of analogies were found between the natural and the human worlds. The persons who engaged in speculations of this sort were referred to in the Han dynasty as members of the school of the *Yin* and the *Yang*, which are, respectively, the female principle of darkness, cold, moisture, quiet, etc., and the male principle of light, warmth, dryness, movement, etc., **the interacting activities [...] which are supposed to produce the natural phenomena of the universe** [my highlight]. (Fung, 1983, p.159)

This seems a far cry away from Aristotle's logic of a world clearly and discretely separated and discernible, without the possibility of overlap. Yu-Lang also quotes from the ancient text of *Lü-shih Ch'un Ch'iu* (XIII, 1), which further developed the thinking of Tsou Yen, the father of Yin-Yang philosophy:

> Heaven and Earth and all things are like the body of one man, and this is what is called the Great Unity. The multiplicity of ears, eyes, noses and mouths and the multiplicity of the five grains and cold and heat: this is what is called the Multiplicity of Differences. Thus all things are made complete. (Fung, 1983, p.168)

It appears, then, that in ancient Chinese philosophy, it is the principle of complementarity that dominates the thinking about the natural and human world – different from the ancient Greek philosophy, which perceived the natural and human world much more in terms of separateness.

While the paternalistic, arrogant, and at times chauvinistic tone of Needham's (1956) appraisals of Chinese epistemology are certainly of limited value, he still is unable to denigrate it completely so that in between the lines, we can learn that Chinese epistemology was and to some extent continues to be fundamentally different from Western, Aristotelian epistemology. The difference precisely is that Chinese epistemology, similar to Indian and African epistemology, did not perceive of the world as one neatly fitting into discrete and often binary categories. In ancient China, similar to pre-colonial Africa and India, as well as in pre-1250 Europe, a fuzzy logic prevailed, able to perceive the world as one of multi-valence, of this *and* that, of gradual, non-exclusive propositions.

Silvia Cusicanqui (2012), a Bolivian Aymara scholar, finally, argues that, "The notion of *ch'ixi*, like many others (*allqa, ayni*), reflects the Aymara idea of something that is and is not at the same time. It is the logic of the included third. A *ch'ixi* color gray is white but is not white at the same time; it is both white and its opposite, black." (Cusicanqui, 2012, p.105) The Aymaras

concentrate in the high lands of Bolivia and Peru and have inhabited the highlands of the Bolivian and Peruvian Andes, most likely since the time of the Tiwanaku civilization, dating back to the second century BCE. There are some 2 million Aymara speakers today, most of whom living in the lake Titicaca region of Bolivia.

It is rather astonishing, as I mentioned in the introduction, that such distant and unrelated cultures as Jainism, Melanesian and Chinese thought – both ancient and contemporary, West African -Yoruba - philosophy, and South American Aymara thought all reject the strict and discrete binaries and exclusive categories that are the cornerstones of Aristotelian logic and became, through conquest, the foundations of Western ontology and epistemology. Even the very scant evidence presented here on these five cultures seems to indicated that "the world" was perceived as fuzzy and ambivalent by most cultures outside of the Aristotelian framework – and continues to be perceived and explained that way in those places where Western influence has remained weak or was refuted.

It also appears that outside of the Aristotelian logic, which came to dominate Western thought and science, competing epistemologies and ontologies co-existed and at times even flourished inside the belly of the Western beast. Dialectical thinking developed by Georg Wilhelm Friedrich Hegel in early 19th century Germany recognizes the co-existence of contradictory stages of being and perceiving of the world. Dialectical thinking has in turn inspired such epistemologies as those proposed by Roy Bhaskar (1994), who remains less sanguine about our analytical ability to capture reality adequately in its entirety and instead espouses a more humble and limited epistemological approach of empirical realism that does not rule out the possibility of fuzzy, overlapping, and fractal realities.

Aristotelian logical, therefore, as not gone uncontested, even within the Western scientific tradition. It has not been able, after all, to capture the fractal, fuzzy, composite, overlapping, and oftentimes contradicting realities so characteristic of this world. Aristotelian logic is furthermore, if my reasoning is correct, deeply implicated in the disenchantment of the world and the construction of the 'iron cage of modernity,' which has brought many to take a critical stance against it – both within the West, but particularly in all those parts of the worlds where Aristotelian logic was imposed as an instrument of colonial control. Theodor Wiesengrund Adorno's *Negative Dialects* (1981) thus shares common ground with the Indian, Chinese, Melanesian, and African epistemologies discussed above. They all reveal Aristotelian logic, which rests on a perception of the world as well ordered, as incomplete and ultimately false.

These non-Aristotelian epistemologies all assume a world (ontology) that is fuzzy, fractal, overlapping, multi-variant, and contradicting. From there, they construct epistemologies that take account of this reality as it is – with all its contradictions and its fuzziness.

If we depart from the idea that every culture and every society has a functioning and valid science that allows it to explain its environment, then "successful science" translates into survival and strive. All the cultures discussed above are still very much among us – from Jainism to ancient Chinese philosophy, to Yoruba, Melanesia, and Aymara cultures. They have all endured and survived as integral cultures and systems, with their own cosmo-visions intact. From the vantage point of 2019, when this article is written, it might well be that Chinese Yin-Yang ontology and epistemology might soon become dominant in the world. Jain, Yoruba, Melanesian, and Aymara cultures have survived despite several attempts of conquest and colonization. They are not, as some Western triumphalists argue, threatened with extinction or relics of the past. They might as well, as Vine Deloria (2007), has argued, survive Western culture, which some Native American writers have diagnosed as suffering from 'Wetiko' disease – a form of cannibalism, which devours the world and ultimately itself (Forbes, 2008).

Finally, with the growing awareness of the bankruptcy of Western development models, which all rely on the unsustainable instrumental rationality produced by Aristotelian logic and operationalized in binary computing and discrete value statistics, fuzzy ontologies and epistemologies are gaining ground among many progressive anthropologists, geographers, and political philosophers who seek to free themselves from the hard and narrow binaries that have for so long dominated their fields (Escobar, 2018). They all seek to ground their research instead on more-than-rational and more-than-human foundations by including emotions and non-humans into their assumptions and ontological bases. As the pioneering work of such authors as Orlando Fals-Borda (2007) and Humberto Maturana (2009) show, to think of the world outside of the discrete, rational, instrumental, human-centric, and androcentric parameters imposed by colonization *is* decolonization, because it recognizes, embraces, and actively integrates such non-Aristotelian and hence anti-domination themes as love and 'sentipensar,' Fals Borda's feel-thinking, into scientific praxis.

How, then, can such fuzzy thinking be operationalized so that it can inform research and knowledge production? Again, as already stated above: not all non-Western thought can and should be instrumentalized so it fits within the rather narrow tradition of Western science. If our goals is to engage in better science, a successor science, and in 'strong objectivity,' free of Western and male bias (Harding, 1993) however, then such a step is necessary. It is also possible, it appears, with the help of the rapidly evolving field of contemporary fuzzy logic and fuzzy set social science.

6 | FUZZY LOGIC TODAY: TOWARD AN OPERATIONALIZATION OF FUZZY LOGIC

Fuzzy and dialectical epistemologies, I have sought to argue, are superior to Aristotelian epistemology in their capacity to capture the world as it is and not, as Aristotle did, by assuming a well-ordered and neatly categorizable world as the ontological ground for formulating epistemic claims and statements.

Dialectical thinkers, like Adorno (1981) and Max Horkheimer and Adorno (1997) have long advocated for conducting research by focusing on contradictions instead of patterns and assumed regularities – in a world where such regularities are epiphenomenal at best, but never foundational (Bhaskar, 1997) Dialects has failed, however, to develop a clearly formulated methodology that explicates how exactly this ought to be done. Recent development in fuzzy set methodology, however, have started approaching this problem from the other end. Perhaps because the main developer of contemporary fuzzy logic, Lotfi Zadeh (1921–2017) was an electrical engineer and computer scientist, he approached the problem of a fuzzy reality not from philosophy and epistemology, but from the methods side. Bart Kosko, another fuzzy logic computer engineer, has argued in his work on *Fuzzy Thinking* (1994) that fuzzy logic is indeed superior to discrete, Aristotelian logic. He shows how fuzzy logic, which is able to move beyond 0 and 1 and compute fractional values (0.1, 0.2. 0.3 – all the way to 0.9), is better able to capture reality – and also better able to build machines that respond more adequately to environmental stimuli. For Kosko (1994), it is no coincidence that it is precisely in Japan and China where fuzzy computing has advanced the most, also producing a leading edge in fuzzy mechanical engineering.

It is, however, the American sociologist Charles Ragin (2014) who has advanced contemporary fuzzy thinking the most, developing a whole new way of examining, explaining, and measuring reality, based on fuzzy set theory and Boolean algebra. Also not a philosopher, Ragin

(2014) proposes to address methodological problems and thus develops Fuzzy Set Qualitative Comparative Analysis (FSQCA) in order to take adequate account of the world's complexity, particularly when it comes to identifying causal mechanisms and causally relevant factors contributing to a given outcome. The core insight defended here is that statistical regression cannot capture complexity and situations where different factors work together to produce one outcome. This is so, according to Ragin, because statistical analysis relies on a crude, binary assortment of 0 and 1 to categorize natural and social phenomena. Most phenomena, however, particularly in the social world, are multi-valent and fuzzy, not falling neatly into all-or-nothing categories.

Ragin finds that "That social causation is often both multiple and conjunctural is consistent with commonsense notions about how the world works." (Ragin, 2014, p.25) Furthermore, he argues: "The model of causation implicit in additive multivariate statistical techniques contradicts notions of multiple conjunctural causation." (Ragin, 2014, p.63).

Fuzzy set analysis thus provides a way to compute non-discrete states of being and non-mutually-exclusive, or non-discrete, values. Charles Ragin has by now applied his fuzzy set analysis to hundreds of cases and the overall academic production of fuzzy set qualitative comparative analysis has reached thousands of published works in peer-reviewed academic journals. Ragin himself has developed a free software package (http://www.socsci.uci.edu/~cragin/fsQCA/software.shtml) able to compare complex cases, each one containing several potentially causally relevant conditions so that researchers can assess which ones work together to produce a given outcome. The way these causally relevant conditions are treated is by assigning them set memberships along a fuzzy continuum, ranging from 1 (fully present or in) to 0 (nonpresent or out), but also containing fractional values indicating "almost always nonpresent" (0.2); "mostly nonpresent" (0.4); "mostly present" (0.7); "almost always present" (0.9), etc. in a processed termed "calibration" by Ragin.

Fuzzy set qualitative comparative analysis also allows for the presence of overlapping states of affairs or values and a capturing of such realities as "the sky is blue and white." It actually allows for a computing of the whiteness and blueness of the sky at a given moment and a capturing of a sky that is almost entirely blue, but also a little bit white.

Fuzzy logic and fuzzy set analysis thus are able to take account of the fuzzy ontologies and epistemologies described above as predominant among Chinese, Jain, Yoruba, and Aymara thought and fuzzy set analysis is a methodology that can successfully operationalize these epistemologies so they can serve as the basis of a non-Western science.

It should not surprise us that Lotfi Zadeh was Iranian.

7 | CONCLUSION

Statistical analysis, which has been the prime tool to measure, assort, and control people and the world ever since Francis Galton (1822–1911) developed it to measure the distance separating European colonizers from African colonized peoples, is unable to adequately account for reality's, let alone social reality's complexity and fuzziness. It is unable to compute complex and interacting causal factors, particularly when these causal factors do not have the same value. The world, and particularly the social world, is fuzzy (ontology) and as a result, our epistemologies and methodologies aimed at examining and explaining the world ought to be fuzzy as well (epistemology and methodology). The Aristotelian logic upon which is relies is, after all, a logic that assumes a well-ordered world, even a perfect world where everything strives toward its own perfection.

While Charles Ragin is focused on developing a fuzzy-set methodology for the purpose of advancing methods in sociology and political science, particularly in comparative politics, which, by definition, relies on case study research, the critiques he offers can be fruitfully applied to a broader field of different inquiries and to the debate about fuzzy logic as a epistemology able to inform more suited and precise methodological tools to understand and analyze the world in general. Ragin is most likely unaware of African, Chinese, Melanesian, and Indian pre-colonial thought. The similarities among his critique and methodological proposals are however strikingly similar to those advanced in the Global South. Ragin is able to provide a pragmatic, structured, explainable, and hence teachable methodology to capture a complex, multi-variant, fuzzy and contradicting reality, thus adding an applicable component not just to fuzzy ontology and epistemology, but also to dialectical thinking and epistemology.

Ibn Khladun asserts that there are different ways of knowing. However, the Aristotelian tradition has narrowed the ways of knowing exclusively to one: a narrowly conceived definition of reason, reducing it to mathematical procedure, statistics, and calculus – all operations that rely on a parsing the world into neat and mutually exclusive attributes and categories. By doing so, Western science has been overestimating what this sort of reason can achieve. In its colonial arrogance, it has also declared that whatever reason cannot grasp is not true, thus coupling a limited understanding of the world with the arrogance of declaring that what is understood by Western science is all there is.

The latest advances in science, as well as in methodology, however, seem to cast serious doubt on the effort of approaching reality through the rigid lens of discrete and binary epistemologies and methodologies. It also appears that the Non-Western epistemologies discussed here provide a more fitting foundation for the latest advances in Western science: Fuzzy set qualitative comparative analysis and standpoint theory in the social sciences and quantum theory in the physical world. The world is not exclusive and discrete; apparent contradictions can be resolved at a higher level or simply coexist. Social science should be the least adamant about finding the one right answer and exclude all others.

The basic insight, already formulated by such pioneers as Einstein, Heisenberg, and Russell, remains: the "harder" the science, the less it is able to capture, describe, and explain human social life. (Lindley, 2008) Human reality is not reducible to discrete 0 s and 1 s, to black or white, either or. It is instead gray, fuzzy, and always, at least in part, driven by willful human action and hence not explainable through "hard" laws governing human action and interaction. There are no hard laws and regularities governing human affairs. At best, such regularities are epiphenomenal and as such, they tell us nothing about causes – why something is occurring. Science freed from the quest for discovering cause, however, becomes a science free of commitment to change the course of history. It becomes a "neutral" and "objective" science, simply dedicated to finding out what is – instead of engaging in the bigger questions: how did we get there, and: how can we change it? While objectivity and neutrality might seem more at grasp for the natural sciences (where it is an illusion as well, as the above authors have demonstrated), it is becomes a naïve and misleading attempt in the social sciences and humanities. This is so because regularities in human social life are not governing or foundational, but all math, calculus, and statistics can do is assess hard regularities and laws. (Little, 1998).

The fact that it was feminist critique that highlighted the shortcomings of universalist claims formulated, almost entirely, by white, European males points at the agency and power behind colonialism: the power to sort, name, categorize and impose an epistemology that claims that it is so and only so was exercised, for the most part, by white European males. Colonialism, to some extent, thus is androcentrism.

A proper ontological and epistemological foundation for the social sciences requires a reckoning with human unpredictability and constructing methodology that takes adequately account of it. This is what this article seeks to labor toward – even if achieving this goal requires a larger and more systematic engagement and a broader search for alternative, non-Western ontologies, epistemologies, and methodologies.

Academic disciplines often rely on borrowing from other disciplines for innovation. In the social sciences, however, this "looking across disciplinary borders" has been unidirectional over the past decades. Inspired by the achievements of the natural sciences, many social scientists have sought to innovate by integrating math and methodologies built on mathematical procedure to innovate. Economists have thus heavily borrowed from calculus; sociologists, political scientists and anthropologists, in turn, from economists. By doing so, they consolidated a hierarchy of science, with STEM leading the field (Science Technology, Engineering, and Math), followed by the "harder' social sciences" (like economics), and trailed by the "softer" social sciences. History and other disciplines not relying heavily on math, calculus, and statistics have been pushed to the very end of the value vector that attributes worth to science.

Gone are the days when sociology was perceived as the "queen of the sciences. Instead, engineering has taken a lead in academic prestige, elevating a technology into the realm of science – still understood as the seeking of Veritas: truth. In most universities, engineers still earn a "Doctorate in Philosophy" (Ph.D.), even though their discipline has apparently given up the search for veritas and instead focused on more mundane technological problems to solve. Philosophy, the foremost contender for the throne of science, is being pushed to the margins. Anybody doubting this hierarchy can simply compare average salaries of professors by discipline.

In this article, I have argued that the social science's "physics envy" (Clark & Primo, 2012) is ill suited and that borrowing from math and calculus holds no promise for any of the social and human sciences. Instead of seeking innovation from copying methods from the "hard sciences," I propose to look the other way: to the humanities and those methodologies properly "social." I seek to lay the groundwork for such a re-orientation by focusing on non-Western fuzzy ontologies and epistemologies.

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