Fuzzy Logic in a Postmodern Era

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Abstract

An event is a spatio-temporally localizable occurrence. Each event in our universe can be defined within a two-dimensional space in which one dimension is causality and the other is serendipity. Unfortunately, the majority of scientists in the Modern Era in their fascination with rules of causality and wanting to believe in a complete deterministic expression of the universe have banished all notions of serendipity to the realm of fiction, religion and/or, the occult. But the hegemony of Newtonian causality finally crumbled under the gravity of Heisenberg's Uncertainty Principle which demonstrated that an external observer can never acquire enough information to fully express the state of a system. This was a quantum physical expression of what was later eloquently put by Heidegger in his philosophical definition of *Ereignis*, to designate an unpredictable and often uncontrollable disruption of the spatio-temporal causal continuity. In the Postmodern Era, when events such as 9/11 occur beyond any assessable realm of causal relationships, we can no longer afford to discard the serendipity component of events if we wish to understand with clarity. Instead we must devise rules of conformity between the causal and non-causal fields of reality. Fuzzy Logic provides such a vigorous system of thinking that can lead us to this accord. This paper uses the tools of Fuzzy Logic to find pathways for events taking place within a causal-serendipity space. As a first approach, an event is defined on a hyperbolic path in which the degree of serendipity multiplied by the degree of causality is constant. This allows for the diminution of serendipity as scientific knowledge about a subject increases and the enhancement of serendipity to become dominant when data are scarce or measurements uncertain. The technique is applied to several different types of causality – direct, chain-like, parallel, and accumulation.

Introduction

Modernity (19th and most of the 20th century) was overwhelmed with the acquisition of knowledge that was defined as our only connection to the so-called "absolute" realities of the universe (as separate from the human mind). In other words, the mind of the scientist along with other scientific instruments were considered as non-intervening probes into the realm of reality. Post-Modern philosophers who have their roots of thinking in Kant and more recently, Heideger, and Kierkegard, have disengaged themselves from the concept of an external existing "absolute" reality and instead, have concerned themselves with knowledge as it exists in the human mind. Derrida, Lytord, and Foucault are some of the most eminent Post-Modern philosophers who, though rejecting many of each other's views, are all skeptical of "absolute" or universal truth-claims. Modernity's dogmatic view on causality and deterministic exposition of the universe, comes from this Aristotelian absolutism. By the end of the Modern era, human interaction with the universe has became so complex that simplistic deterministic models based on absolutism fail to provide satisfactory or even, satisfying results. The birth of Fuzzy Logic was a necessity of our time which was first sensed by engineers rather than philosophers, who were in immediate contact with evolving complexity in human need. Fuzzy Logic was first used in control systems, where the perception of human comfort interacts with external physical realities. The approximation of a response surface became a "good-enough" solution to provide adaptable control that out-performed exact mathematical functions. But even

Zadeh, when he first proposed this logic believed that the largest impact of his ideas would be found in the field of the "soft" sciences – natural language programming and understanding, linguistics, automated translation, technology-transfer, and philosophy. It has taken considerable time and effort for Fuzzy Logic to be accepted by the scientific world. For many years, Zadeh and his disciples were viewed by the mainstream scientific and engineering community as pariahs preaching folk-art. But as the number of followers continued to grow, as the numbers of successful applications increased steadily, and as so many other fields of science and technology began to grasp the truthfulness of fuzzy-thinking and its intrisic ability to solve problems for which the "hard" sciences could not offer global solutions, the nay-sayers have fallen by the way-side and Fuzzy Logic now sits at the pinacle of all other forms of logic.

This paper is an attempt to look at Fuzzy Logic as an instrument to deal with practical issues in an era in which fuzzy-thinking has become a norm rather than an exception.

Philosophical Overview

What is the relationship between necessity on one hand and possibility and actuality on the other? The basis for causality is that one thing is necessary to make the coming to existence of another thing. That other thing that comes to existence based on a determinant cause must have been something that was possible all along. Of course, something impossible (e.g., a contradiction) cannot come to existence. Hence we are talking about a cause necessitating the coming to existence of something possible (i.e., making something an actuality that was previously possible). Hence causality is in fact the transformation of possibility to actuality, and cause is something that changes a "possible" to an "actual".

Having established a framework to examine causality, we will briefly review the relationship between cause and effect, first from a philosophical perspective and then, from a mathematical point of view.

The first serious attempt to explain the causal relationship was offered by Hume. Hume's argument goes as follows: The idea of necessity so far as it is revealed to our mind is always ascribed to the relation between causes and effects. There are two things that can be immediately perceived about two objects in a casual relationship, that they are *contiguous* in time and place, and that the object we call the "cause" *precedes* the other that we call the "effect".[1] Hume however established that reason, as distinguished from experience, can never make us conclude that a cause of a productive quality is absolutely requisite to every beginning of existence of a thing.[2]

According to Hume, by merely observing the "efficacy" of a relation between two objects, there is no way to discern the cause from the effect. It is only after we observe very many of the same instances in which the same objects are conjoined together that we begin to name one object the cause and the other the effect[3]. However by witnessing them repeatedly in the past, the natural propensity of our imagination expects that we will see them repeated together in the future. Hence, necessity is not something belonging to the structure of the objective reality. It rather belongs to the human mind.[4]

Through this interpretation, we only know passively about necessity and efficacy which struck Kant in two different ways. In one way, as this interpretation is related to metaphysics, it "interrupted Kant's dogmatic slumber". In another way, as this interpretation relates to fields of scientific theory and morality, it was more like an alarming skeptical voice needing a response. Why was Hume's skeptic attack on necessity and efficacy alarming to Kant? The main difference between the worldview of all forms of empiricism (including skepticism) and that of Kant is that to empirical thought, the world is given, while for Kant it is to be created.

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[1] [1] – pp.205 - 206
[2] Ibid, p.207
[3] Ibid, p.214
[4] "Necessity is something that exists in the mind, not in the objects" – Ibid, p.217

Since Kant, we now have two explanations for the nature of a causal relationship, i.e. two attempts to understand, i.e., explain, how a cause is related to its effect – that offered by the empiricists and that by Kant. No other explanation is offered by anyone else, and as stated above, their relation is utterly shrouded in mystery.

Cause, Effect, Change, and Necessity

Coming back to the basic idea of causality as a process that brings the possible into existence, a more fundamental question arises: What changes take place when a possible thing becomes real (actual)?

It is known since Aristotle that to rationalize change, we must speak of something that persists throughout that change. To say otherwise about change is nonsensical. The persistent element, the substance, or the essence of the thing that changes, remains unchanged. Hence coming into existence (or actuality) does not change the essence of a thing. Hence change is not in the essence of a thing, but rather in its being[5].

If "possible", by virtue of having a "cause", becomes necessary to "exist", what is the necessary change in the possible that brings it into existence? To examine this question, Kierkegaard asks: Can necessary come to existence? [6] Necessary cannot "not exist", or it is a contradiction. Necessary always *is*. Hence necessary cannot come into existence, because this would mean that it was not necessary before, which is a clear contradiction. "Being" is the essence of necessary (i.e., necessary means necessary to be). We indicated above that something that has come to existence (actual) and has the potential to come to existence (possible) are the same thing (i.e., they have the same essence). This essence cannot be "Being", or the thing would have existed and did not have to come to existence. Hence "necessary" is "essentially" different from "possible" and "actual", whereas "possible" and "actual" are "essentially" the same thing.
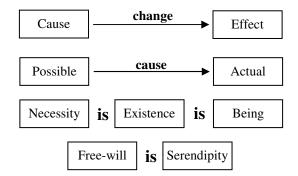

Fig. 1. Linguistics used in "cause and effect" philosophy.

What does this mean? If "possible" becomes "actual", it cannot be because actuality becomes a necessity in the possible. Nothing can become necessary or it is a contradiction, as indicated above. Nothing comes to existence by way of necessity, and neither can necessity come into existence nor can something by coming into existence, be necessary. Nothing exists because it is necessary, but necessary exists because it is necessary. Actual is no more necessary than Possible, for necessary is absolutely different from both.[7]

If coming to existence (i.e. actualization of the possible), is not necessary, then how does it occur? The simple answer can be: "coming into existence occurs in freedom, not by way of necessity".[8] We can at least assume that there is a degree of liberty (free-will) in any causal relation. From an observer's viewpoint, this degree of liberty may be insignificant in some cases (e.g. Newtonian mechanics), but very significant in others (e.g., human relations).

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[5] [3] – p.73
[6] Ibid – p.74
[7] Ibid – pp.74 - 75
[8] Ibid – p.75

Causality in Transition from Modern to Post-Modern

The systemization of human knowledge has always been an effort undertaken by philosophy from the early Greek. This systematization achieved significance as achievements in scientific theory and practice gained momentum at the dawn of industrialization in Europe. As exact sciences portrayed a clockwork vision of the world, the philosophical reaction was equally embodied in an effort to portray a model of human knowledge and understanding analogous to the precision of the exact sciences. The sum total of this vision attained by many great achievements in scientific theory and practice is a culture that we all have lived with through the era referred to as Modernity - a culture marked by its absolutism and idealogism that Lyotard famously referred to as *grand narratives*.[9] Before the so-called Post-Modern era, the rejection of grand narratives is an effort shared by many philosophers who helped shape the transition from Modernity to Post-Modernism; most notably, Nietzsche and Heidegger.

Nietzsche's famous criticism of the sanctity of reason is most eloquently captured in his characterization of the modern philosophical lack of historical sense as a form of archaic "Egyptianism".[10] With this metaphor Nietzsche referred to the mummifying tendency of modern philosophers to consider all things only in terms of abstract concepts taken out of real experience. Thus, these philosophers reduce the whole realm of change, transience, and coming into a fantasy of pure Being *in-itself*: Reason is the cause of our falsification of the evidence of the senses.[11] With this, Nietzsche achieved a reversal of the traditional Western philosophical valuation of reason over the senses. Western philosophical tradition has been largely based on the skeptical devaluation of the senses, and of the so-called *apparent world*. The task of reason was always to keep the prudent philosopher from falling prey to errors of perception. Thus the realm of philosophical inquiry set itself apart from that of theology, the former using reason as its main organ and the latter relying on faith. By debunking reason from its throne, Nietzsche reset faith or *passion* (to use less religious language) as the main tool in the search for truth. Kierkegaard achieved a similar end when he underlined the problems with Descartes' proof for the existence of God.[12]

The relevance of faith (or passion) to our discussion is its intervention in our perceptions. In transition from computing with numbers to computing with perceptions as put forward by Zadeh[13], we need to understand how faith (or passion) affects our perceptions. The conventional AI community has mimicked the human mind by considering things as being binary in nature, i.e., either true or false. This approach derived from the use of the binary system as the fundamental building block of programming a computer. But the AI community is naïve if it assumes that a person's faith belongs only to their transcendental experience (such as God and religion) and has nothing to do with their mundane perceptions. In a Post-Modern era, we should not isolate the scientist from faith, especially when we wish to understand complex events perpetrated by one person or group on another. The true perception of a scientist is an integral of the entire universe of human experience from mundane to sublime and everything in between.

By replacing the traditional metaphysical opposition to subject and object with the unified phenomena of being-in-the-world, Heidegger places reason and the theoretical stance towards the world as a derivative mode of Being. What has been understood as Heidegger's so-called *pragmatism* is a testimony to the human being's (Dasein[14]) unity with the world. The human being is essentially cognitively ambivalent to the world. Knowledge, in the cognitive sense, is only acquired when the fundamental pragmatic relationship with the world is disrupted. Thus, for Heidegger, reason, knowledge, and the scientific outlook on the world are essential derivatives of a primordially pragmatic relationship with the world. Thus it can be said that for Heidegger, the reality of human practice in the context of everyday doing/making is a fundamental element of the reality of human consciousness. As a result, human actions (including "perceptions") always precede theoretical speculation of which it is fundamentally independent. It was a

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[9] [5]
[10] [6]
[11] Ibid
[12] [4]
[13] [Zadeh 1998]
[14] Heidegger's term for "being-there" the existence that self-conscious human beings uniquely possess.

mistake of the Modern mind to posit reason as the foundation of action. Heidegger put it eloquently when he said: "in the most hidden ground of his essence, man truly is, only when, in his way, he is like the rose – without why".[15]

The deconstruction of metaphysics was started by Heidegger and later influenced Jacques Derrida immensely. As mentioned by Derrida, *déconstruction* was his attempt to translate and re-appropriate for his own ends the Heideggerian terms *Destruktion* and *Abbau* via a word from the French language.[16] Derrida's writings question the authority of philosophy. According to Derrida, the essence of the metaphysical (or physical) discourse depends on the validity to establish its intent through the texts upon which it is based. But can such an unambiguous intent be established in any such discourse? This is the question that led Derrida in his effort to rethink the correspondence between object and name both in phenomenological and structural thoughts.[17]

Derrida's deconstruction is grounded in the transition heralded by structuralism from the traditional Augustinian view of language. According to Augustine, language acquires meaning through a one-to-one relationship between a signifier (a word) and a signified (an object in the external world). This model of language took a significant fall with the advent of the structural linguistics developed by Saussure. According to Saussure, a given signifier acquires meaning with respect to its difference from other signifiers in the language.[18] Thus - to the interest of the AI community - the word *orange* does not mean what is meant when referring to a specific visual phenomenon in the external world, but rather, by its difference and similarity to other signifiers such as *red*, *green* and *blue*[19].

Lacan radicalized this view by positing an impenetrable *wall* between "signifiers" and "signifieds". There is no interaction between the realm of signifiers and those objects in the external world to which they are assumed to refer. For Lacan, language sustains its integrity by virtue of the existence of a certain *privileged* signifier that maintains an intimate tie with the external world and thereby prevents other signifiers from falling into meaninglessness. This privileged signifier prevents the subject from becoming psychotic use of language where words become mere objects in themselves and lose all power of representation.[20]

Derrida further extended Lacan's thesis about the fundamental separation of the realm of signifiers from signifieds by emphasizing the instrumental role of "context", beyond which nothing can be defined (e.g., there is nothing that is simply cure or simply poison). In other words, context refuses to settle down as the mere *appearance* of *true* knowledge.[21]

Perhaps, the Post-Modern era can best be thought of as a time that has awakened to the recognition of and appreciation for the richness and fullness of the degree of density of all aspects of the human experience (social, scientific, cultural, linguistic, religious, etc.). Embracing this richness by means that allow an unmitigated or distorted representation is an undertaking that can transform many (if not all) aspects of our lives. The Modern era was built on an understanding of the world through which the God-made and Man-made worlds were governed by absolute timeless universal laws, and the efforts of human beings in the Modern era has always focused on approximating the "laws of nature". The agenda in the Post-Modern era was mistakenly taken as debunking the hope of discovering new universal causal laws. That is incorrect. Rather, the new agenda is to debunk the belief that universal causal laws are the *only* dimension on which reality can be modeled, explained, predicted, and/or justified.

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[15] [7] – p.73
[16] [13]
[17] [11]
[18] [15]
[19] This is why we can speak of colours without having any guarantee whatsoever that what one subject means by "orange" is at all *actually* the same as what another subject understands by the term. What matters is that the *relation* between one colour to another is the same for all.
[20] [16]
[21] [10]

The idea that the source of events is not merely definable by a measurable and traceable chain of phenomena is not new to philosophy. Kant realized that philosophy must account for freedom of choice as another dimension for the origin of actions. But if freedom of choice itself is caused by a chain of measurable and traceable phenomena, then there is not much left for freedom or choice as they are completely consumed by the necessity imposed by the preceding chain of events. Kant approached this issue in his categorization of the third antinomy of pure reason. His solution to this antinomy was to project freedom into a separate dimension from that in which causality operates. Kant's famous bi-dimensional model maps causality as a fundamental rule of our understanding of the dimension of appearances, or so-called phenomena that are the realm of ordinary experience, whereas freedom is mapped on the dimension of things in themselves, or the so-called noumena. World events can only be defined through such a two-dimensional plane in which freedom has the power to act despite the causes that yield appearances within which such freedom must act. In such cases, freedom of choice will be the cause of a brand new chain of events unrelated to what precedes freedom in the world of appearance. In a more romantic sense, our world is being constantly re-set by totally unpredictable events.

The realm within which freedom acts is referred to as the intelligible cause as opposed to causality by appearances. Thus the intelligible cause, with its causality, is outside the apparent chain of events; while its effects, on the contrary, are encountered in a series of empirical conditions[22]. The intelligible cause, as a dimension of defining empirical events, is totally inaccessible by *understanding* and is beyond measurable and traceable chains of phenomena. The free agent stands totally outside the condition of time, for time is only a condition of appearances, but not of things in themselves.[23]

Kant's argument was further radicalized by Kierkegaard in his treatment of possibility, actuality and necessity. In Kierkegaard's view, "necessity" which is the logical category under which efficacy falls, is totally unable to explain why a "possible" becomes an "actual". To Kierkegaard, any phenomenon of coming into existence is caused by a free act that emphasizes the importance of a coefficient of freedom in this regard: all types of "coming into existence" occur in "freedom", not because of "necessity".[24]

The two major philosophical trends in 20th Century were also heavily influenced by Kant's bi-dimensional model with some reservation in admitting (or accepting) the dualistic view latent in Kant's metaphysics – phenomenology and structuralism respectively. Phenomenology, particularly in Heidegger's view, took questioning of the definition of events to a deeper lever in which the question was replaced by that of "Being a human" in the world. In this view what we used to call a phenomenon is only a secondary and less significant question. A phenomenon is the external manifestation of what Heidegger refers to as "*Ereignis*", "enowning or presencing", through which "Dasein" experience and practice being and acting. It is no longer a case of talking "about" something and representing something objective, but rather of being owned over into "*Ereignis*". This amounts to a transformation of the human from "rational animal" to Da-sein.[25] In this way Heidegger's contribution to the definability of phenomena through linear causal relation is a so-called pragmatic answer wherein, it depends on the state of a Dasein's Being. In this view the causal relation between cause and effect can never be taken out of the context.

Structuralism on the other hand approached the interaction among events in a different way. In any significant human creation such as language, culture, and society, the best way to capture and represent these interrelationships and interdependencies of the elements is not explained by causality, but rather through a mutual effect exerted by substructures on each other. In this nexus, the efficacy relationship is minor and secondary, and has very local/tactical importance. Language is the ultimate model for a structural relationship and the analysis of language ultimately reveals how other structures such as society and culture hold up through mutual interaction of their substructures. Structures find their meaning in a structural interdependency, wherein they lean upon each other as cards in a house of cards.

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[22] [2] – p.535
[23] Ibid – p.536
[24] [3] – p.75
[25] [8] – p.3

Derrida single-handedly delivered a very substantial criticism of structuralism and phenomenology, and under his criticism, causation found yet another philosophical interpretation. Derrida did not agree with structuralism that language has any arch or phallus upon which an objective evaluation of meaning can be rendered. Hence the house of cards is destructible in a moment's notice. He believed the only thing that renders meaning to signifiers is the context within which signifiers are placed. As such, meaning is completely relative to the context. There is only context and nothing else. This is the end of any Objectivism upon which a cause can be objectively and unambiguously related to an effect. A cause and effect relationship can be only represented, understood, and acted upon within a given context.

Non-linearity in the Cause and Effect System

Causality is one of the most important concepts that have concerned humanity from the beginning of our intellectual endeavours. Emphasizing the central role of causality in the human mind, Zadeh[26] attempted to bring the subject from its traditionally-held high-heavens of philosophical debate to the ground-zero of mathematical treatment. In his view, human knowledge occupies a wide spectrum beginning with a crisp end wherein concepts are arithmetically-definable to an amorphous end that passes through a fuzzy universe.

During the era of Modernity (now being overlapped by Post-Modernity) we were so fascinated by an assumption of linear relations between cause and effect, that we rejected or ridiculed all domains of knowledge that did not conform to this assumption. Predictions of events were solely based on a linear causal relationship, a system that is inputted by a series of discernable causes and outputted by a series of measurable effects. A non-linear causal relation, on the contrary, is explained by a system that is inputted not only by discernable causes, but also by certain non-discernable factors. In mathematical terms:

$$E_i = \sum S * C_j \tag{1}$$

where "S" is the system, C is the causal input matrix to the system, and E is the output effect matrix.

A non-linear system can be expressed by:

$$E_i = \sum S * C_j + s \tag{2}$$

where "s" stands for all factors that may contribute to the effects but are beyond the perceived system of causality (S). We call this set of non-linearity elements "serendipity". Note that philosophers refer to this as "free-will", alluding to a concept that there are elements of "absolute free-will" in the universal system that act beyond the rules of causality.

In other words, some may link the "s" elements to trans-causal domains, while others may call it the "ignorance elements". We do not attempt to link these elements to any transcendental field, as this leads to a debate beyond the purpose of this paper. Rather, we acknowledge the existence of "s" factors (without being sarcastic) and try to incorporate these phenomena into our predictive assessment of reality by providing a context to express observed non-linearities in some cause-effect systems.

Context and Tools

First, we must provide some tools to assess the magnitude (or importance) of the "s" elements in a predictive model. This can be done empirically from a study of historical events (i.e., similar events that have happened in the past). As the nature of "s" is totally unknown, we can legitimately assume that it is independent of our perceived system of causality (S). This independence is not necessarily in the domain of "realities" that exist beyond human perception. Rather, it is meaningful only in the very context of our perceptions of reality. Note that we cannot make any judgments beyond the context of our perceptions. In

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[26] [Zadeh 2003] [17]

other words, "pure" reality is beyond us. This takes us to the Post-Modern idea that "there is no reality beyond the context" as frantically put by the late Post-Modern guru, Jacques Derrida.

Setting aside the debate on context and reality, the independence of the "s" factors from the causal system can provide a new context for communication. In mathematical terms, this can be defined by a two-dimensional coordinate system in which the orthogonal axes represent causality C and serendipity s. Every event is thus identified by a point on this 2-D space. Those events that lie close to the C axis are dominated by linear causal factors that can be identified and factored into the prediction model. Those events that are in the proximity of the s axis are serendipitous (i.e., not controlled by an identifiable set of causes).

The history of past events can be reviewed within this context to provide us with pathways for future events. One of these pathways would be related to empirically accumulating knowledge about certain events. Increased knowledge will move the event along a hyperbolic curve, towards the C axis. In mathematical terms, our knowledge about an event moves along a curve in which causality times serendipity is constant (or relatively so):

$$C \cdot s = K \tag{3}$$

The graph of C versus s is an inverse relationship with its position dependent on the value of K. The higher the value of K, the farther the curve lies from the centre of the origin. Different pathways can be defined for different types of events. Higher values of K mean that the event is more amorphous, while lower values of K lead to crisp events. Examples of crisp types of events are natural phenomena such as earthquakes (close to the serendipity axis and virtually unpredictable at meaningful time scales) or rain (close to the causality axis in which our ability to accurately predict such weather has grown enormously over the past century).
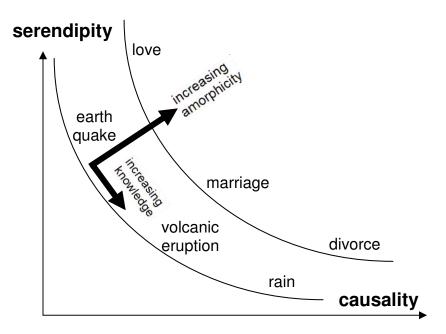

Fig. 2. Crisp events, such as those that occur in nature, are less amorphous. Fuzzy events, such as those involving human relations, are more amorphous.

Zadeh[27] believed that causality is totally amorphous as "there does not exist a mathematically precise definition of causality such that, given any two events (observables) A and B, the definition can be used to

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[27] [Zadeh 2003] [17]

answer questions such as: 'is there a causal connection between A and B?' and 'what is the strength of the causal relation?' "

In our model of events, we have chosen not to link amorphicity directly to causality (defined as an independent component of events). Rather, amorphicity comes from a 2-D space, in which one dimension defines the degree of causality while the other defines the degree of serendipity. In our model, a causal relation can be identified, if it can be separated from its serendipitous components. The strength of a causal relationship can be mathematically defined once the other dimension (i.e., serendipity) is accounted for.

Our model provides a tool for mathematical expression of amorphous events by segregating causality from serendipity. Note that in our model, amorphicity has a more generalized definition in a 2-D space. Neither do we attribute amorphicity totally to the serendipitous component of events. Rather, the model treats amorphicity as a measure of complexity. Those event categories that are more complex (i.e., more advanced in the 2-D causality-serendipity metric) are naturally more shapeless. Even with an event that is 100% determined by causality, as the degree of complexity advances, a certain degree of amorphicity appears.

The human mind makes a complex thing amorphous in order to develop a general feeling about the event. On the serendipity-causality domain, a "ghost" is the ultimate amorphous picture in the human mind. The reason is the complexity of our mind's interaction with a ghost's reality (whatever that may be!). Shapelessness comes from a high degree of complexity in which serendipity interacts with causality. If things are totally serendipitous or causal, they are not shapeless, as the model can mathematically deal with these situations. When causality and serendipity both increase, their interaction creates a degree of complexity that we call shapeless (or amorphicity).

An example of a totally serendipitous event with low amorphicity is "belief in other life-forms in the universe". An example of a totally serendipitous event with high amorphicity is "belief in a God" or "belief in Intelligent Design or the Theory of Creativity".

The philosophical discussion of whether an event takes place by causality or free-will does not enter this model. Events can be considered serendipitous because of lack of knowledge about the causal factors or because of a lack of known causal factors with the event in existence. For all reasons then, if we cannot delineate the causal factors, we call the event serendipitous.

With an amorphous event, causes cannot be identified with full clarity. In other words, as the subject of discussion or interest moves from the mind of science to that of humanity, events become more amorphous. While a probabilistic approach may apply for low values of K, with a high K-value (or amorphous) event, a fuzzy logic approach provides more flexibility to deal with the extreme complexities of the event.

Amorphicity of Fuzzy Logic
One of the important attributes of Fuzzy Logic is its intrinsic low level of information (or amorphicity) within a particular context. This provides a degree of liberty for other intervening parameters including free-will. One of the advantages of human language is its inherent elasticity and/or plasticity that provide a tolerating space for complex human inference in text interpretation. Modernity placed a great deal of importance on maximizing the information density in expressing a so-called reality. The Post-Modern trend gives more importance to the context rather than to the reality itself. Note that the context belongs to each of us as observers or participants, while the reality is typically beyond us. The most extreme side of the Post-Modern spectrum considers only the context as relevant; in Derrida's famous statement that "il n'y a rien d'hore context" (there is nothing beyond the context). This emphasis on context instead of reality is necessary in human communication (both between each other and with reality). Sometimes when we put too many information constraints on a phenomenon, we deprive it from the liberty needed to transition from possibility to reality. Heisenberg's Uncertainty Principle is compatible with this transition. In a 100% predictable system, nothing will happen (i.e., electrons cannot move) because of a lack of tolerance for unpredictable elements that are necessary in any phenomena. More liberty is naturally needed for human possibilities to become realities. It is therefore with good reason that human language is not crisp.

Obviously, the degree of amorphicity increases with increasing human intervention in an event. The degree of amorphicity is further increased as we move from body to soul (the language of love being more amorphous that the language of economics).

Post-Modernity Appreciates Amorphicity

Modernity placed too much value on the simple binary oppositions dominant in 19th Century and early 20th Century thinking to the degree that philosophers and scientists isolated knowledge from ignorance, or correct from incorrect, and presence from absence. Post-Modernity actually began with skepticism towards this duality. Note that this denial of a duality is not the same as the Relativism of the early 20th Century. While Relativism abandoned authority (or absolutism), the Post-Modern view denies duality creating an opening towards the meaning of authority or absolute. Modern philosophers saw the "cause" as the authority (or absolute). This Aristotelian confrontation with reality persisted throughout the Middle Ages, and into the Renaissance, eventually becoming central to the Modern Western scientific attitude.

Epilogue

Rapid changes that our Modern world has undergone during the last decades of the 20th Century are dramatically affecting all dimensions of human activity on earth. Societal norms are breaking, intellectual frameworks are deforming, and our relationship with nature is being completely re-defined. All these changes suggest that a second Renaissance is being shaped, or at least, is being felt all around us. This second Renaissance, has been given a name, before it has been defined. Nobody knows where Post-Modernity is leading us. But it is clear that Modernity is running out of ammunition in its sacred war against uncertainties. So, our "Brave New World" is better off to concede and come to terms with uncertainty. To do so, we need to respect the unknown and to understand (or even celebrate) amorphicity. We need to find new tools to probe the "unseen" and the "irrational". We need to use all our faculties, even those which go beyond reason, to find solutions for complex problems of our time. Fuzzy Logic, although still in its infancy, has the modesty to be a beginning. In the wider philosophical scope, Fuzzy Logic should be seriously explored, and its capabilities re-examined to find the new metric that is needed to challenge the complexities of our Post-Modern framework.

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