Remark on Five Applications of Neutrosophic Logic: in cultural psychology, economics theorizing, conflict resolution, philosophy of science, and cosmology

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Abstract

In this short article, we review five applications of NFL which we have explored in a number of papers. Hopefully the readers will find a continuing line of thoughts in our research in the last few years.

Introduction: what is Neutrosophic Logic?

A definition is given here: Neutrosophic Logic is (Or "Smarandache logic") A generalisation of fuzzy logic based on Neutrosophy.[1] A proposition is t true, i indeterminate, and f false, where t, i, and f are real values from the ranges T, I, F, with no restriction on T, I, F, or the sum n=t+i+f. Neutrosophic logic thus generalises:

- intuitionistic logic, which supports incomplete theories (for 0<n<100 and i=0, 0<=t,i,f<=100);

- fuzzy logic (for n=100 and i=0, and 0<=t,i,f<=100);

- Boolean logic (for n=100 and i=0, with t,f either 0 or 100);

- multi-valued logic (for 0<=t,i,f<=100);

- paraconsistent logic (for n>100 and i=0, with both t,f<100);

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[1] **http://gallup.unm.edu/~smarandache/NeutLog.txt**

- dialetheism, which says that some contradictions are true (for t=f=100 and i=0; some paradoxes can be denoted this way).

Compared with all other logics, neutrosophic logic introduces a percentage of "indeterminacy" - due to unexpected parameters hidden in some propositions. It also allows each component t,i,f to "boil over" 100 or "freeze" under 0. For example, in some tautologies t>100, called "overtrue."

So, in this chapter we will review Neutrosophic Logic, a new theory developed in recent decades by one of these authors (FS).

Vern Poythress argues that sometimes we need a modification of basic philosophy of mathematics, in order to re-define the redeemed mathematics [6].

In this context, allow us to argue in favor of Neutrosophic logic as one basic postutale, in lieu of the Aristotle logic which creates so many problems in real world.

In Neutrosophy, we can connect an idea with its opposite idea and with its neutral idea and get common parts, i.e. <A> /\ <nonA> = nonempty set. The common part of the uncommon things! It is true/real... paradox. From neutrosophy, all started: neutrosophic logic, neutrosophic set, neutrosophic probability, neutrosophic statistics, neutrosophic measure, neutrosophic physics, neutrosophic algebraic structures etc.

It is true in restricted case, i.e. the Hegelian dialectics considers only the dynamics of opposites (<A> and <antiA>), but in our everyday life, not only the opposites interact, but the neutrals <neutA> between them too. For example: you fight with a man (so you both are the opposites). But neutral people around both of you (especially the police) interfere to reconcile both of you. Neutrosophy considers the dynamics of opposites and their neutrals.

So, neutrosophy means that: <A>, <antiA> (the opposite of <A>), and <neutA> (the neutrals between <A> and <antiA>) interact among themselves. A neutrosophic set is characterized by a truth-membership function (T), an indeterminacy-membership function (I), and a falsity-membership function (F), where T, I, F are subsets of the unit interval [0, 1].

As particular cases we have: single-valued neutrosophic set {when T, I, F are crisp numbers in [0, 1]}, and interval-valued neutrosophic set {when T, I, F are intervals included in [0, 1]}. Neutrosophic Set is a powerful structure in expressing indeterminate, vague, incomplete *and* inconsistent information.

In this short review article, we discuss 5 applications of NL theory.

5 applications of NL in various fields of science:

a. cultural psychology

Culture is a shared meaning system, found among those who speak a particular language dialect, during a specific historic period, and in a definable geographic region.

Collectivism is a **cultural** pattern found in most traditional societies, especially in Asia, Latin America, and Africa. It contrasts with **individualism**, which is a **cultural** pattern found mostly in America and Europe.

This theme was expored by Prof. Harry Triandis.[2] Triandis was born in Greece in 1926.[2] During the Second World War, he learned four foreign languages and developed his curiosity about the differences that exist between cultures. His time getting to know people across various European nations inspired him to research cultural disparities in the way people think.

This issue can be reconciled by the help of NL theory.

b. economics theorizing [3]

In a series of papers, we outlined a more general approach to reconcile those classical tension between individualism-collectivism. In our opinion, our tendency to cooperate or compete is partly influenced by the culture that we inherit from our ancestors. One of us (VC) once lived for a while in Russia, and he found that many people there are rather cold and distant (of course not all of them, some are friendly). He learned that such a trait

[2] https://www.researchgate.net/profile/Harry_Triandis

is quite common in many countries in Europe. They tend to be individual and keep a distant to each other. In physics term, they are like *fermions*.[3]

There is a developmental psychology hypothesis that suggests that perhaps such a trait co-relates to the fact that many children in Europe lack nurtures and human touch from their parents, which make them rather cold and individual. Of course, whether this is true correlation, it should be verified.

On the contrary, most people in Asia are gregariously groupie (except perhaps in big metropolitans). They tend to spend much time with family and friends, just like many Italians. They attend religious rituals regularly, and so on. In physics term, they are *bosons*. Of course, this sweeping generalization may be oversimplifying.[4]

Therefore, it seems quite natural to us, why Adam Smith wrote a philosophy book suggesting that individual achievement is a key to national welfare (because he was a British which emphasized individualism).[5] It took more than hundred years until mathematicians like John F. Nash, Jr. figured it out that individual pursuit toward their own goals will not lead them to achieve a common goal as society.[6]

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[3] While our proposed simplifying analogy of human behaviour, i.e. individualism and collectivism sound not so common. Indeed such cultural psychology research has been reported since Harry C. Triandis et al. See for example: (a) The Self and Social Behavior in Differing Cultural Contexts, Psychological Review, vol. 96 no. 3; (b) Harry C. Triandis and Eunkook M. Suh, CULTURAL INFLUENCES ON PERSONALITY, Annu. Rev. Psychol. 2002. 53:133–60; (c) J. Allik & A. Realo, Individualism-collectivism and social capital, JOURNAL OF CROSS-CULTURAL PSYCHOLOGY, Vol. 35 No. 1, January 2004, 29-49. This last mentioned paper includes a quote from Emile Durkheim: "The question that has been the starting point for our study has been that of the connection between the individual personality and social solidarity. How does it come about that the individual, whilst becoming more autonomous, depends ever more closely upon society? How can he become at the same time more of an individual and yet more linked to society?"

[4] After writing up this article, we found that Sergey Rashkovskiy also wrote a quite similar theme, albeit with a statistical mechanics in mind. The title of his recent paper is: "'Bosons' and 'fermions' in social and economic systems." Here is abstract from his paper: "We analyze social and economic systems with a hierarchical structure and show that for such systems, it is possible to construct thermostatistics, based on the intermediate Gentile statistics. We show that in social and economic hierarchical systems there are elements that obey the Fermi-Dirac statistics and can be called fermions, as well as elements that are approximately subject to Bose-Einstein statistics and can be called bosons. We derive the first and second laws of thermodynamics for the considered economic system and show that such concepts as temperature, pressure and financial potential (which is an analogue of the chemical potential in thermodynamics) that characterize the state of the economic system as a whole, can be introduced for economic systems." Url: https://arxiv.org/ftp/arxiv/papers/1805/1805.05327.pdf

[5] If only Adam Smith was born in Bangkok or Manila, probably he wrote his book in a different way.

[6] Imagine 10 players of a football team go simultaneously to make a goal to their opposite team, will they succeed? Of course no, they should arrange according to their coach's instruction: 1-4-4-2, or other type of arrangement.

So, which is better: *to be like fermions or bosons*? Our opinion is: just like in particle physics, both fermions and bosons are required. In the same way, fermion behavior and boson behavior are both needed to advance the quality of life. Fermion people tend to strive toward human progress, while boson people are those who make us alive.
This issue again can be reconciled by the help of NL theory, i.e. such a human tension is always there, but they don't have to be conflicts, just like in classic tensions between capitalism (emphasizing individual achievements) and socialism.

c. <u>conflict resolution [5]</u>
Binary choices are another source of problems. As a one-liner joke says:

> There are two kinds of people in the world: Those who think there are two kinds of people in the world and those who don't. (Plus some others who aren't sure.) [7]

A funnier joke on binary logic:

> There are 10 kinds of people in the world: Those who understand binary and those who don't.[8]

As Broumi et al remarked:

> "These two possibilities, these alternatives, are the basis of cognition, and allow choice and therefore action through the fact that a preference becomes possible: either I prefer there is X, or I prefer there is no X. Then autonomy appears. And indeed the valuation or affect too: "I like" or "I don't like", and it goes with it together.
> The stages described here are not as distinct as those of Piaget, they overlap, include and extend. The "there is no" is opposed to the "there is" forming the opposite. Thus the binary appears and the logic of the same name also: either "there is", or "there is not": X or non-X, one and the other being mutually exclusive.
> …There is this and that and that again: a perception of the environment, a representation of a situation as a collection of objects. Our other most frequent and fundamental conception is opposition: there is or there is not. What also gives one thing and its opposite: day and night, hot and cold, big and small ... The importance of this simplifying binary conception of two situations sliced diametrically away in opposite is the most prominent form of mental life. It is the emblematic *form of a choice."*[9]

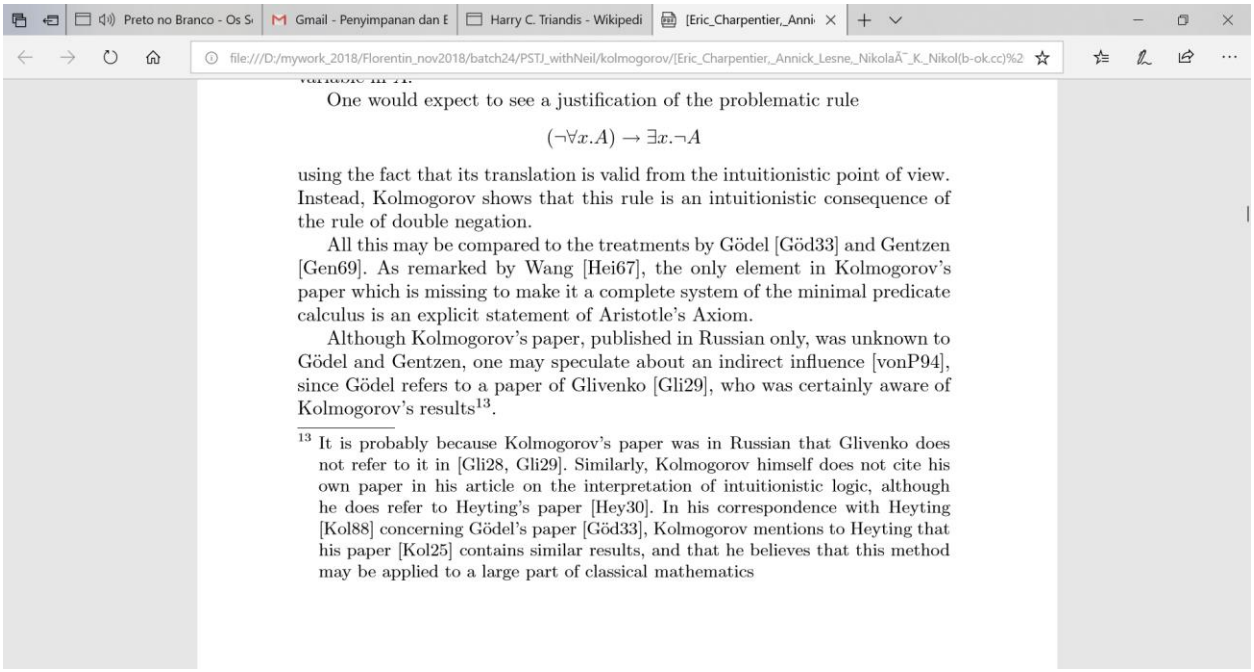
[7] http://philippe.ameline.free.fr/humor/TwoKindOfPeople.htm
[8] http://philippe.ameline.free.fr/humor/TwoKindOfPeople.htm
[9] Quote from S. Broumi et al. *Thinking on Thinking: The Elementary forms of Mental Life Neutrosophical representation as enabling cognitive heuristics*. Submitted for review

In this regards, One of us (FS) recently published a new book, with title: *Neutropsychic personality*.[13] In this book, FS described possible extension of Freudian mental model: *id-ego-superego*, using his Neutrosophic Logic theory. His definition of Neutropsychic is as follows:

> "Neutropsyche is the psychological theory that studies the soul or spirit using the neutrosophy and neutrosohic theories. It is based on triadic neutrosophic psychological concepts, procedures, ideas, and theories of the form (<A>, <neutA>, <antiA>), such as (positive, neutral, negative), (good behavior, ignorant behavior, bad behavior), (taking the decision to act, pending, taking the decision not to act), (sensitive, moderate, insensitive), (under-reacting, normally reacting, over-reacting), (under-thinking, normal thinking, over-thinking), and so on, and their refinements as (<Aj>, <neutAj>, <antiAj>)." [13, p.29]

Perhaps it would be necessary to develop an improved model of neutropsychic basis of decision making process.

Another possible way of resolution of this fundamental problem of human societies, is to accept the otherness, without being absorbed that otherness. In other words, we should try to find common trust, where people can do dialogue and do peaceful co-existence. While this notion of peaceful co-existence belong to social psychology, we can also think of them starting from principle of contradiction, proposed by Kolmogorov. To summarize, he argues that there is fundamental problem in developing complex arguments, they always lead to contradiction. This is proven later by Godel.



One would expect to see a justification of the problematic rule

$$(\neg\forall x.A) \rightarrow \exists x.\neg A$$

using the fact that its translation is valid from the intuitionistic point of view. Instead, Kolmogorov shows that this rule is an intuitionistic consequence of the rule of double negation.

All this may be compared to the treatments by Gödel [Göd33] and Gentzen [Gen69]. As remarked by Wang [Hei67], the only element in Kolmogorov's paper which is missing to make it a complete system of the minimal predicate calculus is an explicit statement of Aristotle's Axiom.

Although Kolmogorov's paper, published in Russian only, was unknown to Gödel and Gentzen, one may speculate about an indirect influence [vonP94], since Gödel refers to a paper of Glivenko [Gli29], who was certainly aware of Kolmogorov's results[13].

[13] It is probably because Kolmogorov's paper was in Russian that Glivenko does not refer to it in [Gli28, Gli29]. Similarly, Kolmogorov himself does not cite his own paper in his article on the interpretation of intuitionistic logic, although he does refer to Heyting's paper [Hey30]. In his correspondence with Heyting [Kol88] concerning Gödel's paper [Göd33], Kolmogorov mentions to Heyting that his paper [Kol25] contains similar results, and that he believes that this method may be applied to a large part of classical mathematics

Figure 1. Screenshot from ref. [2].

d. philosophy of science
In a book we have just completed with a number of contributors, there is special chapter whether two authors argued on empiricism vs. logicism. While that was a quite intense debate, after Publisher's request for abstract to that particular chapter, one of us (VC) put these wordings:

Abstract

In this chapter, two authors from different backgrounds engage in an intense dialogue over empiricism and logic in developing physical theories. At one side, Neil Boyd argues that observation and direct experience are very essential to find the truth, probably because of his interpretation of Godel's incompleteness theorem. On the other side, Akira Kanda argues among other things: "Typical experimental physicists does not want to discuss anything out of empiricism. They do not know the way how empiricism was developed. For them, empiricism became an absolute religion not to be questioned. As I pointed out the biggest founder of empiricism, Hume, admitted that empiricism is not just induction upon empirical data, it is standing upon some fundamentally important non-empirical truth such as mathematics." In essence, this is an old problem in theoretical physics, which is most significant: to meditate and observe, or to derive theory based on a few axioms? Perhaps the answer is not so easy to grasp, but both approaches are

complementary. Such an intensity of this dialogue can be viewed as reflecting the message of this book: there are serious old problems which call for attention by modern physicists and mathematicians alike.

This can be viewed as another case which calls for implementation of NL theory: whenever there are two opposite sides, there is always a choice to keep at neutral side.

e. Cosmology [7]

Questions regarding the formation of the Universe and what was there before the existence of Early Universe have been great interest to mankind of all times. In recent decades, the Big Bang as described by the Lambda CDM-Standard Model Cosmology has become widely accepted by majority of physics and cosmology communities. Among other things, we can cite A.A. Grib & Pavlov who pointed possible heavy particles creation out of vacuum and also other proposal such as *Creatio Ex-Nihilo theory* (CET).[36-37]

But the philosophical problems remain, as Vaas pointed out: Did the universe have a beginning or does it exist forever, i.e. is it eternal at least in relation to the past? This fundamental question was a main topic in ancient philosophy of nature and the Middle Ages. Philosophically it was more or less banished then by Immanuel Kant's *Critique of Pure Reason*. But it used to have and still has its revival in modern physical cosmology both in the controversy between the big bang and steady state models some decades ago and in the contemporary attempts to explain the big bang within a quantum cosmological framework.

Interestingly, Vaas also noted that Immanuel Kant, in his *Critique of Pure Reason* (1781/1787), argued that it is possible to prove both that the world has a beginning and that it is eternal (first antinomy of pure reason, A426f/B454f). As Kant believed he could overcome this „self-contradiction of reason" („*Widerspruch der Vernunft mit ihr selbst*", A740) by what he called „*transcendental idealism*", the question whether the cosmos exists forever or not has almost vanished in philosophical discussions.

In a paper accepted recently by Asia Mathematika J., we take a closer look at Genesis 1:2 to see whether the widely-accepted notion of *creatio ex-nihilo* is supported by Hebrew Bible or not. It turns out that Neutrosophic Logic is in agreement with Kant and Vaas's position, it offers a resolution to the long standing disputes between beginning and eternity of the Universe. In other words, in this respect we agree with Vaas: "how a conceptual and perhaps physical solution of the temporal aspect of Immanuel Kant's „*first antinomy of pure reason*" is possible, i.e. how our universe in some respect could have both a beginning and an eternal existence. Therefore, paradoxically, *there might have been a time before time or a beginning of time in time*."

To summarize, Neutrosophic Logic study the dynamics of neutralities. And from this viewpoint, we can understand that it is indeed a real possibility that the Universe has both initial start (creation) but with eternal background. This is exactly the picture we got after our closer look at Gen. 1:1-2.

Concluding remark

In this short article, we review five applications of NFL which we have explored in a number of papers. Hopefully the readers will find a continuing line of thoughts in our research in the last few years, emphasizing our better understanding of various branches of human knowledge. All of these branches were enhanced and elevated to a higher level through applications of NL theory.

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VC & FS

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