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LETTERS TO PROGRESS IN PHYSICS

Introducing a Theory of Neutrosophic Evolution: Degrees of Evolution, Indeterminacy, and Involution

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During the process of adaptation of a being (plant, animal, or human), to a new environment or conditions, the being partially evolves, partially devolves (degenerates), and partially is indeterminate i.e. neither evolving nor devolving, therefore unchanged (neutral), or the change is unclear, ambiguous, vague, as in neutrosophic logic. Thank to adaptation, one therefore has: evolution, involution, and indeterminacy (or neutrality), each one of these three neutrosophic components in some degree. The degrees of evolution/indeterminacy/involution are referred to both: the structure of the being (its body parts), and functionality of the being (functionality of each part, or inter-functionality of the parts among each other, or functionality of the being as a whole). We therefore introduce now for the first time the Neutrosophic Theory of Evolution, Involution, and Indeterminacy (or Neutrality).

1 Introduction

During the 2016–2017 winter, in December-January, I went to a cultural and scientific trip to Galápagos Archipelago, Ecuador, in the Pacific Ocean, and visited seven islands and islets: Mosquera, Isabela, Fernandina, Santiago, Sombrero Chino, Santa Cruz, and Rabida, in a cruise with Golondrina Ship. I had extensive discussions with our likeable guide, señor Milton Ulloa, about natural habitats and their transformations.

After seeing many animals and plants, that evolved differently from their ancestors that came from the continental land, I consulted, returning back to my University of New Mexico, various scientific literature about the life of animals and plants, their reproductions, and about multiple theories of evolutions. I used the online scientific databases that UNM Library has subscribed to, such as MathSciNet, Web of Science, EBSCO, Thomson Gale (Cengage), ProQuest, IEEE/IET Electronic Library, IEEE Xplore Digital Library etc., and DOAJ, Amazon Kindle, Google Play Books as well, doing searches for keywords related to origins of life, species, evolution, controversial ideas about evolution, adaptation and in-adaptation, life curiosities, mutations, genetics, embryology, and so on.

My general conclusion was that each evolution theory had some degree of truth, some degree of indeterminacy, and some degree of untruth (as in neutrosophic logic), depending on the types of species, environment, timespan, and other hidden parameters that may exist.

And all these degrees are different from a species to another species, from an environment to another environment, from a timespan to another timespan, and in general from a parameter to another parameter.

By environment, one understands: geography, climate, preys and predators of that species, i.e. the whole ecosystem.

I have observed that the animals and plants (and even human beings) not only evolve, but also *devolve* (i.e. involve back, decline, atrophy, pass down, regress, degenerate). Some treats increase, other treats decrease, while others remains unchanged (neutrality).

One also sees: adaptation by physical or functional evolution of a body part, and physical or functional involution of another body part, while other body parts and functions remain unchanged. After evolution, a new process start, re-evaluation, and so on.

In the society it looks that the most opportunistic (which is the fittest!) succeeds, not the smartest. And professional deformation signifies evolution (specialization in a narrow field), and involution (incapability of doing things in another field).

The paper is organized as follows: some information on taxonomy, species, a short list of theories of origin of life, another list of theories and ideas about evolution. Afterwards the main contribution of this paper, the *theory of neutrosophic evolution*, the dynamicity of species, several examples of evolution, involution, and indeterminacy (neutrality), neutrosophic selection, refined neutrosophic theory of evolution, and the paper ends with open questions on evolution/neutrality/involution.

2 Taxonomy

Let's recall several notions from classical biology.

The **taxonomy** is a classification, from a scientifically point of view, of the living things, and it classifies them into three categories: **species**, **genus**, and **family**.

3 Species

A **species** means a group of organisms, living in a specific area, sharing many characteristics, and able to reproduce with

each other.

In some cases, the distinction between a population subgroup to be a different species, or not, is unclear, as in the *Sorites Paradoxes* in the frame of *neutrosophy*: the frontier between <A> (where <A> can be a species, a genus, or a family), and <nonA> (which means that is not <A>) is vague, incomplete, ambiguous. Similarly, for the distinction between a series and its subseries.

4 Theories of origin of life

Louis Pasteur (1822–1895) developed in 1860 the theory of *precellular (prebiotic) evolution*, which says that life evolved from non-living chemical combinations that, over long time, arose spontaneously.

In the late 19th century a theory, called *abiogenesis*, promulgated that the living organisms originated from lifeless matter spontaneously, without any living parents' action.

Carl R. Woese (b. 1928) has proposed in 1970's that the *progenotes* were the very first living cells, but their biological specificity was small. The genes were considered probable (rather than identical) proteins.

John Burdon Sanderson Haldane (1872–1964) proposed in 1929 the *theory that the viruses were precursors to the living cells* [1].

John Bernal and A. G. Cairns-Smith stated in 1966 the *mineral theory*: that life evolved from inorganic crystals found in the clay, by natural selection [2].

According to the *little bags theory of evolution*, the life is considered as having evolved from organic chemicals that happened to get trapped in some tiny vesicles.

Eigen and Schuster, adepts of the *hypercycle theory*, asserted in 1977 that the precursors of single cells were these little bags, and their chemical reactions cycles were equivalent to the life's functionality [3].

Other theories about the origin of life have been proposed in the biology literature, such as: *primordial soup*, *dynamic state theory*, and *phenotype theory*, but they were later dismissed by experiments.

5 Theories and ideas about evolution

The theory of *fixism* says that species are fixed, they do not evolve or devolve, and therefore the today's species are identical to the past species.

Of course, the *creationism* is a fixism theory, from a religious point of view. Opposed to the fixism is the theory of *transformism*, antecedent to the evolutionary doctrine, in the pre-Darwinian period, which asserts that plants and animals are modified and transformed gradually from one species into another through many generations [22].

Jean Baptiste Pierre Antoine de Monet Lamarck (1749–1829), in 1801, ahead of Charles Darwin, is associated with the *theory of inheritance of acquired characteristics* (or *use-inheritance*), and even of *acquired habits*. Which is called

Lamarckism or *Lamarckian Evolution*.

If an animal repeatedly stresses in the environment, its body part under stress will modify in order to overcome the environmental stress, and the modification will be transmitted to its offspring.

For example: the giraffe having a long neck in order to catch the tree leaves [4].

Herbert Spencer (1820–1903) used for the first time the term evolution in biology, showing that a population's gene pool changes from a generation to another generation, producing new species after a time [5].

Charles Darwin (1809–1882) introduced the natural selection, meaning that individuals that are more endowed with characteristics for reproduction and survival will prevail ("selection of the fittest"), while those less endowed would perish [6].

Darwin had also explained the structure similarities of leaving things in genera and families, due to the common descent of related species [7].

In his *gradualism* (or *phyletic gradualism*), Darwin said that species evolve slowly, rather than suddenly.

The adaptation of an organism means nervous response change, after being exposed to a permanent stimulus.

In the *modern gradualism*, from the genetic point of view, the beneficial genes of the individuals best adapted to the environment, will have a higher frequency into the population over a period of time, giving birth to a new species [8].

Herbert Spencer also coined the phrase survival of the fittest in 1864, that those individuals the best adapted to the environment are the most likely to survive and reproduce. Alfred Russel Wallace (1823–1913) coined in 1888 the terms *Darwinism* (individuals the most adapted to environment pass their characteristics to their offspring), and Darwinian fitness (the better adapted, the better surviving chance) [9].

One has upward evolution (*anagenesis*, coined by Alpheus Hyatt, 1838–1902, in 1889), as the progressive evolution of the species into another [10], and a *branching evolution* (*cladogenesis*, coined in 1953 by Sir Julian Sorell Huxley, 1887–1975), when the population diverges and new species evolve [11].

George John Romanes (1848–1894) coined the word *neo-Darwinism*, related to natural selection and the theory of genetics that explains the *synthetic theory of evolution*. What counts for the natural selection is the gene frequency in the population [12]. The Darwinism is put together with the paleontology, systematics, embryology, molecular biology, and genetics.

In the 19th century Gregor Johann Mendel (1822–1884) set the base of *genetics*, together with other scientists, among them Thomas Hunt Morgan (1866–1945).

The *Mendelism* is the study of heredity according to the chromosome theory: the living thing reproductive cells contain factors which transmit to their offspring particular characteristics [13].

August Weismann (1834–1914) in year 1892 enounced the germ plasm theory, saying that the offspring do not inherit the acquired characteristics of the parents [14].

Hugo de Vries (1848–1935) published a book in 1901 on *mutation theory*, considering that randomly genetic mutations may produce new forms of living things. Therefore, new species may occur suddenly [15].

Louis Antoine Marie Joseph Dollo (1857–1931) enounced the *Dollo's principle (law or rule)* that evolution is irreversible, i.e. the lost functions and structures in species are not regained by future evolving species.

In the present, the *synergetic theory of evolution* considers that one has a natural or artificial multipolar selection, which occurs at all life levels, from the molecule to the ecosystem — not only at the population level.

But nowadays it has been discovered organisms that have re-evolved structured similar to those lost by their ancestors [16].

Life is... complicated!

The genetic assimilation (for *Baldwin Effect*, after James Mark Baldwin, 1861–1934) considered that an advantageous trait (or phenotype) may appear in several individuals of a population in response to the environmental cues, which would determine the gene responsible for the trait to spread through this population [17].

The British geneticist Sir Ronald A. Fisher (1890–1962) elaborated in 1930 the *evolutionary or directional determinism*, when a trait of individuals is preferred for the new generations (for example the largest grains to replant, chosen by farmers) [18].

The *theory of speciation* was associated with Ernst Mayr (b. 1904) and asserts that because of geographic isolation new species arise, that diverge genetically from the larger original population of sexually reproducing organisms. A subgroup becomes new species if its distinct characteristics allow it to survive and its genes do not mix with other species [19].

In the 20th century, Trofim Denisovitch Lysenko (1898–1976) revived the Lamarckism to the *Lysenkoism* school of genetics, proclaiming that the new characteristics acquired by parents will be passed on to the offspring [20].

Richard Goldschmidt (1878–1958) in 1940 has coined the terms of macroevolution, which means evolution from a long timespan (geological) perspective, and microevolution, which means evolution from a small timespan (a few generations) perspective with observable changes [1].

Sewall Wright (1889–1988), in the mid 20th century, developed the *founders effect of principle*, that in isolated places population arrived from the continent or from another island, becomes little by little distinct from its original place population. This is explained because the founders are few in number and therefore the genetic pool is smaller in diversity, whence their offspring are more similar in comparison to the offspring of the original place population.

The founders effect or principle is regarded as a particular case of the *genetic drift* (authored by the same biologist, Sewall Wright), which tells that the change in gene occurs by chance [21].

The mathematician John Maynard Smith has applied the game theory to animal behavior and in 1976 he stated the *evolutionary stable strategy* in a population. It means that, unless the environment changes, the best strategy will evolve, and persist for solving problems.

Other theories related to evolution such as: *punctuated equilibrium* (instantaneous evolution), *hopeful monsters*, and *saltation (quantum) speciation* (that new species suddenly occur; by Ernst Mayr) have been criticized by the majority of biologists.

6 Open research

By genetic engineering it is possible to make another combination of genes, within the same number of chromosomes. Thus, it is possible to mating a species with another closer species, but their offspring is sterile (the offspring cannot reproduce).

Despite the tremendous genetic engineering development in the last decades, there has not been possible to prove by experiments in the laboratory that: from an inorganic matter one can make organic matter that may reproduce and assimilate energy; nor was possible in the laboratory to transform a species into a new species that has a number of chromosomes different from the existent species.

7 Involution

According to several online dictionaries, **involution** means:

- Decay, retrogression or shrinkage in size; or return to a former state [Collins Dictionary of Medicine, Robert M. Youngson, 2005];

- Returning of an enlarged organ to normal size; or turning inward of the edges of a part; mental decline associated with advanced age (psychiatry) [Medical Dictionary for the Health Professions and Nursing, Farlex, 2012];

- Having rolled-up margins (for the plant organs) [Collins Dictionary of Biology, 3rd edition, W. G. Hale, V. A. Saunders, J. P. Margham, 2005];

- A retrograde change of the body or of an organ [Dorland's Medical Dictionary for Health Consumers, Saunders, an imprint of Elsevier, Inc., 2007];

- A progressive decline or degeneration of normal physiological functioning [The American Heritage, Houghton Mifflin Company, 2007].

8 Theory of Neutrosophic Evolution

During the process of adaptation of a being (plant, animal, or human) B , to a new environment η ,

- B partially *evolves*;

— B partially *devolves* (involves, regresses, degenerates);

— and B partially remains *indeterminate* which means *neutral* (unchanged), or ambiguous — i.e. not sure if it is evolution or involution.

Any action has a reaction. We see, thank to adaptation: evolution, involution, and neutrality (indeterminacy), each one of these three *neutrosophic components* in some degree.

The degrees of evolution/indeterminacy/involution are referred to both: the **structure** of B (its body parts), and **functionality** of B (functionality of each part, or inter-functionality of the parts among each other, or functionality of B as a whole).

Adaptation to new environment conditions means **de-adaptation** from the old environment conditions.

Evolution in one direction means involution in the opposite direction.

Loosing in one direction, one has to gain in another direction in order to survive (for equilibrium). And reciprocally.

A species, with respect to an environment, can be:

- in equilibrium, disequilibrium, or indetermination;
- stable, unstable, or indeterminate (ambiguous state);
- optimal, suboptimal, or indeterminate.

One therefore has a **Neutrosophic Theory of Evolution, Involution, and Indeterminacy** (neutrality, or fluctuation between Evolution and Involution). The evolution, the involution, and the indeterminate-evolution depend not only on natural selection, but also on many other factors such as: artificial selection, friends and enemies, bad luck or good luck, weather change, environment juncture etc.

9 Dynamicity of the species

If the species is in indeterminate (unclear, vague, ambiguous) state with respect to its environment, it tends to converge towards one extreme:

- either to equilibrium/stability/optimality, or to disequilibrium/instability/suboptimality with respect to an environment;
- therefore the species either rises up gradually or suddenly by mutation towards equilibrium/stability/optimality;
- or the species deeps down gradually or suddenly by mutation to disequilibrium/instability/suboptimality and perish.

The **attraction point** in this neutrosophic dynamic system is, of course, the state of equilibrium/stability/optimality. But even in this state, the species is not fixed, it may get, due to new conditions or accidents, to a degree of disequilibrium/instability/suboptimality, and from this new state again the struggle on the long way back of the species to its attraction point.

10 Several examples of evolution, involution, and indeterminacy (neutrality)

10.1 Cormorants example

Let's take the flightless cormorants (*Nannopterum harrisi*) in Galápagos Islands, their wings and tail have atrophied (hence **devolved**) due to their no need to fly (for they having no predators on the land), and because their permanent need to dive on near-shore bottom after fish, octopi, eels etc.

Their avian breastbone vanished (**involution**), since no flying muscles to support were needed.

But their neck got longer, their legs stronger, and their feet got huge webbed in order to catch fish underwater (**evolution**).

Yet, the flightless cormorants kept several of their ancestors' habits (functionality as a whole): make nests, hatch the eggs etc. (hence **neutrality**).

10.2 Cosmos example

The astronauts, in space, for extended period of time get accustomed to low or no gravity (**evolution**), but they lose bone density (**involution**). Yet other body parts do not change, or it has not been found out so far (**neutrality/indeterminacy**).

10.3 Example of evolution and involution

The whales **evolved** with respect to their teeth from pig-like teeth to cusped teeth. Afterwards, the whales **devolved** from cusped teeth back to conical teeth without cusps.

10.4 Penguin example

The Galápagos Penguin (*Spheniscus mendiculus*) evolved from the Humboldt Penguin by shrinking its size at 35 cm high (adaptation by involution) in order to be able to stay cool in the equatorial sun.

10.5 Frigate birds example

The Galápagos Frigate birds are birds that lost their ability to dive for food, since their feathers are not waterproof (**involution**), but they became masters of faster-and-maneuverable flying by stealing food from other birds, called kleptoparasite feeding (**evolution**).

10.6 Example of Darwin's finches

The 13 Galápagos species of Darwin's Finches manifest various degrees of evolution upon their beak, having different shapes and sizes for each species in order to gobble different types of foods (hence **evolution**):

- for cracking hard seeds, a thick beak (ground finch);
- for insects, flowers and cacti, a long and slim beak (another finch species).

Besides their beaks, the finches look similar, proving they came from a common ancestor (hence **neutrality**).

If one experiments, let's suppose one moves the thick-beak ground finches back to an environment with soft seeds, where it is not needed a thick beak, then the thick beak will atrophy and, in time, since it becomes hard for the finches to use the heavy beak, the thin-beak finches will prevail (hence **involution**).

10.7 El Niño example

Professor of ecology, ethology, and evolution Martin Wikelski, from the University of Illinois at Urbana-Champaign, has published in *Nature* a curious report, regarding data he and his team collected about marine iguanas since 1987. During the 1997–1998 El Niño, the marine algae died, and because the lack of food, on one of the Galápagos islands some marine iguanas shrank a quarter of their length and lost half of their weight (adaptation by **involution**).

After plentiful of food became available again, the marine iguanas grew back to their original length and weight (re-adaptation by **evolution**).

[J. Smith, J. Brown, The Incredible Shrinking Iguanas, in Ecuador & The Galápagos Islands, Moon Handbook, Avalon Travel, p. 325.]

10.8 Bat example

The bats are the only mammals capable of naturally flying, due to the fact that their forelimbs have developed into webbed wings (**evolution** by transformation). But navigating and foraging in the darkness, have caused their eyes' functionality to diminish (**involution**), yet the bats "see" with their ears (**evolution** by transformation) using the echolocation (or the bio sonar) in the following way: the bats emit sounds by mouth (one emitter), and their ears receive echoes (two receivers); the time delay (between emission and reception of the sound) and the relative intensity of the received sound give to the bats information about the distance, direction, size and type of animal in its environment.

10.9 Mole example

For the moles, mammals that live underground, their eyes and ears have degenerated and become minuscule since their functions are not much needed (hence adaptation by **involution**), yet their forelimbs became more powerful and their paws larger for better digging (adaptation by **evolution**).

11 Neutrosophic selection

Neutrosophic selection with respect to a population of a species means that over a specific timespan a percentage of its individuals evolve, another percentage of individuals devolve, and a third category of individuals do not change or their change is indeterminate (not knowing if it is evolution or involution). We may have a natural or artificial neutrosophic selection.

12 Refined Neutrosophic Theory of Evolution

Refined Neutrosophic Theory of Evolution is an extension of the neutrosophic theory of evolution, when the degrees of evolution/indeterminacy/involution are considered separately with respect to each body part, and with respect to each body part functionality, and with respect to the whole organism functionality.

13 Open questions on evolution/neutrality/involution

13.1. How to measure the degree of evolution, degree of involution, and degree of indeterminacy (neutrality) of a species in a given environment and a specific timespan?

13.2. How to compute the degree of similarity to ancestors, degree of dissimilarity to ancestors, and degree of indeterminate similarity-dissimilarity to ancestors?

13.3. Experimental Question. Let's suppose that a partial population of species S_1 moves from environment η_1 to a different environment η_2 ; after a while, a new species S_2 emerges by adaptation to η_2 ; then a partial population S_2 moves back from η_2 to η_1 ; will S_2 evolve back (actually devolve to S_1)?

13.4. Are all species needed by nature, or they arrived by accident?

14 Conclusion

We have introduced for the first time the concept of *Neutrosophic Theory of Evolution, Indeterminacy (or Neutrality), and Involution*.

For each being, during a long timespan, there is a process of partial evolution, partial indeterminacy or neutrality, and partial involution with respect to the being body parts and functionalities.

The function creates the organ. The lack of organ functioning, brings atrophy to the organ.

In order to survive, the being has to adapt. One has adaptation by evolution, or adaptation by involution — as many examples have been provided in this paper. The being partially evolves, partially devolves, and partially remains unchanged (fixed) or its process of evolution-involution is indeterminate. There are species partially adapted and partially struggling to adapt.

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