THE SIMPLICITY OF THE COMPLEX SYSTEMS
(Essay)

Abstract:

In this essay, the widely accepted paradigm that "The whole is more than the sum of its parts" is criticized. It is also argued that no system properties emerge, but a cumulative effect and interaction in the system just reveals the part's hidden properties that cause a perception of Emergence phenomena. A system acts as a "litmus paper" and a "magnifying glass" that just reveal the element's properties not observable otherwise.
To explain the living system phenomenon, it is proposed that Consciousness is a fundamental property of MATTER. According to this hypothesis, Consciousness property is not observable in the non-living equilibrium systems. However if a system steered far enough from an equilibrium and passed the critical point, a non-equilibrium system will emerge that may reveal the property that wasn't recognized in their elements. This property we call - LIFE.

CONTENT

1. INTRODUCTION

I have always been intrigued that such a mysteriously complex system, as a living cell, consists of comparatively simple elements - macromolecules - which we believe know almost everything about. Apparently, the link between simplicity of the part and complexity of the whole is missing.

There are two major radically different approaches to this missing link– Reductionism and Holism.

According to Reductionism all properties and the complexity of the system could be derived from studying its parts and their interactions using fundamental physics and chemistry. Reductionists accepted that in many cases, it wasn't currently possible for science to make such deduction and predictions - this shortcoming was a reflection of the state of the art in science. In time, it was said, reductionism would be able to give a full accounting for the system phenomena.

I personally see one major problem with Reductionism, actually not with Reductionism itself that declares that "THE NATURE OF COMPLEX THINGS COULD BE REDUCED TO THE NATURE OF SUMS OF SIMPLER OR MORE FUNDAMENTAL THINGS", but with its narrow interpretation that "the system properties could be reduced to the KNOWN laws of the Physics and Chemistry". I will return to this point in chapter 3.

During the first half of the 20th century the shift in paradigm occurred. Reductionism, as was concluded, is a limited methodological tool applicable to the simple system only, but to solve the complex phenomena like Life, the new Holistic approach is more adequate. Holism proclaims that the essential properties of a system as a whole could not be explained using properties of its elements, because "The whole is more than the sum of its parts".

Over the past hundred of years, holistic approach has produced a large body of theories and vague terminology; however, I did not notice its impact into understanding of a living system phenomenon. Instead, I think that the concept of Irreducible Complexity just provides an "excuse" for the failure to explain life phenomena (it is irreducible-unexplainable any way) and fills a void between Dead Mater and Life with a metaphysical concept of Emergence.

British emergentists of the late-nineteenth, work out a comprehensive emergentist picture using classical examples from the basic chemistry. When chemical ingredients are mixed together the resultant compounds (Whole) has property that can't be found in the original ingredients, even the underlying chemical reactions are completely reducible to the basic chemistry and physics and nothing unexplained emerge in this case. Following this holistic approach, the whole field of macrophysics is often regarded as Emergent phenomena. To name a few: crystal growth and morphology, phase transitions, the surface texture of a substance, aerodynamics, and especially fluid dynamics.

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One of the main problems with Complexity theory, as I see it, is subjective character of Emergence and Complexity phenomena.
For example, if we ask habitants of some town that undergone a significant transformation to describe these changes - the description will be different depending whom you ask: one who just come back after many year of absent, will describe the changes in term of sudden transformation and emergence, but one who lives there all the time – will describe it in term of gradual development.

The similar problem is with scientific definition of Complexity. It is still not clear what the term Complexity denotes and also depends whom you ask. For example, if you ask what is more complex - to build a house, surgically remove appendix or solve a linear differential equation - the answer depends on whom you ask: Carpenter, Surgeon, or Mathematician.
Someone may argue that living systems are complex, regardless whom you ask and this make the Complexity of this system an objective phenomenon. However, this argument always runs the risk of being overridden by history in the development of science. It took thousand years to reduce the enormous variety and complexity of motions and dynamic**s** around us, to the simple Newtonian mechanics.

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Another problem with Holistic approach is lock of the critical analysis while presenting the evidences supporting it. For example, according to Holism, "Emergence is associated with dynamic systems whose behavior often cannot be predicted from knowledge about the parts **in isolation**". However, it is important to understand that **isolated** by all means part will not exhibit any properties at all. When we refer to experiment on an isolated part, it is not actually isolated. Instead, the part is placed in the controlled environment and is subjected to specific interaction that allows observing the specific properties only. The problem arises when the part has a property we do not know about, so we never intentionally subject the part to specific interaction that could reveals this property. If within a natural system this part participates in an interaction that reveals this property, we claim that this system exhibits new properties emergence.
We cannot uncover a new, not directly observable part property without questioning its existence – as if we cannot receive the answer for the question, we did not ask.

A good example that demonstrates the properties observable only during interaction - is an electron. We know that an electron possesses an electrical charge, but we cannot observe this property unless electron interacts with another charged particle. We do not declare that charge property of the electron emerges during interaction with another charged particle, instead we know that the electron always posses the charge (whether we observe it or not) and reveals this property only while interacting with another charged particle.

There is a unique case, however, where the system property indeed could not be predicted from examining its part – this case is Universal Gravity phenomenon. The gravitational force is the property of the elementary particles but it cannot be directly observed, because it is extremely small: for electron, for example, it is equal to 10E-39 of electrical forces. However, this property being accumulated in the macro system starts to play a dominant role in Space.
I think that the gravitation force of macro system could be the best evidence in favor of emergence phenomenon, and the systems theorists loose their best opportunity, by not including it in the foundation of the system theory.
Putting aside an irony, the lesson of this example is that by describing properties of a system through the properties of its parts, it may be critical to do not overlook a property having a very low level of intensity. In general, we never should claim a complete knowledge of a part, because we cannot subject it to all possible experimental conditions or observe it in all natural systems.

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Another typical "evidence" that laid a foundation of the Emergence paradigm I found in the book "The Web of Life. A New Scientific Understanding of Living Systems" by Capra Fritjof. The following segment was used to illustrate this concept: "The taste of sugar as a system phenomena

could not be found in the carbon, hydrogen, and oxygen atoms that constitute sugar components". In this example the whole was limited to sugar only and the very crucial element of the system is missing – SOMEONE who tastes the sugar and constitutes the sugar taste property.
The majority of examples, the system approach based on, omits the invisible SOMEONE who designed, tests, observes or designates the processes. Without this SOMEONE, the system properties as taste of sugar would not exist at all. Omitting the creator or user of the system is the far most common mistake in the system approach. For example, a complex computer is built of the simple semiconductor components and it seems that the "computational intelligence" of the computer is a new emerging phenomenon, because it cannot be found in its parts. However, the complexity of the computer is also due to Property (complexity) of HUMAN INTELLIGENCE, which was not seen while we were observing the computer. This HUMAN INTELLIGENCE is also one of the system's component and his/her properties determine the Complexity of the semiconductor components, the complex wiring of logic components, and sophisticated algorithms. In other word, there are no emerging properties in this example and the properties of a computer (Whole) could be reduced to the properties of its elements that include the creators of this computer.

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It is seems that the attractiveness of the Holistic paradigm, causes many reducible to underlining rules phenomena, like Cellular Automaton (CA), to be included into the list of Irreducibly Complex and Emergence phenomena. It is often claimed, that CA exhibits symptoms of Emergence phenomenon, because CA may generate complex, unpredictable pattern that cannot be determined without performing actual computations.
If this type of unpredictability is a symptom of Emergence phenomena, any natural number **A,** resulted from **B** + **C,** belong to emergence phenomenon also, because **A** is unpredictable without performing an actual calculation!!!
While observing the complex pattern of CA it is important to remember that it results not of simple rule only, but of applying the very complex tool also – a computer (or human intelligence, if modeling/calculation is performed manually) to reveal the result. Therefore, the complexity of observable pattern includes also a complexity of computational process and eventually a human intelligence, not visible while we observe the CA pattern.

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Another classic example of Emergence phenomenon is an ant colony. "Despite the limited repertoire of the individual agents - the ants - the colony exhibits a remarkable flexibility in probing and exploiting its surroundings. Somehow the simple laws of the agents generate an emergent behavior far beyond their individual capacities".
My problem with this example is – what do we know about ant's individual capacity? What was done to reveal ant's complexity? Did we examine an assumption that complexity of ant colony is due to accumulated complexity of the individual ants, the same way as the enormous sophistication of the Human civilization is due to a limited intelligence of Human-Being's.
By the way, Human would hardly demonstrate any intelligence, if He or She would be studied and treated the same way as we study bugs in a jar. To reveal an intelligence of any creature we need to create a special circumstance - an intelligent type of interaction that occurs in the social system.

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The phenomenon of self-organizing bifurcation dissipative systems and their spatial resemblance with living systems challenges our imagination. These phenomena are widely used as an example

of Irreducible Complexity and Emergence. These systems are studied very extensively, however regardless Holistic terminology, these phenomena have being explained (reduced) to the underlying processes of chemistry of non-linear thermodynamics. A huge gap between these and the living systems still exists.
I will return to dissipative system phenomenon later.

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I may continue criticizing the evidences supporting Holism, but this is not a goal of this investigation. The goal is to present a hypothesis about emergence of Life, which I would not able to carry out without demonstrating the problems with Irreducible Complexity paradigm first.
In this investigation, I will use the terms complexity and emergence, but as a human perception only, where **Complexity** reflects an insufficient knowledge or inability to comprehend an observed phenomena and **Emergence** reflects unexpected outcome of the system development.

To summarize this section I state that:

There is no new system properties emerge. Instead, the interactions in the system just reveal the part's hidden properties. A system acts as a "litmus paper" and a "magnifying glass" that reveals properties of the parts that are not observable otherwise. Therefore, the properties of any system could be reduced to properties of its parts and therefore a WHOLE IS **EQUAL** TO THE SUM OF ITS PARTS.

This summary represents Neo-Reductionism, but because of negative perception of this term, I am proposing a new one - the **Principle of Conservation of Complexity -** and this way I am "enriching" a Science with one more useless definition.

2. HIDDEN PROPERTIES OF MACROMOLECULES.

If we follow the **Principle of Conservation of Complexity**, proposed in the previous chapter, not only the lower level of organization could provide explanation of the higher level of organization, but the reverse methodology is effective as well - THE HIGHER LEVEL OF ORGANIZATION CAN PROVIDE EXPLANATION FOR THE LOWER LEVEL OF ORGANIZATION.

Let's start from a living cell. Even the simplest unicellular organisms, Humble Paramecium for example, behaves as very sophisticated one. For she swims about her pond with her numerous tiny hairline legs – the *cilia* – darting in the direction of bacterial food which she senses using a variety of mechanisms, or retreating at prospect of danger, ready to swim off in another direction. She can also negotiate obstructions by swimming around them and demonstrates other aspects of an intelligent behavior, which is the most mysterious property of a single cell organism.

In general, the most basic properties of single cell organisms can be reduced to the properties of its components. For instance, the cell's ability to self-reproduction is due to autoreplicative property of the DNA molecules. The ability to perceive the external information is due to the property of messenger membrane proteins, sensitive to the external factors. The ability to respond is due to the properties of the cytoskeleton molecular structures. Yet, the cell ability to process information and act accordingly does not belong to any known intracellular structures or macromolecules. The attempts to reduce this property to some intracellular mechanisms have

been continued for a long time, but without a noticeable progress.

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The enormous complexity and sophistication of intracellular processes is managed by protein molecules. Their functions and mechanism have been studied in grate details, but my impression is that we not fully appreciate their complexity. For example, some DNA polymerases catalyses a newly-synthesized DNA in a first step and then checks if the product is correct in a second step. If an incorrect base pair is recognized, DNA polymerase reverses its direction, eliminate the incorrect base pair, and continue replication. This two-step process is called the "proof-reading" and results in average error rates of less than 1 error in 100 million reactions. The fact that a SINGLE PROTEIN MOLECULE can perform such an “intelligent” function makes me think that these macromolecules “have a mind of their own.”

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One of the most studied and still not fully understood is the mechanisms by which the newly forming macromolecular chains of protein undergo folding into their native three-dimensional shape. In general, it follows the minimum free energy state even the biologically active conformation may not be the most thermodynamically favorable.
The folding paradox proposed by Cyrus Levinthal in 1969 states that if a protein were to fold by sequentially sampling of all possible conformations, it would take about 10^{10} years to finish folding. Because proteins fold typically on time scales of milliseconds, Levinthal proposed that a random conformational search does not occur in folding, and the protein must, therefore, fold by a directed process. Later, it was indeed found the specialized proteins, called chaperones, whose function is to aid in the folding of other proteins, however the proteins self-folding is observed also without chaperones. There is no explanation how the protein molecule chooses a proper conformation, but it is clear that polypeptide chain do not try all possible 10^{60}conformations, but some how “figures out” the appropriate one.
Stephen Wolfram in his book “A New Kind of Science” proposes the Principle of Computational Equivalence - that all processes occurring spontaneously in Nature can be viewed as computations following the basic laws of nature.”
Let us for a moment consider this possibility and assume that any protein molecule indeed possess some sort of "Molecular computation ability.” Thanks to this property, protein molecules may figure out how undergo folding into their native conformation, control the biosyntheses of macromolecules, manage regulatory processes in a cell etc. In general, it means that the mystery of the “CELL-SAPIENCE” could be hidden in an unknown property of these macromolecules and in order to understand this property, we have to take a good look at...

... but, at this point, I was interrupted by a contradiction that crops up my sight.

3. "MYSTERY OF LIFE IS HIDDEN ON THE LOWEST STEP OF THE MATTER".

A. Einstein

If we continue to follow the proposed approach, we have to admit that atoms or even elementary particles, such as electron, may also have "Elementary Intelligence.” Electron, for example, may have a “free will” and moves anywhere it chooses, but because of “internal needs” for interaction it chooses to move toward the positively charged particle. It would mean, that electron’s motion may caused not by an external forces, that push or pull electron, but because a source of the motion is in electron itself.

Looks like we start to contradict with everything we know about physics and physical forces.

Historically, the concept of force, taken originally in analogy to human will power, spiritual influence, or muscular effort, became projected into inanimate objects. In elementary or introductory courses in physics a force is still interpreted in the traditional animistic manner as a "tendency" or "striving" or "attraction".
In quantum chromodinamics however, the Standard Model of "force" is replaced by ontologically less demanding concept of "interaction" between particles, which manifest itself by the exchange of additional particles that mediate this interaction. Clearly, what one calls the "fundamental forces of nature" are no longer "forces" in the traditional sense. Modern particle physics seems to support the thesis that the concept of forces has reached the end of its life cycle even though the term "force" continues to be part of our scientific vocabulary.

If the external force, as a physical reality, does not exist, the only source of the motion may lay in the particle itself and is determined by the particle's internal properties. Because this property wasn't observed, I can only speculate about its nature. For example, a particle needs interactions in order to exchange by small-mediated particles and this "trade" decrease the "free energy" of both interacting particles. Because of that, the particles should be actively searching for interactions. Electron for example, may "look around" for positively charged particles and move toward its direction if senses it. The shorter a distance between the particles, more virtual photon they can "trade," and the stronger attraction is and faster they move toward each other.
Generally speaking, all known physical phenomena can be explained in term of "freedom of choice" "ability to make decision", "goal" etc. In addition, it is necessary to introduce a "memory" as fundamental property of an elementary particle. Inertia, for instance, could be due to this property: a particle "remember" the direction where an attraction came from and even after attraction disappear the particle continue moving in the same direction. Due to the "memory", every elementary particle is unique because it has a unique experience and may act differently from other particle under identical circumstances. In this description, the elementary particle revives from the ashes and a new the "elementary living creature" is born.

I am not only one, who considers the intelligence as a fundamental property of the Nature. Several biologists, including Bernan Rensch, who ascribe some rudimentary forms of life, sensation, and even volition to entities such as molecules, atoms, and subatomic particles. "The appearance of recognizable mind in the soma would not be creation *de novo* but a development of mind from [the] unrecognizable into [the] recognizable. In short, mind is present in all matter, only it is not recognizable as such until it reaches a certain level of complexity".

Nick Herbert in his book "Elemental Mind" expressed his views on this subject as follow:
"…I propose here a kind of "quantum animism" in which mind permeates the world at every level. I propose that conciseness is a fundamental force that enters into necessary cooperation with matter to bring about the fine details of our every day world. I propose, in fact, that mind is elemental...

So an idea that mind is fundamental property of the mater isn't new, but it is hard to imagine that matter around us may hide some "intelligence". For intelligence, we rather look into a telescope than into a microscope.

Let us put our-self in the shoes of those whose intelligence is ignored.
Let imaging that some Aliens discovered our planet. They were huge in size and compare to them we are just the small particles. The Aliens were impressed by sophisticated infrastructures found on our planet, and they were surprised that these well-organized infrastructures are resulted from

seemingly chaotic activity of the human-particle colony. The Aliens Scientists started an investigation of this phenomenon and soon they found some correlation between money ($) and human behavior. To learn more about this observation, Alien Scientist conducted an experiment by placing a dollar bill on a quiet street and begins to observe a human who stumbles on the placed dollar bill. The experimenter found that practically all Human are attracted to money. The Experimenter also found that higher the value of the dollar bill is, the more obstacles the human is ready to overcome to get money.. For instance, if money were placed behind a fence the human overcomes this obstacle if the value of the bill was significant and a fence was not too high. This is very similar to how all physical nature acts: movement of any physical body is proportional to attracted force and inversely proportional to an obstacle altitude. Therefore Alien Scientist come to conclusion that the human is indeed a pretty simple particle whose behavior can be described in term of attraction to money, with the force proportionally of the dollar-bill value. The theory of Money Force Field was concluded - the Money Force Field drives practically all processes at the primitive human-particle colony.

A small percentage of human was outstanding of this rule and acted sometimes unpredictable. Yet the Alien Scientist was not discouraged by this inconsistency, because the quantum elementary particles behave the same way - Quantum Mechanics predicts only the probability of the micro event. In this regard, the Alien Experimenter argues that only the probability of human action can be predicted, and rule is created through statistical processing of the collected data. Using this theory Aliens, indeed, were able to explain, with a high accuracy, the majority of phenomenon they observed in the human colony. It was also concluded that that the sophistication of the Infrastructures, developed by humans, belong to the System phenomena and no further detailed study of an individual “human particle” is necessary.

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For the great majority of Applied Science the atom is a ground zero, land all other knowledge. For them physical structures, are seen as springing from them. For these scientists working at the surface, the practical significance of the exploration below ground is essentially zero. They believe that if the particle physicists one-day find a complete, profound, and satisfying explanation for the existence and properties of neutron, protons, and electrons, our knowledge of chemistry and biology will not benefit at all.

Today most physicists accept quantum mechanics as the basis of their discipline. However controversy that started sixty years ago is no mere historical footnote. It still argued that certain vital area of quantum mechanics covered not by convincing computations, but by a transparent tissue of ideology. Einstein insisted until his death that quantum mechanics gave a useful but fundamentally incomplete account of the physical word.

4. FROM THE INTELLIGENCE OF THE ELEMENTS TO THE SYSTEM INTELLIGENCE
or
THE TRUTH IS WHAT THE MAJORITY BELIEVED IN.

To examine the “intelligence” as a property we have to find a way to measure it. Like any other measurements that occur only in the process of interaction, we will measure the “intelligence” of a system that interacts with the particular problem. It is important to understand that the “intelligence” cannot be defined as an absolute value but relative only. Its value depends upon the type of a problem selected to measure the “intelligence”. For example if the problem is protein folding, then any single molecule of protein is much more intelligent that we are.

The value of the intelligence that solves the particular problem within specific time frame could be determined as follow: the value of the intelligence is equal to 1 GRADE if the probability **p** of correct answer is 100%. If an individual is solving the specific class of problems, with the 10% success rates his/her intelligence, relative to this type of the problems is 0.1.

In general, a group (system) is able to solve a more complex problem that an individual member. Suppose that the group of **m** individuals is solving the same problem that has one correct answer chosen among vast amount of incorrect ones. Suppose also that these individuals solve this problem independently and then compare their answers at the end. The identical results, most probable are the correct answer, but the different results are random, and therefore will be canceled out as incorrect. Therefore, the identical results represent the correct answer defined by the group. The more members are in the group, the higher is the probability that a system comes up with a correct answer and therefore its "intelligence is higher.

The described mechanism determining system intelligence is applicable to the "democratic" system only where independence is preserved and authority is distributed more or less evenly among its members. If an authority or power in a system plays a role in determining a "correct answer", the optimum solution may not be achieved and this system intelligence could be compromised.

Using the described above mechanism, a system able to accumulate an intelligence of its elements producing a higher level of intelligence. The existence of hierarchical organization of mater from elementary particle to human society is a series of mind levels, which became more and more sophisticated from one hierarchical level to the next level.

According to proposed hypothesis, described above mechanism solving problem by a group, occurs on all levels of organization. The elements of any system, independently analyze the external to the system conditions, come up with a solution to achieve tangible benefits (minimum free energy or equilibrium), compare the results among the members of the system and only than act upon the decision dictated by majority. For example, a nail, hit on the head by a hammer, moves downward, penetrating the wood not just because of the brutal force of a hammer, but because the nail's constituent part resolute the "conscience" decision to move downward (rather than waiting for the second hit. – I am joking). Regardless of the absurd description of this example, it would not contradict to the nail's motion described by the Newtonian dynamics.

The by-product of this discussion is a new definition of a TRUTH. According to described above group solving problem mechanism - there is no absolute TRUTH (unless GOD exists), but a relative TRUTH only. This TRUTH is what a majority believes in. For example, what is the TRUTH about the structure of our universe? The CORRECT answer may vary. A thousand years ago, the CORRECT answer was - the Sun, the few planets, and the stars are rotated around the Earth. Since then we learned a grate deals about our solar system and have another CORRECT answer. Tomorrow we may learn more profound facts about our universe and the CORRECT answer could be different from today's one. This TRUTH depends on an initial condition of the given problem. These initial conditions are changing from time to time or from culture to culture, thus causing the different correct answers or a TRUTH.

5. CONNECTING THE DOTS: GOAL, RESULT, AND ORIGIN OF LIFE.

Since we are talking about a system that is solving a problem we have to consider two possible outcomes: the system will come up with the correct answer or an incorrect one. It is naturally to assume that if a system is solving a problem (searching for equilibrium, for example) and got the

correct answer the system will approach the equilibrium, but the incorrect answer moves it away from the destination.

Imagine a fisherman who lives on a small, remote Island. Every day he takes a boat to fish within a visible distance from the Island and therefore he has no problem to find his way back home. However, one day, by accident, he got slightly farther from the Island so he cannot see it any more. In this case, the complexity of the problem to find an Island exceeds the threshold of this man ability and therefore the more this man tries to find his Island by searching randomly, the further he moves away from it.
If one observes this man moving away from the Island, the observer may assume that this man has the goal to find more open space rather than the Island.

This example reminds me the complex systems development that is studied by nonlinear thermodynamics. This discipline considers the two outcomes of the system evolution: if the system is not far from equilibrium, it develops toward equilibrium (as non-living matter does), but if a system is far enough from equilibrium and pass the critical point, a small change can push the system into chaotic behavior (Edge of Chaos) and move it even further from an equilibrium and eventually causes the various types of the self-organization processes. Significant accomplishments have been made to extend the self-organization processes of the non-equilibrium system into the realm of living organisms.

The similarity between the man, who moves away from the Island (and probably has to develop many “tricks” to survive in this journey), and the self-organization systems that move away from equilibrium lead me to think that these two events belong to the same phenomenon.

The observation of evolution and development of Living Nature shows that it continues to move away from equilibrium, but now I would be very cautious about conclusion that this evolution and development is the real goal of Nature. Instead I would consider the opposite: the Living systems actually looking for an equilibrium, but move in the opposite direction, because they were “lost“ after series of mistakes to get back to the equilibrium and their continuous attempt to find an equilibrium has brought them further and further from the goal.

6. CONCLUSION

Consciousness is the fundamental property of MATTER that is just not observable in the non-living system. If the system steered far enough from an equilibrium and passed the critical point, the complexity of the problem to find equilibrium exceeds the system’s “Intelligence”. As a result of continuing attempts to find the equilibrium, a system starts developing in the direction out of equilibrium and a non-equilibrium self-organized system will emerge. The further development of this system in the direction out from equilibrium will reveal the property, which was not recognized in their elements - elementary particles. This property we call - LIFE.

If LIFE indeed was emerged due to the inevitable MISTAKE, the CORRECT answer is DEATH, but the living things have to search throughout their life, to find this answer.

APPENDIX

UNOBSERVABLE MOTION AND PARTICLE/WAVE DUALITY PHENOMENON.

I do not have an adequate background in Physics, but I cannot resist a temptation to speculate more about elementary particle "free will".

Niels Bohr once suggested that the quantum wave function of matter represents its mental aspect, that the wave of the electron is the equivalent of the mind of matter.
David Bohm noted that "quantum force" in his model was in many cases so irregular that the particle's path would resemble those of Brownian motion. It was suggested that quantum mechanics could be derived from the principle that elementary particles are subjected to a universal jiggling of unspecified cause.

I am suggesting that this unspecified cause is the particle's conscious need for an interaction. In case of electron, it is continually searching for positively charged particle by scanning and probing the space around it (Fig.1). Electron's scanning motion (Y) is unobservable, because electron does not dissipate energy while searching. Electron dissipates energy, only into direction of attraction to overcome the obstacles and that makes Electron observable.
The observable motion of elementary particle determines its corpuscular properties and non-observable oscillating motion determines its wave properties.

Because an electromagnetic wave propagates with a speed of light, we may conclude that **electron's wave-like motion has also constant speed of light.** This should not contradict with

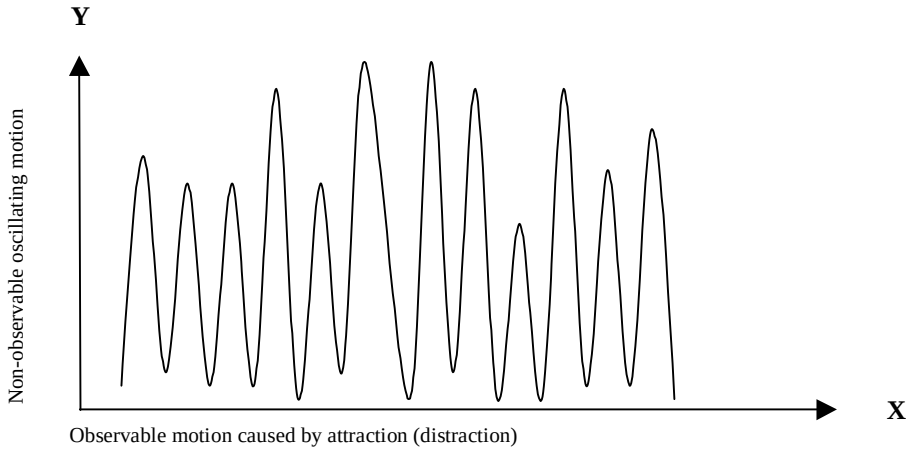
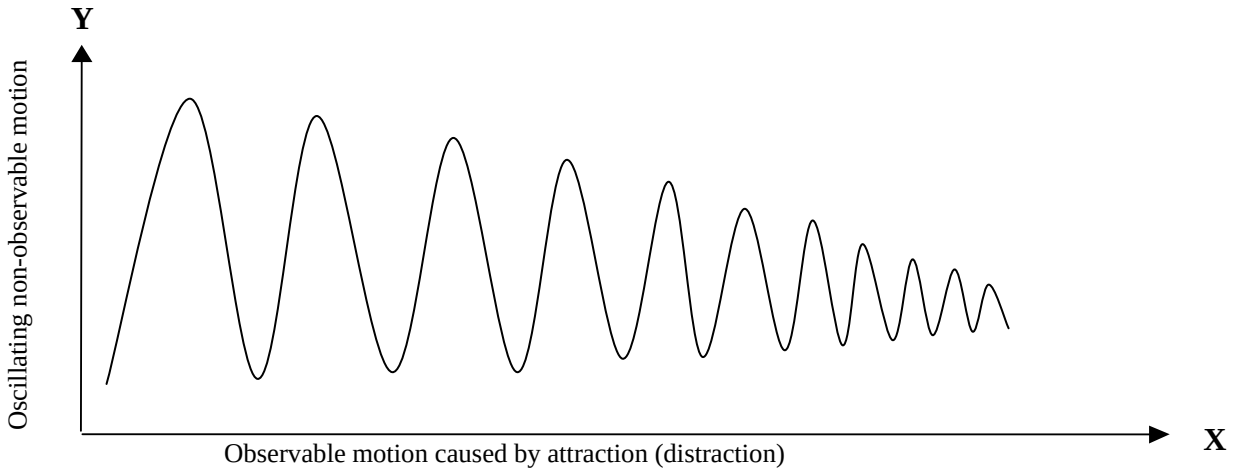


Fig. 1. Scanning (wave like) elementary particle's motion.

fundamental physics laws, because they applied to observable motion only.

When electron senses other charged particle, through mediating interaction particles, it starts moving up gradient concentration of these mediating particles. At the same time, the electron continues oscillating, by sampling the space with a higher accuracy that causes shorter wavelength λ **(Fig. 2)**. The longer electron senses "attraction", the higher the "confidence" that it moves in the proper direction that causes electron acceleration. To maintain overall constant speed of light, an electron shortens its oscillating amplitude. In the extreme case, when an electron has an absolute "confidence" in the chosen direction, it discontinues oscillating motion

and moves in the straight-line trajectory to the target with a speed of light.



. **Fig. 2 While approaching an attracted object, elementary particle shortens the wavelength and decreases the oscillating amplitude.**

The same approach can be applied to any particle exhibited corpuscular/wave properties. Photons also should move in the wave-like fashion. Since their observable velocity is equal to **C,** the non-observable absolute velocity must be higher than the speed of light.

The proposed views may help to explain a number of quantum phenomena. First, it explains the collapse of wave function paradox, since, quantum particle occupies (continuously scanning) the space described by the wave function, but reveal itself only during interaction.
Another quantum puzzle that would be easy to explain is “two slits paradox” where a single particle incident on a screen containing two closely spaced parallel slits **(Fig. 3)**. The paradox is that a particle passing through one slit somehow “knows” whether another slit is open or closed. The explanation of how particle “knows” condition of second slit is that particle samples both slits (if the distance between the slits is in the range of oscillating amplitude) before moving through one of them.

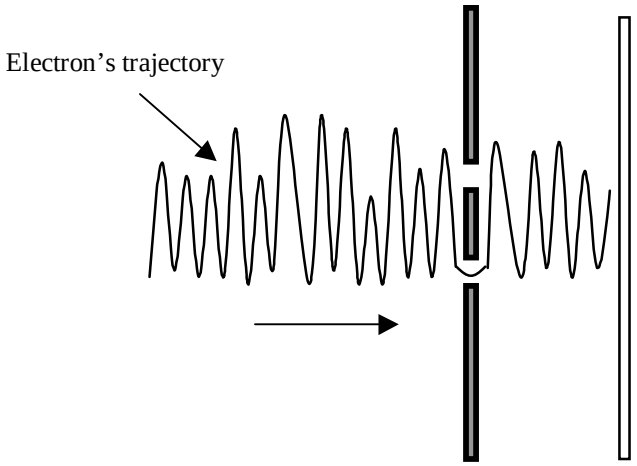


Fig. 3. Particle samples both slits before moving through one of them.