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Passing the systems among levels of quantum reality

IOAN CUNCEV[*]

ASTR – Technical Sciences Academy of Romania,
Calea Victoriei, 118, Bucharest, Romania

Abstract. The visible reality at a given moment is a result of the modification of the quantum states of the observables of some systems from another level of quantum reality. The projection towards the new reality is done by collapsing some states described by simple wave functions or resulting from quantum superpositions. Collapses are also achieved through measurements of observables, influencing quantum phenomena, bringing some phenomena to another level of reality. These can pass from a higher level of quantum reality to another level, effectively measuring certain observables, but also through discoveries, studies, identifying the dynamics of the supply-demand balance from the "cloud" of the market's equilibrium points, the realization of new products or services, etc. That is, the still invisible objects will become visible by extracting them from the original quantum reality with the help of projectors, through collapses. The quantum state of the systems also changes through decoherence, through the interaction with the surrounding environment. In the following, some directions are suggested for the development of models for unitary treatment of objects from different levels of reality.

Keywords: quantum reality, wave function, decoherence.

1. Introduction

Everything that exists now has already existed before, only the probability waves and forms in which the quantum states of the systems are composed have been modified. These are just the "objects" that can be seen, but there are many other systems in states whose wave functions being not yet collapsed, invisible states (Ecl. 1.9-10). The conventional layering of reality on levels of complexity that mutually transform from one to another through quantum phenomena and processes, puts the systems in a position to move vertically, sometimes progressing and sometimes regressing. The development of knowledge regarding quantum

[*]Correspondence address: icuncev@yahoo.com

reality, as well as the increasing complexity of systems of any nature, require new theories and models to drive systems on and between different levels of reality. In such situations of technological breakthrough and progress in all fields, there is a need for new methodological approaches to adapt systems planning to the new circumstances. After many approaches, such as optimization through mathematical programming, process simulation, modeling reality through category theory, graph's transformations and others like them, we tried many times an approach starting from the premise that quantum reality offers the possibility to model the subtleties of future systems and manage their efficacy (effectiveness) and efficiency. That means, to move to a new, non-conformist way of thinking, starting from the idea that all levels of reality, including physical reality, are quantum realities.

In the following, some flashes are presented regarding the directions of approach through which the concepts, the paradigms in general, could be modernized, to suit the new requirements that will come.

2. Levels of quantum reality

Between quantum and macro-reality

Reality is perceived differently by those who observe it. Let's take, as an example, traffic on a transport infrastructure such as a highway. An aerial view of it shows a physical reality in which many and various vehicles drive and maneuver. In fact, more accurate is the quantum reality based on the microtubules of the brain system of each driver who controls the vehicle that amplifies his personal abilities. That is, an augmented quantum reality, as a technology for combining quantum and macro-physical realities.

The quantum reality could be conventionally fragmented in levels of reality, a kind of hyperplanes, depending on certain criteria by which the "objects" and the relationships between them (morphisms) are separated and then regrouped, resulting in somewhat homogeneous varieties. Also in the conventional way, it is customary for macro-reality to be called physical reality, having references to approaching objects through the methods of classical mechanics. In fact, any level of reality is of a quantum nature, the main proof being their transitory character, including the current reality. Theories and models used on certain levels of reality are only particular cases or generalizations of those used on other levels of reality. Theories and models change from one level to another, preserving certain related invariants.

Even when the distance between the levels of reality is great, as in the classical versus quantum case, there are connections between the micro-particles space and the macro-reality that must be sought further, despite the fact that objects and events from macro-reality do not seem to display quantum mechanical features such as superposition. After the first initiatives, using a thought experiment in

which a cat is put in a quantum superposition of two states [1], it was proposed [2][3][4] that, under suitable conditions, a macroscopic object with many microscopic degrees of freedom could behave quantum mechanically, provided that it was sufficiently decoupled from its environment. Much progress has been made [5] in demonstrating the macroscopic quantum behaviour of various systems such as superconductors [6][7][8][9][10], nanoscale magnets [11][12][13], etc. Some experimental evidence has been obtained that a superconducting quantum interference device can be put into a superposition of two magnetic-flux states [5].
When discrepancies appear between quantum and classical mechanics, an explanation could also be sought in quantum decoherence, the state of the system being also related to the state of the surrounding environment.

Physical reality, as a quantum one

Current physical reality is a visible variant of quantum reality obtained by changes or even collapses of states described by simple wave functions or resulting from quantum superpositions. The human perception of it is in fact, an approximate reality, it is what each person can see depending on his abilities and the knowledge he has at the time. The changes are made through measurements of observables that influence quantum systems, which thus bring them to another level of reality. The system can move from one level of quantum reality to another, measuring certain observables, modifying wave functions or adding new quantum subsystems through technological discoveries and developments, exploratory studies, identifying the dynamics of supply-demand balance from market's probabilistic cloud, making new products or services, etc. That is, the still invisible objects will become visible by extracting them from the original quantum reality with the help of projectors or through collapses of wave functions. The quantum state of the systems also changes through decoherence, due to the interaction with the environment.

3. System dynamics

From ignorance to knowledge

An ignoramus lives in a quantum environment. As knowledge accumulates, more and more wave functions collapse. After a while, it "wakes up" in a deterministic environment. Main causes could be the effects of the knowledge society, the role and effects of education etc.
The dynamics of a system is similar with human evolution, fig. 1, from birth to maturity (decreasing entropy) and back to physical death (increasing entropy).

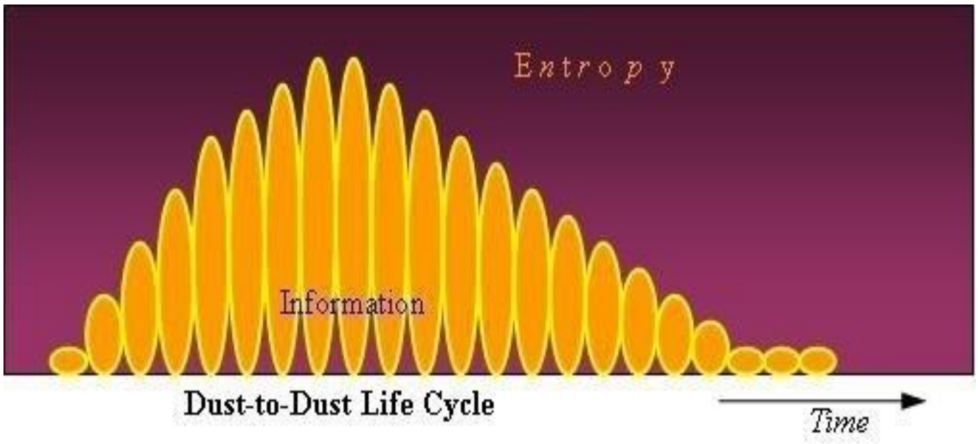

Fig. 1. Informational dynamics of a system.

Successive quantum realities

Quantum reality assumes a bundle of variants of movement the state of the system, defined by the wave function Ψ(r,t), the Schrödinger equation, the Heisenberg models, etc. Over time, updates occur through collapses of the wave function on certain observables or components of the system, and as a result, quantum reality is modified. A new quantum process results, starting from the states described by the new wave functions, etc. It is like in the process of solving a chess or sudoku game in stages, starting from intermediate configurations at certain moments: the solution trajectory (the sequence of collapses) depends on the interaction mind-brain, the configuration (pattern) of the chessboard or the sudoku square, having a different quantum state described by a new wave function after each move. Passing from one pattern to another, the variables of the observables successively pass from random to deterministic, finally resulting in a solved game, that is, the initial quantum reality has transformed into current physical reality. One starts from the initial conditions (initial pattern) and applies the search rule by which the mind optimizes the trajectory of successive collapses. After each collapse (state change), the intermediate result is the initial condition for searching the next collapse.

Levels of reality in systems planning

What seems hasardous on a certain level of reality i, could be deterministic (in term of decision) on other level of reality j, $i \neq j$. As a result, top-down planning must be deterministic, and its bottom-up implementation is probabilistic. The one who plans must know what he wants, and the one who applies the plan must follow it regardless the barriers.
In exploratory and visionary researches, the quantum level of reality k, $i < j < k$,

from which strategies are substantiated through collapse of wave functions, must also be considered. In certain situations, these levels of reality must be hierarchised differently.

Continuous system identification

For the continuous updating of management strategies, it is necessary to continuously identify the system in order to facilitate its planning. A technical system seems to be deterministic, in terms of operation, because it is easy to measure its characteristics and the work environment, it is easy to predict its evolution and technical state, etc. It is more difficult to model the behaviour of the system interfering with the human factor (for example, the human-vehicle relationship), requiring new models of the type of quantum systems. It is also the case of organizational and managerial systems, social or political systems, etc.

The balance strongly leans towards the quantum behaviour in cultural and especially artistic systems, containing many metaphors and abstract elements that change over time. For example, in paintings, most of aesthetic elements and symbols are not explicit, representing sets of perceptible quantum variables and observables (collapsible wave functions) according to the tastes and qualification of the viewers, as well as the time factor (the number of accumulated observations). That is, the perception is different in the short versus long term. The same observer perceives a certain work differently if he sees it as soon as it is exhibited, or after a while, after several viewings, after knowing beforehand the opinions of art critics.

The same considerations are valid in case of project analysis, which makes public debate necessary before approval, as well as quality management of the system in operation, even continuously. These issues should also be considered in artificial intelligence applications, self-learning being a form of repeated collapse of wave functions by observing the quantum process.

The quantum couple (system-environment)

At a certain moment, systems (especially when they also have people integrated in their operation) exist in certain environmental conditions, on a certain level of reality, known differently by each system or individuals. This, conventionally, is the physical reality in which the current state of the systems and the environment make up a quantum ensemble whose wave function reflects the superposition of states of the systems and the environment. The reality is perceived differently from one system to another, in terms of position and other observables, the states of quantum systems being described by certain wave functions on the respective level i of physical reality. The other levels of reality (i+k), are quantum realities from which, through the collapse of some wave functions, physical reality resulted from a given moment. Even the physical reality, being also a quantum reality, substantiated from the other levels (i+k), evolves towards the levels (i-k) through the further collapse of the wave functions. The system travels vertically to different levels of quantum reality, as it advances in knowledge or the level of quantum reality becomes more complex through the development of civilization, increasing the challenges for the whole (system-environment) ensemble, influenced by incoherence too. So, nothing is immutable, everything is in motion, everything is oscillatory. The role of the environment can also be played by the observation tool that modifies the wave function of the states.

The classical vs quantum correspondence principle says that objects obey the laws of quantum mechanics, and classical mechanics is only an approximation of systems of macro objects, i.e. quantum statistical mechanics models on large sets of particles. This principle can provide a method of understanding and accepting quantum concepts by referring to traditional classical benchmarks.
In this context, let's recall some basic notions from quantum reality theory. For a quantum system there is a linear Hermitian operator $\hat{H}$, called the Hamiltonian operator, which determines the time evolution of the wave function through the Schrödinger equation:

$$i\hbar \frac{\partial}{\partial t}\Psi(r,t) = \hat{H}\Psi(r,t)$$

where, ħ is the reduced Planck constant, which has units of action the energy multiplied by time [14].
The probability that the particle is found in position r at time t is defined by the intensity of the wave function:

$$P(r,t) = |\Psi(r,t)|^2 = \Psi(r,t)\Psi(r,t)^*$$

where, $\Psi(r,t)^*$ is the complex conjugate of the wave function.
The Hamiltonian operator corresponds to the total energy of the system, so the eigenvalue equation for it is written in the form:

$$\hat{H}\,\varphi_n = E_n\,\varphi_n$$

where the E_n numbers are the possible values of the total energy.
Knowing the wave function at the initial time, one can determine the wave function of the system at a time t, starting from the explicit form of the operator $\hat{H}$:

$$\hat{H} = \left(-\frac{\hbar^2}{2m}\nabla^2 + \hat{V}(r,t)\right) ,$$

where, m is the mass of the particle, and $\hat{V}(x,t)$ is the potential operator that represents the environment.
In the one-dimensional case 1D, Schrödinger's equation is:

$$i\hbar \frac{\partial}{\partial t}\Psi(x,t) = (-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2} + V(x,t))\,\Psi(x,t)$$

where, the wave function $\Psi(x,t)$ assigns a complex number to each point x at each time t.
A method for solving the differential equation is the separation within the wave function of the x- and t-dependent parts:

$$\Psi(x,t) = \psi(x)\, f(t),$$

resulting in the end the solution:

$$\Psi(x,t) = \psi(x)\exp(-iEt/\hbar)$$

which, is the energy eigenequation of the quantum system. The corresponding solutions have eigenvectors $\psi_n(x)$ with eigenvalues E_n. So, the state of a quantum particle can be described by the superposition of the eigenwave functions of different energy levels:

$$\Psi(x,t) = \sum_n c_n(t)\,\psi_n(x)$$

where, $c_n(t)$ is the probability amplitude of n-th energy state.
According to the principle of superposition of states, if a quantum system can be found in the states described by the wave functions Ψ_1, Ψ_2, ..., Ψ_n, it can also be found in the state described by:

$$\Psi = \sum_i c_i\,\Psi_i$$

The linear combination can have an infinity of terms provided that the respective series is convergent. The sets of orthonormal and complete vectors are called orthonormal basis.

Although, in term of the principle of causality, quantum mechanics and classical mechanics are deterministic theories, in quantum mechanics the state of a system changes both with the passage of time and as a result of measurement is made on the state. The causal description ceases to be valid when the system interacts with the observation (measurement) instrument. Under these conditions, the system is no longer isolated, the properties attributed to the system are properties of the ensemble (quantum system - measuring instrument) and the separate description of the system by the wave function Ψ can no longer be achieved. For this reason, it is not possible to say with certainty in which state the system will be found after a measurement process, but only statistical predictions can be made. It results in a limitation of the principle of causality in quantum mechanics, this not being a completely deterministic theory.

4. The quality of observers

The risk of corrupting observations

Before analysis, the system does not exist. Quantum reality looks different, depending on the measuring instruments. Statistics or simple external examination of the system helps us to know only its behavior and its visible appearance. The identification of the system is based on a model that approximates its structural and functional mechanism. But deeply knowledge about a system is more difficult, especially since people who are integrated into its functioning are also involved. For example, often when someone requests statistical data about a system, the civil servant asks in advance "for what and for whom it is necessary", then delivers the information according to the answers received [15]. If among all the methods of modeling, measurement and analysis of indicators, those that make the system appear to be in accordance with one's interests are chosen, then it results in a reality depending on the client's interest. So, it is better to call different authors to develop several versions for, say, a master plan, and then organise a second round to chose the optimal plan.

The lateral thinking of the observer

Knowing a system from quantum reality is actually a process of observation, investigation of directions and trajectories towards the truth, followed by choosing one of them, collapsing some wave functions and resuming the process in the next phase of identification process, updating the wave function. It results in the gradual revelation of the truth through repeated collapses.

The knowledge process can be improved by different methods such as changing the position of the observer, the angle of approach. That is, something similar to lateral thinking is used [16]. For example, in a real case, the politicized management of a company with majority state owned capital was pressuring a high-performing employee to make him leave in order to leave them a free field of action in the destruction and looting of the company's patrimony. One of the psychological methods of pressure was forcing him to submit a daily report on his own activity. In this context, the employee realized how rich, intense and creative his daily activity was (collapsing the wave function of the image he had in his mind about his work). Moreover, after three months he read his pile of reports, noting the interesting dynamics of his own daily activity, thus identifying how the quantum state of the realization of his projects within the company is gradually revealed. It was confirmed again that "the attackers unwittingly contribute to build the statue of the attacked".

Same effect is achieved through criticism, be it positive or hostile. Literary criticism can reveal aesthetic qualities, impressing even the author of the respective work of art who thus becomes aware of new ineffable values that were in his quantum consciousness.

Similarly, the need for periodic auditing of a company's activity, the implementation of a development strategy, exploratory survey of the future, brain-storming sessions, workshops, conferences, congresses can be supported.

The quantum nature of human consciousness

It has often been mentioned in this work that "a system has quantum behavior, especially when it is integrated with the human factor". Let's explain why.

Many researchers argue that the concerted activity of neurons in the brain generates consciousness from quantum processes on which the collapse of the wave function acts. Each neuron contains microtubules that carry substances to the cells. The theory of quantum consciousness formulated by Penrose and Hameroff claims that microtubules are structured according to a fractal pattern that would allow quantum processes and the complexity of human consciousness.

Hameroff beeing interested in the part played by microtubules in cell division, he speculates that they were controlled by some form of computing. It also suggested to him that part of the solution of the problem of consciousness might lie in understanding the operations of microtubules in brain cells, operations at the molecular and supramolecular level [*17*]. Hameroff's first book [18] argues that microtubules allow for computation sufficient to explain consciousness.

On the similar idea, Roger Penrose had published his book on consciousness [19]. On the basis of Gödel's incompleteness theorems, he argued that the brain could perform functions that no computer or algorithms could, meaning that consciousness itself might be fundamentally non-algorithmic. Penrose argued that non-algorithmic process in the brain required a new form of the quantum wave reduction, later given the name objective reduction (OR), which could link the brain to the space-time geometry. Hameroff suggested that the microtubules were a good candidate site for a quantum mechanism in the brain, and Penrose was interested in the mathematical features of the microtubules lattice. So, the two collaborated in formulating the orchestrated objective reduction (Orch-OR) model of consciousness. Following the collaboration, Penrose published his second consciousness book [20]. Then, Hameroff has been active in promoting the Orch-OR model of consciousness on his lectures.

History with no ifs or buts

Some people, especially among decision-makers, tend to talk about the past in terms of ifs or buts. That is, if there were good conditions for the activity, he would have done more and more. History is not with ifs or buts because it relates facts. Only knowledge of historical facts is probabilistic, even quantum.

Others, sometimes even the same individuals, talk about the future with precision, although this is the area of probable variants, difficult to predict, being quantum. Those who talk about future in deterministic terms substitute themselves to divinity who is the only omniscient about what will happen, as if it happened.

There are also decision-makers who claim that "the future is certain, the present is uncertain, and the past is in continuous transformation". The present can be approximated as certain, relative to the facts known as happened, while the intentions remain uncertain. That is, someone says one thing and performs another thing.

The dynamics of physical reality

It is the result of a collapsing dynamic of wave functions, which makes quantum reality differ from one level to another. For example, if someone, initially in state A, had done B instead of C, then would have happened M instead of N. In this dynamic, the chain A-C-N contains realized collapses, and B and M are collapses of unrealized alternative realities. Different selections of collapses make up as many potential packages that, being realized, make certain forms of reality possible.

The quantum revolution

There are already seeds in the scientific world that will make one of the biggest leaps in human history, the quantum revolution. It is considered that man is an integrated composition of body, soul and spirit. The quantum revolution will approach the knowledge and harmonization of quantum technologies with the human soul, pushing knowledge and, as a result, civilization, to levels of reality hard to imagine today. The quantum revolution will coincide with the migration of human activity into the near cosmic space and will fundamentally change the paradigms of human society. In turn, the quantum revolution will prepare the next technological eruptions with influences in all fields, approaching the ineffable spirit, obviously, without touching it. In order for the huge developments that will come to be beneficial, other fields of thought and activity must also evolve as quickly as possible, such as biology, psychology and sociology, ethics, new forms of social organization, education, etc. Obviously, science will come very close to religion, helping people to understand and glimpse what is "beyond".

5. Conclusions

Approaching systems as objects on different levels of quantum reality can contribute to performing refined analyzes of their activity, as well as to the development of methods and models for creating new flexible structures for their development and planning. That is, systems and services suitable to the new paradigms generated by the knowledge society, artificial intelligence, human integration with systems will be created, to meet the increasingly sophisticated requirements of the markets. In this sense, research must be intensified also in the direction of links between the objects of quantum reality, the pure quantum ensemble, and environment. Such a subject, decoherence, is already yielding results.

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