

## ON EXTENDED QUANTUM-HOLOGRAPHIC FRAMEWORK FOR CONSCIOUSNESS AND FREE WILL: ROUND TRIP FROM SCIENCE TO SPIRITUALITY

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**Abstract.** The subject of this paper is our extended quantum-informational theoretical framework for consciousness and free will. The presented framework might have significant epistemological-cognitive and psychosomatic-spiritual implications, providing better understanding of transpersonal origin of quantum-informational psychosomatic processes in integrative medicine and transpersonal psychology. The paper also provides two appendices: the first one reviews what a psychologist needs to know on our extended quantum-holographic / quantum-gravitational informatics, while the other one presents physical and informational extended glossary for more interested readers.

**Keywords:** Extended Hopfield-like quantum-informational theoretical framework, consciousness, free will, integrative medicine, transpersonal psychology.

### 1. Introduction

*Consciousness* has been the *central theme of philosophical essays* for a long time from the very beginning of philosophical thought, or *traditional esoteric practices* of the East and West which have reached significant level in control of altered states of consciousness with significant *philosophical-religious implications*.

The first scientific attempts to enlighten the nature of consciousness appeared only in *psychology* of the second half of 19th century (through development of psychophysics and theories of personality, and afterwards in 20<sup>th</sup> century through attempts to establish controversial experimental parapsychology, which however have contributed to *holistic climate* for development of *transpersonal psychology* and *integrative medicine* in recent decades [1-3]), in *physics* of the beginning of 20th century (through development of quantum mechanics and articulation of the problem of the so called wave function reduction, and the role of observer in that process), and in *computer sciences* of the second part of 20th century (through development of artificial intelligence and the conception that the whole cognitive process can be reduced to a computer algorithm). In past two decades *Center for Consciousness Studies* of the University of Arizona in Tucson is organizing annual multidisciplinary conferences on consciousness [4], as research on the nature of consciousness comes again in the focus of the world scientific community because of *potential implications* in many scientific fields.<sup>1</sup>

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<sup>1</sup> For instance [5], in *medicine*, it might give rise to enlightening of the role of acupuncture system and consciousness in development of psychosomatic diseases and their prevention and healing. In *psychology*, we could understand mechanisms and roles of altered states of consciousness in the growth of personality, control of creativity, as well as transpersonal phenomena usually accompanying these states. In *biology*, it might appear that limits of interactions between individuals are more provisional than widely believed, which would be of significance not only for adaptive mechanisms on the level of the whole biological species, but even for deeper understanding of the very significance of morals in human population. In *physics*, an understanding of the nature of consciousness and free will could give rise to a deeper understanding of fundamental problems of the observer's role in quantum-mechanical act of measurement, which would demonstrate that consciousness, space, time, and matter are more deeply interwoven than widely believed. In *communications*, an understanding and controlling of transpersonal interactions might radically surpass many traditional barriers. In *computer sciences*, an understanding of the nature of consciousness could give rise to

The paper is organized as follows (with numerous more explaining footnotes throughout). Section 1 introduces the motivation and significance of consciousness studies. Section 2 considers the wave function collapse as a fundamental framework for searching physical origins of consciousness and free will. Sections 3 and 4 review epistemological-cognitive and psychosomatic-spiritual holistic implications of our extended quantum-holographic / quantum-gravitational (QHQG) theoretical framework of consciousness and free will. Section 5 discusses transpersonal global origins of trans-generation holistic programs and spiritual freedoms of their optimization. Section 6 concludes on necessity of global reprogramming of collective consciousness, with shift towards holistic gentle actions for solutions of the world risk society. There are also two appendices: Appendix A comprises information what a psychologist needs to know on our extended QHQG informatics, while Appendix B presents physical and informational extended glossary.

## 2. Wave Function Collapse: On Consciousness and Free Will

When we speak about quantum processes, the term *quantum* refers primarily to the discrete element of energy  $E$  in the *microsystem*, to which the fundamental oscillation frequency  $\nu$  is ascribed, according to the famous Planck formula  $E = h\nu$ , where  $h$  is the Planck constant. This deep relation between discrete energy levels and oscillation frequencies lies in the basis of wave / particle *duality*, characteristic of quantum phenomena. The laws governing these microscopic quantum entities differ from those that govern the everyday classical world, for example, quantum particles can exist in multiple states or multiple locations simultaneously, where such multiple parallel *quantum superposition* alternatives (of which each alternative is measured by a complex number) would be described by a mathematical quantum *wave function*.

From the very beginnings of *quantum mechanics*, the so-called *problem of measurement* was recognized, as a question why we do not observe quantum superposition in *macro-world* as well, where we do not see objects and particles in various locations and in different states. More precisely, the problem of measurement is the *conflict* between two fundamental procedures in quantum mechanics. The first procedure relates to continuous *deterministic* evolution of the quantum state, known as *unitary evolution* (described by fundamental *Schrödinger equation*). The second procedure is applied when *measurement* on the quantum system or *observing* the quantum system is achieved, where the quantum state is *discontinuously* and *probabilistically* replaced by another quantum state, known as a *state reduction* or *wave function collapse* (described by *von Neumann projection postulate*) [6].

This conflict is marked as a *problem of measurement* (perhaps more precisely the *paradox of measurement*), and its problematic nature becomes manifest when we consider the *measuring apparatus itself as a quantum entity*, which is part of the entire quantum system consisting of the original observed system together with this measuring instrument. The apparatus is composed of the same quantum constituents (electrons, photons, protons, neutrons, etc.) as the observed system, and is subject to the same quantum laws and is described by continuous unitary evolution. How, then, can the discontinuous and probabilistic reduction result from the interaction (measurement) between the two parts of the quantum system? It is a paradox that basically indicates that quantum mechanics is still an *incomplete theory*. There are several attempts to solve this paradox, and some include different *objective reductions (ORs)* with a specific objective threshold that causes a quantum state reduction [7,8].

On the other hand, the indeterministic characteristics of *free will* indicate that (related to it) *consciousness* must play an essential role in the *wave function collapse* [6-13], the only indeterministic property of quantum mechanics, which still has *manifestly open problems* of the physical nature of *nonlinear collapse* and relativistically inconsistent instantaneous distant action of the *nonlocal collapse* of the wave function [9-13].

One possible solution of the problem of (nonlinear) collapse is proposed by Penrose [8] in *gravitationally induced OR of the wave function (superposition of quantum-entangled alternatives of*

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computers with artificial consciousness, which would function on deeper quantum-mechanical principles. Finally, in *philosophy* and *religion*, we might radically shift our scientific understanding of some ultimate questions, traditionally remaining outside the domain of theoretical and experimental scientific methods of natural sciences, being therefore a subject of deep and painful irrational divisions throughout the whole history of human civilization.

quantum system ( $S$ ) / measuring apparatus-environment ( $E$ )), in which the gravitational field of  $E$  implies the superposition of different space-time geometries included, and when these geometries become sufficiently different (i.e. gravitational self-energy  $E_G$  of the difference of mass distribution of the superimposed states) this implies the break of standard quantum-entangled superposition of the states  $S / E$  (ill-defined in strictly separate space-time geometries!) and Nature *must choose* between one of them and actually affects *OR* of the wave function for time  $\tau \approx \hbar/E_G$  (inversely proportional to the size of quantum system  $S$ ).<sup>2</sup>

According to our extended *quantum-holographic / quantum-gravitational (QHGG) theoretical model of consciousness* [9-12], the similar *OR* of the wave function might have quantum-gravitational origin in microscopic space-time *wormholes of highly noninertial microparticle interactions* in quantum measurement-like situations (fully equivalent, according to Einstein's *Principle of equivalence*, to strong gravitational fields - in which opening of wormholes is predicted [15,16]). The question how it is possible that these highly non-inertial microparticle processes with inevitable relativistic generation of microparticles' wormholes were not taken into account within quantum mechanics which is yet extremely accurate theory(?) - might be answered as they were(!), but implicitly within the ad hoc von Neumann's projection postulate [6] to account for quantum mechanical *OR* of the wave function in quantum measurement-like situations - implying also that von Neumann's *ad hoc Projection postulate is based on quantum gravitational phenomena* [9-12], on deeper physical level than nonrelativistic quantum mechanical ones!<sup>3,4,5,6,7,8,9,10,11</sup>

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<sup>2</sup> Regarding *non-algorithmic quantum-gravitational aspects of consciousness* [8], Hameroff and Penrose tried to search for *sufficiently isolated relevant macroscopic quantum degrees of freedom* in microtubular cytoskeletal structures of neurons (thus avoiding ultra-short *OR-based 'proto-conscious observations'* of the stochastic environment!), in order to keep unitary evolution of the quantum superposition of microtubules until the time of *orchestrated reduction (Orch OR)*  $\tau \approx \hbar/E_G \approx 25$  ms (characteristic for  $\gamma$ -brainwaves in EEG, neurophysiologically correlated with consciousness), which might produce the moment of consciousness according to the *Orch OR* scheme [7] - which was undergone to severe critiques in Tegmark's paper [15].

<sup>3</sup> Such *macroscopically accumulated exotic OR-induced anti-gravitational imprints* might possibly be observable on cosmological scale (or have been already detected (!) by recent advances in the cosmological tests, that invite again the *Einstein's cosmological constant* and related concept of hypothetical "*dark energy*" or "*quintessence*", which permeates all of space and tends to accelerate the expansion of the universe [17]; cf. also Footnote 6)!!

<sup>4</sup> In this context, it is expected that only on the level of future *Quantum gravitation theory* the nature of '*black holes*', '*wormhole*' tunnels, and '*cosmological singularities*' will be revealed, when on the Planck-Wheeler's scales of length  $\sim 1,62 \cdot 10^{-35}$  m and time  $\sim 0,54 \cdot 10^{-43}$  s the concept of space-time ceases to exist and remains only Wheeler's '*quantum foam*', out of which space-time singularities and surrounding parts of space-time are made [18].

<sup>5</sup> The relic of the aforementioned microscopic processes remained on the macroplane in the transitional states of individual consciousness (as highly non-inertial processes of the space-time quantum-gravitational mentally-channeled tunneling of the displaced part of the acupuncture EM-ionic quantum-holographic neural network), which can be a biophysical basis [9-12] of transpersonal communication [19-24] - in which mental addressing on the target implies unique ontological personal aspect of individual human consciousness [9-12], which is the widespread thesis of Christian religious tradition [25,26].

<sup>6</sup> It should be noted that many *transpersonal phenomena* are even practically incorporated in the *psychosomatic energy correction* (cf. [3] and refs. therein) and that their physical explanation should be sought at the *very border of the existing scientific paradigm*. In our extended *QHGG theoretical framework* of consciousness and psychosomatics [9-12], it is assumed that they are of deeper *quantum-gravitational origin* (in spatio-temporally transcending highly-non-inertial strong-gravitation-equivalent (according to Einstein's principle of equivalence!) *transitional* states of consciousness (from high-dielectric body to low-dielectric out-of-body states!), based on locally generated *wormhole space-time tunnels*, quantum-gravitationally stabilized by so-called *exotic matter* (quantum vacuum fluctuations in strongly curved space-time wormhole tunnels [15]) *with anti-gravitational effects*, really observed in *transpersonal psycho-kinetic manifestations* of vital energy / prana / qi [21-24].

<sup>7</sup> The *exotic aspect of wormhole tunnels and vital energy* might be extended to *acupuncture channels* (with vacuum-like outside inflow of vital energy / prana / qi) - implying that such type of *exotic transpersonal communication* enables *continuously-refreshing interaction between the two mentally-addressed persons* [27]. This *transpersonally stabilizes quantum-entanglement of their acupuncture systems / consciousnesses* i.e. *prevents dis-entanglement* of their

macroscopic quantum-entangled non-stationary states by *OR-like* interaction with their local somatic environments (*contrary to situation in microworld* without such stabilizing mentally-addressing exotic transpersonal effects, where laboratory-created quantum-entangled pairs of particles must be *well isolated from environment* in order to prevent their subsequent quantum-decoherence)!

[Regarding the EM microwave (MW) experiments [28] with unusual vacuum-like  $n = 1$  refraction index of *acupuncture channels* - based on the principles of *photonic crystals* and *photonic bandgap guiding* (where the confinement of photons in some low-index hollow-core 3D-defect might be achieved by exploiting photonic *bandgap reflectivity* of the surrounding higher-index (quasi) periodic medium [29]!) - this inspired us to suggest an interesting possibility [30] to consider *acupuncture channels* as *3D photonic crystal channel waveguides of propagated EM MW photons* (influencing backward the structure and ionic conductivity of the channels) - *confined* by the surrounding higher-index (*quasi*) *periodic cellular body medium* outside channels (of  $n = 5\div 6$  in the cellular cytoplasm and  $n \gg 1$  in the cellular membranes of metabolic depending striking polarization of the volume ion density [31]), with *non-propagated EM MW evanescent photons* [32] pervading our body.]

<sup>8</sup> Additionally, if put in the theoretical context of the fundamental *holographic principle* [33,34], according to which any 3D physical system is *isomorphic* to the holographic information embedded on its 2D surface, then *quantum-holographic informational content of a body* could also be contained in *corresponding surface layer of vital energy of the astral-mental body (aura)*, as has been stated in various traditions - in accordance with our extended QHQG framework for psychosomatics and proposed close relationship of the acupuncture system and consciousness (supported by meridian psycho-energy therapies as well, with the rapid elimination of traumas, phobias, allergies and other psychosomatic disorders, by simultaneous emotional-involved intensive visualization of psychosomatic problems and tapping / touching on prescribed acupuncture points [10,35])! It was also conjectured [34] that volume itself is illusory and that *Universe is really a hologram* isomorphic to information "inscribed" on the surface of its boundary.

<sup>9</sup> Our extended QHQG theoretical framework might also imply that quantum-holographic hierarchical parts carry information about the whole (which resembles the Hindu relationship *Brahman / Atman*, as a whole and the part which contains information about the whole [10-12], allowing subtle *fractal coupling of various hierarchical levels* in Nature [36]. This might be supported by *acupuncture system and its projection zones* (ECIWO holographic concept [37]) and the discovery of *quantum-holographic influence of verbal communication on the expression of cell genome* (by voice-modulation of irradiating-laser beams [38]), as well as by the *origin of the amazing creativities* (Tesla and Mozart as case studies [11,12]) and *predestined life paths and temptations* (as indicated by the contemporary experiences of hypno-regressions [39] as well as experiences of different traditions [19], while still emphasizing that it is *possible to optimize them by spiritual purification*).

<sup>10</sup> According to our extended QHQG framework [9-12], *transpersonal interactions* might be interpreted by *OR-related consciousness-channeled quantum-gravitational tunneling of operator's individual consciousness - mentally addressed on the target's content of the collective consciousness / environment in operator's transitional states of consciousness* (short-lasting and therefore poorly reproducible!) - thus *intentionally channeling state of operator's individual consciousness*:  $|\Phi\rangle_S \rightarrow |\Phi_j\rangle_S$  and *automatically influencing the complement collective consciousness / environment output*:  $|\Psi\rangle_E \rightarrow |\Psi_j\rangle_E$  in *quantum-gravitationally-induced and consciousness-channeled OR*:

$$|\Phi\rangle_S |\Psi\rangle_E \rightarrow \sum_i c_i |\Phi_i\rangle_S |\Psi_i\rangle_E \xrightarrow{p_j = |c_j|^2 \approx 1} |\Phi_j\rangle_S |\Psi_j\rangle_E \quad (1)$$

The above relation is basically description of *quantum entanglement between memory attractors of individual consciousness*  $|\Phi_i\rangle_S$  and *collective consciousness*  $|\Psi_i\rangle_E$  (*quantum-correlated via consciousness-based resonant recognition / interaction of associatively-related attractors of individual and collective consciousness*), followed by *body-induced OR-related stochastic process* (with previously mentally enhanced  $|c_j| \approx 1$  contribution by focusing on  $|\Phi_j\rangle_S$  memory attractor of individual consciousness, cf. Fig. 1(a)). In this respect, the "*gauge quantum field theory and quantum gravity correspondence*" of any quantum entangled system (i.e. Einstein-Podolsky-Rosen correlated quantum pair) and corresponding connected miniature (non-traversable) *wormhole* (i.e. quantum-gravitational Einstein-Rosen bridge) [16] should be pointed out - as note added in proof of our extended QHQG framework for transpersonal interactions via miniature wormholes (on their *possible traversability* in cosmological conditions see ref. [15], while in transpersonal conditions see refs. [9-12]).

[Note that the above expression also describes a much more frequent, *constantly fluctuating*, spontaneous interaction of *individual consciousness with a closer environment*, making that with sensory-focused contents we have the experience of reality as in *normal states of consciousness*! This continuous fluctuation has its analogy in the *quantum biomolecular*

On the other hand, *nonlocality of collective consciousness* [8-12], as a giant space-time associative neural network with distributed individual consciousnesses (related to bodily acupuncture MW ULF-modulated quantum-holographic neural networks, mutually interacting quantum-gravitationally in transitional states of individual consciousnesses), might explain (apparently) *instantaneous action* in (nonlinear) quantum-gravitationally induced and (nonlocally) channeled OR by field-related collective consciousness. At the same time, the analogy of mathematical formalisms of *Hopfield's associative neural network* and *Feynman's propagator version of Schrödinger's equation* [41] - points to *collective consciousness* as a possible *ontological property of the physical field itself* [8-12]<sup>12</sup> with different micro-quantum and macro-quantum excitations (non-biological and biological, real and virtual), which is widely spread thesis of *Eastern traditions* [19-24].

### 3. Epistemological-Cognitive Implications

Our extended *QHQG approach to consciousness and psychosomatics* also implies *two modes of knowledge* (as preserved in many traditions!), according to coupling strength consciousness-body-environment [10-12,27]: (i) *strongly-coupled indirect mode* (in *bodily* perceptively-rationally mediated *classically-reduced stationary normal states of consciousness*, like sensory perception, logic and scientific reasoning...); and (ii)

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*world, between continuously fluctuating non-complementary "states of biomolecular energy" and "states of biomolecular conformation" (and entangling "states of biomolecular environment") [40]!*

<sup>11</sup> It should be pointed out, that in the context of *necessary conditions for decoherence* described by the expression in the footnote above, defining of open quantum system and its environment is - *simultaneous process* - so that in the context of universal validity of quantum mechanics *consciousness is relative concept*, non-locally also influenced by farther parts of existing observing universe (and *vice versa*!), simultaneously creating conditions for the process of decoherence in the context of *existing relative borderline* [9-11]:

$$|\Phi\rangle_S |\Psi\rangle_E \equiv |(partial) individual / collective consciousness\rangle_S / ((complement) environment)_E. \quad (2)$$

This is fully in accordance with the idea of *collective consciousness* as a possible *ontological property of the physical field itself*, with different micro-quantum and macro-quantum (both non-biological and biological, real and virtual) excitations. Then, as *cosmic collective consciousness* (coincident with the "field" of Universe) has its complement "particle" cosmic environment, their strong-interaction-coupling affects *decoherence of the "field" of cosmic collective consciousness* into stationary *classically-reduced (observing) stochastic state*, with probabilities of realizations of corresponding classically-reduced states of cosmic collective consciousness.

[However, note that the *cosmic composite quantum state*:

$$|\Phi\rangle_S |\Psi\rangle_E \equiv |cosmic "field" collective consciousness\rangle_S / ((complement) cosmic "particle" environment)_E \quad (3)$$

*evolves without collapse* (due to absence of the complement outside-cosmic environment!), which implies that *Universe as a whole is presumably quantum hologram* subject to deterministic Schrödinger evolution (in the context of universal validity of quantum mechanics!).]

<sup>12</sup> According to direct mathematical correspondence between classical neural variables (left) and quantum variables (right):  $q \Leftrightarrow \phi$ ,  $q^k \Leftrightarrow \phi^k$ ,  $J \Leftrightarrow G$ , and corresponding Hopfield's classical and Feynman's quantum equations [10,41], it might be realized that *quantum memory attractors*  $\phi^{k_i}(r, t)$  of (any!) quantum system behave as quantum analogues of classical neural activities in space  $r$  and time  $t$  - implying that *wave functions*  $\phi^{k_i}$  ( $i = 1, \dots, P$ ) at *space-time points*  $(r, t)$  are behaving fundamentally as *P-dimensional parallel neural quantum processors* (notice also their difference in respect to usually exploited *2-dimensional qubits* in quantum informatics).

[This allows successive reconstruction of the wave functions of the memory states at the output of quantum-holographic Hopfield-like neural network (complete, of both amplitude and phase) in recognition of the wave function of the previously memorized state displayed again at its input (which is the basis of every holography, but everything here is simpler than in the standard laser holography, which requires so-called coherent reference & object laser beams). It should be added that practical requirements for 2-qubit quantum computers are very demanding, with low tolerance ( $\sim 0.1\%$ ), which will require operation at very low temperatures ( $\sim \mu K$ ) to eliminate thermal noise, as well as high degree of isolation from environments to eliminate the effects of decoherence. Due to its mode of operation (where the decoherence by the environment is included in their very information processing), the quantum-holographic Hopfield-like neural networks are significantly more robust and more resistant to the above requirements - with possible operation at room temperature (like biological acupuncture system / consciousness)!]

*weakly-coupled direct mode* (in *out-of-body* spiritually-creative *quantum-entangled non-stationary transitional states of consciousness* / *quantum-coherent stationary altered states of consciousness*, like prayer, meditation, daydreams, lucid dreams, deep creative insights...) - with conditions of mutual transformation [10-12] (cf. also Fig. 1 and footnote 18).<sup>13,14,15,16</sup>

<sup>13</sup> This implies the *generally poor informational rationalization* of any direct quantum-holographic spiritual / religious mystical experience (as *OR-like collapse of the implicate order of quantum-entangled (quantum-holographic) superposition of states of individual and collective consciousness into the explicate order of observed classically-reduced states of individual and collective consciousness*) - which differ from tradition to tradition! On the other hand, the *consensuses of the mystics of the same tradition of a similar partial rationalization of mystical experiences* could be understood as *part of the same dominant-channeling trans-generational contextual heritage of members of the same tradition* (because we are not born as so-called *tabula rasa*, as being indicated by contemporary experiences of hypno-regressions and experiences of different traditions as well, cf. also Fig. 1(b)!).

[So science is closing the circle, by re-discovering two different modes of knowledge and at the same time setting its own epistemological limitations [10-12] - as preserved for millennia in *shamanistic tribal traditions*, which consider that true reality is represented by lucid dreams, and that the waking state is an illusion [20,21], or as concisely described by *Patanjali in Yoga Sutras* more than two millennia ago, pointing out that mystical experience (*samadhi*) is "filled with truth" and that it is "above inference and the scriptures" [42], or as formulated at the beginning of the last century by *Berdyaev in Philosophy of Freedom* as the difference of two modes of knowledge, prayer-mediated "comprehension of affairs invisible" and rationally-mediated "comprehension of affairs visible" [43]!]

<sup>14</sup> In addition, necessity of direct quantum-holographic coupling of individual and cosmic collective consciousness in an observation of the implicate order might need weak *out-of-body quantum-communication coupling consciousness-environment*, i.e. previous *reprogramming of almost all psychosomatic loads* (cleansing of the possessive or hedonistic emotional-mental sinful / karmic connections with world - which as loading "mental addresses" would give rise to quantum projections of the mentally-channelled tunnelled consciousness upon the out-of-body environment, and thus to classically-reduced *out-of-body stationary extrasensory observing* of the mentally-addressed environment). In this context the efforts of mystics of all traditions to *purify consciousness / soul via spiritual practice* (prayer, meditation...) and thus to reach their *final eschatological goal* (Kingdom of God, nirvana...), i.e. *post-mortem salvation of soul* (non-bounded sin-free / karmic-free) by *re-union (re-ligare / yoga)* with the *supreme God* [23] might appear reasonable!

[But it still would leave room for *personal love*, whose highest manifestation is ability and readiness for *permanent and unconditioned forgiving* (to loving person, and because of him / her to everybody else, including enemies!), in spiritual prayer and (subtly related quantum-holographic) living practice; the same refers to love for relatives and friends [10,11].]

<sup>15</sup> A nice example of the description of *two modes of knowledge* is also found in Mexican *Jaki tradition* [44], as two types of reality, *tonal* (sensory-perceived in the normal state of consciousness) and *nagual* (extrasensory-perceived in altered states of consciousness, with "silver ribbons" of vital energy that transpersonally connect us with our environment). Something similar is also mentioned in African-Haitian *voodoo tradition* (in which visualization deliberately can create a "silver ribbon" between the operator and the victim) [45] - which naturally exists between mother and child, and is spontaneously created by the intensive exchange of vital energy between relatives, close associates, current and former lovers, friends and enemies, and even *post mortem* can survive between living and deceased persons).

<sup>16</sup> It should be added that *transpersonal esoteric concepts of different spiritual traditions* [23] - might be accounted within our *extended QHOG approach* (with elaborated psychosomatic relationship consciousness / acupuncture macroscopic quantum-holographic Hopfield-like EM-ionic-exotic associative neural network [10,11,27]): (i) *astral body* (*manomaya, lingasarira, manovijnana, ka, psyche, nephesh, nafs, subtle body, psychic body, soul...*) - versus ionic component of the out-of-body displaceable EM-ionic-exotic macro-quantum acupuncture system (connected with the body by miniature "wormhole" space-time tunnel, generated in the highly-non-inertial transitional states of consciousness, as frequently observed in non-stationary extrasensory near-death experiences); (ii) *mental body* (*vijnanamaya, suksmasarira, manas, ba, thymos, ruach, ruh, noetic body, spiritual body, mind...*) - versus EM component of the out-of-body displaceable EM-ionic-exotic macro-quantum acupuncture system (embedded within ionic component of the out-of-body displaceable EM-ionic-exotic macro-quantum acupuncture system); (iii) *distributed centers of consciousness* (*chakras, acupuncture points, sephiroths, holy discs...*) - versus EM-ionic-exotic condensations in the structured out-of-body displaceable EM-ionic-exotic macro-quantum acupuncture system; (iv) *vital energy* (*chi / qi / ki, prana / akasha, mana, ka, pneuma / ether / natura medica / anima mundi, yesod, baraka, the Holy Spirit / Uncreated Light, Heilstrom, Innate Intelligence, bioenergy / biofield...*) - versus EM-ionic-exotic macro-quantum condensates (unstructured / structured, virtual / real) within acupuncture channels (with possible generalization from the EM field to the unified field, in line with the broader traditional meaning of vital energy, as all-pervasive cosmic quintessence).

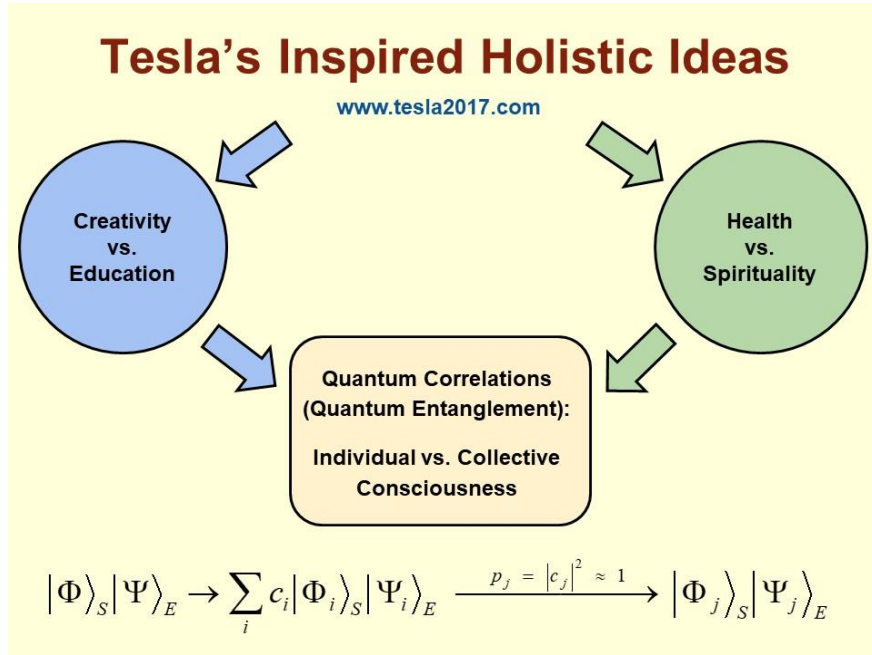


Figure 1. (a) Symbolic representation of *mentally controlled-directed increasing* of macro-quantum correlations of individual and collective consciousness in *transpersonally-entangling creative phases* (left-hand side of the image and formula above, with previous mental increase of the focused weight contribution  $c_j$  and subsequent (practically non-stochastic) classically-reduced selection of this dominant weight contribution  $c_j$ ) [11,12]; and (b) Symbolic representation of *mentally controlled-systemic decreasing* of macro-quantum correlations of individual and collective consciousness in *transpersonally-disentangling spiritual phases* (right-hand side of the image and formula above, with previously systemic mental decreasing of almost all weight contributions  $c_i$  and subsequent (practically non-stochastic) classically-reduced selection of the remaining dominant weight contribution  $c_j$  (related to mentally-embedded address on the founder of the corresponding mystical tradition) [11,12].<sup>17</sup>

[Aforementioned consensus on the *transpersonal esoteric concepts* in different spiritual traditions, demonstrates that acquired information in their transpersonal extrasensory perceptions may give rise to *non-distorting OR-like stationary extrasensory perception* of their mentally-addressed out-of-body environments of collective consciousness (in Tesla-like creative way [10-12]!) - in contrast to *non-stationary mystical states of consciousness* (with *distorting OR-like non-stationary collapse of the implicate order of quantum-entangled (quantum-holographic) superposition of states of individual and collective consciousness into the particular explicate order of the observed classically-reduced states of individual and collective consciousness, related to corresponding mystical tradition*).]

<sup>17</sup> In the context of *creative insights and incredible Tesla inventions* (directly visualized in his consciousness with the details of the functioning of the devices, without any application of Maxwell's electromagnetics!), it is interesting to consider the *possibility of controlling creative processes* within our extended QHQG theoretical framework [11,12]. They predict *transpersonal properties* of psyche in short-lasting *quantum-entangled non-stationary transitional states of consciousness* (with subsequent *OR-reduced stationary extrasensory perception of the previously focused mentally-addressed out-of-body complementary environment*, which may also be Jung's "archetype" of the *problem-with-solution at the level of quantum-holographic collective consciousness*, which raises associations on Tesla's "mental inventions" and Plato's "world of ideas" as well). After returning of the displaced consciousness upon the body, in order that *transpersonally acquired information ascends to the level of normally conscious state*, it is necessary to *overcome two filters*: (i) *acupuncture system / nervous system threshold filter* (which requires "emotional colouring" of the solving problem) and (ii) *frontolimbic amplification filter* (which requires "emotional-thinking priority" of the solving problem).

[According to our investigations, all mentioned conditions might be realized in quantum-coherent stationary state of *waking meditation* (by entering in this prolonged altered state of consciousness, with mental addressing on the solved problem) - which Tesla has been doing by *persistent mental focusing* on the solving problem! On the other hand, during the *sleep state* the mentioned conditions might be realized in quantum-entangled non-stationary transitional states of *falling asleep* and quantum-coherent stationary states of *REM-sleep* (with previous *intense concentration* on the solving problem before sleep & subsequent *amplification* of the obtained classically-reduced answer in the form of symbolic dream, which should be then *correctly interpreted* in the context of personal internal symbolism) - *widely applicable*



This is in line with *re-awakened interest* in fundamental and applied *holistic research* in past decades, anticipating the occurrence of *grand synthesis of two modes of knowledge* in the framework of *extended QHOG paradigm* - where the role of each individual becomes *indispensable* due to influence and care for *collective mental environment and social well-being*.

And can help us realize that *all our partial rationalizations* (classically-reduced mappings!) *are just approximations of fundamentally-holistic reality* (quantum-holographic territory!), *and that all divisions are tragic misunderstanding of spiritually immature epoch of civilization* (as map is not the territory!).

All this indicates the *full significance of holistic education and behavior* - demonstrating ultimate necessity of *redefining the global educational / informational / political goals*, with the shift towards holistic gentle actions for global solutions of the world risk society.

#### 4. Psychosomatic-Spiritual Implications

Holistic approach to *integrative medicine* and *transpersonal psychology* is of particular importance because of their ever-increasing use in developed countries [1-3] - since modern research into psychosomatic diseases indicates the need to apply *holistic methods* (with a focus on body's *acupuncture system and consciousness* [3,10-12]), oriented to treating a *person as a whole* (including mental environment), implying their *macroscopic quantum origin*. According to our extended *QHOG approach*, the healthy psychosomatic state (of (open) acupuncture system / consciousness) is considered as simplest informational state of the lowest quantum entropy (with single memory attractor), while disordered psychosomatic states are considered as more complex states of the higher quantum entropy (with additional side memory attractors, cf. Fig. 2).

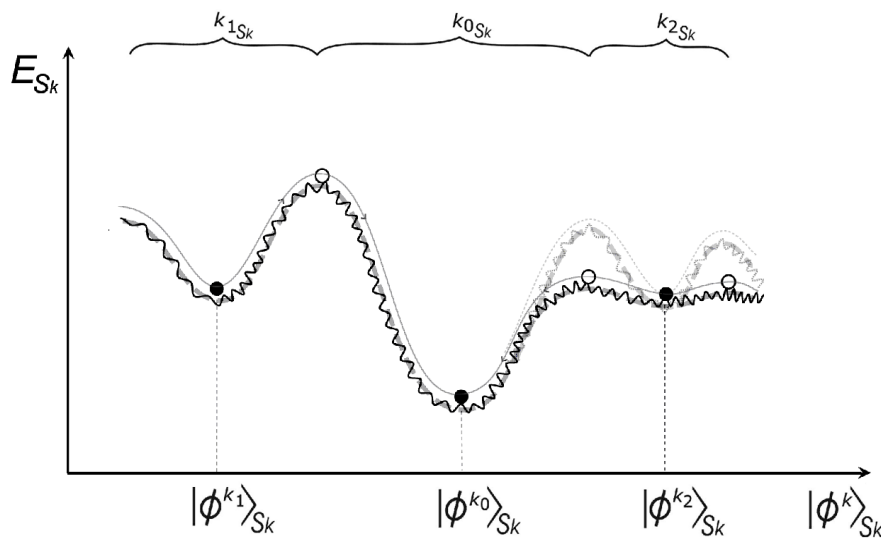


Figure 2. Schematic presentation of the adaptation of memory attractors in the energy-state hypersurface of the quantum-holographic memory / propagator of various hierarchical levels of biological macroscopic open quantum system(s)  $S_k$  [10,11,46] (local cell's biomolecular protein / target, local acupuncture system / consciousness, or nonlocal out-of-body consciousness / collective consciousness). This implies necessity of quantum-informational successive bioresonant balancing of all unwilling side memory attractors (like  $\phi^{k_2}$  in Fig. 2), which would otherwise

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even to meditation-non-trained persons! Of course, for solving conceptually complex *scientific problems* it is necessary to be an *expert* in the corresponding field, in order to *scientifically rationalise a solution* representing scientific shift.]

[The same might be applied to *artistic creative experiences* and their subsequent *artistic expressions* (Mozart as an excellent example!), while very *art-works* then behave like *mental addresses of "archetypes"* being in contact with artists in mentally-addressed transpersonal communications during the acts of creation. Then *deep artistic experiences of the public* might have strong *spiritual note* too, through *spontaneous mental addressing of the artistic public on the masterpeace* and emotionally-induced *excitation into transitional state of consciousness*. Finally, this could similarly be extended to *deep spiritual experiences of the believers* with their *mental addressing on holy icon / relic* & emotionally-induced *excitation into transitional state of consciousness*.]



cause development of psychosomatic diseases on the individual level, and interpersonal fights in this and further generations on the collective level.<sup>18,19</sup>

Thus, all holistic acupuncture-based and consciousness-based approaches and techniques could be treated as quantum-informational therapies, by imposing new healing boundary conditions in the energy-state space of the (open) acupuncture system / (individual and collective) consciousness - implying *three fronts lines of integrative medicine* in top-down order, according to our extended *QHQG approach to psychosomatics* [10,11,46]: (i) collective consciousness;<sup>20</sup> (ii) acupuncture system / individual consciousness;<sup>21</sup> and (iii) somatic level. It should be pointed out that *necessary activities* in the second and

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<sup>18</sup> It should be noted that Nature presumably has chosen elegant room-temperature solution for quantum-holographic information processing, fluctuating between quantum-coherent and classically-reduced states of (open) biological macro-quantum system(s)  $S_k$ , via non-stationary bioresonance interactions with out-of-body farther environment and decoherence by bodily closer environment - by adaptation of corresponding quantum-holographic memory / propagator [10,11,46] (with *time-adapting density of states of (open) macro-quantum system(s)*  $S_k$ , represented by corresponding depths of minima like in Fig. 2):

$$G(r_2, t_2; r_1, t_1) = \sum_{i=1}^P \phi^{k_i}(r_2, t_2) \phi^{k_i*}(r_1, t_1) = \sum_{i=1}^P A_{k_i}(r_2, t_2) A_{k_i}^*(r_1, t_1) e^{\frac{i}{\hbar}(\alpha_{k_i}(r_2, t_2) - \alpha_{k_i}(r_1, t_1))} \quad (4)$$

Thus quantum neural holography combined with quantum decoherence might be very significant element of the feedback bioinformatics, from the level of cell - to the level of organism - and further to the level of collective consciousness, with backward dynamic influence on the expression of genes.

<sup>19</sup> Further on, by considering *psychosomatic state* in generally mixed quantum state of density matrix:

$$\hat{\rho}_S = \sum_i |c_{k_i}|^2 |\phi^{k_i}\rangle_S \langle\phi^{k_i}| \equiv \sum_i p_{k_i} |\phi^{k_i}\rangle_S \langle\phi^{k_i}| \quad (5)$$

(where  $p_{k_i}$  are probabilities of realization of the  $k_i$ -th quantum state), then von Neumann's quantum-mechanical entropy  $S = -k_B \text{Tr}(\hat{\rho}_S \ln \hat{\rho}_S)$  is reduced to classical Shannon's entropy  $S = -k_B \sum_i p_{k_i} \ln p_{k_i}$  [10,11,46]. So, within our extended *QHQG* theoretical framework, *entropy* of pure-healthy state of the psychosomatic system (described by the single  $k_0$ -th term in the superposition, of probability  $p_{k_0} = 1$ ), would be  $S_{k_0} = 0$  (as pure quantum state  $\hat{\rho}_{S_{k_0}}^{(k_0)}$  provides maximal possible information about the quantum psychosomatic system), while entropy of mixed-disordered state of the psychosomatic system (described by the full above superposition), would be  $S_{\hat{\rho}} > 0$  (as mixed stochastic state  $\hat{\rho}_{S_{kv}}^{(k)}$  provides uncomplete information about the quantum psychosomatic system). So, we plausibly obtain that healthy psychosomatic state is the simplest informational state of the lowest quantum entropy (with single memory attractor), while disordered psychosomatic states are more complex states of the higher quantum entropy (with additional side memory attractors, cf. Fig. 2).

<sup>20</sup> Since there is no out-of-cosmic environment to push on non-unitary-OR a quantum-entangled state of the field-related cosmic collective consciousness and the complementary 'particle' cosmic environment, the *proposed mechanism of prayer (intrinsically non-unitary)* sets the necessary new boundary conditions without mutual mentally-loaded addresses - so it can really be said that an *all-forgiving prayer* represents a biophysical basis for the optimization of (quantum) holistic global psychosomatics of collective consciousness (and complementary incoming individual and collective events) [10-12]! Let us add that both traditional and modern experiences of local and transpersonal energy healing [3] (by vacuum-excited spiritually-purifying new macro-quantum portions of vital energy and their subsequent mentally-channeled transfer), indicate that *meditative visualization* (intrinsically non-unitary) imposes new (OR-similar) quantum gravitational boundary conditions (however, in contrast to prayer, it would not eliminate simultaneously all mentally-loaded addresses, but would balance energy-informationally only one particular client. Therefore, in such situations, it is necessary to do *circular meditative-healing visualization from all meta-positions involved in the existing conflict*, thus eliminating simultaneously all mentally-loaded addresses)! Hence, in the context of our QHQG theoretical framework, *spiritual prayer / meditation practices* represent a non-unitary source of free will at the level of collective consciousness, which evolutionary increases the responsibility of every individual and the whole human race!

<sup>21</sup> The goal of these local acupuncture-based and consciousness-based procedures and approaches would be a bioresonant excitation of the psychosomatically disordered state (acupuncture palpatory-painful / psychologically traumatic) - thus enabling that its initial memory attractor is bioresonantly excited (similar to annealing procedure in neural networks [48]) becoming shallower and wider on the account of deepening of the (energy-dominating) attractor

third levels, with *neglect of the first level*, would result in *further transpersonal transfer of memory attractors* on the level of individual and collective consciousness in this and future generations. So, this implies necessity to focus on the *origins of many psychosomatic problems* on underlying *prenatal trans-generational levels* (cf. [47] and refs. therein).

## 5. On Trans-Generation Programs and Freedom of Optimization

Michael Newton, a famous American transpersonal hypno-regression-therapist, writes about a number of psychotherapeutic experiences of post-hypnotic regressions, with systematized messages of his clients that our major life lessons and opportunities to optimize otherwise predestined life-programs are lying in spiritual sphere of purification [39]. Reading of Newton's book(s) brought me a special pleasure, due to many important *associations and implications* on correspondence of the *described experiences and theoretical predictions* of our extended QHQG framework [47]: (i) *transpersonal-spiritual tunneling as exclusive communications, without space-time barriers* (in accordance with our theoretical predictions); (ii) *soul transpersonally chooses a pair of prospective parents, among several offered alternatives previously carefully observed with all details of a future life* (indicating that life is predestined on the physical level by existing boundary conditions at the level of cosmic field / collective consciousness); (iii) *by made choice of the parents, life is not completely fixed, but can be optimized by spiritual means, repenting and forgiving to ourselves and others* (bringing new boundary conditions at the level of cosmic field / collective consciousness, which points to fundamental importance of spirituality as a source of the greatest freedom for optimizing otherwise predestined life-programs, and necessity of careful control of reactions on current life-temptations in order to avoid further deepening of the existing conflicts); (iv) *although the aforementioned experiences evoke strong associations on reincarnation, some of the reported insights suggest the possibility of transmission of information of the same content into several persons during their overlapping lifetime periods* (implying a trans-generational transfer of accumulated information, with experiences that transferred contents leave a strong impression of the previously lived lives).

So, in the context of aforementioned *trans-generationally-predestined quantum-holographic structure of collective consciousness* (as suggested by the experiences of tribal traditions, and traditions of the East and the West as well), *it seems irrational not only to be angry at life program* (previously freely chosen prenatally), but it is also irrational not to optimize it (spiritually-accepting and forgiving ourselves and our environment) - *contributing to both our own spiritual growth and catharsis of our trans-generational mental environment* (which is fundamental question of both mental hygiene and civil decency i.e. both spiritual and civil morality)!<sup>22,23,24,25,26,27,28</sup>

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of healthy (*acupuncture palpatory painless / psychologically traumatic-free*) state [10-12,46] - which is then altogether quantum-holographically projected on the lower quantum-holographic cellular level, thus changing expression of genes.

<sup>22</sup> It is hereby instructive to mention Buddhist interpretation of *karma*, which occurs not as a *result of our spontaneous reaction* to the current situation in life, but as a result of the *latter justification of our conscious reactions against the others* in this situation [49]! In the context of the above mentioned *quantum-holographic predestined life programs*, this is fully justified because we all (*non-consciously*) *react to current conflicting-encoded life-situations* (several hundred milliseconds before we become aware [50]!), but immediately afterwards we have a chance to (*consciously*) *permanently untangle the existing trans-generational conflict by penitent-all-forgiving prayer*. This is *quite fair spiritual opportunity* - and up to each person is either to use it or not - with accompanied either unloading or overloading trans-generational conflicts!

<sup>23</sup> That might be possibly the reason for *Christianity* to insist on *repenting and forgiving* ('*And forgive us our debts, as we forgive our debtors*', Mt.6,12), which represents a level of spiritual maturity of a person. This implies an obligation of spiritually mature persons to help in reprogramming mental / emotional conflicts by praying, even when themselves being victims of the conflicts ('*But I say unto you, love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you, and persecute you*', Mt.5,44). It is not even allowed to see evil in fellow-men and condemn them (an old biblical commandment given to the man in paradise, forbidding to take food '*of the tree of the knowledge of good and evil*' – in fellow-men - '*for in the day that you eat there-of you shall die*' (Gen.2,17), whose violation has caused the *Adam's fall*, and sowed the seed of the growing '*terror of history*'), insisting only on *personal repenting and forgiving*, as the only way in *permanent reprogramming of psychic conflicts*. Anything else would enhance the existing mental / emotional personal loads and enlarge evil in the world, dismissing an

## 6. Conclusion

The above research is in line with awakened scientific interest in researching the nature of consciousness in past decades, with indication of the *grand synthesis of two modes of knowledge* - where the

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individual and humankind from the final spiritual ideal of sinless state of consciousness – an old biblical commandment after Adam's fall (*"The man has now become like one of us, knowing good and evil. He must not be allowed to reach out his hand and take also from the tree of life and eat, and live forever."* (Gen.3,22)).

<sup>24</sup> Bearing in mind the role of a mentally loaded contents in the *post-mortem spiritual evolution of the soul* of the dying (let us mention transpersonal collective levels of consciousness of *Bardo levels* in Tibetan tradition [51] or *aerial toll house* in Christian tradition [52]) - this implies importance of prayers for soul of the deceased with ability not only to *influence its spiritual evolution*, but also *trans-generational preferences for individual and / or collective future offspring* (with possibility of even *retroactive-nonlocal trans-generational dis-entangling / un-binding of mental / emotional conflicts*, as suggested by *experiments with prayer* [20] - bearing resemblance to quantum delayed choice experiments [53], and pointing additionally to quantum roots of consciousness)!

<sup>25</sup> We also mention some tribal traditions where initiated shamans ritually enter the altered states of consciousness and receive answers to the health problems of members of their tribes, and apply their healing methods based on reprogramming the loads on the level of tribes' collective consciousness (like in South America *Ayahuaska tradition* [54], or Nigerian *Abiku tradition* [55], with fascinating spiritual diagnosis and subsequent extension of the predestined-short-life programs; or like in Hawaiian *Ho'oponopono tradition* [56], based on the *participatory* concept of taking full *responsibility for any circumstance* in which we find ourselves and *repenting and forgiving ourselves* in the context of disturbing life situations, with fascinating successes in reprogramming *ourselves and our environment*). In this context, I have to mention an incredible experience of my cousin Milica, with (epi) genetically conditioned high-risk pregnancy of very low level of amniotic fluid, normalized in just a few days of ho'oponopono prayer practices, with subsequent normal delivery!

<sup>26</sup> On the same line, we mention the contemporary spiritual teaching of Bruno Groening (1906-1959), the greatest *faith healer* of the 20th century, renown in Germany for biblical cases of miraculous mass healings during 1950s, whose fascinating *divine healing channel* is remained open after his death via spreading activities of his Circle of Friends all over the world [57]. Groening teaches that one can maintain health and heal from illness by *absorption of a divine life force* (germ. Heilstrom, most similar to Christian notion of Holy Spirit [23]) in upright position with arms and legs uncrossed and palms facing upwards, *keeping strong faith* in healing after mental request to Groening *to take all his/her/its burdens!* He never took credit for the healings, saying that he was only an instrument of God, regardless of persons' religion or nationality. Groening claimed that individual healing was only 5% of his spiritual effects, while the rest 95% was devoted to Great Reversal of humanity (this being very efficient way to optimize not only individual but also collective life programs!).

<sup>27</sup> We also mention the *fascinating world bestseller confession* of Anita Moorjani [58] *on spiritual changing her life program*, in which she decided to change her previous life program (and thus forgive herself and her grieving husband) and to continue to live - with return from clinical death and after a few weeks even *spontaneous healing of terminal phase of cancer*. This greatly contributes to our understanding that even *most difficult psychosomatic illnesses*, like cancer, *have their roots in the energy-information blockages and that healing begins by removing them* - first lovingly to ourselves, accepting ourselves and forgiving ourselves, which is then manifested by love to others and acceptance of others (e.g. by spiritually dis-entangling / un-binding repentant-forgiving prayer [10-12,59])! See also [60] with more details on recommended holistic anti-stress approaches and techniques!

<sup>28</sup> Finally, we mention the experience of Jon RG (John-Richard - 50 years ago) Turner [61]: Some 50 years ago, I was living in Los Angeles, California. I was producing and hosting a talk show *Holistic Viewpoints, Expanding Consciousness* on KPFK-Pacific Radio in Hollywood. At the same time, I had a psychotherapy practice in Beverly Hills. I was getting referrals of patients who had been declared incurable. Sitting at my marvelously carved Mexican desk, I closed my eyes and asked my Whole-Self what I could possibly do to assist these patients who had failed to find homeostasis after 5, 10, some even 20 years of various therapies. What entered my mind were the words "If you will take each person back to the period before they were born each will experience rapid healing!" With this instruction from my Whole-Self, I pioneered in reawakening and releasing the psychic memories each person had from before conception through after birth. What those patients discovered, in the first person is: *Not only am I the synthesis of my parent's genetic DNA coding which gave me my physical characteristics, I am also the synthesis of their energetically charged thoughts and emotions during their pregnancy which gave me my mental and emotional characteristics: my Whole-Self emotional DNA© (W-S eDNA©)*. The healing came from the recognition that the trauma feelings were the result of their mother's event not something they had done.

*role of each individual becomes irreplaceable due to influence and care for collective mental environment - leaving the largest space for free will and fundamentally enhancing significance of spiritual morality.*

Thus *civilization*, via *synthesis* of scientific knowledge in the field of *consciousness* and millennia experiences of the *spiritual traditions*, could contribute that new millennium would be characterized by *wisdom*. *Decisive* role in this process could play all *religious communities and spiritual practices*, *cultivating* a true *spiritual moral* and absolute inter-personal, inter-ethnic and inter-religious *tolerance*, as a measure of individual behavior from the *perspective of death*, i.e. amount of generated and non-reprogrammed psychosomatic conflicts until death, which determines the *spiritual evolution* of the soul of the deceased as well as the *preferences* of the individual and / or collective future of the descendants - that can be *significantly altered via collective prayer and acceptance of ourselves and our neighbors and enemies*, and hence *global reprogramming of collective consciousness*.

This indicates *full significance of holistic education and behavior* - with *necessity of redefining global educational / informational / political goals* [62,63] - and shift towards *holistic gentle actions for global solutions of the world risk society*.

## **Appendix A. What A Psychologist Needs To Know On Extended QHQG Informatics**

I recommend the book *Holographic Universe* to all interested in the phenomenology of various states of consciousness, with numerous well-documented mysterious phenomena in altered states of consciousness [21]. In this book, Michael Talbot relies heavily on the works of famous quantum physicist David Bohm and neurophysiologist Karl Pribram, who point out that the Universe could be a giant quantum hologram, the type of mind construct at the boundary of a subject / object - by relativizing the question of whether objective reality exists or constantly fluctuates between implicate and explicate orders? The book suggests that many well documented mysterious phenomena, like synchronicity and precognition, extrasensory perceptions and out-of-body experiences, psychokinesis and teleportations, miraculous healing and mystical religious experiences - could be explained within the (still controversial) holographic paradigm (cf. Glossaries B.1 - B.3). The reading and presentation of this book brought me great personal satisfaction, for my own research of quantum basis of consciousness and holistic psychosomatics and their implications [10,12,46,47] (with numerous empirical / rational assertions, I recognized associatively by reading a book).

As an extraordinary case study, we mention *Tesla's extraordinary creative experiences in his altered states of consciousness* (categorized in his time as nonphysical phenomena) - with Tesla's conviction "when we start to study nonphysical phenomena, we will progress more in ten years than we have for centuries". In this context, it seems that Tesla's legacy for the new millennium is introspective evidence of his transpersonal creative communications [11], with fascinating possibility of his *meditative eidetic control and increase of macro-quantum correlations with the quantum-holographic primal source of collective consciousness* (cf. Fig. 1(a) and Footnote 17). It could serve as a case study for understanding biophysical basis of both *transpersonal psychology and control of creative processes*, based on *subtle interplay of normal and transitional and altered states of consciousness in meditation and sleep*, and may help in *developing future strategies for education* [11,12]. These phenomenological insights could also serve as an additional confirmation of our *extended QHQG theoretical framework of consciousness and psychosomatics*, based on the *systemic reduction of quantum entropy and macro-quantum correlations between the acupuncture system / individual consciousness and collective consciousness* (cf. Fig. 1(b)), which could help in *developing future strategies for integrative medicine and transpersonal psychology*; and in wider context, these insights could provide inspiration for *rethinking global educational / informative / political goals* - with reorientation towards *holistic gentle actions for global solutions to world's risk society* [11,12].

According to *prevailing scientific paradigm*, information processing within the central nervous system is occurring through *hierarchically organized and interconnected neural networks* [10]. It seems that this hierarchy of biological neural networks is going down sub-cellular *cytoskeleton* level, being according to some scientists a kind of interface between *neural* and *quantum* levels [7]. On the other hand, as *any quantum system in Feynman's propagator version of quantum mechanics* has formal mathematical

structure of the *quantum-holographic Hopfield-like associative neural network* [10,41] (cf. Footnote 12 and Glossaries B.4 - B.6) - then closely related macro-quantum *acupuncture-based and consciousness-based memory attractors* can be treated as psychosomatic states *representing quantum holistic field records* (cf. Fig. 2)! So, within our *extended QHQG theoretical framework*, the healthy psychosomatic state is the simplest informational state of the lowest quantum entropy (with single memory attractor), while disordered psychosomatic states as more complex states (with additional side memory attractors) are of the higher quantum entropy (cf. Footnote 19 and Glossary B.6).

Then, according to our *extended QHQG theoretical framework* all holistic acupuncture-based and consciousness-based approaches and techniques could be treated as quantum-informational therapies, by imposing new bioresonantly exciting healing boundary conditions in the energy-state space of the (open) acupuncture system / (individual) consciousness. However, when this process is hindered by transpersonal entangled blockages in the energy-state space of EM field of the (open) acupuncture system / (individual and collective) consciousness - then memory attractors of quantum-holographic network of the field-related collective consciousness should be removed as well (via bioresonantly exciting prayer or circular psychotherapies from all relevant meta-positions included in the problem, to disentangle energy-informationally all mental addresses included in the problem, with final goal to achieve permanent healing i.e. spiritual integration of personality [10,46]). So, this implies necessity to focus on the *origins of many psychosomatic problems* on underlying *prenatal trans-generational levels* (cf. [47] and refs. therein).

Further on, according to our *extended QHQG theoretical framework* [10-12], *physical explanation of transpersonal phenomena without space-time barriers* (even practically incorporated in psychosomatic energy-corrections [3]) - presumably might be sought in combination of *quantum-gravitational-like transitional states of consciousness and Principle of equivalence and objective reduction (OR) of quantum wave function* (cf. Eq. (1) in Footnote 10, and Glossary B.4). This relation is basically also description of *quantum entanglement between memory attractors of individual  $|\Phi_i\rangle_s$  and collective consciousness  $|\Psi_i\rangle_E$  (quantum-correlated via consciousness-based resonant recognition / interaction of associatively-related attractors of individual and collective consciousness), followed by body-induced OR-related stochastic process (with previously mentally enhanced  $|c_j| \approx 1$  contribution by focusing on  $|\Phi_j\rangle_s$  memory attractor of individual consciousness* (cf. also Fig. 1(a)).

In this respect, the "*gauge quantum field theory and quantum gravity correspondence*" of any quantum entangled system (i.e. Einstein-Podolsky-Rosen correlated quantum pair) and created miniature (non-traversable) *wormhole* (i.e. quantum-gravitational Einstein-Rosen bridge) [16] should be pointed out (cf. Glossaries B.7 - B.10) - as note added in proof of our extended *QHQG framework* for transpersonal interactions *via* miniature wormholes (on their *traversability* in cosmological conditions see ref. [15], while in transpersonal conditions see refs. [10-12]). Note that Eq. (1) in Footnote 10 can also describe a much more frequent, *constantly fluctuating*, spontaneous interaction of *individual consciousness with a closer environment*, making that with sensory-focused contents we have the experience of reality as in *normal states of consciousness* (cf. also Glossary B.2). This continuous fluctuation has analogy in the *quantum biomolecular world*, between *continuously fluctuating non-complementary states of biomolecular energy and states of biomolecular conformation* (and entangling states of biomolecular environment) [40].

On the other hand, according to our *extended QHQG theoretical framework* [9,10], the similar *highly-non-inertial transitional processes* should be expected in *highly non-inertial microparticle interactions* in quantum-measurement-like situations (fully equivalent, according to Einstein's *Principle of equivalence*, to strong gravitational fields - where opening of wormhole-tunnels is expected [15,16]). The question how it is possible that these highly non-inertial microparticle processes with inevitable relativistic generation of microparticles' wormholes were not taken into account within quantum mechanics which is yet extremely accurate theory(?) - might be answered as they were(!), but implicitly within the ad hoc von Neumann's projection postulate [6] to account for quantum mechanical wave function *OR* in measurement-like situations - implying also that von Neumann's *ad hoc Projection postulate is based on quantum gravitational phenomena* [9,10], on deeper physical level than nonrelativistic quantum mechanical ones!

On these lines, *explanation of the long standing open problems of the physical nature of psychosomatic acupuncture system and consciousness, including exotic transpersonal aspects of vital energy* (essentially

important for our functioning according to Eastern traditional medicine!) - should presumably be sought on deeper quantum-gravitational level as well. The *exotic aspect of wormhole tunnels and vital energy* might be *extended to acupuncture channels (with vacuum-like outside inflow of vital energy / prana / qi)* - implying that such type of *exotic transpersonal communication* enables *continuously-refreshing interaction between the two mentally-addressed persons* [27]. This *transpersonally stabilizes quantum-entanglement of their acupuncture systems / consciousnesses* i.e. *prevents dis-entanglement* of their macroscopic quantum-entangled non-stationary states by *OR-like* interaction with their local somatic environments (*contrary to situation in microworld* without such stabilizing mentally-addressing exotic transpersonal effects, where laboratory-created quantum-entangled pairs of particles must be *well isolated from environment* in order to prevent their subsequent quantum-decoherence)!

Additionally, if put in the theoretical context of the fundamental *holographic principle* [33,34] (cf. Glossary B.7), according to which any 3D physical system is *isomorphic* to the holographic information embedded on its 2D surface, then *quantum-holographic informational content of a body* could also be contained in *corresponding surface layer of vital energy of the astral-mental body (aura)*, as has been stated in various traditions (cf. Footnote 16) - in accordance with our extended QHQG framework for psychosomatics and proposed close relationship of the acupuncture system and consciousness (supported by meridian psycho-energy therapies as well, with the rapid elimination of traumas, phobias, allergies and other psychosomatic disorders, by simultaneous emotional-involved intensive visualization of psychosomatic problems and tapping / touching on prescribed acupuncture points [10,35])! It was also conjectured [34] that volume itself is illusory and that *Universe is a hologram* isomorphic to information "inscribed" on the surface of its boundary.

Our extended QHQG theoretical framework might also imply that quantum-holographic hierarchical parts carry information about the whole (which resembles the Hindu relationship *Brahman / Atman*, as a whole and the part which contains information about the whole [10-12], allowing subtle *fractal coupling of various hierarchical levels* in Nature [36]. This might be supported by *acupuncture system and its projection zones* (ECIWO holographic concept [37]) and the discovery of *quantum-holographic influence of verbal communication on the expression of cell genome* (by voice-modulation of irradiating-laser beams [38]), as well as by the *origin of the amazing creativities* (Tesla and Mozart as case studies [11,12]) and *predestined life paths and temptations* (as indicated by the contemporary experiences of hypno-regressions [39] as well as experiences of different traditions [19], while still emphasizing that it is *possible to optimize them by spiritual purification*).

It should be also added, that in the context of *necessary conditions for decoherence*, defining of open quantum system and its environment is - *simultaneous process* - so that in the context of universal validity of quantum mechanics (cf. Glossary B.4) *consciousness is relative concept*, non-locally also influenced by farther parts of existing observing universe (and *vice versa*!), simultaneously creating conditions for the process of decoherence in the context of *existing relative borderline* [9] (cf. Eq. (2) in Footnote 11). This is fully in accordance with the idea of *collective consciousness* as a possible *ontological property of the physical field itself*, with different micro-quantum and macro-quantum excitations. Then, as *cosmic collective consciousness* (coincident with the "field" of Universe) has its complement "particle" *cosmic environment*, their strong-interaction-coupling affects *decoherence of the "field" of cosmic collective consciousness* into stationary *classically-reduced (observing) stochastic state*, with probabilities of realizations of corresponding classically-reduced states of cosmic collective consciousness. However, note that the *cosmic composite quantum state of cosmic "field" collective consciousness* and (complement) *cosmic "particle" environment* (cf. Eq. (3) in Footnote 11) *evolves without collapse* (due to absence of the complement outside-cosmic environment!), which implies that *Universe as a whole is presumably quantum hologram* subject to deterministic Schrödinger evolution (in the context of universal validity of quantum mechanics!).

So, in the context of the above *proposed mechanism of prayer (which intrinsically non-unitary sets the necessary new boundary conditions without mutual mentally-loaded addresses*, cf. Footnotes 20-24) - it can really be said that an *all-forgiving prayer* represents a biophysical basis for the optimization of (*quantum*) *holistic global psychosomatics of collective consciousness* (and complementary incoming individual and collective events) [10]! Let us add that both traditional and modern experiences of local and



transpersonal energy healing [3] (by spiritually-excited and mentally-channeled new macro-quantum portions of vital energy and their subsequent mentally-channeled transfer), indicate that *meditative visualization imposes new (decoherence-like) quantum gravitational boundary conditions* (however, in contrast to prayer, *it would not eliminate simultaneously all mentally-loaded addresses, but would balance energy-informationally only one particular client*; therefore, in such situations, it is necessary to do *circular meditative-healing visualization from all meta-positions involved in the existing conflict, thus eliminating simultaneously all mentally-loaded addresses*)!

Hence, in the context of our QHQG theoretical framework, *spiritual prayer / meditation practices* represent *non-unitary source of free will at the level of collective consciousness*, which evolutionary *increases the responsibility of every individual and the whole human race* [10-12]! It is hereby also instructive to mention *Buddhist* interpretation of *karma*, which occurs not as a *result of our spontaneous reaction* to the current situation in life, but as a *result of the latter justification of our conscious reactions against the others* in this situation [49]! In the context of the above mentioned *quantum-holographic predestined life programs* (and experiences of various traditions [19] and post-hypnotic regressions [39]), this is fully justified because we all (*non-consciously*) *react to current conflicting-encoded life-situations* (several hundred milliseconds before we become aware [50]!), but immediately afterwards we have a chance to (*consciously*) *permanently untangle the existing trans-generational conflict by penitent-all-forgiving prayer*. This might be possibly the reason for *Christianity* to insist on *repenting and forgiving*, as anything else would enhance the existing mental / emotional personal loads and enlarge evil in the world, dismissing an individual and humankind from the final spiritual ideal of sinless state of individual and collective consciousness!

In the context of *trans-generational* cosmic quantum hologram, although on the level of collective consciousness everything is *quantum-holographically predestined* - as suggested by experiences of different spiritual traditions [19] and post-hypnotic regressions [39] as well - they also suggest the possibility of *optimizing life-programs by spiritual purification* (cf. Footnotes 25-28 and Glossary G.1). In particular, let us mention Hawaiian *ho'oponopono* tradition with *remarkable reprogramming of the life situations by contextual repenting and forgiving ourselves* [56]; or South American *ayahuaska* and Nigerian *Abiku* traditions with *fascinating spiritual diagnoses and extensions of the predestined-short-life programs* [55]; or *fascinating world bestseller* of Anita Moorjani [58] on *spiritual changing her life program* with return from clinical death and after a few weeks *spontaneous healing of terminal phase of cancer*; or contemporary spiritual teaching of Bruno Groening with *incredible healing channel* remained open after his death [57], *in optimizing both individual and collective life programs*! This greatly contributes to our understanding that even *most difficult psychosomatic disorders have their roots in the energy-information blockages*, and that *healing begins by removing them* - first lovingly to ourselves, accepting ourselves and forgiving ourselves, which is then manifested by love to others and acceptance of others (e.g. by spiritually dis-entangling / un-binding repentant-forgiving prayer [10-12])!

## Appendix B. Physical & Informational Extended Glossary

### B.1. Altered States of Consciousness [Adopted from Wikipedia]

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**Consciousness** is the state or quality of awareness or of being aware of an external object or something within oneself. Recently, consciousness has also become a significant topic of interdisciplinary research in cognitive science, involving fields like psychology, linguistics, anthropology, neuropsychology and neuroscience. The primary focus is on understanding what it means biologically and psychologically for information to be present in consciousness i.e. on determining the neural and psychological correlates of consciousness. Issues of interest include phenomena such as subliminal perception, blindsight, denial of impairment, and altered states of consciousness produced by alcohol and other drugs, or spiritual or meditative techniques.

**Altered state of consciousness (ASC)** is any condition which is significantly different from a normal waking state. A first summary of the existing literature was carried out by Charles T. Tart in his book *Altered States of Consciousness*, which led to a more common use of the term. Tart analyzed a state of consciousness as made up of a number of component processes, including exteroception (sensing the external world);

interoception (sensing the body); input-processing (seeing meaning); emotions; memory; time sense; sense of identity; evaluation and cognitive processing; motor output; and interaction with the environment. Each of these, in his view, could be altered in multiple ways by drugs or other manipulations. Research in this area has not yet reached firm conclusions, but a recent questionnaire-based study identified eleven significant factors contributing to drug-induced states of consciousness: experience of unity; spiritual experience; blissful state; insightfulness; dis-embodiment; impaired control and cognition; anxiety; complex imagery; elementary imagery; audio-visual synesthesia; and changed meaning of percepts.

Altered states of consciousness might have been employed by humans as early as 30,000 years ago. Mind-altering plants and/or excessive dancing were used to attain an ecstatic or mystic state. Examples of early religious use of altered states of consciousness are the rites of Dionysos and the Eleusinian Mysteries, as well as Yoga and Meditation. Followers of various shamanic traditions "enter altered states of consciousness in order to serve their community." Meditation in its various forms is being rediscovered by modern psychology because of its therapeutic potential and its ability to "enable the activity of the mind to settle down". In *Psychotherapy* techniques like hypnosis, meditation, support psychological processes.

Due to the behaviourist paradigm in psychology altered states of consciousness were dismissed as a field of scientific inquiry during the early 20th century. The social change of the turbulent 1960s has decisively led to a change of the scientific perspective to the point that introspection as a scientific method and ASCs as valid realms of experience became more widely accepted. Foundations for the research have been laid out by various scientists such as Abraham Maslow, Walter N. Pahnke, Stanislav Grof and Charles Tart. They focused on seemingly beneficial aspects of ASCs such as their potential to "promote creativity or treat addiction". In the midst of the rise of new-age subculture Stanislav Grof and others formed the new field of *transpersonal psychology*, which emphasized "the importance of individual human experience, validity of mystical and spiritual experience, interconnectedness of self with others and the world and potential of self-transformation".

I recommend the paper "States of consciousness in esoteric practice," by Petar Vujićin, focused on a comparative presentation of two esoteric practices: Upanishads known under term Vedanta (Hinduism) and esoteric Christianity by a contemporary Cypriot mystic Daskalos (teacher). The striking correspondences between these two traditions have been found, from the macrocosm, the structure of the Universe, to the microcosm, the structure of human selfhood, human bodies, human states of consciousness, and precise techniques for expansion of higher states of consciousness.

Also, a brief comment is made on the psychic phenomena in the esoteric tradition, as well as on the research of these phenomena carried out by Western scientists. Finally, it is maintained that implementation of esoteric disciplines and codes of behaviour in the many aspects of human life, personal and social, is the most efficient way for eliminating all evils (wars, crimes, poverty, illnesses, and diseases, unhappiness), having beset humanity in its long history.

Additional recommended references:

- [https://en.wikipedia.org/wiki/Altered\\_state\\_of\\_consciousness](https://en.wikipedia.org/wiki/Altered_state_of_consciousness) (Wikipedia), and refs. therein
- [http://www.dejanrakovicfund.org/file/States\\_of\\_consciousness\\_in\\_esoteric\\_practice.pdf](http://www.dejanrakovicfund.org/file/States_of_consciousness_in_esoteric_practice.pdf)  
(P. Vujićin, "States of consciousness in esoteric practice," in: D. Raković, Dj. Koruga, editors, *Consciousness: Scientific Challenge of the 21st Century*, ECPD, Belgrade, 1995, pp. 89-136)

## **B.2. Holonomic Brain Theory** [Adopted from Wikipedia]

**Holonomic brain theory** is a branch of neuroscience investigating the idea that human consciousness is formed by quantum effects in or between brain cells. This is opposed by traditional neuroscience, which investigates the brain's behavior by looking at patterns of neurons and the surrounding chemistry, and which assumes that any quantum effects will not be significant at this scale. The specific theory of *quantum consciousness* was developed by neuroscientist Karl Pribram initially in collaboration with physicist David Bohm. It describes human cognition by modeling the brain as a *holographic* storage network. Pribram suggests these processes involve electric oscillations in the brain's fine-fibered dendritic webs, which are different from the more commonly known action potentials involving axons and synapses. Gabor, Pribram and others noted the similarities between these brain processes and the storage of information in a hologram, which can also be analyzed with a Fourier transform. In a hologram, any part of the hologram with sufficient size contains the whole of the stored information. In this theory, a piece of a long-term memory is similarly distributed over a dendritic arbor so that each part of the dendritic network contains all the information stored over the entire

network. This model allows for important aspects of human consciousness, including the fast associative memory that allows for connections between different pieces of stored information and the *non-locality of memory storage* (a specific memory is not stored in a specific location, certain cluster of neurons).

While Pribram originally developed the holonomic brain theory as an analogy for certain brain processes, several later papers have proposed that the similarity between hologram and certain brain functions is more than just metaphorical, but actually structural. Several studies have shown that the same series of operations used in *holographic memory models* are performed in certain processes concerning temporal memory and optomotor responses. Other studies have demonstrated the possibility that *biophoton emission* (biological electrical signals that are converted to weak electromagnetic waves in the visible range) may be a necessary condition for the electric activity in the brain to store holographic images. A holographic model can also account for other features of memory that more traditional models cannot. The *Hopfield memory model* has an early memory saturation point before which memory retrieval drastically slows and becomes unreliable. On the other hand, holographic memory models have much larger theoretical storage capacities. Holographic models can also demonstrate associative memory, store complex connections between different concepts, and resemble forgetting through "lossy storage."

I recommend the book *Holographic Universe* to all interested in various states of consciousness, with numerous well-documented mysterious phenomena in *altered states of consciousness*. In this book, *Michael Talbot* relies heavily on the works of famous quantum physicist *David Bohm* and neurophysiologist *Karl Pribram*, who point out that the *Universe could be a giant quantum hologram*, the type of *mind construct* at the *boundary of a subject / object* - by relativizing the question of *whether objective reality exists or constantly fluctuates between implicate & explicate order?*

The book suggests that many well documented *mysterious phenomena* (*synchronicity & precognition, extrasensory perceptions & out-of-body experiences, psychokinesis & teleportations, miraculous healing & mystical religious experiences...*) - could be explained within the (still controversial) *holographic paradigm*. The reading and presentation of this book brought me great personal satisfaction, for my own research of *quantum basis of consciousness & holistic psychosomatics* and their implications (with numerous empirical / rational assertions, I recognized by reading a book).

Additional recommended references:

- [https://en.wikipedia.org/wiki/Holonomic\\_brain\\_theory](https://en.wikipedia.org/wiki/Holonomic_brain_theory) (Wikipedia), and refs. therein
- <https://www.amazon.com/Holographic-Universe-Revolutionary-Theory-Reality/dp/0062014102>  
(M. Talbot, *The Holographic Universe*, HarperCollins, New York, 1991)
- <https://www.amazon.com/Biological-Quantum-Computing-Human-Vision/dp/1615207856>  
(M. Peruš, C. K. Loo, *Biological and Quantum Computing for Human Vision: Holonomic Models and Applications*, Hershey, Medical Information Science Reference, 2011, and refs. therein)

### B.3. Holography [Adopted from Wikipedia]

**Holography** is the science and practice of making *holograms*. The holographic medium, produced by a holographic process (hologram) is usually unintelligible when viewed under diffuse ambient light. In its pure form, holography requires the use of laser light for illuminating the object and for viewing the finished hologram. Holography may be better understood via an examination of its difference from ordinary photography. When a photograph is cut in half, each piece shows half of the scene. When a hologram is cut in half, the whole scene can still be seen in each piece - because, whereas each point in a photograph only represents light scattered from a single point in the scene, each point on a holographic recording includes information about light scattered from every point in the scene.

The Hungarian-British physicist Dennis Gabor was awarded the Nobel Prize in Physics in 1971 "for his invention and development of the holographic method". The technique as originally invented is still used in electron microscopy (known as *electron holography*). The development of the *laser* enabled the first practical *optical holograms* that recorded 3D objects to be made in 1962 by Yuri Denisjuk in the Soviet Union and by Emmett Leith and Juris Upatnieks at the University of Michigan, USA. Several types of holograms can be made. Transmission holograms are viewed by shining laser light through them and looking at the reconstructed image from the side of the hologram opposite the source. A later refinement, the "rainbow transmission" hologram, commonly used for security and authentication, allows more convenient illumination by white light

rather than by lasers. Reflection holograms can also be viewed using a white-light illumination source on the same side of the hologram as the viewer and is the type of hologram normally seen in holographic displays; they are also capable of multicolour-image reproduction.

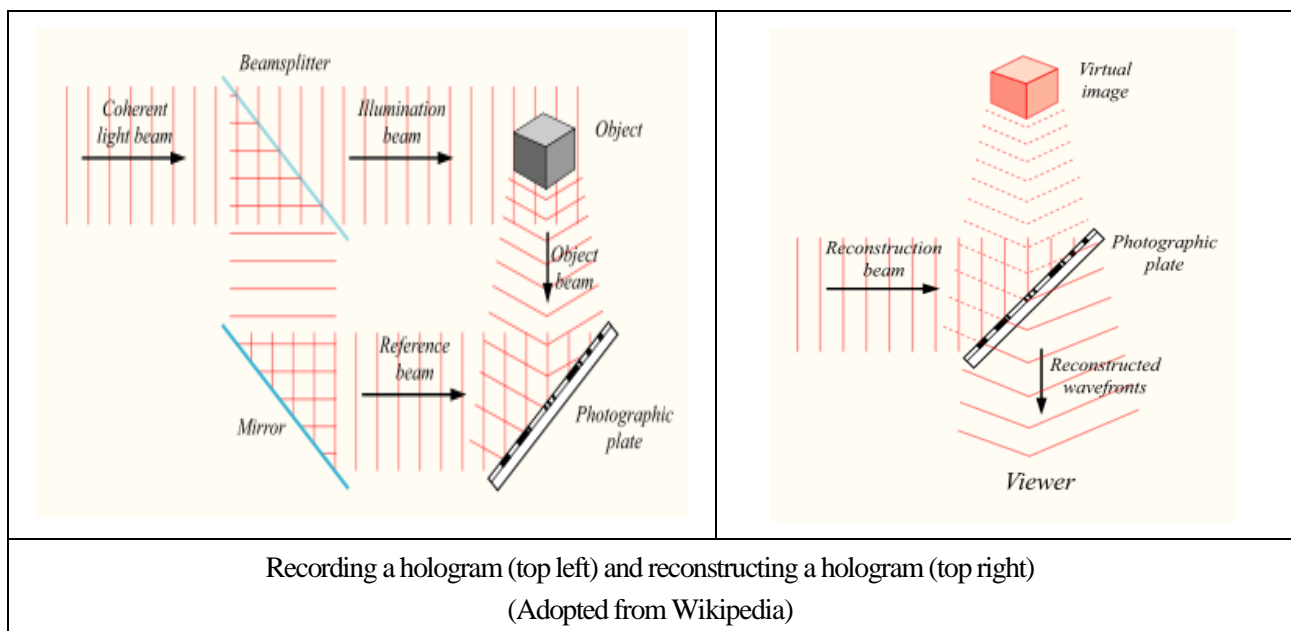
**Mathematical model** (Adopted from Wikipedia). A single-frequency light wave can be modeled by a complex number,  $U$ , which represents the electric or magnetic field of the light wave. The amplitude and phase of the light are represented by the absolute value and angle of the complex number. The object and reference waves at any point in the holographic system are given by  $U_O$  and  $U_R$ . The combined beam is given by  $U_O + U_R$ . If a photographic plate is exposed to the two beams and then developed, its transmittance  $T$  is proportional to the light energy proportional (with constant  $k$ ) to the square of magnitude of the combined beams:

$$T = k|U_O + U_R|^2 = kU_O U_R^* + k|U_R|^2 + k|U_O|^2 + kU_O^* U_R$$

When the developed plate is illuminated by the reference beam, the light transmitted through the plate,  $U_H$ , is equal to the transmittance,  $T$ , multiplied by the reference beam amplitude,  $U_R$ , giving

$$U_H = T U_R = kU_O |U_R|^2 + k|U_R|^2 U_R + k|U_O|^2 U_R + kU_O^* U_R^2$$

It can be seen that  $U_H$  has four terms. The first term is proportional to  $U_O$ , and is the reconstructed object beam, which enables a viewer to 'see' the original object even when it is no longer present in the field of view. The second and third beams are modified versions of the reference beam. The fourth term is the "conjugate object beam", and has the reverse curvature to the object beam itself and forms a **real image** of the object in the space beyond the holographic plate. When the reference and object beams are incident on the holographic recording medium at significantly different angles, the virtual, real, and reference wavefronts all emerge at different angles, enabling the reconstructed object to be seen clearly.



Additional recommended references:

- <https://en.wikipedia.org/wiki/Holography> (Wikipedia), and refs. therein
- <https://www.amazon.com/Basics-Holography-P-Hariharan/dp/0521002001>  
(P. Hariharan, *Basics of Holography*, Cambridge Univ, UK, 2002)

#### B.4. Quantum Mechanics [Adopted from Wikipedia]

**Quantum mechanics (QM)**, including quantum field theory, is a fundamental theory in physics which describes nature at the smallest scales of energy levels of atoms and subatomic particles. Classical physics, the physics existing before QM, describes nature at ordinary (macroscopic) scale. Most theories in classical physics can be derived from QM as an approximation valid at large (macroscopic) scale. QM differs from classical physics in that energy, momentum, angular momentum and other quantities of a bound system are restricted to



*discrete values (quantization)*; objects have characteristics of both particles and waves (*wave-particle duality*); and there are limits to the precision with which quantities can be measured (*uncertainty principle*).

QM gradually *aroses from theories* to explain observations which could not be reconciled with classical physics, such as Max Planck's solution in 1900 to the black-body radiation problem, the correspondence between energy and frequency in Albert Einstein's 1905 paper which explained the photoelectric effect. Early quantum theory was profoundly *re-conceived* in the mid-1920s by Erwin Schrödinger, Werner Heisenberg, Max Born and others, when *re-formulated* in various specially developed mathematical formalisms. *Applications of quantum theory* include quantum chemistry, quantum optics, quantum computing, superconducting magnets, light-emitting diodes, laser, transistor, semiconductors such as microprocessor, medical and research imaging, like magnetic resonance imaging and electron microscopy. Explanations for many biological and physical phenomena are rooted in the nature of the chemical bond, most notably the macro-molecule DNA.

In the formalism of QM, the *state of a system* at a given time is described by a *complex wave function*, also referred to as *state vector* in a *complex vector space*. This abstract mathematical object allows for the *calculation of probabilities* of outcomes of concrete experiments. Contrary to classical mechanics, one can never make simultaneous predictions of *conjugate variables*, such as position and momentum, to arbitrary precision. The possible results of a measurement are the eigenvalues of the operator representing the observable - which explains the choice of *Hermitian operators*, for which all the eigenvalues are real. The probability distribution of an observable in a given state can be found by computing the *spectral decomposition* of the corresponding operator. Heisenberg's uncertainty principle is represented by the statement that the operators corresponding to certain observables *do not commute*.

In his treatise *The Mathematical Foundations of Quantum Mechanics* in 1932, John von Neumann deeply analyzed the so-called measurement problem, and concluded that the *entire physical universe could be made subject to the Schrödinger equation (the universal wave function)*, and described how *measurement could cause a collapse of the wave function (the projection postulate)* (originally in the von Neumann's "chain": quantum object + apparatus + observer, but later on *necessity of self-consciousness* has been usually seen as *non-physical* solution of the problem). Later on, *quantum decoherence* framework developed in 1980s for *open quantum systems*, has been used by Wojciech Zurek to provide an explanation for *apparent* wave-function collapse, as the quantum nature of the system "leaks" into the environment. A total superposition of the global or *universal wavefunction* still exists (and remains coherent at the global level), but its ultimate fate remains an *interpretational issue*. Specifically, quantum decoherence does not attempt to explain the *measurement problem*, but provides environment-induced *superselection rules* for transition of the system from quantum-coherent to classically reduced states.

Since its inception, many counter-intuitive aspects and results of QM have provoked strong philosophical debates and many interpretations. Even fundamental issues, such as Max Born's basic rules concerning probability amplitudes and probability distributions, took decades to be appreciated by society and many leading scientists. Richard Feynman once said, "I think I can safely say that nobody understands QM." According to Steven Weinberg, "There is now in my opinion no entirely satisfactory interpretation of QM." Although QM has held up to rigorous and extremely precise tests in an extraordinarily broad range of experiments (not one prediction from QM is found to be contradicted by experiments), there exist a number of contending schools of thought over **interpretation of quantum mechanics**. These views on interpretation differ on such fundamental questions as *whether QM is deterministic or random, which elements of QM can be considered "real"*, and *what is the nature of measurement*, among other matters. Despite nearly a century of debate and experiment, *no consensus* has been reached amongst physicists and philosophers of physics concerning which interpretation best "represents" reality.

**Copenhagen interpretation** - due largely to Niels Bohr and Werner Heisenberg - remains most widely accepted amongst physicists, some 75 years after its enunciation. According to this interpretation, the probabilistic nature of QM is not a temporary feature which will eventually be replaced by a deterministic theory, but instead must be considered a final renunciation of the classical idea of "causality." It is also believed therein that any well-defined application of the QM formalism must always make reference to the experimental arrangement, due to the *conjugate nature* of evidence obtained under different experimental situations.

The *probabilistic nature* of QM thus stems from the *act of measurement*, one of the most difficult aspects of quantum systems to understand. It was the central topic in the famous *Bohr–Einstein debates*, which provide a vibrant critique of the Copenhagen Interpretation from an epistemological point of view. Einstein considered particular proposal for hidden variables to obviate the acausality and non-locality of quantum mechanical measurement. In arguing for his views, he produced a series of objections, including the most famous *Einstein–Podolsky–Rosen (EPR) paradox*.

John Bell showed that this EPR paradox led to *experimentally testable differences* between QM and theories that rely on added hidden variables. By the early 1980s, Alain Aspect's and other experiments had shown that Bell's inequalities were indeed violated in practice - so that there were in fact correlations of the kind suggested by QM. At first these just seemed like isolated esoteric effects, but by the mid-1990s, they were being codified in the field of *quantum information theory*, and led to constructions with names such as *quantum cryptography* and *quantum teleportation*. Entanglement, as demonstrated in Bell-type experiments, does not, however, violate causality, since no transfer of information happens.

**Everett many-worlds interpretation**, formulated in 1956, holds that all possibilities described by quantum theory simultaneously occur in a *multiverse* composed of mostly independent parallel universes. This is not accomplished by introducing some "new axiom" to QM, but on the contrary, by *removing the axiom* of the collapse of the wave packet. All of the possible consistent states of the measured system and the measuring apparatus (including the observer) are present in a real physical *quantum entangled state*. While the multiverse is deterministic, we perceive non-deterministic behavior governed by probabilities, because we can only observe the universe that we, as observers, inhabit. Everett's interpretation is fully consistent with Bell's inequalities and makes them intuitively understandable. However, according to the theory of *quantum decoherence*, these "parallel universes" are not accessible to us.

**De Broglie–Bohm theory** (also known as the *pilot wave theory*) is a theory of QM by Louis de Broglie and extended later by David Bohm to include measurements. Particles, which always have positions, are guided by the wavefunction. The wavefunction evolves according to the Schrödinger wave equation, and the wavefunction never collapses. The theory takes place in a single space-time, is *non-local*, and is *deterministic*. The simultaneous determination of a particle's position and velocity is subject to the usual uncertainty principle constraint. The theory is considered to be a *hidden-variable theory*, and by embracing non-locality it *satisfies Bell's inequality*. The *measurement problem is resolved*, since the particles have definite positions at all times. *Collapse is explained as phenomenological*.

In general, only *closed* composite quantum system  $S + E$  (composed of interacting *open* quantum subsystems  $S$  and  $E$ ) is subject to Schrödinger law (with *quantum entanglement* or *quantum correlations* of the states of subsystems  $S$  and  $E$ , as explicit on the r.h.s. in Eq. (I))

$$|X\rangle_{S+E} \equiv \hat{U}|\Phi\rangle_S|\Psi\rangle_E = \sum_i c_i |\Phi_i\rangle_S |\Psi_i\rangle_E; \quad (\text{I})$$

$\hat{U}(t) = \exp(-2\pi i \hat{H}t / h)$  denotes the unitary time-evolution operator with Hamiltonian  $\hat{H} = \hat{H}_S + \hat{H}_E + \hat{H}_{\text{int}}$ , and  $|\Phi_i\rangle_S$  and  $|\Psi_i\rangle_E$  constitute orthonormalized bases in the Hilbert state spaces of subsystems  $S$  and  $E$  (considered initially approximately isolated / closed), where interaction Hamiltonian  $\hat{H}_{\text{int}}$  depends on observables of both subsystems  $S$  and  $E$ . It should be pointed out that Schrödinger law does not hold true separately for neither  $S$  nor  $E$  as interacting *open* quantum subsystems, when two-stage *quantum decoherence* terminates (cf. Eqs. (I) & (II), or Eq. (1) in Footnote 10) into classically-reduced states of finally decoupled subsystems  $S$  and  $E$ , as explicit on the r.h.s. in Eq. (II):

$$|\Phi\rangle_S |\Psi\rangle_E \rightarrow |X\rangle_{S+E} \equiv \sum_i c_i |\Phi_i\rangle_S |\Psi_i\rangle_E \xrightarrow{p_j = |c_j|^2} |\Phi_j\rangle_S |\Psi_j\rangle_E \quad (\text{II})$$



On the other hand, when  $\hat{H}_{\text{int}}$  can be reduced to the "external field", its *potential term*  $\hat{V}$  can be added to  $\hat{H}_S$ , providing new self-Hamiltonian of the subsystem  $S$ , dynamically decoupled from the observables of the environmental subsystem  $E$ , and then subsystem  $S$  can be treated as the *closed* quantum system. This is the case, for instance, in most situations in *quantum chemistry*, with Schrödinger equation applied to the explored *closed* many-atomic quantum system with appropriate boundary conditions and adopted computational approximations (giving rise to *stationary* ground and excited electronic-vibrational energy *eigenstates* of all possible many-atomic *isomers*). It should be noted that Schrödinger equation *cannot apply to nonstationary* excitations and relaxations of the many-atomic quantum system, not only in-between different isomers but also within the same isomer - when quantum deexcitation / decoherence must apply to *non-potential interaction* of the *open* many-atomic quantum subsystem  $S$  (*non-describable* fully by its self-Hamiltonian) with its quantum environment  $E$  (generally *field-related*, including *vacuum*).

**Objective collapse theories** differ from the Copenhagen interpretation by regarding both the wave function and the process of collapse as *ontologically objective* (meaning these exist and occur independent of the observer). In objective theories, collapse occurs either randomly ("spontaneous localization") or when some physical threshold is reached, with observers having no special role. Thus, objective-collapse theories are *realistic, indeterministic, no-hidden-variables theories*, requiring for an extension of QM. Examples include: *Ghirardi-Rimini-Weber theory* and *Penrose interpretation*.

**Consciousness causes collapse interpretation** includes John Archibald Wheeler's *participatory anthropic principle* which says that consciousness plays some role in bringing the universe into existence. Originally, John von Neumann deeply analyzed the so-called measurement problem, and concluded that the "collapse" is ultimately referred to *self-consciousness* of the observer, as the final element of the von Neumann's "chain" (quantum object + apparatus + observer). This point of view was prominently expanded on by Eugene Wigner, who argued that experimenter consciousness was critical for the collapse.

**Quantum information theories** have attracted growing support. They subdivide into *two kinds*: Information ontologies, such as J. A. Wheeler's "it from bit", being described as a *revival of immaterialism*; Interpretations where QM is said to describe an observer's knowledge of the world, with some similarity with Bohr's thinking, being described as *similar to instrumentalism*.

Additional recommended references:

- [https://en.wikipedia.org/wiki/Quantum\\_mechanics](https://en.wikipedia.org/wiki/Quantum_mechanics) (Wikipedia), and refs. therein
- <http://www.dejanrakovicfund.org/knjige/2009-Integ-Biophys-Quant-Medic.pdf>  
(D. Raković, *Integrative Biophysics, Quantum Medicine, and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications*, IASC & IEPSP, Belgrade, 2009, Apps. 6.1–6.9, and refs. therein)
- <http://www.dejanrakovicfund.org/papers/2002-INFORMATICA.pdf>  
(D. Raković, M. Dugić, "A critical note on the role of the quantum mechanical 'collapse' in quantum modeling of consciousness", *Informatica*, vol. 26, no. 1 (2002), pp. 85-90)
- <https://www.amazon.com/Quantum-Mechanics-Theoretical-Leonard-Susskind/dp/0465062903>  
(L. Susskind. A. Friedman, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, New York, 2014)

## B.5. Neural Networks [Adopted from Wikipedia]

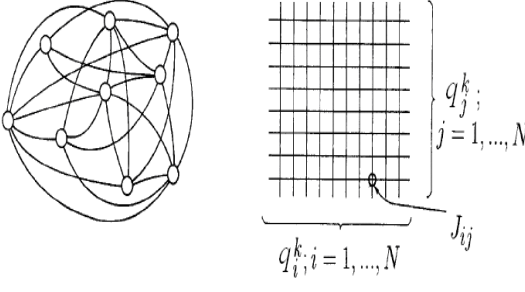
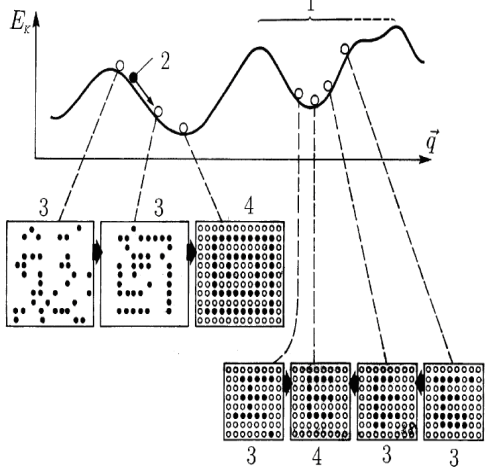
**Neural networks** were originally based on efforts to model information processing in biological systems (contrary to *digital computers* evolved from the von Neumann model, which operate via the execution of explicit instructions through access to memory by a number of processors). Neural network is either biological made up of real biological neurons, or artificial made up of artificial neurons, which change their structure based on external or internal information that flows through network.

*Biological neural networks* (BNNs) are composed of a group of chemically connected or functionally associated neurons. A single neuron may be connected to many other neurons and the total number of neurons and connections in a network may be extensive (up to 40,000). Connections, called synapses, are usually formed from axons to dendrites, though dendrodendritic synapses and other connections are possible. Apart from the electrical signaling, there are other forms of signaling arising from neurotransmitter diffusion.

*Artificial neural networks* (ANNs) are composed of artificial neurons or nodes. Artificial neurons were first proposed in 1943 by neuro-physiologist Warren McCulloch & logician Walter Pitts, who collaborated at University of Chicago. Concept of neural network was first proposed by Alan Turing in his 1948 paper

"Intelligent machinery". Connections of artificial neurons are modeled as weights: positive reflect excitatory connection, while negative mean inhibitory connections. All inputs are modified by weight and summed. Finally, an activation function controls the amplitude of the output. For example, an acceptable range of output is usually between 0 and 1, or it could be  $-1$  and  $1$ .

One classical type of ANNs is *recurrent Hopfield network*. The utility of the ANNs models lies in the fact that they can be used to infer a function from observations and also to use it, for solving *artificial intelligence* (AI) problems, like in speech recognition, image analysis and adaptive control, and autonomous robots as well. Unsupervised ANNs can also be used to learn representations of the input that capture the salient characteristics of the input distribution, like in *deep learning* algorithms, which can implicitly learn the distribution function of the observed data. Learning in ANNs is particularly useful in applications where the complexity of the data or task makes the design of such functions by hand impractical.

	<p>Diagram of Hopfield's NN (left) and corresponding memory matrix <math>J</math> (right), where:</p> $J_{ij} = \sum_{l=1}^P q_i^{k_l} q_j^{k_l}$ $q_i = \sum_{j=1}^N J_{ij} q_j$ $E_K = -\frac{1}{2} \sum_{i=1}^N \sum_{j=1}^N J_{ij} q_i q_j$
	<p>Configuration-energy hypersurface of Hopfield's NN:  1 – basin of attraction; 2 – momentary state of NN;  3 – nonstable configuration; 4 – attractor pattern, i.e. stable configuration (left).</p> <p>Hopfield-like Classical &amp; Quantum holographic Peruš's analogies (bellow):</p> $q \Leftrightarrow \phi, \quad q^{k_l} \Leftrightarrow \phi^{k_l}, \quad J \Leftrightarrow G$ <p>(cf. Footnotes 12, 18, 19, and Fig. 2 in the text), where</p> $G(r_2, t_2; r_1, t_1) = \sum_{i=1}^P \phi^{k_i}(r_2, t_2) \phi^{k_i*}(r_1, t_1) =$ $= \sum_{i=1}^P A_{k_i}(r_2, t_2) A_{k_i}^*(r_1, t_1) e^{\frac{i}{\hbar}(\alpha_{k_i}(r_2, t_2) - \alpha_{k_i}(r_1, t_1))}$

Additional recommended references:

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(D. Raković, *Integrative Biophysics, Quantum Medicine, and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications*, IASC & IEPSP, Belgrade, 2009, Chs. 2, 4, 5, and refs. therein)
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(M. Peruš, C. K. Loo, *Biological and Quantum Computing for Human Vision: Holonomic Models and Applications*, Hershey, Medical Information Science Reference, 2011, and refs. therein)

## B.6. Entropy In Thermodynamics & Information Theory [Adopted from Wikipedia]

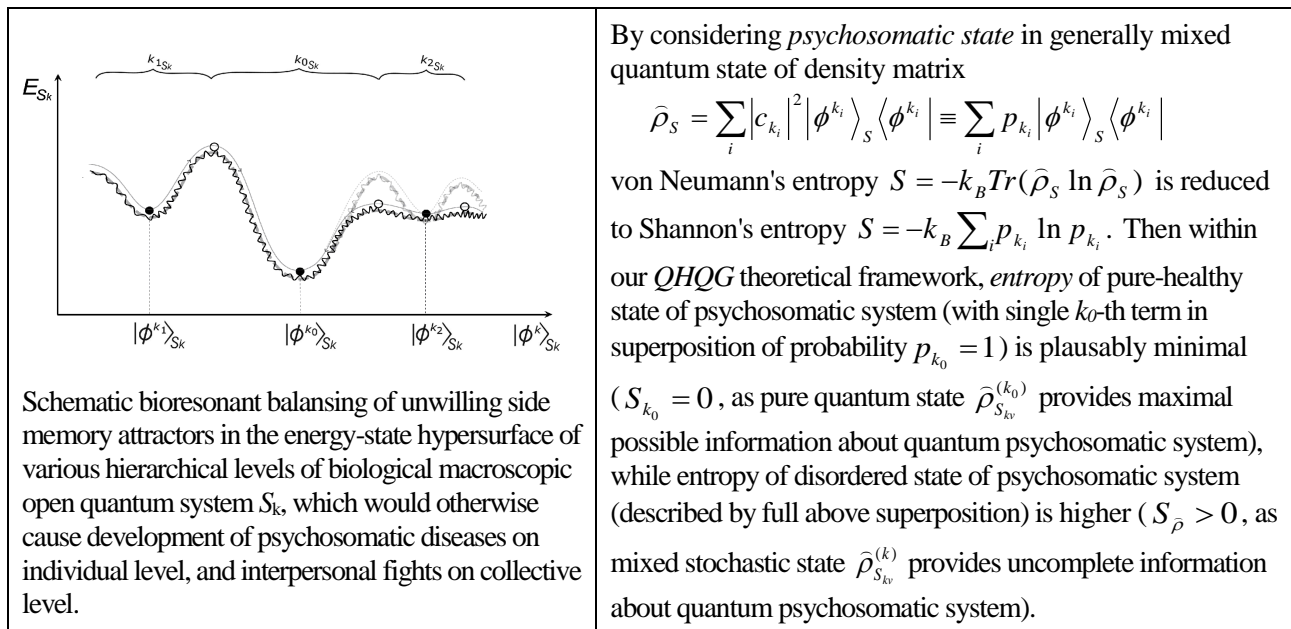
The defining expression for *entropy in the theory of statistical mechanics* established by Ludwig Boltzmann and J. Willard Gibbs in 1870s is:  $S = -k_B \sum_i p_i \ln p_i$ , where  $p_i$  is the probability of the *microstate*  $i$  taken from an equilibrium ensemble, and  $k_B$  is Boltzmann constant. If all the microstates are equiprobable (a

microcanonical ensemble), *statistical thermodynamic entropy* reduces to form given by Boltzmann:  $S = k_B \ln W$ , where  $W$  is the *number of microstates that corresponds to macroscopic thermodynamic state*, and depends on temperature. The logarithm in the thermodynamic definition is the natural logarithm. It can be shown that the Gibbs entropy formula reproduces all of the properties of the *macroscopic classical thermodynamics* of Rudolf Clausius. In *quantum statistical mechanics*, described by a *density matrix*  $\rho$ , the extension of classical Gibbs entropy is *von Neumann entropy*,  $-\text{Tr}(\rho \ln \rho) = -\langle \ln \rho \rangle$ .

The defining expression for *entropy in the theory of information* established by Claude Shannon in his article "A mathematical theory of communication" in 1948 is:  $H = -\sum_i p_i \log_2 p_i$ , where  $p_i$  is the probability of the message  $m_i$  taken from the message space  $M$ . Information entropy is calculated using base 2 logarithms, when unit of the entropy is *bit*. Mathematically  $H$  may be seen as an *average information*, taken over the message space.

Despite the foregoing similarities, there is a difference between the two quantities. The information entropy  $H$  can be calculated for *any* probability distribution (if the "message" is taken to be that the event  $i$  which had probability  $p_i$  occurred, out of the space of the events possible), while the thermodynamic entropy  $S$  refers to thermodynamic probabilities  $p_i$  specifically. The difference is more theoretical than actual, however, because any probability distribution can be approximated arbitrarily closely by some thermodynamic system.

Shannon's entropy has been related by physicist Léon Brillouin to a concept sometimes called *negentropy*. In 1953, Brillouin derived a general equation stating that the changing of an information bit value requires at least  $kT \ln(2)$  energy (this is the same quantity found by Rolf Landauer in 1961). In his book *Science and Information Theory*, he further explored this problem concluding that any cause of a bit value change (measurement, decision about a yes/no question, erasure, display, etc.) will require the same amount,  $kT \ln(2)$ , of energy. Consequently, acquiring information about a system's microstates is associated with an entropy production, while erasure yields entropy production only when the bit value is changing. Setting up a bit of information in a sub-system originally in thermal equilibrium results in a local entropy reduction. However, there is no violation of the second law of thermodynamics, according to Brillouin, since a reduction in any local system's thermodynamic entropy results in an increase in thermodynamic entropy elsewhere.



Additional recommended references:

- [https://en.wikipedia.org/wiki/Entropy\\_in\\_thermodynamics\\_and\\_information\\_theory](https://en.wikipedia.org/wiki/Entropy_in_thermodynamics_and_information_theory) (Wikipedia), and refs. therein
- <http://www.dejanrakovicfund.org/knjige/2009-Integ-Biophys-Quant-Medic.pdf> (D. Raković, *Integrative Biophysics, Quantum Medicine, and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications*, IASC & IEPSP, Belgrade, 2009, App. 6.5, and refs. therein)
- <https://www.amazon.com/s?k=9780486439181&i=stripbooks&linkCode=qs> (L. Brillouin, *Science and Information Theory*, 2nd ed., Dover, New York, 2013)

## B.7. Holographic Principle [Adopted from Wikipedia]

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**Holographic principle** is a tenet of *string theories* and a supposed property of *quantum gravity* that states that the description of a *volume of space* can be thought of as encoded on a *lower-dimensional boundary* to the region - such as a light-like boundary like a gravitational horizon. First proposed by Gerard 't Hooft, it was given a precise *string-theory interpretation* by Leonard Susskind who combined his ideas with previous ones of 't Hooft and Charles Thorn (who observed in 1978 that string theory admits a lower-dimensional description in which gravity emerges from it in what would now be called a holographic way).

The prime example of holography is the *AdS/CFT correspondence*, sometimes called *Maldacena duality* or *gravity/gauge duality*. On one side are *anti-de Sitter spaces* (AdS) which are used in theories of quantum gravity, formulated in terms of string theory or M-theory. On the other side of the correspondence are *conformal field theories* (CFT) which are quantum field theories, including theories similar to the Yang–Mills theories that describe elementary particles. *AdS/CFT duality* represents a major advance in our *understanding of string theory and quantum gravity*.

The holographic principle was inspired by *black hole thermodynamics*, which conjectures that the maximal entropy in any region scales with the *radius squared*, and not cubed as might be expected. In the case of a black hole, the insight was that the informational content of all the objects that have fallen into the hole might be entirely contained in surface fluctuations of the event horizon. The holographic principle resolves the *black hole information paradox* within the framework of string theory. In an article in the August 2003 issue of *Scientific American* titled "Information in the holographic universe", Bekenstein summarizes that "Thermodynamic entropy and Shannon entropy are conceptually equivalent: the number of arrangements that are counted by Boltzmann entropy reflects the amount of Shannon information one would need to implement any particular arrangement" of matter and energy. The only salient difference between the thermodynamic entropy of physics and Shannon's entropy of information is in the units of measure; the former is expressed in units of energy divided by temperature, the latter in essentially dimensionless "bits" of information.

As the holographic principle states that the entropy of ordinary mass (not just black holes) is also proportional to surface area and not volume, Bekenstein conjectures that volume itself is illusory and the *universe is really a hologram* which is isomorphic to the information "inscribed" on the surface of its boundary.

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(L. Susskind, J. Lindesay, *An Introduction to Black Holes, Information and the String Theory Revolution: The Holographic Universe*, World Scientific, Singapore, 2005)

## B.8. String Theory [Adopted from Wikipedia]

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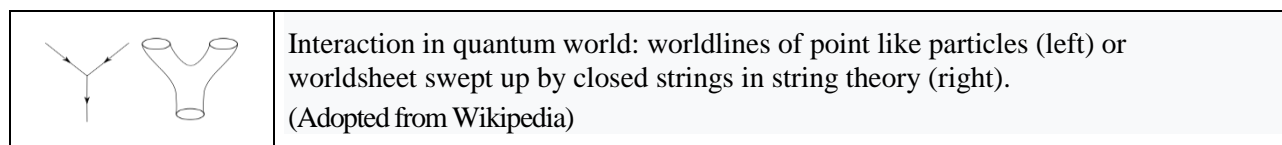
**String theory** is a theoretical framework in which the *point-like particles* are replaced by *one-dimensional strings*. It describes how these strings propagate through space and interact with each other. *On distance scales* larger than the string scale, a *string looks like an ordinary particle*, with its mass, charge, and other properties determined by the *vibrational state of the string*. In string theory, *one of the many vibrational states of the string corresponds to the graviton*, a quantum mechanical particle that carries gravitational force. Thus string theory is a *theory of quantum gravity*.

String theory has been applied to a variety of problems in black hole physics, early universe cosmology, nuclear physics, and condensed matter physics, and it has stimulated a number of major developments in pure mathematics. Because string theory potentially provides a *unified description* of gravity and particle physics, it is a candidate for a *theory of everything* (TOE), which describes all fundamental forces and forms of matter. Despite much work on these problems, it is not known to what extent string theory describes the real world or how much freedom the theory allows in the choice of its details.

String theory was first studied in the late 1960s. Subsequently, it was realized that the very properties that made string theory unsuitable as a theory of nuclear physics made it a *promising candidate for a quantum theory of gravity*. The earliest version of string theory, *bosonic string theory*, incorporated only the class of particles known as bosons. It later developed into *superstring theory*, which posits *supersymmetry* between *bosons* and the class of particles known as *fermions*. In the mid-1990s it was realized that there is only one



limiting case of superstring theories in eleven dimensions known as *M-theory*. In late 1997, an important relationship called the *AdS/CFT correspondence* related string theory to a quantum field theory.



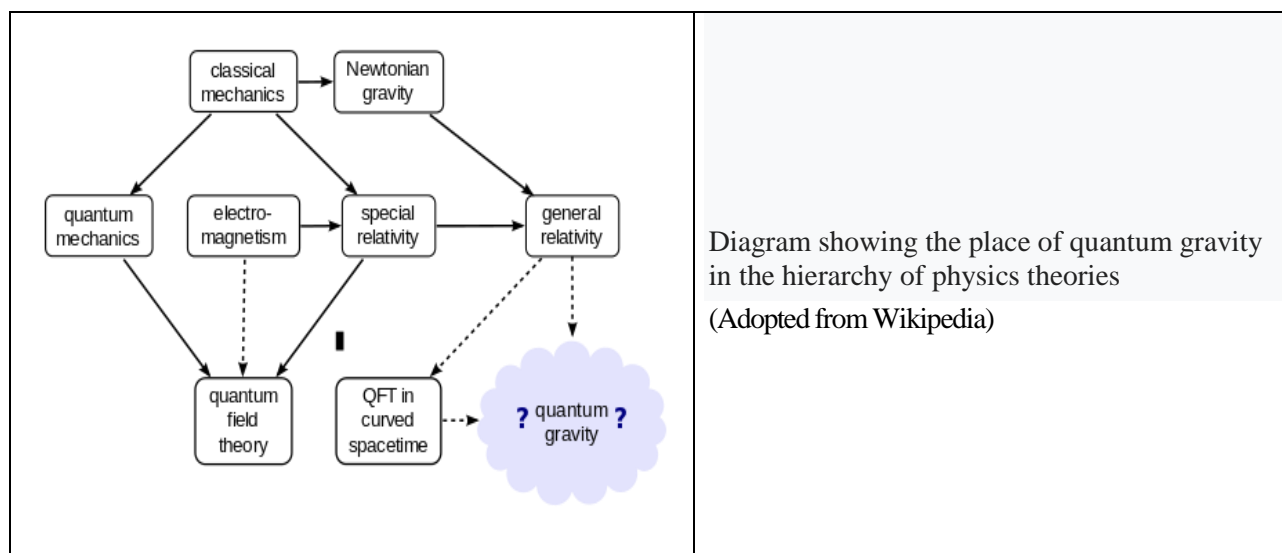
Additional recommended references:

- [https://en.wikipedia.org/wiki/String\\_theory](https://en.wikipedia.org/wiki/String_theory) (Wikipedia), and refs. therein
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(L. Susskind, J. Lindesay, *An Introduction to Black Holes, Information and the String Theory Revolution: The Holographic Universe*, World Scientific, Singapore, 2005)

## B.9. Quantum Gravity [Adopted from Wikipedia]

**Quantum gravity (QG)** is a field of theoretical physics that *seeks to describe gravity* according to the *principles of quantum mechanics*, and where quantum effects cannot be ignored, such as near compact astrophysical objects where the effects of gravity are strong. The *current understanding of gravity* is based on Albert Einstein's general theory of relativity, formulated within the framework of *classical physics*. On the other hand, the *other three fundamental forces of physics* are described within the framework of *quantum mechanics and quantum field theory*, radically different formalisms for describing physical phenomena. It is sometimes argued that a quantum mechanical description of gravity is necessary on the grounds that one cannot consistently couple a classical system to a quantum one.

While a quantum theory of gravity may be needed to reconcile general relativity with the principles of quantum mechanics, *difficulties arise* when applying the usual prescriptions of quantum field theory to the *force of gravity via graviton bosons*. The problem is that the theory one gets in this way is *not renormalizable* (it predicts infinite values for some observable properties such as the mass of particles) and therefore *cannot* be used to make *meaningful physical predictions*. As a result, theorists have taken up *more radical approaches* to the problem of QG, the most popular approaches being *string theory* and *loop quantum gravity*. So *string theory* tries to unify gravity with other fundamental forces, aiming to form a *quantum field theory of gravity* unified with a *grand unified theory*, so called *theory of everything* (TOE), while *loop quantum gravity* makes an effort only to *quantize the gravitational field* while kept separate from the other forces.



Additional recommended references:

- [https://en.wikipedia.org/wiki/Quantum\\_gravity](https://en.wikipedia.org/wiki/Quantum_gravity) (Wikipedia), and refs. therein
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(C. Rovelli, *Reality Is Not What It Seems: The Journey to Quantum Gravity*, Riverhead Books, New York, 2017)

## B.10. Quantum Field Theory [Adopted from Wikipedia]

**Quantum field theory (QFT)** is a theoretical framework that *combines classical field theory, special relativity, and quantum mechanics* and is used to construct physical models of *subatomic particles* (in particle physics) and *quasiparticles* (in condensed matter physics).

QFT treats particles as *excited states* (also called *quanta*) of their underlying *fields*, which are - in a sense - more fundamental than the basic particles. Interactions between particles are described by *interaction terms* in the *Lagrangian* involving their corresponding fields. Each interaction can be visually represented by *Feynman diagrams*, which are formal computational tools, in the process of *relativistic perturbation theory*.

As a successful theoretical framework today, QFT emerged from the work of generations of theoretical physicists spanning much of the 20th century. Its development began in the 1920s with the description of interactions between light and electrons, culminating in first QFT - *quantum electrodynamics*. A major theoretical obstacle soon followed with the appearance and persistence of various infinities in perturbative calculations, a problem only resolved in 1950s with invention of the *renormalization procedure*. A second major barrier came with QFT's apparent inability to describe the weak and strong interactions, to the point where some theorists called for the abandonment of the field theoretic approach. The development of *gauge theory* and the completion of the *Standard Model* in the 1970s led to a renaissance of QFT.

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