THE PSYCHO-BIO-PHYSICAL NATURE OF MAN, POSSIBILITY AND TECHNOLOGY OF THEIR EXTENDED MIND

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ABSTRACT: The facts and inferences exposed in this writing, and the arguments that support it, allow us to conclude that the «extension of the mind», opened during the evolutionary process, since always and today accelerated by the work of human intervention, in no case authorizes us to consider that the «extension of mind» has changed human nature, as we have always known it. Therefore, there is no justification to speak of transhumanism, as if a new man, a «transhuman», had appeared at the moment of the *Singularity*, whose nature had undergone substantial changes in relation to the usual human nature. For this reason, we consider that we should continue speaking of an «extensive humanism». No more.

KEY WORDS: Human nature; Mind; Psycho-bio-physical evolution; Classical mind; Quantum mind; Neural networks; Mind extension; Breadth of technologies; External networks; Computing; Transhumanism; Simulation; Ontological identity; Functional identity; Extensive humanism.

La naturaleza psico-bio-física del hombre, posibilidad y tecnología de la extensión de su mente

RESUMEN. Los hechos e inferencias expuestos en este escrito, y los argumentos que lo avalan, permiten concluir que la «extensión de la mente", abierta en el curso del proceso evolutivo desde siempre y hoy acelerada por obra de la intervención humana, en ningún caso nos autoriza a considerar que la «extensión de la mente" ha hecho cambiar la naturaleza humana, tal como siempre la hemos conocido. No tiene justificación por tanto, hablar de transhumanismo, como si hubiera aparecido, en el momento de la *Singularidad*, un hombre nuevo, un «transhumano», cuya naturaleza hubiera sufrido cambios sustanciales con relación a la naturaleza humana de siempre. Por ello, consideramos que debemos seguir hablando de un «humanismo extensivo». No más.

PALABRAS CLAVE: naturaleza humana; mente; evolución psico-bio-física; mente clásica; mente cuántica; redes neurales; extensión de la mente; amplitud de tecnologías; redes externas; computación; transhumanismo; simulación; identidad ontológica; identidad funcional; humanismo extensivo.

Man has, without a doubt, a «nature». Man is constituted by a way of being real, he is real in a certain way that makes him a generator of operations oriented towards survival. We speak of the «physical nature of the stones», thereby describing how they are real. The way stones operate in the world responds to their nature. We also talk about the biological nature of any animal, and its consistent way of operating.

Now, what is nature, how has it been formed? What properties and differences does the nature of the various real entities, and their various species and subspecies have? How should we understand what is the nature of man?

What do we intend, therefore, in this writing? We simply want to value the current claims of the transhumanist currents to the creation, through the work of human intervention, of a new nature of man; to create, ultimately, a transhuman. A new man who assumes, surpasses, and transcends current men, produced as an effect of natural evolution. As we know, this transition from society to the

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transhuman would be the moment that Ray Kurzweil calls «Singularity» (using a term that already existed). What is ultimately intended is the extension of human faculties, that is, an extension of mind, through reality in vast external networks of information; in computer networks that, immersed in the human body by nano sensors, could control organic variables; in the natural identification with the cyborg, since the machines will become human and the humans will be machines, this being the transhuman appearance of the man-machine, etc.

1. Man, evolutionary nature of the human mind

We begin, then, a reflection, based on the knowledge produced in science, on the evolutionary nature of the human mind[1]. Two initial observations to understand the evaluations of what we are going to expose. A) The first thing is to understand that we move within an approach, or paradigm of human sciences that we qualify as evolutionary-emergentist-neuropsychic. It understands that *evolution* has produced the *emergence*, from the physical world, of the *neural network* system (sensation, perception, consciousness, psychic-subject). The neural system supports the constitution in living beings (gradually) of a psychic structure of unitary sensation-perception-consciousness of the body itself. In this psychic structure emerges, little by little, evolutionarily, a «psychic subject» that drives unitary responses to the environment to survive effectively. B) Today, most scientists who work in biology, psychology, neurology, psychiatry, medicine, philosophy, and humanistic disciplines in general move within this neural paradigm... This approach also gives us an idea of man that is fully consistent with professional praxis and the functional organization of society. This is based on the idea of a personal human subject, free by self-awareness (although very conditioned and, in some way, with freedom nuanced by vital contexts) and always responsible for his actions. Without these assumptions, the logic of social life, politics, the economy, the established legal order... would make no sense at all.

From this neural paradigm, what we could call the «logic of life», using François Jacob's expression, is presented to us with very clear profiles. This logic confirms that in living organisms, initially only mechanical systems, the ability to «sense» emerged (to feel one's own body and to feel the surrounding world in which survival actions must be promoted). This «sensitivity» became an evolutionary advantage of the first order since it allowed a much more efficient adaptation to the environment and optimum survival. The sustainability and richness of a life supported by sensitivity had a much higher quality for efficient adaptation than blind mechanical action-reaction systems.

[1] As a general bibliography for this article, especially for this section I, I refer to the bibliography presented in my article: Monserrat, Javier, «Matter, Man, Universe: The Ontology of Human Openness to the Cosmic Holism», in *Pensamiento*, special series, n. 9, vol. 75, n. 283 (2019) 131-170. See also: Monserrat, J., «How Brain and Neural Networks explain Human Reality», in *Pensamiento*, extraordinary 2016 / 2, vol. 72, no. 273 (2019) 1043-1070.

Thus, living organisms evolved along the lines of perfecting their nervous (neural) systems as an instrument of coordination and efficacy of the sensation-perception-consciousness produced in the organism. Living organisms, therefore, have evolved a coordinated balance between mechanism and «psychic life.» The ontology (real way of being) of the nervous system has been organized to produce «psychic life»: sensations in the various sensory-perceptive systems (vision, hearing, proprioception...), knowledge, thought, emotions... a whole world of psychic experiences. All of them given and produced in the psycho-bio-physical ontology of the living being.

Therefore, correctly understanding what the psycho-bio-physical ontology of living beings and of man is necessary to be able to judge, and assess, the possible types of extension of human mind, which today are in question due to the proposals presented by transhumanist thought in general. But valuing them, that's what it's obviously about, from the point of view and criteria of the knowledge that science provides us.

1.1. The human mind and its evolutionary origin

We propose that the definition of mind be this: the set of contents produced by physical, biological, and psychic structures and mechanisms, conscious and unconscious, which are at the functional base of our psychic activity. The mind is thus a subsystem of the psyche: we have built a mind because our body is a psyche; because it has a psychobiophysical ontology that allows it. Our psyche leaves open a horizon of possibilities: by filling it with content, each man builds «his» mind from it and the human species builds «the» mind. The human mind always has content and functional forms common to all men; but the mind also has individual traits. Each man builds his individual mind.

The mind became possible as an evolution of life. But when and how did the long process begin that led to the appearance of living organisms with a psyche, capable of producing in them the birth of a mind?

The mind begins to function. We confirm the initial idea of how the evolutionary process shows the emergence of the psyche in living beings: when life ceases to be a blind mechanical process and life begins to «feel». Sensation is the beginning of the human mind. After the emergence of the nervous system (sensory-perceptual systems, consciousness) and the psychic subject, the definitive advance towards mind occurs with the appearance of memory: sensations (images of things) are recorded and can leave back on stage when the psychic subject remembers them. In addition, the images are related to each other through neural connections (links) that end up drawing a complex map of the world of sensations, images, valences (vital values) and emotions. A dog sees the image of its master and the links with which the neural system has organized its images cause the dog's mind to remember (by activating the memory registers) the image of the master feeding him, the image of caresses and many others. This combination of images through the multidirectional links of the brain is the beginning of thought in the animal world. But let us

note that it is a question of thinking through images that will later be helped by language and other abstractions. But deep-down thought thinking is always a sensitive representation of reality... The animal-human psyche produces sensitivity, and the mind is built as a network of sensations in real-time[2] and updated from the image memory registers.

1.2. The classical/quantum origin of mind

Since the 1920s we have known, therefore, that there is not only a physics of particles, but also a physics of fields. Both describe aspects of the same corpuscular-wave unitary physical reality. However, something has happened throughout the history of physics in the twentieth century when it has been «reduced» to a physics of bodies and particles. In fact, physics applied to the explanation of the psyche has been «reductionist» (reduced to classical mechanics) and it was only at the end of the 20th century that it was intuited that physical fields (which ware already ancient and had been known since radiation of the nineteenth century) had to play an essential role in explaining the «physical support» of the psyche.

Newton: evolutionary origin of the classical world. Newton's physics observes the macroscopic objects that constitute, differentiated and punctually, space-time. We observe stones, planets, celestial bodies, plants, animals, men, molecu-les, atoms, particles... They are real differentiated entities because they are independent bodies that exert a wide variety of interactions with each other. Newton's physics described that world by mathematical analysis and defined a complex system of variables to study it (mass, weight, force, space, time, speed, acceleration, direction, work, etc.), as well as quantitative methods to measure them and the mathematical functions that related them. But what are these bodies and interactions of the Newtonian world? Where have they evolved from?

Today we know that the universe began as pure radiation; this is true both for the big-bang theory and for the speculative hypotheses proposed by superstring theory. As the radiation field cooled, the particles that would later constitute the «matter» of the bodies were born. Physics today knows that corpuscles of many kinds arose. Essential for us is the distinction between boson (Bose-Einstein) and fermionic (Enrico Fermi) particles. Now we deal with the so-called «fermionic» because the world of classical mechanics is preferably constituted of them. Fermions (proton and electron are) have properties derived from their type of vibration (or wave function). An essential feature is that they tend to remain differentiated, without merging with each other or with other particles,

[2] Today we know that the subject has his experience in real time with a small-time lag in relation to the real facts that are perceived. The same thing happens on a larger scale, when we perceive the image of the sky in real time. It is the image of a much older universe.

forming a common, undifferentiated, and unitary vibratory field. In an atom, for example, the electrons vibrate in certain orbitals (each one in its space-time) without merging and maintaining independence; although the electron in its orbital is not a corpuscle but a vibration, it remains differentiated in its orbital, without merging with other electrons that will vibrate in other differentiated orbitals. Thanks to the persistence of these particles in remaining independent, there are atoms, molecules or bodies that are generally compact, with their own geometry, separated in space, different from each other and with differential properties. This is the world of objects of classical mechanics that makes possible independent living beings who build our history amid a world of objects that are also differentiated. If there were not the type of matter that we call fermionic, the universe that we know and that has made our lives possible would not exist. We would not exist.

A world of classical causal interactions. The interactions between fermionic particles and classical bodies explain what we see in our macroscopic experience. Due to the action of the four great known forces of nature (gravitational, electromagnetic, strong nuclear and weak nuclear), particles attract or repel each other precisely, sticking together to form atoms, molecules, minerals, living beings or bodies in general. Two colliding billiard balls, the celestial gravitational forces of the Newtonian universe, are examples of classical cause-effect interactions. Electrons —essential constituents of matter— interact by electromagnetic forces; Atoms stick together and unstick through covalent or ionic bonds. The effect produced by classical causality (the four forces) sticks or takes off, attracts, or repels, displaces, deforms, divides into parts, etc., but always acting on differentiated and independent entities in space-time. This causality is deterministic: given certain antecedent conditions of the state, the effect is produced inexorably; for example, between two electrons a covalent bond will be produced or broken, a magnetic field will produce such precise effects, a force applied continuously to a mass will produce a precise acceleration. The field of classical causality thus appears as a network of infinite cause-effect series or chains that together produce an effect that can be illustrated in the image of a «machine». It is a deterministic-mechanistic closed system.

Classic reductionist neurology. For her, the brain is a field of classical causality in the reductionist sense exposed. The light, the mechanical vibrations of the air, the gravitational fields of the Earth, the senses, the retina, the cochlea, the neurons, the axons, the nervous stimuli, everything is a very complex chain of classic causes-effects. All are classic causal interactions on the border between some entities and others (electrons, macromolecules, calcium ions, potassium pumps, neurotransmitters, photons, photopigments, etc.). Sometimes the causal action and its effects occur amid huge numbers of chaotically interacting events (e.g., in the cytoplasm of the cell). But on the whole, with statistical-probabilistic certainty, such or such deterministic effects will finally occur. Living beings are thus transmission chains of cause-effect interactions that leave from one point and arrive at another (e.g., from the retina to the terminal

neural activations of the image engram). In the neuronal world, classical effects are transmitted, but there is a tendency to forget and investigate what happens with fields and quantum effects[3].

1.3. Quantum causality of mind

Classical mechanical/quantum mechanical connection: physical holism. Classical mechanics was born long before quantum. However, the quantum perspective has assumed the explanation of the classical-macroscopic world. In some way, quantum mechanics explains how fermionic particles are structurally trapped in the order of matter and bodies, giving rise to a world of mechanical determination and statistical-probabilistic regularities. Quantum mechanics has also assumed that field radiation phenomena, known since the 19th century, have constituted and continue to constitute an essential aspect of the explanation of the universe.

Quantum holism: bosonic matter. Bosons (e.g., the photon, light) have a wave function that makes it easier for them to lose their individuality (unlike fermions) forming with other particles similar states of undifferentiated unitary vibration that fill certain bounded spaces. Bosonic matter tends to constitute, therefore, holistic states (in which everything is united to «everything», of the unitary field of reality) or vibration fields of undifferentiated matter. In the current universe there is not only stable matter produced by fermions, but there are also niches or bounded physical areas where holistic effects of a quantum nature are produced, within a classical world differentiated from isolated entities of fermionic matter.

Quantum coherence. The state of «quantum coherence» designates that physical situation in which the particles lose their individuality entering field states of undifferentiated unitary vibration in defined space-times. This is what was already discovered in Bose-Einstein condensates. The process in which a system in quantum coherence loses it and is reduced to individual particles is what is known as the «quantum de-coherence» process. Producing or maintaining quantum coherence processes is not easy, even with bosonic particles, since the interaction with the classical macroscopic world interferes and induces decoherence that leads these particles to also be trapped in the ordered rigidity of the classical world.

Action at a distance and non-locality: EPR effects. The famous imaginary experiment of Einstein, Poldolski and Rosen in 1935, when Einstein was already at Princeton, allowed conceiving that the idea of matter in quantum mechanics allowed the existence of a new type of causality (which seemed

[3] For example, see: Folder, Tim, «Crossing the quantum frontier», in: *Investigación y Ciencia*, September (2018), Spanish edition; also: Weinberg, Stephen, «The problem of quantum mechanics», two articles, in: *Investigación y Ciencia*, August (2017), Spanish edition; Aspelmaier, Markus, Arndt, Markus, «Macroscopic quantum effects», in: *Investigación y Ciencia*, March (2013), Spanish edition.

inadmissible for classical mechanics): non-local causation or action-at-a-distance. Various areas of matter in quantum coherence, for example, at a distance and without local contact, could enter interaction forming part of unitary systems[4].

Quantum superposition states. This new property known in quantum mechanics affects all kinds of matter, fermionic or bosonic; although the latter, being freer and more oscillating, perhaps has a greater ontological facility to be in states of superposition. Superposition means that the same particle, or a quantum state, can be indeterminate, that is, floating, without being defined in relation to different values of a variable or property of that system: that is why it is said that a system in superposition is at same time in many states (because they are possible) and in none (because none have yet been committed to). When, for example, a particle in superposition is made by «choosing» one of its possible states, the «collapse» of the wave function of that particle occurs[5].

Quantum uncertainty. It is known that, in the face of completely deterministic classical causality, quantum mechanics considered it necessary to introduce the hypothesis of the indeterminacy of quantum events. After Schrödinger proposed his famous equation to describe the position of the electron, two other mathematically equivalent systems were proposed, Heisenberg's matrix mechanics and Dirac's algebra.

Holistic quantum neurology. In principle, it is a heuristic hypothesis: a way of understanding what properties the type of «physical support» that has

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[4] Einstein, A., Podolsky, B., Rosen, N. «Can Quantum Mechanical Description of Physical Reality Be Considered Complete?», in: *Physical Review*, May (1935).

[5] Hameroff, Stuart, Penrose, Roger, «Orchestrated Reduction of Quantum Coherence in Brain Microtubules: A Model for Consciousness», in: *Toward a Science of Consciousness*, The First Tucson Discussions and Debates, eds. Hameroff, S. R., Kaszniak, A. W. and Scott, A. C., Cambridge, M. A.: MIT Press, (1996) 507-540. Hameroff, S., Penrose, R., «Orchestrated Reduction of Quantum Coherence in Brain Microtubules: A model for Consciousness», in: *Journal of Consciousness Studies*, 3 (1996) 36-53. Hameroff, Stuart, «Conscious Events as Orchestrated Space-Time Selections», in: *Journal of Consciousness Studies*, 3 (1996) 36-53. Hameroff, Stuart (1998), «Quantum Computation in Brain Microtubules? The Penrose-Hameroff «Orch OR» Model of Consciousness», in: *Philosophical Transactions Royal Society London* (A) 356 (1998) 1869-1896. Hameroff, Stuart (1998), «Did Consciousness Cause the Cambrian Evolutionary Explosion?», in: Hameroff, S. R., Kaszniak, S.vR., Scott, A. C. (eds.), *Toward a Science of Consciousness II: The Second Tucson Discussions and Debates*, Cambridge, M. A.: MIT Press (1998) 421-437. Hameroff, Stuart (2003), «Time, Consciousness and Quantum Events in Fundamental Spacetime Geometry», in: Buccheriu, R., Saniga, M., *Proceedings of a NATO Advanced Research Workshop*. Hameroff, S., *Ultimate Computing. Biomolecular Consciousness and Nanotechnology*, Tucson, Arizona, Personal Edition (2003). Hameroff, Stuart, «Quantum States in Proteins and Protein Assemblies: The Essence of Life?», in: *Proceedings of SPIE Conference on Fluctuation and Noise*, Canary Islands, June 2004. Hameroff, Stuart (2006), «Consciousness, Neurobiology and Quantum Mechanics: The Case for a Connection», in: Tuszynski, Jack (ed.), *The Emerging Physics of Consciousness*, Berlin-Heidelberg, Springer-Verlag (2006).

made possible the evolutionary emergence of sensitivity-consciousness could respond to. Classical neurology (classical neural network theory), as we have seen, opted for the hypothesis that interactive chains of classical causality were sufficient to explain the psyche. However, it fell into reductionism because the freedom, indeterminacy, the spontaneous choice that occurs in both the animal and human worlds (what the Anglo-Saxons call the *choise*) and the field (campal) phenomenological experience given in the psyche (Gibsonian direct perception) can hardly be explained by the classical physics of a differentiated, discontinuous world, with blind, deterministic, and mechanical causality.

Quantum neurology, compared to classical neurology, is simply the heuristic bet that considers that psychic properties could have their «physical support» in the properties of the quantum world: above all in quantum coherence and action at a distance or non-local causality (which would explain both the psychic field experience of one's own body and external fields of reality, such as vision, hearing, and gravitational sensation), quantum superposition, and indeterminacy (which would explain the essential capacity of the mind, choice in a realm of freedom, the choise in all its dimensions). These are the properties that we have just exposed. It is, therefore, a defined search program: first, those psycho-bio-physical structures, which should occur in the neuronal system, which in living beings would be the support of «niches» or areas of quantum states in which the described properties could occur and that could be connected with the explanation of the psyche. Between the properties of the psyche and the properties of the quantum world there seem to be surprising parallels.

1.4. Classical/quantum neural networks that produce the human mind

The knowledge produced in neurology —especially since the individual neuron recording technique was enabled in the 1950s by Kuffler— has made it possible to describe a multitude of neuronal correlates of psychic activity. What has been known are patterns, circuits, guidelines, engrams, networks, structures, canons, maps or mappings, etc., of neuronal interaction through ordinary synaptic connections, links, in the nervous system. These engrams belong to various modules or systems (visual, auditory, motor, linguistic, as well as thought, plan representations and motivations in the frontal areas, etc.) which, in turn, are connected to each other in multimodule systems. The basic idea is that from an experimental point of view there is a correlation between the various modalities of psychic activity in our mind and the networks of neural activity that support them. The essential inference derived is that psychic activity in all its facets is caused by, or consists of, the activation of these networks. The motto of the neural network theory is I and my psychic activity are nothing other than my brain and my neurons. When these neural networks are understood according to the functional principles

of the ordinary reductionism of physical paradigms and, moreover, no faculty of control or descending causality acting on the bio-physical is attributed to sentience-awareness, then the role of the psychic inner world, of the mind, is reduced to a minimum. However, neuronal emergentism, even in its classic version, is based on these assumptions: 1) neural networks as a correlate and cause of psychic activity; 2) acceptance of the psychic experience described by ordinary phenomenological methods; 3) downward causality and neural control exerted by psychic activity; 4) and finally bidirectional psychophysical interactionism.

This position is defended by most of the great current classical neurologists: Edelman, Damasio, Gazzaniga, Koch, Crick, Ramachandran, etc.: the explanatory causes of psychic activity are the neuronal engrams. Now, if these are explained within the framework of reductionist physics, is this knowledge enough to explain how all the phenomenological properties of the psyche are possible? Some —Damasio, Gazzaniga, Ramachandran— would say that they respect quantum hypotheses, but reserve their assessment. Others —Edelman, Koch, or Crick— would instead say that they are inappropriate and reject them. They would think that the classic interaction between engrams is enough to explain the phenomenological properties of the psyche[6].

Most of the brain, in fact, is made up of dense networks of engrams (patterns) that, when activated, do not produce psychic effects. Once a system of cells (neurons) was evolutionarily selected in multicellular animals to form the nervous system, this became largely a mechanism for receiving afferent signals that, through activated engrams, triggered efferent signals to the functional, regulatory, thermal, biochemical in general and motor control of the organism for its optimal adaptation. Even psychic activity (motor control, control of thought, language, emotions, etc.) is built on a huge network of engrams that when activated do not produce a psychic correlate (they are unconscious), but are at the base of the consciousness, in the same way

[6] The authors that we quote in this paragraph are examples of the interpretation of brain functioning from neural networks. For example, Edelman, Gerald M., *Neural Darwinism – The Theory of Neuronal Group Selection*. N. Y. Basic Books, (1987); Edelman, Gerald M. (1988). *Topobiology – An Introduction to Molecular Embryology*. Basic Books, New York (1988); Edelman, Gerald M., *The Remembered Present – A Biological Theory of Consciousness*, Basic Books, New York (1989). Edelman, Gerald M. (1992), *Bright Air, Brilliant Fire – On the Matter of the Mind*. Basic Books, N. Y. (1992). Edelman, Gerald M., «Neural Darwinism: selection and reentrant signaling in higher brain function», *Neuron*, 10 (2) (1993): 115-25. Edelman, Gerald M., «Building A Picture of the Brain», in: *The Brain*, Gerald M., G. M. Edelmann; J.-P. Changuex (eds.), Routledge, Taylor & Francis Group, London and New York 2000. Edelman, Gerald M., *Wider Than the Sky – The Phenomenal Gift of Consciousness*. Yale University Press (2004). Edelman, Gerald M., *Second Nature – Brain Science and Human Knowledge*, Yale University Press (2006). Edelman, Gerald M.; Gally, Joseph A. (2013). «Reentry: a key mechanism for integration of brain function», in: *Frontiers in Integrative Neuroscience*, 7 (63) (2013): 63. Edelman, Gerald M.; Tononi, Giulio (2000). *A Universe of Consciousness – How Matter Becomes Imagination*, Basic Books, N.Y. (2000).

that the protruding top of the iceberg is supported by an immense mass of submerged ice base[7].

Register and memory: intramodular and intermodular logic networks. Let's see the example of the vision: we make a trip to India and the impressive images are registered as in a folder of the visual module. We forget them, but after two months we evoke the trip to India and their images emerge in our mind, connecting with each other endlessly. There is an order of registration and retrieval that is mediated by the hippocampus. Another example: we build in our mind in frontal areas a dense network of engrams that allow us to know, register and think about the psychic fact of «perception». If this plot is logically well constructed, we will be able to retrieve it and mentally work on it efficiently. This «modular» logical order is also coordinated with a higher intermodular order that also responds to precise networks. We do not know, to this day, the neural way of building these logical networks, although we infer that they must exist. If we discovered it, it would be as important a discovery as the three-dimensional ordered structure of DNA chains. We assume that this logic of order has a close evolutionary relationship with time and content, always aiming at optimal survival by functional integration of the entire system.

Quantum neurology: the classical-quantum interface. Now, how to understand the evolutionary implementation of quantum principles in organisms and their integrated coordination in classical bodies of fermionic matter describable by classical causality?

How to choose (choise) or activate the most appropriate engrams for each action in each context? Von Neumann understood that classical mechanics could not deterministically justify the choice of due neural activation. Classical causality was thus incomplete. It was necessary to find the appropriate physical support for the choices that manifested in the psychic sphere. Von Neumann intuited that the physical support that these choises allowed had to be found in the quantum sphere, namely, in the «quantum jumps» from one state to another (within a plurality of superimposed possibilities) and the indeterminacy of the quantum states integrated in the very fabric of reality.

This approach understands, therefore, that the microphysical world and the psychic world are explained from the same ontology: it is the quantum ontology that allows indeterminacy, in the choice of the agent and in its effect on nature. This scheme, according to Von Neumann-Stapp, should be at the base of neurological theory: volitional acts must be explained from quantum processes (choise), and it must be understood how they are translated into causal processes in the mechano-classical world (causation). and what are the indeterminate final effects that are caused in the quantum microphysical world

[7] Monserrat, J., https://tendencias21.levante-emv.com/la-nueva-ciencia-comienza-a-explicar-por-que-el-universo-fisico-produce-la-conciencia_a43265.html. Monserrat, J. (2006), «Gerald M. Edelman and his neurological anthropology: Presentation and discussion of his theory of mind», in: *Pensamiento*, vol. 62 (2006) 441-170.

(chance). This would be, according to Stapp, a modern way of understanding the concept of «idea-motor» of William James. However, assuming this general criterion that choise occurs by quantum leap from a previous range of (superimposed) possibilities, when and how could these quantum leaps occur? What would induce them and to what biophysical logic would they respond?[8]

Bidirectionality of the classical-quantum interface. We start, therefore, from the verification of two phenomenological facts: the holistic experience or field sensation (proprioception, vision) and the experience of the open, indeterminate, free, oscillating volitional impulse (the Von Neumann-Stapp choise). When looking for a scientific explanation, one starts from various assumptions. 1) Infeasibility of a mechano-classical explanation: due to its determinism (which does not explain the choise) and due to its discontinuity, fermionic differentiation of entities, lack of field dimension (which does not explain the field sensation). 2) Recurrence to properties of matter known by quantum mechanics to explain them. It would be to explain it in terms of quantum mechanics and to do it by quantum properties such as coherence, superposition, non-locality, indeterminacy, etc. Consequently, this would lead to the need to know the real bio-physical way of implementing these quantum states in a classical medium (organisms and bodies), with their implied interfaces. Two systems would be at stake: the classical system that constitutes the entire body and the quantum system that is terminally the «inner world of the mind».

Now, the classical and the quantum respond, for current physical science, to the same underlying ontology. In classical matter the properties of the quantum world are also present. There is only one matter, with the same ontology: all matter responds to quantum principles, although in the classical Newtonian world the quantum properties are not manifested by the wave function of the fermionic particles (which, in the evolution since the big-bang, have produced the classical world of our immediate experience). Therefore, the existence of a deterministic classical-quantum interface should be postulated that would generate from the classical world (bottom up) the terminal psychic sensation of the quantum field (one of the basic psychic experiences that must be explained). An interface should also be postulated in the other direction, quantum-classical, which would produce open volitional acts and control (top down) the mechano-classical processes of the organism that lead to the control of actions (the experience of choice). Consequently, as can be seen, the heuristic model is the psycho-bio-physical, neurological repertoire of questions, and is not identified with any specific answer. It is a theoretical construct that aims only at research from the persuasion that the

[8] Uriah, Kriegel, «Philosophical Theories of Consciousness: Contemporary Westerns Perspectives», in: Zelato, Moscovichts, Thompson (Ed.), *The Cambridge Handbook of Conciousness*, Chapter 3. On Choise Analysis in the Von Neuman-Stapp Hypothesis.

phenomenological and scientific evidence makes us intuit that the answers lie in a certain direction[9].

The classical-quantum bottom-up interface. It is an assumption of the heuristic model that we have just established. It responds to the phenomenological aspect that we have called «field sensation» (Gibsonian «direct perception»). This should occur, within the assumption in which we move, by activating a neuronal pattern (engram theory) that would lead to the activation of a set of quantum effects that would produce the «field sensation». Now the cues to sensation are outside the brain in the classical world. Thus, the key to the visual image is in the external physical world. Sensation will only be evolutionarily useful if it reproduces, or is isomorphic with, the internal and external environment. Therefore, the content of the «world of the senses» is imposed in a deterministic way by the external mundane environment (or the internal environment «external» to the brain, the body). This external, deterministic, and precise information reaches the brain through mechano-classical processes and has to flow into a border area (interface) in which these mechano-classical effects are translated into the activation of quantum effects that, according to our Of course, they would produce the «field sensation». In this bottom-up direction, the quantum world would behave passively and would be activated determined by classical guidelines imposed with determinism by the real world in which it must survive (organisms do not «invent» the environment, although they «recreate» or «represent» it psychically —e.g., the color— with enough precision to adapt to it).

The quantum-classical top-down interface. The postulation of this new interface, from a direction other than the sensitive one, that is, top down, responds to the phenomenological aspect of the indeterminate and oscillating volition typical of living beings (choise). It is evident that volitions (behavioral decisions) are made once the organism has been sensitively (passively) informed of the «state of the environment». But the assumption is that volition is generated from a quantum «physical support» in which the choise is not, as we have seen, imposed by blind determinism but the result of a wave function collapse, induced by the psychic subject, between a universe of possible superimposed states. Therefore, it can be assumed that organic activity is initiated by quantum effects that are translated downwards in a chain of mechano-classical cause-effects that end up controlling the motor activity that supposes the optimal adaptation to the environment. I decide to move and, in effect, the neural engrams that control my movements are activated. To understand how quantum impulses (volition) are translated into mechano-classical processes, it is necessary to postulate a new interface in the opposite direction to the sensitive one, that is, top down. The quantum should be able to be accurately translated into the control of the physical, as it is understood up to now in classical mechanics. The psychic

[9] If a longer explanation of the biological process of the classical/quantum interface is desired, as we have exposed here, I refer to my work: Monserrat, Javier, *Visual Perception. The architecture of the psyche from the perspective of visual perception*, Biblioteca Nueva, Madrid 2008, written in Spanish, second edition, chapter XIV, 533ss, especially 554ss.

subject, from a classical physical support, but terminally quantum, quantum-mechanical, would thus control organic behavior with the flexibility that is verified by phenomenological experience[10].

2. Possibility and technology of an «extension of mind» in the human being

It is obvious that to talk about the possibility and technology of an «extension of mind», we have to previously clarify two concepts: a) what we understand by mind and b) what we understand by «extension of mind». According to these two concepts we could consider, first, if it is possible, and what it would consist of, an «extension of mind» and, second, if possible, what technology, or technologies, could make it possible[11].

2.1. Ontology and engineering of Mind

Psycho-bio-physical unity of mind. When in ordinary language, even scientific, we refer to the «mind» (both animal and human) we want to point to the superior

[10] I have dealt with many of these issues monographically in various articles of mine. Monserrat, J. (1996), «Francis Crick and the emergence of visual consciousness», in: *Pensamiento*, vol. 52 (1996) 241-252. Monserrat, J. (2000), «Penrose and the quantum enigma of consciousness», in: *Pensamiento*, vol. 56 (2000) 177-208. Monserrat, J. (2001), «Neural engrams and theory of mind», in: Pensamiento, vol. 57 (2001) 176-211. Monserrat, J. (2002), «John Searle in the discussion about consciousness», in: Pensamiento, vol. 58 (2002) 143-159. Monserrat, J. (2003), «Theory of mind in Antonio R. Damasio», in: Pensamiento, vol. 59 (2003) 177-213. Monserrat, J. (2005), «Evolutionary Genesis of representation and knowledge», in: Martínez-Freire, Pascual F., Cognition and representation, Contrasts, Supplement 10, Málaga 2005, 51-70. Monserrat, J. (2006), «Gerald M. Edelman and his neurological anthropology: Presentation and discussion of his theory of mind», in: Pensamiento, vol. 62 (2006) 441-170. Monserrat, J. (2007), «Neural Networks and Quantum Neurology: Speculative Heuristic Towards the Architecture of Psychism», in: Mira, J., Álvarez, J.R. (Eds.), *Bio-inspired Modeling of Cognitive Tasks*, Berlin-Heidelberg, Springer Verlag. Part I, 1-20. Except this last one, all these articles are written in Spanish.

[11] I cite here, initially, basic reference works that have influenced the way of understanding the technological possibilities of the extended mind. Keep in mind that, until the arrival of transhumanism, it was not understood that the technologies of the extended mind involved a transformation of human nature. In general, and with nuances, obviously, the general point of view agreed with the thesis that we defend here. Namely, that the extension of mind, however sophisticated it may be, does not imply a transformation of human nature. See Clark, Andy, Chalmers, David, «Extended Mind», in: *Analysis*, vol. 58, 1 (January 1998) 7-19, journal published by Oxford University Press. Commented article, years later, in the book edited by: Menary, Richard, *The Extended Mind*, MIT Press, 2010. She also established criteria on human nature: Kronfeldner, Maria, *What's Left of Human Nature? A Post Essentialist, Pluralist, and Interactive Account of a Contested Concept*, MIT Press/Penguin Random House 2018. Rheingold, Howard, *Tools for Thought: The History and Future of Mind-Expanding Technology*, MIT Press 200, many times reissued. Newen, Albert, De Bruin, Leon, Gallagher, Shaun, *The Oxford Handbook of 4E Cognition*, Oxford University Press 2018. Rupert, Robert D., *Cognitive Systems and the Extended Mind*, Oxford University Press 2009.

part of man. Namely, the human subject in awareness of himself as such, of his body and his faculties, his perceptive abilities, his memory, his ability to decide on survival actions, his emotions, vital interests, life plans and motivations, the language and the thoughts that allow him to «talk to himself», to live his inner life, the life that emerges from his psychic system, etc. The «mind», then, is the entity that makes all this possible, namely, it makes possible the integral psychic subject: a conscious system as a subject capable of controlling the body and promoting survival actions in the environment. When we speak of «mind» we refer primarily to that «superior» or «terminal» part of man, his conscience, his sensitivity, his thoughts... in short, to the «conscious inner man», that is, to the «psychic subject» that directs life because of a powerful «conscious inner world». But the «superior, terminal mind» is supported by a complex psycho-bio-physical network, which unites it to the universe.

Therefore, this conscious and directed work of survival is made possible by the «mind», that is, by that inner conscious system that springs, that emerges, from a material body, that has its roots in the external, material world, mechano-classical/quantum, that is, «classical/quantum» (as explained above). A body, in turn, that has its roots in the classical/quantum material ensemble of the world and the universe.

The «mind», therefore, is the upper part of the man we have described, that is, the life of the inner man who directs the actions of survival as a conscious psychic subject, but emerging like the visible tip of the iceberg, of a world of classical/quantum matter, of the body and of the universe in which man finds himself. Therefore, the mind is not an independent psychic entity, but the entity constituted by a psycho-bio-physical unit that is the one that causes, through its interactions, the empirical properties of the psyche, of the mind.

One ontology, two systems of causal interaction: the classical/quantum balance. The universe is, as we have explained before, for science, monistic: it is made up of a single type of matter; in other words, matter is the same throughout the universe and in all the beings that constitute it. This is how it is in the cosmic radiation of the big-bang, in the matter of the celestial bodies, in the dark matter, in the physical, in the biological and in the psychic. The universal properties of primordial matter produce the kind of interactions we call «quantum». But, after the big-bang, in the emerging quantum matter there was the formation of a type of particles (fermionic, mainly protons and neutrons), whose vibrational wave (vibration is undulatory) led to endowing them with a «wave function» (the mathematical description of its form of vibration) that made it highly difficult for certain interaction properties, ordinary in quantum matter, to be fulfilled within this type of particle. For example, it was difficult for fermionic particles to enter quantum coherence. For this reason, in the classical world, which Newton described in his physics, certain forms of interaction appear between the bodies formed in it that respond to properties that we call classical. Hence, the interaction properties between classical matter and quantum matter are different.

We find, then, that, for science, the only existing matter in the universe (in the primarily quantum universe and in the classical universe, which appears

later), which responds to quantum properties (the classical world is a case special), has the same ontology (the same way of being real). If the higher world of the mind (sensitivity, perception, consciousness, psychic subject, memory, thought, emotions...) is produced by the properties of matter in its quantum states (as we have said before), then this means that the ontology of matter in a monistic universe is the explanation of everything, of all the contents of the psycho-bio-physical unity of living organisms and of man. We move in a causally monistic universe. Everything that happens in the world (psychic, biological and physical events), for science, cannot have any other type of «physical support» than the only existing matter in the universe. Current science therefore excludes all kinds of «dualistic» explanations.

As discussed before, the explanation of events in the real world is achieved by a balance between classical causality and quantum causality. It is the balance, as the Anglo-Saxons say, classical/quantum. This balance occurs in a world that presents a single ontology in the matter that constitutes it. However, it is a fact that in this ontologically unitary universe two forms of matter have appeared evolutionarily. Classical matter (described in Newton's physics, which writes the world of objects of our immediate experience) and quantum matter (described in quantum physics). Classical matter is, basically, quantum matter (it is known, for example, that electrons, under extreme experimental conditions, produce quantum coherence).

There are, therefore, two different systems of states and interactions of the only matter in the universe. The first system is the universe that we inhabit (and makes human life and history possible) it is the universe that has been made possible by the evolution and organization of classical matter. The second system (the deepest, most basic, and primordial) is the quantum matter that presents a set of properties and interactions that we referred to before, and that are no longer fulfilled in the classical (Newtonian) system or world.

Therefore, in this classical universe, quantum matter is also present. Quantum matter is present in every corner of the classical universe, and in our (Newtonian) world of immediate experience the classical and the quantum are intertwined. The presence, accessible to our experience, of matter in quantum states is manifested in the macroscopic sensation-perception of the universe (e.g., electromagnetic fields of light), but also, and this is of special importance to us, in the «quantum niches» with which matter in a quantum state has made its way (or has emerged and intermingled) within the classical structure of living organisms. As we have explained, it would be these «quantum niches» that would produce the field states of indeterminacy and freedom, typical of the higher stages of the human mind.

Once emerging in living organisms (probably in older stages of cellular evolution) the quantum states that allow the sensitivity of the environment, the resources of adaptive survival increased considerably. Feeling allowed a more efficient adaptation of the environment. For this reason, from lower evolutionary stages, evolution was oriented towards the empowerment and development of the psychic (nervous) system that effectively guided survival

responses. The psychic subject that gives birth to the mind, as we have explained, is an example of how the entire organism in its classical aspects has evolved to produce and support the higher mind, arising in part from quantum effects, which directs the optimal process. of survival.

We have already seen how the mind, which is born from a psycho-bio-physical organization, has a classical/quantum support. Interaction processes in the classical body system produce effects (say, upstream) on the system of quantum interactions. Thus, in the same way, the system of quantum interactions produces effects (say, descending) on the classical system. This requires the existence of two interfaces: one that allows bottom-up the classical structure to surface effects in the quantum system of the mind; another top-down interface by which the mind produces classical effects and directs the functioning of the brain, by which it controls movements and actions in the world. These two interfaces are possible because they occur within the same ontology, which constitutes both classical and quantum matter[12].

2.2. Extension of the mind

«*Mind extension*». Being this way the things, being this the nature of the mind, what can we understand by «extension of the mind»?

As we have seen, the existing mind in men has a real ontology and a way of functioning to fulfill its ends, which depends on its classical/quantum ontology. The mind is what it is, just as science tells us, and we have summarized in this writing. Evolution has been, therefore, in the line of enhancing the functions of the higher mind to better survival.

According to this, to speak of «extension» of mind should be understood in the sense that the mind reaches new more powerful possibilities to fulfill its objectives in the organism. That is, the mind «extends» fulfilling its functions more effectively and qualitatively or reaching new functions that allow it to contribute more effectively to optimal survival. But we speak of mind, as the mind is, and we have just synthesized. It is about «extending» in the sense of «enhancing» the functions of the existing mind[13].

Some observations, therefore, on the «extension of the mind».

1) «*Natural extension*» *and* «*designed extension*». The natural extension has been produced in the same evolutionary process. There has been, therefore, a

[12] Byron, Frederick W., Fuller, Robert W., *Mathematics of Classical and Quantum Physics*, 2 vol. Addison-Wesley 1969-1970. Eunen, Chris, «The Many Classical Faces of Quantum Structures», in: *Entropy*, 19-4 (diciembre 2014).

[13] Nagel, Saskia K., Reiner, Peter B., «Skillfull Use of Technologies of The Extended Mind Illuminate Practical Paths Toward an Ethics of Consciousness», in: *Front. Phycol*. (July 0218), https://doi.org/10.3389/fpsyg.2018.01251. Cocchiarella, Christopher, «Extended Mind Theory: Out of Your Head, Into Your Technology», in: *Mindfull Technics* (September 2019). https://mindfultechnics.com/extended-mind-theory/. Folger, Tim, «Crossing the quantum frontier», in: *Investigación y Ciencia*, Spanish edition (September 2018).

«natural extension» as society has perfected its classical/quantum system by learning a better use of the capacities of mind, still today not fully exercised in the vast majority of men. But, in addition, there has been an «extension designed» and controlled by man himself. When today we speak of «mind extension» we refer, above all, to the latter.

Note that for there to be a «designed extension» of the mind, the assumption would obviously be that the «extended mind» maintains its ontology and essential functions. The mind could be enhanced and transformed, without losing its ontology and functions. But, if the mind (in its ontology and in its functions) disappeared, we could not properly speak of «extension of the mind». If the mind we know disappears, there can be no «mind extension». It would be about something else: the creation of a new entity, a new form of mind with new ontology and functions.

It is perfectly understood that the intervention on man for a «designed extension» of mind would be subject to ethical principles, which we do not address directly here, but which we will mention. There are many ways to extend the mind, maintaining what the mind is, without the human entity disappearing. But there are others that break the ontology and functionality of the mind and enter a new dimension: the realm of the transhuman, of what ceases to be simply «human» to become «transhuman». These new possibilities therefore require an ethical reflection.

2) «*Bio-physical intervention*» *and* «*psychic intervention*». Therefore, in principle, human intervention to a «designed extension» of mind can be done in two ways, made possible by the classical-quantum psycho-bio-physical unity of living beings and of man. We know that two systems of causal interaction coexist in this unit: the classical, deterministic, and the quantum, indeterministic. Both systems are born from within the same ontology and the same functional system. For this reason, as we said, evolution has designed two interfaces that control the causality from the classical to the quantum (bottom up) and the causality from the quantum to the classical (top down). Work is currently under way to understand how both interfaces work. Therefore, there would be a path of intervention through the bio-physical, which would have terminal effects on the mind, and a psychic intervention, which would also produce effects on the classical control of the body. It would be two ways for the «extension of mind».

Bio-physical interventions. We list some, but not exhaustively.

a) Numerous interventions, of *purely physical technology*, allow an improvement in the activity of mind. Suppose an office where psychic activity is hampered by heat or noise from outside, or other causes. An intervention designed to the case by air conditioning, soundproofing or light control technologies, will allow a functional improvement or «extension of mind». Any physical intervention on the environment is «extension of mind». The possibilities of action in this sense are today

numerous. For example, the study of natural light on spaces to achieve certain effects on mind.

b) *Pharmacology*, for many years, can also be considered a form of designed intervention, bio-physical, whose objective is to improve the physical state of the human body, but producing (by the psycho-bio-physical unity and by the action of the interfaces mentioned) an enhancement of the higher functions of mind. We already know the effects of a simple aspirin, or of the wide range of drugs available today in psychology and psychiatry to help improve mood and mind distortions.

c) Simple *biomechanics*, extended to *bionics*, also allows physical intervention designs that are transmitted, through the corresponding interfaces, to the upper part of the mind, contributing to its improvement and «extension». A mechanical arm or leg allows a physical improvement that is transmitted to the higher mind, allowing it to function better. Although it is something physical, it transmits its effects to the higher mind. By bionic we mean animal adaptive survival systems that can be physically applied to the human body to improve its physical and thus mental efficiency. Brain or retinal implants are also possible as physical interventions that improve or restore the passage of electricity from one part of the brain to another, or from the retina/brain, restoring «bridges» that continue to join parts of the neural system that had been severed by neurological deterioration (a stroke, Parkinson's disease, or macular degeneration). Likewise, pure metal plate implants in the spine allow substantial psychic improvements.

d) *Genetic engineering* is also, without a doubt, a technology that could allow an «extension of mind». The animal/human brain, in the evolutionary process, has been «extending», not only in dimensions, but in an improvement of its internal organization that has improved, in various lines, its benefits in terms of survival. The brain that is currently born in the human species, after the embryological development process governed by DNA, already has, genetically assimilated, for example, the modules and connection links with the retina that make vision possible. The neural structure of the sight system has been translated into DNA and the human brain already contains, at birth, the basic architecture for the actual exercise of vision to produce images in real time, which will be recorded and updated later as memory. Genetic-evolutionary engineering endows us with the birth of the system to have images, but it does not endow us with the images themselves. These, by evolutionary order, must be produced and recorded by the individual in engrams, patterns, or brain circuits, made up of thousands of neurons, with images connected to each other forming complex mappings of images and thoughts or ideas.

The genetic organization that from the DNA, in the evolutionary process of embryonic development, governs the formation of the brain could be intervened by genetic engineering to transform the modules or basic organization to improve both the perception of images of all kinds and their organization,

registration and manipulation (intelligence). But genetic engineering could not endow the living being with that content of images, knowledge, thoughts, emotions... that must be individually constructed by the living being from the system that transmits embryonic development. Today we barely have the knowledge about the organization and neural registry that would make possible an intervention on the contents that every mind builds by itself.

The mention, which we have surely already heard incredulously, of a pharmacological treatment of pills that, once ingested, put in our minds such or such knowledge or emotion, say, the experience of having been in India, the knowledge of the Russian language, or a treatise on mechanics... it's not only science fiction, but something much more serious. It is the suggestion as possible, in the format of «science fiction», of something that science itself currently tells us would be impossible. That is, it is not scientific or even conceive of it as «science fiction». It is not only unscientific, but also even immoral.

Psychic intervention. As explained, the extension of mind can be the object of «designed» interventions by bio-physical means. All this is made possible by the psycho-bio-physical ontology of the human being, inserting nature into the universe. But our ontology is also «psychic», the psychic dimension being essential to the result of the mind. Would it also be possible a «psychic» intervention, that is, direct (influencing top down) on our psychic system?

a) «Bio-physical» interventions are always indirect: they reach the terminal psychic mind indirectly. But the affirmative answer to the previous question springs forth immediately. We already have extensive experience of this in the history of education. Not only of education, but of psychology and psychiatry. In this way, the brains of great professionals have been «mapped» and continue to be «mapped». Through interpersonal communication, we can induce new neurally (engrams, patterns) mapped maps to be constructed that the same neural system knows how to introduce, and functionally coordinate, in the complex networks of patterns that govern behavior and thought. What we are not able to do by genetic or pharmacological intervention, we can achieve with all cleanliness and precision, simply by interpersonal dialogue.
b) The effects of quantum events on the mind are, basically, a physical effect on the mind since the quantum is physical. Now, we know from what has been said so far, that the psychic nature of man, the mind, within its psycho-bio-physical unit, is especially linked to the biological-neural «quantum niches» and their connection with external quantum states of the universe. For this reason, we can point to a set of quantum processes that have a more immediate effect (without classical mediation) on the psychic states and the processes of the mind. It would therefore be possible to consider them as a special form of direct intervention on the psychic. We refer to phenomena of the so-called «mirror neurons» type, or the transmission of psychic states, for example emotions, from one living being to another by quantum effects of action-at-a-distance, or

the natural affection of magnetic physical fields, present in the universe, which are felt by living beings, such as birds, which govern their precise journeys from one point to another on earth.

3) *Independent ontology external systems*. As we said, the human being has two systems in his psycho-bio-physical unit. It has a classical system, which responds to the bio-physical, and a classical/quantum system that makes the psychic dimension and the mind possible. These two systems function as a unit because they are born from the same ontology, the monistic ontology of matter that constitutes the universe. For this reason, it is relatively easy to postulate that there is a bottom-up interface, ascending, and another top-down, descending. We explained it before. They are two systems internal to the human being, which are organized within their unity, ontological and functional, psycho-bio-physical.

But, in addition, the human being is open to the effects on his psycho-bio-physical system, of other systems of ontology, and functionality, independently, produced within the universe. In general, the natural events produced in the universe, whether classical or quantum, can have effects on the psycho-bio-physical entity of living beings and of man; as an example, all climatic events (classical) or the electromagnetic fields present in space (quantum). For this type of natural effects, organisms have already evolved their own sensors. Its effects are therefore powerful extensions of the mind in the physical universe.

But there are also purely physical systems, very natural, externally constructed by man that do not produce direct effects on the human being (such as those produced by the climate or the electromagnetic fields of space, which directly affect the classical/quantum system of the human body, ontologically and functionally immersed in the universe). But, for these systems, given their way of being built, to become powerful extensions of mind, the implementation of an appropriate interface is always necessary. We understand it with some examples.

a) Examples are *knowledge*, *thought* and the *human emotional world*, which are *independent systems* not accessible by other human beings. But, through language and writing (previously by pure signs), as an interface, it can be possible, through the perceptual systems of hearing and vision, the intercommunication of some human beings with others. A man and another man are independent psycho-bio-physical systems. There is a certain communication, through the immediate senses, but it is very limited, given the enormous density of the mind of each one. The knowledge of others, through language and writing, is an immense extension of mind, which has been progressing since prehistoric men. Any library, from the library of Alexandria, is a huge interface for human intercommunication. Nowadays, knowledge, science, technology... are made by decisive use of the computer and are also accessed through the computer.

b) Another example, then, is the computer, a device built by man. Computer and man do not come into direct contact. These are two ontologically and

functionally independent systems. One and the other cannot communicate directly with each other. The computer has a hardware of silicon plates, input, output, and internal data transfer buses, it has data memory and program memory units (always in series of zeros and ones, in correspondence with a physical state capable of having two positions, 0 and 1), a unit (or several) central processing unit... The computer is a blind mechanical system, a machine designed by man that produces what it can produce, due to its engineering design.

The same can be said of the PDP (parallel distributing processing) connectionist computer. The so-called artificial neurons are not biological. Man, on the other hand, has a psycho-bio-physical ontology that endows him with sensitivity and consciousness (he is not blind), because of a dense web of neural networks designed by the evolutionary process, which produce and organize sensation- perception-conciousness, making it useful for optimal survival. Man, and computer are two systems that, even forming part of the same monistic universe, are ontologically and functionally diverse and independent. It is not possible to link the two systems directly.

Man has built the computer, that is, its basic hardware. Through a top-down interface, man has entered information into the computer (sounds, images, language, writing, numbers...) and complex programs have been developed to process it (software). But everything that the computer contains, and what comes out of it, can be presented, and manipulated through the interface of the keyboard, the speaker or the screen, or others, thus being accessible by the user who, therefore, reaches an important extension of his mind. The computer, being designed as a system by man, has made use of previous interfaces, already created by man: language based on sounds, endowed with meaning, writing, numerical systems, images... Hardware and software, or engineering physical and logical, has been created by man according to these previous interfaces, already appeared in culture. In addition, when the computer, after storing information and processing it, wants to transmit its content to man (who wants to make use of the computer's content, according to what the computer demands), it translates its content to the various interfaces that are enabled for communication. computer/man intercom.

c) External computer networks have provided an immense extension of mind, using the computer. Let us see some examples in the networks of *the information society* and in external networks for the *biomedical control of organisms*.

Internet engineering has been the great advance for the creation of the *knowledge society*. The Internet user through a computer has access to an immense network of information, contained in thousands and thousands of servers that immediately serve the information that is requested. Hundreds of thousands of web pages offer all kinds of cultural, philosophical, political, economic, scientific, literary, artistic, and journalistic knowledge. Libraries have put all their collections on the Internet and their access is immediate from anywhere on earth.

The content that circulates through the network does so in codes of very long series of zeros and ones (one or another physical state) that are transmitted by cable or through space, wirelessly, thanks to knowledge of the states, and frequencies, of electromagnetic waves in space that process sounds, images, words, language, numbers... encoded in a series of zeros and ones, with specific frequencies in space, that the computer translates through its interface into content that can enter directly into the user's mind.

Mobile telephony has been another important step for human intercommunication and the *knowledge society*. The old telephone that only transmitted the voice to the final interface that allowed the user to hear an intelligible language, has become a minicomputer that allows connection to the Internet, with the same features as a computer.

Expert systems for computational control of the physical environment. They are already used in industry, for example, to control the operation of all the variables and states of the system in a nuclear power plant. The physical system of meteorological phenomena in nature (which already directly influences the classical/quantum entity of the body, as we said), through an expert system designed for this, can record all the values of the various variables throughout the world and compose a weather forecast, which the user can access through the ordinary computer interface.

Expert systems for the computational *control of society, politics, and the economy*. They are also of ordinary application today and do not need any explanation.

Expert systems for computational control of bio-medical systems. There are already numerous expert computational systems that allow the diagnosis and hypothetical design for the treatment of diseases. This computer control is today qualitatively enriched by the future possibility of introducing nanorobots into the organism, which detect states and values of organic variables from within. When transmitted to the expert system, treatments could be diagnosed and designed with much greater precision. At the same time, nanorobots could also be carriers of drugs and drugs that are delivered to the precise places in the body that need them. Likewise, the nanorobot could carry out the nanosurgery work for which it is prepared. Biomedical nanotechnology is today totally dependent on biomedical expert systems and is an extension of them. Nanotechnology would hardly be possible without the computer and wireless data transmission.

d) *Computational technology for the implantation of sensors and plates*. In addition to bio-mechanical implants, for example retinal or brain implants, which we referred to earlier, a new technology for implanting sensors and plates is currently being developed with the aim of making mental control of external systems possible. The technology can be applied to a huge variety of external systems; The process is always the same. The plate, or the specific sensors, are designed to accurately record specific neural activity (let's remember current electroencephalography), in very precise areas of the

brain, that occurs in certain decision-making (yes, no, forward, backward, stop, turn on…). These signals are processed on the board, reinforced, and sent to the external system that is to be controlled. We refer here, by way of example, to the fields, in development and experimentation that are best known today.

Computer mind control. The board detects precise brain signals, reinforces them, and sends them to the computer. This has a system prepared to receive these signals and proceed accordingly. *Mind control of bio-medical expert systems*. The subject can control through these technologies the expert systems that, by computation, deal with their problems (for example, through possible nanotechnology techniques) and get the expert system to present them in the appropriate interface (for example, voice or screen) what you need to know to control your own improvement. *Mental control of driving*. The automatic control of moving machines is today the order of the day: in maritime navigation, ships, trains, planes, automobiles... can work by means of automatic systems. Likewise, for example, in car driving, the implantation of plates prepared to be a mind control vehicle, can allow the mind control of automobiles. *Mental control of bio-mechanical and bionic systems*. A leg, a hand, an arm can be controlled by biomechanical abilities (the individual must be trained for it), but they can also be mentally controlled by applying this same technology of plates and sensors that convey the connection between the mind and the bio-mechanical device, or bionic (if its design is inspired by other living systems).

2.3. Conclusion: possibility and technologyof a «mind extension» in natural man

Mind extension? It is obvious. Not only an extension of the current mind, but also the mind of the past and the future. In the past, the extension of the mind has been one of the great protagonists of evolution. The enlargement of the brain, from the primitive limbic system to the modern cortex, offers us the common thread of the extension of mind. The progress of knowledge, the advancement of culture, science, education... have meant a prodigious extension of the mind. Today some of the numerous techniques, enabled by man himself, that we have just exposed, have left open numerous avenues of extension of mind that will continue to expand in the present and in the future.

Man has extended his mind by means of external technology that he himself has been able to create. The extension of the mind has supposed, then, for man and for humanity, the opening of an immense number of new possibilities of improvement and improvement of human nature, that is, of «natural» man (the man produced evolutionarily in an evolutionary nature).

We have seen that natural man is a psycho-bio-physical entity within a monistic universe. The natural man is part of the unity of the universe. However, the universe has evolutionarily produced two possible ways of interacting

with matter, given its properties. Classical matter and quantum matter. In the universe, naturally in the mechano-classical world and by human fabrication, there are systems whose properties of interaction between their objects and states do not respond to those of other systems, such as living beings, in which the properties of the quantum matter are present.

However, mechano-classical systems, such as a computer, can serve as an extension of mind, this being a classical/quantum system and, therefore, with a non-classical system of interactions. The reason is that the bidirectional interface systems, bottom up and top down, which we have explained, make it possible.

Therefore, and this is the main thing, all the possibilities and technologies for the «extension of the mind», which we have exposed, do not alter human nature at all. They are just new open possibilities that, over time, will undoubtedly grow in quantity and quality. But we still have our same psycho-bio-psychic nature. We continue with our mind that, in a conscious way, makes possible the psychic subject that directs our life, in a similar way to previous centuries and centuries of human history.

3. Transhumanism, towards a new human nature?

For some years now, the school of thought known as transhumanism has argued that technologies, mainly computational, of «mind extension» will lead to such a transformation of man that his nature will also be essentially affected. They will therefore be transformations that will no longer be compatible with the previous human nature, as we have known it up to now. These changes will lead to a new human nature: the previous nature will give rise to a new real way of being of man. We will enter the new time of «transhumanism», a new man, produced from the previous one but with such profound transformations that they will force us to recognize that the history of man has entered a new era. The moment in which this change will take place is called, for these authors, «Singularity».

What will the changes and transformations that will mean by their very entity a change towards transhumanism consists of? What will the new paths of «mind extension» consists of that imply the disappearance of the old nature and the appearance of a new nature? These are the fundamental questions that we must answer to understand what transhumanism is and what the new human nature that it will bring with it consists of. In short, what does transhumanism contribute to the «extension of mind».

As we have said, the ontology of the universe is monistic: everything has emerged from the same type of matter. Primordial matter is quantum; but, after the big bang, quantum matter led to a type of matter in which some of the primordial properties of that same matter did not occur. It is classical matter, described in the Newtonian world according to interaction properties that we call classical. Man is a classical/quantum real being; a

drug, for example, an anxiolytic, can be assimilated by the body's classical system and have terminal effects on the mind, resulting in part from quantum effects. Well, we said that there are classical systems, built by man, mainly the computer, that cannot be directly connected to the classical/quantum system of man. These classic systems can produce results of great interest for the extension of the mind, but this is only possible if the computer, as we saw, is accessible to the human mind through an appropriate interface. For example, the computer screen.

What is the new extension of mind proposed by transhumanism? It is the consideration that the extension of mind through external networks, of one type or another, can always be done directly, without the intervention of an interface. Thus, the computer and man, the human mind, would form a single system, without the mediation of interfaces. It would be the appearance of the «man machine». Machine and man belong to the unitary ontology of the universe. But the evolutionary process has produced the appearance of two modes of being real, two «second order» ontologies (the first order ontology would be the monistic ontology of the universe): namely, the quantum-mechanical system, with the system of interactions primordial of matter, and the mechano-classical system, with the classical system of interactions. We have stated so far that these two systems («second-order» ontologies) cannot be linked directly. Transhumanism considers so. An immediate ontological and functional unit, without interfaces.

We consider that the reasons for considering the viability of the immediate union of both systems are not scientifically sustainable. Therefore, the «extension of the mind» proposed by transhumanism, in our opinion, is not possible and, therefore, could never become a real extension of the mind.

We make some considerations about the engineer Ray Kurzweil, true introducer of transhumanism and author of basic reference[14].

[14] The fundamental books of Kurzweil to which we refer in this writing are these. In 1989 he published The Age of Intelligent Machines. In 1999 he appeared The Age of Spiritual Machines, which he completed in 2002 with a response to his critics: Are we Spiritual Machines? Ray Kurzweil versus the Critics of Strong IA. In 2005 his most important work appeared: The Singularity is Near: When Humans Transcend Biology. Finally, in 2012 his third anthropological-philosophical work was published: How to Create a Mind: The Secret of Human Thought revealed. Also, perhaps to be added: *Virtually Human: The Promise – And the Peril – Of Digital Immortality*, written by Martine Rothblatt and Ray Kurzweil (issued September 9, 2014). The other books that can be seen on the market deal with aging and health, and are therefore not particularly important from a scientific, anthropological, and philosophical point of view. The works from 2005 and 2012 have been translated and published in Spanish by Lola Books, Berlin. *The presentation of How to create a mind. The Secret of Human Thought*, was held at Comillas University in 2013, with the presence of José Luis Cordeiro (from the *Singularity University*), Adolfo Castilla and the Editor in Spanish.

3.1. Kurzweil's extensive humanism

Ray Kurzweil, New York 1948, from a Jewish family emigrated from Europe due to Nazi persecution, is a relevant personality in engineering, philosophy, futurology, but above all in the computational theory of living beings and of man. He founded companies that designed major software and speech, text, or image recognition technologies (such well-known applications as Omnipage or Siri, used on Apple's iPhone or iPad, go hand in hand with Kurzweil's name). He has been awarded honorary doctorates from more than twenty universities and has received the highest honors from the American government and private business world, including three awards from three different American presidents. Kurzweil has been one of the main promoters of the foundation in 2009 of the *Singularity University* in Moffett Field CA, supported by Google and the Nasa Ames Research Center, among other companies and individuals (including Arnold Schwarzenegger).

Kurzweil's contribution. What, then, does Kurzweil's thought consist of? A) First, Kurzweil provides a computational theory of man and living beings. This theory is based on a theory about the computer as a product of human engineering and on a theory of living beings, their neuronal system, and especially the human neocortex, as well as a theory tending to show the functional identity between computers and the animal and human mind. B) In accordance with this idea of AI (*artificial intelligence*) and the animal/human mind, Kurzweil enters the field of futurology announcing that technological development, to which he attributes exponential growth due to the *Law of Accelerated Returns*, it will lead humanity to enter a future *Singularity*, or a moment in which history will enter a new phase, essentially and qualitatively different from the previous one. This new stage will be characterized by the union, in the same ontology and functionality, of the machine and the living being.

Extensive humanism. To explain the «mood» of Ray Kurzweil's work, let us first think of «reductionism». For him, what, according to our phenomenological, personal, and social experience, is more important (consciousness, sensitivity, thought, language, motivations, psychic subject, rational mind, free and responsible decisions...) is «reduced» to the systems of deterministic and mechanical interaction of the mechano-classical world. Ultimately, living beings and man are «reduced» to the condition of pure robots; very complex, certainly, but robots. Most computational theories of man are now «reductionist». For computational robotism and neural determinism, our life is only a deterministic and mechanical consequence of blind cause-effect chains that are explained by the physical interactions of classical mechanics. But the psychic subject, supported by the psychic processes that give him the false appearance of being the protagonist of life, does not actually have any «controlling descending causality of the physical-chemical». The subject is a pure epiphenomenal witness to the products of a deterministic world.

Falsely, the subject is felt as the causal protagonist of the behavior, but he is not[15].

However, this is not Kurzweil's point of view. He does not identify with the «reductionism» of so many colleagues. Where then is his thought situated? In principle let us say that he wants to save man, according to the experience that man has of himself; according to the «humanist» experience and convictions that are at the base of social, religious, philosophical, legal, economic, and political life. Kurzweil is a man with «common sense» (perhaps not extended to all his followers) and he knows that he cannot offer a «reductionist» idea of man that, deep down, is incompatible with our personal and social life, making it impossible. Therefore, Kurzweil strives to maintain a «humanistic» idea of man. For him man has a conscience, personal identity, is free and responsible for his actions (up to a certain point), building his life through a series of decisions that put into play the use of an emotional and psychological psyche, a rational psyche. This means that for Kurzweil, in my opinion, the psychic world is not epiphenomenal (or reductionist). The human mind has a real physical-chemical downward controlling causality.

Kurzweil does not intend to deny those psychic properties of man on which «humanism» is based in our personal and social life. In his perspective it is not about «denying» but about «extending». The question is not to deny, or «reduce», the mind, but to affirm it and «extend» it (extended mind). For him, modern technology, based on computer systems, in the development of its hardware and software programs that can be implemented, is giving birth to new forms of reality that will suppose an «extension» of the properties of mind: conscience, identity, the condition of free subject and responsible for their actions. The human, then, will extend beyond what was «human» until now, entering new spheres and dimensions of reality.

Spiritual machines. Kurzweil knows perfectly well that real man and society are built from an unquestionable radical fact: consciousness. Individuals make themselves personally, and society is what it is, from a property of the mind that makes it possible to live a responsible human biography (there is a subject of attribution) that founds the social order: it is consciousness (sensation-perception-consciousness). Therefore, if it is a question of arguing that in

[15] The computational idea of man (and living beings) can respond to the strong metaphor of the computer or to the weak metaphor. The strong metaphor understands that computer and living being are ontologically and functionally the same, although it is evidently recognized that the computer does not have biological hardware. Notwithstanding animal and human biology, the neurological system is an evolutionary implementation of a pure computational system. This can be understood in two ways, serial, or connectionist PDP. The consequences of this way of thinking lead to robotic reductionism. Classic serial reductionism began in the 1960s with the work of Herbert Simon and Allen Newell. PDP connectionism with Rosenblat initially only to take off with the work of McLeland and Rummelhart in the 1980s. The computational vision of man can be seen in authors such as Jakendorf, Kosslyn or Dennett, as well as in the great MIT dictionary. The neurological version of causal determinism is found in the so-called neural determinism that in Spain has been defended, among others, by J. Rubia.

the *Singularity* there will be an extension of humanism to machines (*spiritual machines*), this will hardly be possible if the machines are not conferred consciousness. Not only consciousness, but also the other properties of the mind constituted in a biological entity like ours. It is evident that cyborgs are not «biology» and Kurzweil knows this perfectly.

Ultimately, the beauty of that future, in which Kurzweil believes, depends on whether extensive humanism can be realized. Therefore, it is not about denying the humanistic experience of man that constitutes our personal and social being, but about extending it. Therefore, if our human reality as a biological entity is founded on properties such as consciousness, personal identity, freedom, rationality, etc., the extension of humanism must assume an «extension» of those properties to machines. But this is where the problem begins for Kurzweil.

For the creation of new quasi-human entities, the problem arises as to whether the extension of properties can be attributed to these entities. The biological entity of man has «consciousness». Now, can consciousness be attributed to a robot, an avatar, cyborg or android, whose programs almost perfectly simulate human consciousness? Man is a personal entity that remains in time and that constitutes a specific biography. Does it make sense to say that a robot is also a personal entity? Man, and at his level, animals enjoy degrees of freedom. Can it be said that a humanoid robot is also a free entity that builds its history through a set of free choices derived from its personality? Kurzweil's problem is that many (indeed, most) scientists and philosophers deny that these properties can legitimately be applied to robots, to machines. It is the question of whether it will be possible to create a new type of entities that suppose the extension of the properties of the human biological entity. It is the essential problem of *How to Create a Mind*, the 2012 book.

3.2. Functions, processes, and states of a system: simulation, ontological identity and functional identity

The question is, then, whether spiritual machines, cyborgs, androids... could have the contents and functions of living beings and, especially, of man: conscience, psychic subject, personality, responsibility, freedom, morality, etc. To assess the answer, we can first draw certain conclusions about the functions, processes, and states of a system, as well as what we understand as ontological and functional identity between systems.

1) In principle, we can imagine the structure of the functions, processes, and states of a system, regardless of how it could be constructed in reality (i.e., of its ontology, whether biological or not). Thus, it would be possible to imagine a system capable of receiving information through various channels external to the system and internal to the system itself; capable of analyzing that information, registering it, retaining it, recovering it

and relating it to each other; capable of weighing this information in order to certain values related to the optimal maintenance and operation of the system; capable of acting motorically in the environment for the benefit of the system itself; capable of learning and capable of constructing refined and selected forms of information; capable of learning and building refined and selected value systems; capable, through this learning, of building a global property bias in the capture of information, in its evaluation and in the design of the forms of motor action in the environment («personality»); capable of a reflexive analysis (of the system on itself) of the information itself, of the forms of learning, of the value systems, of the processes of response to the environment through the movement of the system (programs); capable of building various programs or forms of information, assessment and response, having forms of choice among the various possible options... We put «ellipsis» because we could continue the enumeration and qualification of the properties and attributes of this «imaginary system». Now, a system with these «imaginary» characteristics, how could it really be built?

2) A first answer is obvious and is given to us by our experience of the psycho-bio-physical entity that constitutes us and that we can describe in a phenomenological way, as we explained before. The psycho-bio-physical ontology of reality has made possible the existence of living beings, and of man, as balanced systems between determination (mechano-classical interactions) and sensibility-consciousness-subject (with the added participation of classical/quantum interactions). These systems of psycho-bio-physical ontology (more shortly, of biological ontology) allow, in fact, to build living beings with consciousness, psychic subjectivity, knowledge, values, identity, free will and the many other properties that we notice in our psychic lives. This is what we have been describing. In a system of ontology and biological functionality like ours, an imaginary system like the one proposed (point one) could be applied.

3) A second answer is given today when extracting the consequences of the engineering and logic of computation. A system like the one we imagined in point one could be made a reality based on computer engineering and logic. We have seen how Kurzweil predicts that we will soon have robotic machines that will make the cyborgs or androids, that we see today in science fiction movies, a reality. They can be constructed in such a way that they not only have the properties of the imaginary system described above, but also have properties like those of a psycho-bio-physical implementation of that system: consciousness, identity, personality, emotions, free will, etc. We do not doubt that it could be possible in the future to build this type of android that, in practice, would be indistinguishable from a human (robots that would finally pass the so-called Turing test).

4) Now, between the psycho-bio-physical systems, produced by the evolution of the real universe, and the computational systems, produced by the computational engineering of androids, is there an ontological identity? That is, are they identical by the hardware that constitutes them internally? Let us point out that we do not harbor, nor can anyone harbor, any doubt about the answer. The entities of biological ontology are made of living tissues in which sensitivity-consciousness has emerged, a psyche made up of consciousness and psychic subjectivity, of neural networks that produce psychic life and the mind, as we have explained and today science describes. Computational ontology entities, on the other hand, are made of chips, silicon, digital memory units, CPSs, programs or algorithms of operations, artificial neural networks, or physical processing units (PDPs), etc. But all this is objectively a logical-mathematical system of «mechanical and blind» algorithms. We do not have any objective data that allows us to doubt that this is the case. In other words, there is no «ontological identity» between man (living beings) and the computer (machines)[16].
5) Now, between the functions, processes, and states of both systems —biological and computational entities—, is there identity? The fact that two systems can reach similar results (intelligent results, rational analysis, reflection on oneself, personality, identity, free will...), does not justify affirming that the two systems reach those results through functions, processes, and identical states. That is, the similarity in the results does not allow us to speak of ontological and functional identity. We know that there is no ontological identity between biological entities and computational entities. The human mind works by bringing into play sensitivity-perception-consciousness, the psyche (consciousness plus subject) in a harmonic coordination with many mechanical and deterministic processes, also regulated by the brain, united in the classical/quantum psycho-bio-physical ontology that we have been explaining.

   The computational «mind», on the other hand, due to its own ontology, works by mechanical, deterministic, and blind logical-mathematical algorithms. What the robot/android does (or will do) can never really be anything other than «simulate» functional properties, processes, and states of biological entities: consciousness, subjectivity, identity, free will, etc. But he does not make this simulation either

[16] Kurzweil's extensive humanism, in our opinion, although it considers the brain according to the strong metaphor, is not reductionist, since it maintains all the existential properties that give man his dignity: conscience, personhood, identity, free will… But it keeps them on a plane like that of a machine. The new idea of man and machine will coincide in a new dimension in which human consciousness and machine consciousness will be similar. Kurzweil, therefore, does not deny humanism, but rather reinterprets it and extends it to the world of «spiritual» machines.

from an «ontological identity», nor from a «functional identity». The computer can arrive at similar results (for example, free will in the Watson machine that plays Jeopardy), but it arrives at them by different ontological, and therefore also functional, processes. Hence, in our opinion, the «strong metaphor» of the computer has no serious arguments in its favor (not so the «weak metaphor» that in many ways can be admitted)[17].

6) Therefore, the fact that the computer can «simulate» functions, processes, and states of biological entities (psycho-bio-physical), such as consciousness, subjectivity, identity, personality, emotion, free will, etc., does not mean neither ontological identity nor functional identity. It does not seem, therefore, appropriate to describe the functions, processes and states of a biological entity and a computational entity with identical terms. Our proposal would be obvious: to speak, on the one hand, of sensitivity-consciousness, or simply consciousness, biological, or psycho-bio-physical, and, on the other hand, of computational consciousness, computational identity, computational free will, etc., in such a way that by adding the adjective «computational» it would be explicitly indicated that it is a special form of these properties that is not identical to that of living beings, although it may be similar. What the machine does is a pure simulation based on algorithms designed by human engineering.

Pass (overturn) a «mind» to the computer. The idea of passing a mind to a computer is today a recurring issue, which is mentioned in science fiction, but also when talking about things that are considered plausible. More likely, of course, in the age of transhumanism. A mind is the set of experiences, images, interpersonal memories, thoughts, life plans and motivations, organized knowledge, emotions and feelings... distributed in the registers of the various brain modules. What the neuronal system produces are all the elements of psychic life that are born from sensation-perception-consciousness. The mind lives and its life is based on consciousness. If we could know a part of that inner world of a man's mind, with an outline of his real personality, perhaps we could make a more or less successful simulation program. But it would only be a simulation. A mind would not have been «spent» (overturned) in the computer. This is ontologically and functionally impossible. Only a simulation program made by a man would have been built. The computer in which that program was installed would continue to be a blind system, without sensitivity-perception-consciousness, it would

[17] We believe that Kurzweil, deep down, understands the neural system according to the strong metaphor of the computer. Why? Because for Kurzweil the brain works, albeit in a biological way, according to the same pattern analysis algorithms typical of the machine's operation. However, Kurzweil offers a moderate assessment of his strong metaphor, in accordance with the principles of extensive humanism that we present below.

continue to be lifeless. The computer would simulate by means of its own ontology and its derived functional system (algorithms, series of zeros and ones). If the computer in which we did the simulation was a cyborg, in the era of alleged transhumanism, it would be the same: in it we would have simulated a certain mind, but without life. If we could attribute consciousness, freedom, personality to that cyborg, it would have these features in the «computer mode», as we have explained before. In no case would we talk about life and biological consciousness.

4. Conclusion: extensive humanism

The facts and inferences exposed in this writing, and the arguments that support it, allow us to conclude that the «extension of the mind», opened during the evolutionary process since always and today accelerated by the work of human intervention, in no case authorizes us to consider that the «extension of mind» has changed human nature, as we have always known it. Therefore, there is no justification to speak of transhumanism, as if a new man, a «transhuman», had appeared now of the *Singularity*, whose nature had undergone substantial changes in relation to the usual human nature. For this reason, we consider that we should continue speaking of an «extensive humanism». No more.

In relation to the main claim of transhumanism, therefore, we think that the arguments presented in this paper allow us to draw precise consequences that we expose conclusively.

1) The assessment made so far assumes that the engineering and technologies that have been applied to achieve an «extension of mind» are natural (the physical environment, psychophysical, pharmacological, or even psychic intervention) or artificial, that is, artificial systems created by man that open up immense possibilities for the extension of mind. Engineering, both hardware and software, main for these extensions has been the computer. It is the technology that, in fact, has been applied, and this technology supposes to be built with a certain ontology and, consequently, with derivative modes of functioning. Internet, as a way of expanding the mind in the knowledge society, or the design of cyborgs in transhumanism, respond to this engineering of silicon plates, physical construction elements, design of operating software from a binary system, series of zeros and ones, capable of being implemented in any physical state capable of having two differentiated positions, a (1) and b (0).

   Hence, in our opinion, it is impossible to establish a direct connection between a computational system and a biological system whose hardware is tissues, neurons, and a living organism. The human mind nests in the brain, which are sensations, emotions, perceptions, knowledge, images...

produced by neural networks of patterns capable of arousing psychic life. The computer is totally different. Neither its ontology nor its mode of functioning has anything to do with the human brain. For this reason, communication between computational systems, whether serial or connectionist (PDP), and biological systems such as man, can never be direct, as transhumanism claims, and is only possible through interfaces designed for it[18].

2) Consequently, our assessment has some limits: if the «extension of mind» is done by applying these modes of intervention and technologies, then no alteration of human nature occurs. This is what we have so far (section II). However, what is exposed in this writing (section I) supposes the thesis of the material monism of the universe and the psycho-bio-physical unity of living organisms. Classical/quantum matter, in the evolutionary process, has been engineering the forms of organization of classical matter until producing the emergence of sensitivity-perception-consciousness, and later of the psychic-subject, supported by the «niches quantum» present in the classical bio-physical world. Well, what evolutionary nature has done could also be tried by human engineering.

   Therefore, we do not exclude that classical/quantum bio-physical engineering could generate living beings with sentience-perception-consciousness. It would be quantum engineering, within the framework of the creation of artificial life, specifically oriented to the creation of classical beings in which quantum states would emerge that would lead to sensitivity. Today, research on artificial life, and more quantum engineering oriented to the emergence of sensation, are in a rudimentary stage, in practice almost non-existent.

   For the sake of the interests of transhumanism, it is surprising that its main authors, like Ray Kurzweil himself, reject the viability of a quantum neurology. This is, deep down, a rejection of the only path that could lead transhumanism to achieve what it seeks.

3) Lastly, we must state our persuasion that the current advancement of «mind extension» oriented technologies will produce, in the years and decades to come, an astonishing improvement in human possibilities. We do not put any limits on it, only the ethical limitations that may arise, backed by social support. Although, if everything continues as

[18] Cfer, How to create a Mind, cited edition in Spanish, pp. 196-197. Searle is one of the authors who insist that consciousness is an essential property of man and living beings that emerges from his biological ontology. Therefore, Kurzweil considers him one of the main adversaries, from whom he must distance himself. On the other hand, Dennett considers that the neural system is a computer and, therefore, he would be more open to his formal (computational) system having a «formal» coincidence with the formal system of a cyborg (this is precisely what Kurzweil points out).

before, human nature, although undoubtedly improved, will remain unchanged[19].

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Este artículo responde a la ponencia tenida en las Jornadas sobre *Transhumanismo*, que tuvieron lugar en la Universidad Comillas, Escuela Técnica Superior de Ingeniería, Cátedra Hana y Francisco José Ayala de Ciencia, Tecnología y Religión, los días 29 al 31 de mayo de 2019.

[19] We do not doubt that it is possible to build robots-androids or cyborgs so perfect that they can hardly be distinguished from humans (who passed the Turing test). We do not say so, because we do not have Kurzweil's futuristic beliefs. But it could come true. We do not limit the ability to program a simulation of living beings. These machines could have, we do not deny it, what in the previous paragraph we called, specifically, computational consciousness, computational identity, computational free will, computational emotion, etc. But these machines would have neither ontological identity nor functional identity with the entities we call biological, or psycho-bio-physical. Thinking like this is a requirement of objective facts and science. Is it possible to argue against? We don't think so. However, it is also evident that the construction of these new quasi-human robot-androids represents an important qualitative leap in the history of engineering. These spiritual machines, as Kurzweil often says, will not be for us the same as a fan or a refrigerator, for example. They will start a new way of moral and ethical behavior towards them. In the same way that an animal is biological, but not human, and there is a morality in the behavior towards animals, in the same way the new spiritual machines will not have biological sensitivity-awareness (which animals have), but they will be closer to man, because they will better possess certain similar properties (that is, computational) such as consciousness, identity, reason and existential design, emotionality, personality, etc. How will these machines be integrated into our lives? Undoubtedly, respect and recognition of their quasi-human condition should be respected before them. The sympathy, respect, existential solidarity, with which humans treat the cyborg androids in science fiction that we see in novels, in movies and television series, are a foretaste of what will probably be the moral integration of these spiritual machines in science fiction, in future society. It is also evident that the appearance of these androids will mean the appearance of an unquestionable «extensive humanism». The human condition will undoubtedly have been «extended» to machines created by man himself (with the precautions and restrictions that we have explained). But even if these machines are not biological (they do not have an ontology and a psycho-bio-physical functionality), they will certainly be a form of artificial extension of the human condition. Therefore, there will be an «extensive humanism» possible, based on the similarity between these spiritual machines and man. But an «extensive humanism», understood as Kurzweil seems to do it, we do not think it was possible.