

Medical imaginaries and the future horizons of consciousness physiology in the work of Stanisław Lem

Abstract

This article analyses some of the most significant aspects of the exploratory adventure around the physiology of consciousness which the Polish writer Stanisław Lem provides in his science-fiction novels and essays. It is argued that the onto-epistemological and ethical problems associated with the complex mind-brain relationship, the sophisticated medical intervention devices that involve neuronal communication, and the challenges that humankind faces in view of the physical and intellectual evolutionary advance largely determine Lem's perspective, which is shown to lie between fantastic inventiveness and plausible foresight.

Keywords

Stanisław Lem, neuroscience, human intelligence, neuromodulation technologies, bio-enhancement



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European Society for History of Science (ESHS) | chsierra@idcbis.org.co

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Man has gone out to explore other worlds and other civilizations without having explored his own labyrinth of dark passages and secret chambers, and without finding what lies behind doorways that he himself has sealed.

Stanisław Lem, *Solaris* (1961)

Introduction

One of the essential issues that marks the fascinating exploratory adventure into the human condition undertaken by the Polish writer Stanisław Lem (1921-2006) has to do with the metaphysical, epistemological or even ethical repercussions which derive from modern medicine advances as well as from incredible anticipated scenarios of future projection in the central nervous system research.

This particular interest, repeatedly manifested in his work, is by no means accidental. His curiosity for the various fields of medicine can be explained, in part, by the family environment in which he grew up in; an atmosphere inclined towards to the popularization of science in general and medicine in particular. The extensive scientific library owned by his father Samuel Lem (a renowned otolaryngologist from Lviv), in which the young Stanisław delightfully admires anatomical atlases, osteological illustrations and illustrations of the central nervous system, as well as the practices and exploratory instruments used by his father during his private consultations, leave a deep imprint in Lem's memory, leading him to study science¹ and to include these scenes as literary figures in some of his writings².

However, it's his meeting in 1947 with philosopher, psychologist and founder of the Psychometry Laboratory of the Polish Academy of Sciences, Mieczysław Choynowski, that marks Lem's intellectual destiny, when he is rigorously and exhaustively introduced to the world of science³.

It is therefore unsurprising to notice that, in his novels of anticipation and science fiction (ranging from the sinister psychiatric practices of *Hospital*

¹ Lem will be forced to interrupt his medical university studies on several occasions. He begins at the Lviv Medical Institute in 1939. After a several year gap, he enrolls in the second year of his studies in 1944 and ends up enrolling again, this time at the Medical Faculty of the Jagiellonian University, in 1946. He receives his certificate of completion in 1949.

² Some of his experiences such as that of the skull fragment (apparently a temporal bone) that adorned one of his father's library shelves and the references to the corpse illustration motifs in the anatomical atlases are integrated into the plot of *Memoirs Found in a Bathtub* (1961). For further analysis of medical issues in Lem's novels and short stories, see Janiuk 2006: 35-78.

³ Choynowski offers Lem an assistant position for the reorganized seminar "The Science of Science" (Konwersatorium Naukoznawcze) taught at Jagiellonian University and includes him in the revision of scientific press and the drafting of articles for the "Monthly Journal of Science of Science" (*Życie Nauki. Miesięcznik Naukoznawczy*) published in Kraków until 1949. On this subject, see Lem, Fiałkowski 2018: 57.

of the Transfiguration to the protoplasmic ocean-brain of *Solaris*, from *Are you there, Mr. Jones?* to *Peace on Earth*), in his masterful short stories (*The Conditioned Reflex*, *Terminus*, *The Hammer*, *Lymphater's formula*, etc.), as well as in his numerous journalistic texts or philosophical essays (*Dialogs*, *Summa Technologiae*, *Philosophy of Chance or Moloch*), there is an underlying effort to sustain speculative reflection, or even prospective theories built on plausible empirical verisimilitude, associated with medical imaging techniques, sophisticated advances in biochemical synthesis, cutting-edge surgical procedures, unusual attempts at techno-genetic intervention, astonishing innovations in the field of biomedical engineering, etc.

Regarding neuroscience in particular, Lem creates an exciting and strongly substantiated imaginary narrative with a virtuosity that is both erudite and stylistic. The objective is to propose daring considerations and hypotheses on the artificial supplementation of brain activity, the origin and nature of consciousness, the emergence of self-awareness in robotic science and even the possibility (or impossibility) of establishing certain ontological correspondences or communicative links with supposedly non-human intelligences. From this point of view, Lem's predilection for neuroscience not only offers a suitable way to predict the future horizon of cutting-edge medical techno-science (characterized by brain prosthetics, robotic microsurgery, technological transfer of mental processes, neurocybernetics, etc.), but also allows him to fully enter philosophical and bio-ethical questions about human organicity itself (and its "extropic" potential), forcing the reader to carefully review their vision of human consciousness' essence as well as its autonomy and integrity.

The epistemological limits of anthropomorphic intelligence. Exploring the mystery of human consciousness

If one carefully reviews Lem's rich and dynamic narrative universe, his audacious experiments in metafiction and superb philosophical-speculative plots, one can easily notice the vehemence with which he confronts the reader with the following reminder, elevated by Lem to a cosmic scale, that science is conditioned by inherent epistemological limits. In this sense, the Polish writer's stories dust off, over half a century later, certain assumptions that arose in the passionate controversy that originated within the European scientific community at the end of the 19th century about the universe's enigmas and science's capacity to elucidate them (*Ignorabimus-Streit*)⁴. Seen from this perspective, Lem's veiled allusions to the theses claimed by Emil du Bois-Reymond, one of

⁴ This was a virulent debate initiated at the end of the 19th century by the German physician and physiologist Emil du Bois-Reymond that would involve the European scientific academy elite: Rudolf Virchow, James Clerk Maxwell, Karl Nägeli, Élie de Cyon, Ernst Haeckel, David Hilbert, etc. On this subject, see Finkelstein 2013.

the most outstanding protagonists in this dispute (Lem 1987: 30), make perfect sense. A famous German electrophysiologist and physician, du Bois Reymond's scientific agnosticism was emblematically summarized in the maxim *Ignoramus et ignorabimus* (we do not know and we will not know)⁵ and applied to questions beyond the reach of our experience, such as the very nature of consciousness seeing as it is surrounded by an impenetrable mystery (at least, from a materialistic-mechanistic approach)⁶.

It is beyond any doubt that the scientific capacity to reveal the inner functioning of consciousness assumption has been a primary object of thought for Lem in some of his most extraordinary science fiction writings; works in which he meticulously examines the different aspects of this question from the most improbable and fabulous points of view. At this stage, it is of course impossible not to mention the already mythical and unmitigated classic novel of 20th century literature *Solaris* (published in 1961). Beyond the substantial plot which focuses on the probable consequences, at different levels, that real contact with an extraterrestrial intelligence would entail for mankind, while also raising the pressing need to transcend the anthropomorphism and anthropocentrism that governs human existence (issues that are also present in *Eden*, 1958 and *Fiasco*, 1986), Lem introduces a subaltern field of reflection associated with the brain and consciousness that I consider of similar importance. The fortuitous discovery of an enigmatic and unfathomable planet, almost completely covered in an omniscient protoplasmic and gelatinous ocean (without it being entirely clear in the novel if it is homeostatic, organic or even a conscious will-iness), not only constitutes a macrocosmic speculative flash of the human image, an indecipherable arcane that forces us to rise to a higher psychic level from which a disturbing "oceanic feeling"⁷ intensifies, but also creates a radical otherness that surpasses our ability to understand and questions the universal reach of human intelligence.

The identification of an extraterrestrial entity with a strange and unusual psychism like that of *Solaris* (an eventuality that should no longer be exclusively contemplated as belonging to the realm of fantastic inventiveness but take into account the astrobiology perspectives now offered), insofar as it becomes receptive to the environment through unknown sensory "organs" and possesses the unsettling ability to penetrate the human mind (to the point of generating, through dreams, imagination and the memories of the protagonists, enhanced artificial syntheses of non-existent bodies), does not, however, guarantee the longed-for hermeneutic encounter, the real contingency of a communication-based understanding, nor is it likely to recognize the very structures or signals by which its perceptive faculty manifests itself. This astonishing starting

⁵ See Du Bois-Reymond 1872.

⁶ Mechanistic Determinism, as conceived by Emil du Bois-Reymond, proved insufficient in reconciling mental universe with brain activity. See Pecere 2020.

⁷ This concept can be found for the first time in a letter from Romain Rolland to Sigmund Freud, dated December 5th, 1927. Rolland refers to the sensation of becoming one with the universe, like a complete unit without perceptible limits. Freud's reply can be found mainly in one of his best-known works: *Civilization and its Discontents* (1930).

point, which underlines a resigned attitude of a distinctly solipsistic nature⁸, allows Stanisław Lem to put interesting epistemological assumptions forward about human neurophysiology.

Firstly, *Solaris*, by means of stealthy scans, navigates the nebulous universe of dreams, nightmares and memories (through the cerebrosides)⁹ of the group of scientists of the orbital station that investigates the inexplicable physical phenomena taking place on its surface. It therefore scrutinizes the incessant activity of the non-conscious neuronal plane, disregarding waking states, to materialize and stabilize, by means of neutrino-based anthropomimetic structures, the beings (visitors) extirpated from the human psyche.

This is, to some extent, understandable in view of the tremendous activity rate and quantity of neural connections that the underlying brain mechanisms, that is to say mechanisms that operate below the radar of consciousness, are capable of absorbing in the form of information units. To this, we must also add the primary function of sustaining physiological homeostasis which is exercised by the neurovegetative nervous system and based on the nerve impulses coordinated in the spinal cord, the brainstem and the hypothalamus. If we adhere to the principles of the neurofunctional model (which is precisely what Lem examines through the penetrative power of *Solaris*), consciousness, in comparison to the overflowing subterranean cognitive activity occurring in the brain, is a minor emergent phenomenological quality that could be disregarded by the organic ocean in its psychic dissection. This is how *Solaris* represents an insurmountable challenge for Lem in epistemological terms; one that outlines and relativizes human intelligence (and with it, science itself), in order to understand our own identity as human beings on one hand, while on the other, be able to approach, from rational anthropomorphic coordinates, the "alien" realities that the universe's immensity hides:

Yet it had infiltrated my mind without my knowledge, surveyed my memory, and laid bare my most vulnerable point. That was undeniable. Without any assistance or radiation transmissions, it had found its way through the armored shell of the Station, located me, and come away with its spoils... (Lem 1987: 164).

Secondly, Lem introduces interesting hypothetical rationales regarding the possibility of the human brain's physical-material structures to possess biomorphic models, physiological properties or comparable electrochemical

⁸ The radical epistemological subjectivism, that Descartes embraces with the now classic "evil genius" hypothesis, is corroborated by Lem through evidence of the intrinsic limits imposed by anthropomorphic cognitive structures. For a brief introduction to Lem's philosophical reflections on the nature of the mind and the self, see Owczarek 2018 and Weissert 1992.

⁹ Cerebrosides are glycolipids with a simple molecular structure that are present in the central and peripheral nervous system or in myelinated nerve fibres belonging to the white cerebral matter. It is worth remembering that this component, decisive in the long-term potentiation of neuronal synapses (i.e. memory), is also mentioned in another referential novel by S. Lem, *Golem XIV* (1981), to underline the dissimilarity between the materials that constitute intelligence and the very contents of thought.

processes that, in short, may be universally extrapolated to any other intelligence that may exist in any distant corner of the universe. In fact, in the heterogeneous and, in some cases, antagonistic theoretical developments and experimental studies that have come to fill entire volumes of solaristic scientific literature, creative and extravagant analogies have become possible ever since that singular planet orbiting a binary star system was discovered 140 years ago. For example, the analogy between an electrical image of a human brain in full activity and certain discharges generated, without a recognizable pattern, within the oceanic plasma (as a previous step to the creation of structures called "polymorpha") or even between epilepsy and the convulsive eruptions that originate the "asymetriads" (very ephemeral structures, "exaggerated quantum phenomena", which end up dissolving into the ocean) (Lem 1987: 174). Let's not forget that based on this supposed epistemological affinity, projecting Kelvin's encephalogram onto the planet with a cannon that emits X-rays is arranged in an effort to establish the desired intellectual contact (Lem 1987: 161).

To our understanding, the answer that Lem sketches before this incognita presents a two-tier level of reasoning. On the one hand, what we are dealing with is, basically, a process of strangeness "appropriation", of incorporating the incomprehensible by joining the cognitive articulation or metabolization of the unknown stimuli coming from *Solaris* with the information coming from human memory and which is the result of the long-term potentiation underlying synaptic plasticity. Let us bear in mind that, in general, a large part (90%) of the perceived information gets lost during the time it takes to be transferred from the eye to the brain, which is why the human brain must guess what it sees based on past experiences. So, the question to ask in this regard seems rather obvious: What happens when we are confronted with a reality for which we have no interpretative reference and, therefore, for which we cannot extract any recognizable experience? Quite simply, we extensively apply our own exteroceptive maps¹⁰. In other words, we construct a perceptual scenario of reality according to anthropomorphic parameters.

On the other hand, according to the bold assumptions advanced by Lem in his novel, intellectual processes may be condensed in material structures different to those configured by the human brain due to the different courses of evolutionary trajectories. On this particular point, he anticipates some epistemological problems related to the emergence of a foreseeable exo-neurobiology which, all proportions kept, brings to mind physician and botanist Jagadish Chandra Bose's (1858-1937) pioneering experiments during the first decades of the 20th century on the physiological reactions of plants (considered at that time as living beings without a sensitive nervous system) by means of electrical stimuli generated by ingenious microelectrode devices (Bose 1926). In plants, similarly to Lem's imagined planet and its exogenous entities, we perceive an unconventional nervous system, that is to say, a singular form of psychism that

¹⁰ The external physical interaction between the body and the world, captured through receptors and sensory terminal organs, is reflected in neural patterns that, in turn, are organized in multiple dynamic representational maps. These maps are anchored in our memory and are relived through the imaginative reminiscence.

responds to environmental variables and is measurable through bioelectrical potentials, thus expanding the vastness and richness of terrestrial biosemiotics (in Lem's specific case, a cosmic astrobiosemiotics)¹¹.

The conscientious exploration of the multiple onto-epistemological variations through which Lem insistently examines the problem of the mind-brain relationship takes a disconcerting and sarcastic turn in *Peace on Earth* (1987); the protagonist's brain, which experiences a functional disconnection caused by an enigmatic and remotely operated microsurgical intervention, unexpectedly triggers the international scale confabulations and plots of this unclassifiable story. The callosotomy (surgical technique to cut the callosal connection between the two cerebral hemispheres) performed with an advanced laser weapon on star traveler Ijon Tichy¹² during a secret expedition to the Moon, allows the Polish writer to give free rein to the sharpest suppositions and conjectures regarding brain function, the causal link between consciousness and the underlying neuronal activity, as well as the cognitive and emotional faculties' location in the different morphological configurations of the cerebral topographic map. This is how the espionage intrigue, unleashed to the highest level in this bizarre story insofar as Tichy's brain's cognitive sequelae prevent access to key information about what is happening on the Moon, offers a fertile ground to fully enter the long-standing controversy between the anatomical localizationism approaches and the "integral" conception centered on the principle of the brain tissue's equipotentiality. It also allows for a philosophical evaluation (with elements from neuroscientific tradition, experimental psychology and computer science) of the implications that the technological manipulation of the functional segregation of the human brain might have on the construction of human identity. In this sense, functional laterality or interhemispheric functional asymmetry¹³, an aspect that Lem meticulously delves into through Michael S. Gazzaniga's classic works (Cazzaniga 2015), opens a formidable reflective horizon, insofar as Tichy's "splitting" leads to the existence of two conscious identities in the same body¹⁴. In this context, and although it may seem paradoxical, the analysis of advances in Cognitive Neuroscience and their logical consequences, based on a materialistic and mechanistic link between the brain and mental activities (*the mind is what the*

¹¹ This is a discipline that emerged in the 1960s through semiotician Thomas Sebeok's research and is dedicated to the study of communication and the transfer of signs and signals between living beings. Regarding plant communication and forest ecology, it is worth mentioning the work of Stefano Mancuso, Suzanne Simard, Peter Wohlleben and David George Haskell. On the issue related to astrobiosemiotics, see Dunér 2018.

¹² Ijon Tichy is undoubtedly one of the most charismatic and famous characters created by Lem. In addition to *Peace on Earth*, he appears in other referential works such as *Diary of the Stars* (1957), *Congress of Futurology* (1971) or *Return to Entia* (1982).

¹³ Brain asymmetry, a concept introduced in the field of neuropsychology through the early work of French physician and anatomist Paul Broca, entails a difference in the two cerebral hemisphere's functions' specialization. In this regard, it has been shown that the left hemisphere is in charge of analytical functions related to speech and information processing while the right hemisphere determines visual and spatial perception.

¹⁴ "[...] Some experts say that he has consciousness on the left side only and that the right is a soulless computer, others believe that he has two consciousnesses but that the right one can't speak because the Broca's area is in the left frontal lobe, and a third group proposes two partially separated egos" (Lem 1994: 7).

brain does), could lead us to seriously consider the technological feasibility of mastering the ontological structures used by Western philosophical tradition to build a hegemonic idea of the "self"¹⁵. And taking into account that techno-medical intervention carried out on neuronal structures' physiological activity can effectively provoke a profound alteration of human subjectivity, we are witnessing a transcendental advance that can be applied to strategic policies in contemporary social engineering, therefore shifting them from persuasive behaviorism at psychosocial level (as advocated by Gustave Le Bon, Wilfred Trotter, Leon Festinger or Edward L. Bernays) to techno-medical modeling of collective behavior.

Reality disturbances. From phantomology to artificial neuromodulation

In *Summa Technologiae* (1964), Lem's ambivalent reflection on the technological phenomenon and its evolutionary paths is one of the most cutting edge in regard to achieving an ideal level of sophistication in the artificial intervention in the brain, to the degree that it may be possible to alter or even substitute the perceptive referent, the subjective experience of reality. On this particular point, he introduces the concept of phantomology or the study of phantomatics (Lem 2013: 191-235), understood as an emerging discipline that addresses the possibility of artificially altering the environment's external conditions and, consequently, of deliberately orienting the cognitive construction processes generated by the human brain. But let us be clear: phantomatics is only a fragmented piece, an incipient and unfinished phase that may constitute a prelude, should neurotechnologies persist in following this path, to a total cerebromatization, that is, an artificial restructuring of the intricate neuronal reticular architectures. It is not, at least in this case, about enhancing intelligence, but about effectively creating an illusory sense of reality. For this reason, Lem advances the possibility that technology will, in a certain way, end up toppling the ontological bases imposed by the natural world, by transferring sensory stimuli to various topological locations of the human brain through the interposition of an artificial supplement. In other words, nature ceases to be the reality towards which human perception is directed and is replaced by an artificially controlled alternative scenario. This is made much clearer when, to serve as an example, Lem focuses his attention on the indirect stimulation of the cerebral cortex, more specifically on various parts of Brodmann's area, located in the occipital lobe, the visual system of perception's¹⁶ processing center. Its purpose is to incorporate to the

¹⁵ "He'd probably just finished his finals, that philosophy student, because he threw Hegel at me and Descartes (I think therefore I am, not we think therefore we are), and Husserl and Heidegger, to prove that my condition was impossible because it contradicted the greatest minds who for thousands of years, beginning with the Greeks, studied the conscious ego" (ibidem).

¹⁶ Of course, we refer to the classification of the cerebral cortex's locations according to its cytoarchitecture as developed by the German neurologist Korbinian Brodmann in 1909 using the Nissl staining technique. On this subject, see Brodmann 1909.

natural eye a similar optical system (a kind of “anti-eye”) that would prevent any direct perceptual communication with the outside world and, therefore, have full control over the processing of information related to the visual field (Lem 2013: 192). When looked at properly, this development entails a reversal of the path normally undertaken by any light stimulus in order to reach the retina (through the cornea, aqueous humor, pupil, lens and vitreous humor) and, of course, the photoreceptors (i.e., the cones, rods and ganglion cells that convert light energy into bioelectrical impulses). This is therefore how information, in the form of stimuli directed at strategic nerve centers, is already processed in front of the ocular organ as an “information gathering attachment”. Now, this cognitive feedback system with an “artificial reality”, which is remarkably similar to the brand new immersive virtual reality brain-computer interface (BCI) systems, does not, as noted above, directly control the brain processes of the recipient. But this circumstance does not necessarily imply an insurmountable technological frontier. In fact, Lem’s appreciations on the subject go much further.

The practical potential and the unsuspected scope held in the artificial mechanism of the world’s “phantomatic” transformation is disturbingly exposed when Lem refers to Peter Milner and James Olds’ 1954 experiments on rats in relation to the cerebral septum (*septum pellucidum* or lateral transparent septum), an area that, when electrically stimulated, secretes a significant dopamine discharge (which leads to intense sensations of pleasure and sexual arousal) (Olds, Milner 1954). It would not be long before these types of experiments were to be carried out on human patients; for example, the famous work in the field of biological psychiatry by Robert Galbraith Heath (Heath et al. 1963: 394-396) or the invention of the brain chip and various neuro-stimulatory devices (*stimoeiver*) by José Manuel Rodríguez Delgado (1969). All of this consolidates a line of research in the field of cutting-edge techno-science that places its entire hopes on neuromodulation in order to effectively correct brain disorders (i.e., epilepsy or depression) and significantly increase the human being’s cognitive capacity (“artificial augmentation”) through a close exposure to electronic regulators (either as mere stimulation or by implanting integrated chips).

In this manner, Lem fully delves into one of the most dynamic frontier science scenarios by looking at the brain as one of the most promising avenues in which the symbiosis with artificial intelligence can be strengthened. The truth is that, in this sense, a large number of predictions and imaginary projections contained in the pages of *Summa Technologiae* have an extraordinary visionary quality, since they outline with great accuracy the ethical, epistemological and pragmatic-instrumental dilemmas that certain emerging technological markets have to face (represented emblematically by companies such as *Neuralink*, *Inbrain Neuroelectronics*, *Kernel*, *PlatoScience*, *Nextmind* or *Neurosphere*) and whose activities are based on invasive and minimally invasive brain treatments or even low intensity focused ultrasound techniques (LIFUP) (see Cain et al. 2021: 301-303).

To put an example, it is by no means unnoticed by Lem that advances in technology associated with “phantomatics” (whether peripheral or central) place, right at the heart of the debate, the possibility of modifying adaptive patterns through the production of a simulated ontology, insofar as the intervention occurs

within the correspondence dynamics between the spatio-temporal distribution of physical energy patterns (the proximal *stimulus* that is captured by the sensory receptors) and the individual's own non-transferable psychological experience associated with the interpretation of each stimulus in order to endow them with meaning. It is interesting to note how this issue reveals a close relationship with the simulation or simulism¹⁷ hypothesis that would deeply determine the ancient philosophical tradition associated with gnoseological skepticism (from Parmenides to Descartes) and, in present days, with the futurological extropianism positions¹⁸ on the validity of a fictional world within a technologically mature "post-human" civilization¹⁹ (fascinatingly evoked by films such as *Matrix*, *Dark City*, *The Truman Show* or *The Thirteenth Floor*). This plausible holographic universe thesis, which is being scientifically tested by means of quantum chromodynamics lattice computational methods (LQCD)²⁰, is nevertheless confronted with deep metaphysical considerations by Lem as he deals with the problem of consciousness, an undercurrent of some of his key works and short stories (*Lymphater's Formula*, *Golem XIV*, *The Cyberiad*) which takes the form of a cosmogonic global consciousness similar to Tsiolkovsky's "cosmistic" panpsychism (a concept proposed in his work *The Will of the Universe*, 1928)²¹.

On the other hand, it is also worth noting that neuromodulation enables continuous tuning mechanisms of the input/output behaviors of neurons (index in the flexibility to change connections) in order to shape an artificial response to external stimuli in different contexts. In this sense, some of the most eloquent conclusions drawn by Lem in his exploration of neurotechnologies dedicated to the management of cognitive enhancers and repressors also incorporate a disturbing imagery that revolves around the intrusive strategies of a governmental social engineering whose radius of action extends on a planetary scale. In *Return from the Stars* (1961), the crew of the spacecraft Prometheus, upon their return to Earth after a risky ten-year mission (which, due to time dilation, is equivalent to 127 Earth years), finds a completely transfigured human society model by the widespread application of "betrization",

¹⁷ This hypothesis has been popularized in our days by philosopher Nick Bostrom through his famous trilemma, an argument by which he identifies certain empirical reasons capable of demonstrating the existence of a simulated world. David Chalmers reaches similar conclusions with his "Matrix hypothesis". On this subject, see Bostrom 2003.

¹⁸ Extropianism is a philosophical branch of transhumanist thought which emphasizes a vision for the future based on technologically-mediated boundless enhancement of the human being.

¹⁹ The term "post-human" refers to a hypothetical future being whose congenital biological conditions have been technologically augmented. Transhumanism can be defined as a current of thought which supports the use of new sciences and technologies in order to improve mental and physical capacities, to correct what are considered to be undesirable and unnecessary aspects of the human condition such as suffering, disease, aging, or even, ultimately, mortality. Raymond Kurzweil, Natasha Vita-More, Hans Moravec, Max More, Nick Bostrom and David Pearce are among its most prominent representatives.

²⁰ A method by which supercomputers are able, for the time being, to simulate tiny portions of the universe on a billionth of a meter scale, something barely larger than an atomic nucleus.

²¹ Lem names a lunar station "Tsiolkovsky" in *The Conditioned Reflex*, a tale which belongs to the collection of science fiction stories entitled *Tales of Pirx the Pilot* (1968).

that is, an enzyme intervention in the human brain that manages to inhibit violent or aggressive behavior. Understandably, biomedical technology has caused such an extreme transformation in human identity that the protagonist of the story, Hal Bregg, is forced to live among the new generation of humans as if they were a strange alien species:

Orpheus went to Hades for Eurydice. Othello killed for love. The tragedy of Romeo and Juliet... Today there is no tragedy. Not even the possibility of it. We eliminated the hell of passion, and then it turned out that in the same sweep, heaven, too, had ceased to be (Lem 2020: 82).

Something similar happens in *The Futurological Congress* (1971) when Ion Tichy, after a period of hibernation, is reanimated in the year 2039 and finds a world where peace reigns and a general well-being prevails due to the society being controlled by psycho-chemical technologies that regulate even the most imperceptible occurrence of daily existence²². These examples, in short, place Lem within a dystopian literary tradition made up of outstanding pieces of work that have forged a certain contemporary techno-scientific imaginary such as *The Island of Doctor Moreau* (1896) by H. G. Wells, *We* (1924) by Yevgeny Zamyatin or *Brave New World* (1932) by Aldous Huxley. In these texts, techno-medical brain intervention plays a prominent role in conforming a paradigmatic model of human beings characterized by unrestricted surrender to fictional escapism, self-absorbed hedonism and compulsive sedative substitutes consumption in the face of genuine experience.

Transhumanism and the Human Brain. Transcending the organic matter

From this brief yet revelatory journey through the “Lemian” writings, we can conclude that brain physiology, as a self-organized system of maximum complexity, is one of the living matter structures that most frequently places us before the problem of biological limits, in the terms set by the biomedical imaginary linked to extropianism, and by the accelerated incursion into the scientific praxis of recent and unprecedented advances that put forward a more than likely techno-evolution planned by human beings.

The question, still unanswered today, relating to the manner and degree in which consciousness is linked to the brain, leads Lem to suggest some reflective key points about the social representations that stem from techno-science

²² “Today I learned the fundamental difference between the new people and the old. The key concept is psychem. We live in a psychemized society. [...] Psychem, on our behalf, does what must be done to the old cerebralness: subdues it, soothes it, brings it round, working from within with the utmost thoroughness. Spontaneous feelings are not to be indulged” (Lem 1976: 70).

and the probability of an artificial self-design equipped with a level of complexity and functional efficiency that are so high that they surpass the organic organization deployed by nature since that remote era when the first signs of life appeared on Earth.

There is no doubt that the challenging fields being opened by computer science (and especially artificial intelligence, AI) raise the hypothesis that the brain, as a physiological structure subject to exhaustive engineering and mapping (such as that currently being undertaken by the *Human Brain* project)²³, can be technologically replicated and, therefore, replaced by artificial devices that manage to improve the qualities of mental transfer. In this context, Lem resolutely examines the pros and cons of artificial anthropogenesis through the creation of a cyborg consciousness or electrobrain, a hypothesis that he analyzes from different perspectives in *Summa Technologiae*, *Fiasco*, *Peace on Earth* or *Non Serviam*. Going further than just speculating on the most feasible methods to achieve this (in principle, by connecting the peripheral nerves or even the nerve networks of two brains), the key point at this stage is to be able to transfer consciousness to an artificial prosthesis that transcends the limited time frame of human beings' homeostasis preservation. Note that this approach is close to the thesis of mind up-loading or mind transfer (Whole Brain Emulation, WBE) and the subsequent reanimation of this information onto a computer defended by the extropian movement (renowned members include Max More, David Pearce, David Dalrymple, etc.). Several elements of thought can be drawn from this.

Firstly, Lem's exploration of the technology of consciousness takes for granted one of Günter Anders' theses, retrieved from his radical diagnosis of the human condition in the age of technological revolutions (Anders 2002). In the new techno-scientific revolution, led today by the emergence of neurosciences and genetic engineering, the human being would split into two new ontological figures: he would be, on the one hand, a *homo creator* capable of transforming all things in a substantial way, including himself; but, on the other, he would become a no less unusual *homo materia*, that is, the "raw material of his own technological productions". The human being thus becomes the main object of technological transformation and direction.

Secondly, the insertion of the emulated mental state into a computer (either through the scanning and mapping of the original organic brain or through the gradual replacement of neurons) puts on the near future horizon a possible modification or even artificial re-creation of the human being with the aim of increasing physical, intellectual and sensory capabilities, as well as extending the duration of existence or controlling emotions. The full confidence in a possible development alternative of technology as the main mechanism to solve the basic problems related to the vulnerability and obsolescence of the human

²³ The Human Brain Project (HBP) is a medical-scientific and technological project funded by the European Union that aims to build biologically detailed simulations of the entire human brain through the creation of specific supercomputing, modeling and computer technologies. Similar projects are being promoted by the USA, Brain Initiative (Brain Research through Advancing Innovative Neurotechnologies) and China, The China Brain Project.

condition, places this approach in line with techno-optimistic determinism. As a result, technology is presented as a benchmark that defines nature and exposes its limitations, as well as a pragmatic-instrumental supplement to reach an unprecedented stage in human functional improvement (*bioenhancement*)²⁴.

Thirdly, Lem recovers the philosophical question about the possible immateriality of the self in order to reshuffle some speculative alternatives that have to do with human identity's and consciousness' location on the outskirts of the psycho-physical legacy and anthropological dualism. If the human mind is characterized by emergent information arising from the organizational patterns of a neural network, it may be possible to replicate it in a different physical medium. But this would not entirely guarantee the preservation of the original consciousness attached to the organic brain, since, in principle, due to its inherently subjective property, it would be unlikely to objectively verify the existence of an autonomous consciousness in the mental copy. Therefore, all of these questions (and others that are impossible to address in this brief discussion) are presented with a high degree of substantiation in the cybernetic universes imagined by Lem. In the case of *Peace on Earth*, explicit reference is made to "telefers" or "remotes", devices produced by a new branch of robotics that looks after consciousness transmission problems and that reproduces, with a never before achieved level of accuracy, the electrical changes that occur in the human body. Likewise, in *Non Serviam*, a fictitious review of a book written by a non-existent author, Arthur Dobb, included in *A Perfect Vacuum* (1971), makes allusion to the figurative science of "personetics" in charge of creating "personoids", that is, disembodied beings, abstractions of the human mind's functions that inhabit computers²⁵. This analysis, taken to the extreme in the form of a kind of metaphysical immanentism, has a counterpart of great interest: the non-coincidence or absence of a physical correlate on which the human mind depends which, therefore implies, the existence of a non-local consciousness.

Behind all these theoretical attempts, there is the central idea (which Lem addresses in essays such as *Dialogs, 1957* or *Summa Technologiae, 1964*) that the epistemological reformulation of the human brain under concrete parameters of technological operability determined, above all, by cybernetics (from Norbert Wiener onwards) and bioengineering (from Heinz Wolff onwards), marks a qualitatively transcendent transitional phase in man's ascent on the gnoseological scale and in his possibility to definitively take the reins of his own destiny as a species. In this sense, Lem notes that the progressive cyberneticization of the organism and the advances in biotechnological intervention practices contribute to consolidating a future horizon centered on "evolutionary participation" or even "directed evolution". In other words, natural selection would become a secondary evolutionary mechanism in relation to technological selection's shaping power.

²⁴ In this particular context, this concept refers to the use of various cutting-edge technologies (especially neurosciences, genetics and nanomedicine) to overcome the limitations of the human body at the reproductive, physical, and mental levels.

²⁵ "As was said, a personoid does not have a body, but it does have a "soul". This soul [...] appears as a "coherent cloud of processes", as a functional aggregate with a kind of "center" that can be isolated fairly precisely, i.e., delimited within the machine network" (Lem 1999: 177).

Everything indicates that the short-term future holds amazing advances in cutting-edge techno-science fields such as neuroengineering and neurobio-technology: optimal levels of biocompatibility for neural implants, functional connections between the brain and a computer, implementation of methods for reprogramming neural circuits through the application of optogenetics, laboratory development of cerebroids and other organoids through stem cells²⁶, etc. In reality, these achievements are symptoms of the end of an evolutionary cycle characterized by humanization and the entry into a new post-human hegemonic period. As it occurred about 40,000 years ago (when there were four or five human species or subspecies)²⁷, this new phase of techno-science brings us back to a world inhabited by a new human diversity, except this time it's artificial ("natural" beings, genetically edited beings and mixed beings modified by biomegatronics, see Carbonell, Ballester 2020). This exploration of brain physiology allows Lem to calibrate this new civilizational context, through disjunctions and burning problems of a philosophical and ethical nature, in which the very onto-epistemological bases of the human condition are questioned:

The thread of such understanding will only be broken when man, in a thousand or a million years' time, gives up his entire animal heritage, his imperfect and impermanent body, for the sake of a more perfect design, and when he turns into a being so much higher than us that it will become alien to us. Our preview of the future will thus have to stop at sketching out the beginnings of this autoevolution of the species (Lem 2013: 40).

Bibliography

- Anders G. (2002), *Die Antiquiertheit des Menschen. Band II: Über die Zerstörung des Lebens im Zeitalter der dritten industriellen Revolution*, C.H. Beck, Munich.
- Bose J.C. (1926), *The nervous mechanism of plants*, Longmans Green, London-New York.
- Bostrom N. (2003), *Are You Living in a Computer Simulation?*, "Philosophical Quarterly", 53, 211: 243-255.
- Brodmann K. (1909), *Vergleichende Lokalisationslehre der Grosshirnrinde in ihren Prinzipien dargestellt auf Grund des Zellenbaues*, Johann Ambrosius Barth Verlag, Leipzig.
- Cain, J. A. et al. (2021), *Ultrasonic thalamic stimulation in chronic disorders of consciousness*, "Brain Stimulation", 14, 2: 301-303.

²⁶ Organoids are three-dimensional (3D) multicellular in vitro tissue constructs grown from stem cells that have a similar structure and function to different organs (brain, liver, kidneys, retina, large intestine, etc.).

²⁷ *Homo sapiens*, *Homo neanderthalensis*, *Homo denisova*, *Homo floresiensis* and another unidentified human species.

- Carbonell E., Ballester J.A. (2020), *Materia viviente, vida pensante. Evolución y prospectiva de la conciencia humana*, Lectio Ediciones, Barcelona.
- Du Bois-Reymond E. (1872), *Über die Grenzen des Naturerkennens: ein Vortrag in der zweiten öffentlichen Sitzung der 45. Versammlung Deutscher Naturforscher und Ärzte zu Leipzig am 14. August 1872*, Verlag von Veit & Co, Leipzig.
- Dunér D. (2018), *Semiotics of Biosignatures*, "Southern Semiotic Review", 9: 7-63.
- Finkelstein G. (2013), *Emil du Bois-Reymond. Neuroscience, Self, and Society in Nineteenth Century Germany*, MIT Press, Cambridge-London.
- Gazzaniga M.S. (2015), *Tales from Both Sides of the Brain: A Life in Neuroscience*, Ecco, New York.
- Heath R.G., Elder S.T., Bishop M- P. (1963), *Intracranial self-stimulation in man*, "Science", 26, 140(3565): 394-396.
- Janiuk, J. (2006). *Stanisława Lema związki z medycyną*, "Medycyna Nowożytna", 13/1-2: 35-78.
- Lem S. (1976), *The Futurological Congress (from the memoirs of Ijon Tichy)*, Avon books, New York.
- Lem S. (1987), *Solaris*, Harvest Books, New York.
- Lem S. (1994), *Peace on Earth*, Harcourt Brace & Company, New York-San Diego.
- Lem S. (1999), *A Perfect Vacuum*, Northwestern University Press, Illinois.
- Lem S. (2013), *Summa Technologiae*, University of Minnesota Press, Minneapolis-London.
- Lem S. (2020), *Return from the stars*, MIT Press, Cambridge-London.
- Lem S., Fiałkowski T. (2018), *Świat na krawędzi. Ze Stanisławem Lemem rozmawia Tomasz Fiałkowski*, Wydawnictwo Literackie, Kraków.
- Olds J., Milner P. (1954), *Positive reinforcement produced by electrical stimulation of septal area and other regions of rat brain*, "Journal of Comparative and Physiological Psychology", 47(6): 419-427.
- Owczarek K. (2018), *Rozważania o filozofii umyśtu na podstawie Dialogów Stanisława Lema*, "Filozofia i nauka. Studia filozoficzne i interdyscyplinarne", 6: 181-195.
- Pecere P. (2020), *Reconsidering the ignorabimus: Du Bois-Reymond and the hard problem of consciousness*, "Science in Context", 33(1): 1-18.
- Rodríguez Delgado J.M. (1969), *Physical Control of the Mind: Toward a Psychocivilized Society*, Harper and Row, New York.
- Weissert T.P. (1992), *Stanislaw Lem and a Topology of Mind*, "Science Fiction Studies", 19(2): 161-166.