Essentials on Advanced Cognitive Neuroscience

Mental Health, Modern Education and Distance Learning

ARTIGO ORIGINAL

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Abstract: This article addresses the intersection between cognitive neuroscience, mental health, and modern education, with some observations aimed at distance learning. The analysis presented highlights the negative impacts of technological excesses in education and their consequences for mental health, especially in a neoliberal context, where the lack of critical reflection and scientific training among education staff results in significant damage to the quality of education and, concomitantly, to the quality of life in general, jeopardizing the survival of millions. The work emphasizes the need to adapt educational practices to the local cultural context, mentioning Brazil, and warns of the risks of a superficial and consumerist approach to technological innovations.

Key words: Cognitive neuroscience, consciousness, mental health, education, technology.

Resumo: O presente artigo aborda a interseção entre neurociência cognitiva, saúde mental e educação moderna, com algumas observações dirigidas ao ensino a distância. A análise apresentada destaca os impactos negativos dos excessos tecnológicos na educação e suas consequências para a saúde mental, especialmente em um contexto neoliberal, onde a falta de reflexão crítica e de formação científica nos quadros da educação resultam em danos significativos para a qualidade do ensino e, concomitantemente, para a qualidade de vida de modo geral, precarizando a sobrevivência de milhões. O trabalho enfatiza a necessidade de adaptar práticas educacionais ao contexto cultural local, mencionando o Brasil, e alerta para os riscos de uma abordagem superficial e consumista em relação às inovações tecnológicas.

Palavras-chave: Neurociência cognitiva, consciência, saúde mental, educação, tecnologia.

1. Introduction

Teaching/learning has suffered significant impacts with the introduction — not always sufficiently discussed — of the so-called "new pedagogies" and technological products at all levels of educational activity. In a neoliberal globalized world, driven almost exclusively by market rules, all suspicions deserve some attention, when we know that astronomical sums of monetary values are always at stake.

Health and education are critical points for the well-being and social development of people. Unfortunately, these are the two areas most affected in Brazil and other socially underdeveloped countries. Drugstores proliferate with astonishing numbers of equivalent medicaments in sales competition, while primary and secondary education show signs of complete bankruptcy, the result of successive "reforms" promoted by an unimaginably incompetent governance. The problem with technologically and scientifically hostage nations is that they are uncritical markets for everything good or bad that is produced in the great emporiums of the global economic power. There is never a serious discussion that at least analyzes the adaptive possibilities to the local cultural context. Everything becomes fashionable, and, like fashion, everything dies out in a short time. The harm is there are things that cannot be irresponsibly treated as simple fads (see the case with coaching in Brazil). Thus, the results portray, as a rule, the setbacks of the absence of critical thinking, professionalism and strategic planning, if not true disasters such as mass admission to universities without a fair selection process.

Distance learning (DL) in Brazil, in the way it was introduced, is a typical example of the uncritical consumption and incompetence of the actors who frequently take over the high management of education in the country. It can be said that functional illiteracy has become endemic at the different echelons of governance in our cartoonish democracy. A serious DL project requires an interdisciplinary team with at least one member who is an expert in cognitive neuroscience, and, if possible, a physicist with great interest in this latter field (like award-winning scientist Douglas Hofstadter). The first, dedicated mainly to the development of attention and ability to focus, and to the study of the regulation between arousal and attention, since attention is not arousal, but requests some level of arousal[1]. The second will certainly make a fundamental contribution to the understanding of the energy balances and entropic processes relating to the mechanism of interaction between brain and mind, as well as to the recognition of consciousness as a phenomenon endowed with a peculiar physical structure[2], whose comprehension certainly brings benefits to cognition. Research with this team configuration must be ongoing, this is not luxury; this is what must be done to build a high-level project co-opting instructional designers and purpose-driven designers who accept the challenge of preserving effective cognition and literacy in a dispersive and accelerated digital world, recognizing the need to weigh the pros and cons of using technologies in education, prescribing their use where they are truly necessary. The leap taken almost forty years ago with the advent of hypertext brought us closer to screens with an illusion of pragmatism, but we paid dearly with damage to our ability to think effectively.

So, apart from any decision on the use of technologies, cognitive neuroscience must transcend the knowledge of cognitive processes in their functional relationships with the cortex, moving towards the physical understanding of the conscious mind and its dynamics supported by the neurophysiologic apparatus. This is undoubtedly one of the biggest challenges in science. This article aims to bring some scientific light that allows us to reevaluate the foundations of mental health, and tackle the challenge of discovering how face-to-face classroom teaching and DL in Brazil must consider the findings and propositions from modern cognitive neuroscience, suggesting some action guidelines for the educational *estamento*, realizing that there is no absolute determinism for this.

[1] In this subject, it will be relevant to consider potential ways to increase the mesencephalic reticular formation activity as an important source of diffuse excitatory cholinergic input to the cortex.

[2] If we still do not see the value of cognitive neuroscience for education, it is because we have not yet understood consciousness on a physical level.

2. The brain's mind and its consciousness

Cognitive neuroscience starts from the conception that a cognitive mental state comprises a matrix of designed activities distributed among many neurons (the regimentation of neural tissue occurs in a distributed manner). This "activation matrix" arises whenever inhibitory or inciteful ties occur in the set of interacting neurons, configuring much more than the sum of the individual neuron actions in ways not yet understood. This minimalist explanation, although correct, is far from helping us in constructing a clear and precise description of what consciousness is (remembering similar words from Bertrand Russell, perhaps it would be worth saying that it is a sign of intelligence not to know what consciousness is).

Several works have addressed the mysteries of consciousness and the brain/mind relationship from different approaches, including education [3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16]. Besides such literature, there has been a lot of criticism in the past decade about the importance of neuroscience for educational processes, especially with regard to the teacher's performance and the supposed gains he would hoard in terms of student acting. This criticism partly arises from the confusion generated by the so-called "neuromyths", and from the mistaken belief that cognitive neuroscience would bring some prescriptive purpose — encapsulated in a discipline known as "neuroeducation" — for teachers' actions in classroom. Add to this the misunderstanding of the purposes of the brain-training industry — a true plutocracy which has earned millions of dollars —, whose performance improvements promoted in specific tasks mainly in the commercial area have in fact very little to do with realistic neuroscientific results inside the context of cognition in the extramural world, and merely reproduce the ideal of maximal productivity of the industrial revolution. Certainly, there is pressure from the narrowness of the socio-behavioral view, which completely ignores the individual neurophysical aspects associated with consciousness and its effects on cognition. To sum up the real problem, there has never been a systematic approach to the whole brain-and-mind, which brought a physical view of cognitive processes to the point of investigating the deep nature of focused consciousness. My impression is that there is little caution among psychologists and neuroscientists who are somewhat dazzled by the measurement technologies available, without considering that although measurements of brain activity can be useful, they do not bring us any advantage or gain of knowledge in the sense of a metaphysical approach, while metaphysics is not understood here as something mystical, but as something beyond our limited capacity for representation. Philosophical and scientific challenging questions arise when we delve deeper into the brain-mind relationship. In my view, as long as the conscious mind is not understood in its physical relationship with the brain, little progress will be made in cognitive neuroscience in concrete terms with regard to education, as has been largely demonstrated by the relative stagnation of literature in this field.

Consciousness summarizes a non-local process in the brain, highly sophisticated and most likely indecipherable in all its complexity. In my understanding of a succession of conscious perceptions, there is one dominant factor that determines the nature of the multiple streams that define a conscious event: time. In fact, not one-dimensional linear time, but a three-dimensional time whose coordinates connect past, present and future. After all, every conscious action or decision in the present presupposes a past experience and a future result, and such things are combined in the same occurrence in the brain. The most surprising thing is that the brain can direct energy to choose the precise convergence of past, present and future in a specific focus of consciousness. In other words, the brain is the physiological entity that allows the manifestation of the conscious mind, such mysterious intertwining of past, present and future made manifest in our actions, decisions and desires. We are very far from a complete understanding of consciousness. Since there is no consensus on whether consciousness exists among other species of animals, I would say that human consciousness is a sophisticated specialization achieved by natural selection, as a manifestation of the universe trying to know itself, a fact that makes the conscious species, understanding this universe, able to survive the dangers of the cosmos, going beyond the torments of its home world.

The theory of the focused mind and consciousness I developed is also a logical consequence of my previous work on quaternions applied to the study of symmetric transformations between space and time

[8], and on thermodynamics [9]. However, one can always find ideas in the fields of philosophy and metaphysics that present themselves as a way of tautologizing the theoretical foundations in question. This is what I found in excerpts of Bergson: "[…] consciousness means primarily memory"[2-a, p.5], a first allusion to the dominant temporal nature of consciousness. And he continues further: "[…] all consciousness is memory — conservation and accumulation of the past in the present" [2-a, p.5]; then, further up, he includes the future and concludes that "if consciousness means memory and anticipation, it is because consciousness is synonymous with choice"[2-a, p.11], understanding choice as the reason for action. What Bergson lacked was to understand the physical nature of duration, the core of the evolution of all things. Bergson's discourse does not go as far as physical modeling, but dialectically it is very plenteous in his clean and fluent style. How can we relate the functioning of the mind to the external universe that we perceive? How can we associate the linear evolutionary time of our experiences and observations with this unintuitive three-dimensional time that supposedly realizes consciousness? Once we must understand them as composites of space and time, brain and mind seem to work in different ways. The brain, a predominantly spatial four-dimensional entity, consumes energy, producing entropy and, therefore, operating in line with the cosmic evolutionary timeline; the mind, a predominantly temporal four-dimensional entity[3], on the other hand, works to the extent of the entropy dissipated by the brain, leaving the Second Law of thermodynamics intact, since each memory ("going to the past") requires energy transformed by the brain over evolutionary time. Nature always finds a way to preserve the Second Law[4]. The mental amalgam of past, present and future determines a ruling conscious action, at the expense of the entropy effluent from brain activity, which is to say "at the cost of the energy consumed by the brain"; each "going to the lived past", as well as “to the imagined future”, occurs at an evolutionary instant, and both “goings” are projected into the present which always shifts to the future with the succession of our actions towards increasing entropy.

So, going to the past, as well as to the future, always happens “now”, that is, any point in the lived past or imagined future is projected into the present, which always moves into the future as our actions take place. Interestingly, the mind's proper time, in its three-dimensional stream, seems to suffer relativistic effects on the resultant pointing to the future in mental states of extreme intellectual concentration. The focused mind's time is supposedly stretched due to the energy required from the brain to exercise maximum focus. On a theoretical level, calculations carried out according to the proposed pseudo-Lorenzian formalism reveal that in ideal conditions, one hour of intense intellectual concentration ticked in an external clock will correspond to a mind's proper time of 2048.999663 s ($\cong$ 0.569166573 h) [9]. This means that mental time does not match standard clocks if maximum focus is achieved (with conventional external clocks we already have information from electrophysiological measures about the temporal dynamics of neural activation in the millisecond range; what we still don't have is an assertive technological way to measure the mind's proper time, something that at the moment will be restricted to indirect methods). For now, this is just a theory supported by some evidence in personal experiments of extreme focus for no more than one hour of study, considered the acceptable limit duration of focus. Experiments in groups of students and researchers are being organized to test the theory, but I recognize that it will not be easy to discard what is purely psychological from what is truly physical.

In a nutshell, from my point of view, there is indisputably a physics behind the phenomenon of consciousness, a time physics to be more precise. My approach seeks to understand this physics, and not to discuss the functionalities and mapping of each part of the brain, not even to pinpoint the partial location of certain neuronal activity, something that is in the good hands of the main experts on these subjects. However, as much as it may be disliked, not every phenomenon or physical fact can be

[3] While the brain, spatially three-dimensional, acts according to the one-dimensional advance of cosmic time, the mind, temporally three-dimensional, moves through streams of electrical impulses along one-dimensional lines of space traced inside the axons.

[4] The Second Law is a result of the way objects relate and evolve in our four-dimensional continuum. In a different four-dimensional manifold, with three temporal and one spatial components, something very different could happen, but it would be pure speculation to talk about that at the moment.

observed or recorded on instruments, and not every measurement process can provide infallible data. Faced with these restrictions, I accept with resignation the incompleteness of my model, although I firmly believe in the correctness of the way I chose.

It is not known whether it will be possible to corroborate completely the relativistic theory of the focused mind, but it is necessary to try. The conceptual basis is, philosophically and metaphysically speaking, consistent with what is inferred from how the mind works and the functioning of the brain, the latter as recorded by measurements carried out on specialized devices. It is also consistent with what we know about the metabolism necessary for neuronal activity and with the perception of time in the combination of memory, prediction and action. On one hand, cerebral thermodynamics; on the other, the temporal complexity of the conscious mind. The precise details of the connection between the two seem to escape reason.

2.1. Understanding perception

As I noted previously, particularly interesting is how Bergson discusses consciousness and time. In a certain way, had he gone beyond the purely psychological character of his understanding to arrive at a true physics of time, I would see him as a precursor, a thinker with original ideas that preceded the theory I propose today. "The universe lasts. The more we delve into the nature of time, the more we will understand that duration means invention, creation of forms, continuous elaboration of the absolutely new" [2-b, p.8]. That's what he said in his beautiful literary style, which in fact earned him the Nobel Prize for Literature in 1927. But, Bergson was not a physicist. Obviously, his conception of time would not allow perception to be brought to the forefront of spatio-temporal action. Perception was, and still is, a phenomenon mostly discussed in psychological terms (as indeed the experience of duration itself), at best in terms of electrochemical responses to stimuli tested in laboratories. In the context of the physical model of mind and consciousness I discuss, it is necessary to understand it in its spatio-temporal essence. And I understand it this way:

> "[…] consciousness does not occur in time, it is predominantly time in its own course, with the neuronal architecture as the organism that registers this course through the apprehension of external world by mental copies of facts in succession, a process known as "perception". Contrary to popular belief, space and time combine in different ways, i. e., a conscious process is a copy-slice of external world (predominantly "duration") recorded in a neuronal structure (predominantly "extension") through an opaque blend of duration and extension called "perception". All these combinations are space-time composites. I really like to summarize all this in a definition that is both philosophical and a little poetic: Consciousness is the awakening of primigenous time-face of the space-time composite in the brain activity of a sentient and rational entity, the ineffable movement that realizes the mind."[9]

2.2. Thinking, causality and cognitive neuroscience

Kantian philosophy certainly exerted a great influence on twentieth-century scientific thought. From the point of view of cognitive neuroscience, highlighting the role of time, Kant's conception of the principle of causality as belonging to the category of *a priori* understanding has a precedence that should not be ignored. Well understood not as an absolute concept, and, by the very nature of reason, we are led to assume that causality is in some way a mental expedient that makes possible the connection between the substantial motivator of a real perception and the realized experience. Even though quantum mechanics has restricted it, at least in the description of observables from the measuring devices it remains valid,

since we need classical concepts to transmit ideas and results. Apparently, a similar restriction applies to certain stages of cognition.

Now, let us consider the connection between past, present and future. The memory of past events influences our decisions in the present about how we shall act in the future. Thus, the present is always the fundamental node of a causal trail of thoughts that approximately reproduces a chain of events, some of which are yet to come. The difference from the node is that the future is unheard-of, imponderable, while the past was consummated. A single decision can give rise to a branching of possible outcomes. The objective here is to discuss, based on these digressions, the causal succession that leads from knowledge to understanding.

I have argued that knowledge is a means; understanding is the true end. The physical process in the brain that leads from one to the other does not appear to be causal. There is no way to identify the neuronal relationships that are involved in the elaboration of knowledge in order to achieve understanding, much less, within these relationships, the contents that interact. It is not a question of ignorance; there is simply no cause, but rather a spontaneous interlacement of countless interactions and iterations between neurons in a dynamic that is not entirely localizable in the brain. There is, of course, an external causal chain between "knowing" and "understanding", driven, if we prefer to say so, by a vague mental instance called "will". However, the "thing in itself", the neuro-spontaneous action, will remain unfathomable in the mind.

Naturally we think that every search for knowledge begins with the manifestation of curiosity. Curiosity is a striking characteristic of the human species, being responsible for the first impulses towards understanding, in most cases a distant goal. However, curiosity is not persistent in and of itself. For it to become genuine interest, it shall be necessary to awaken that vague instance to which I referred: the “will”. There are no neuroscientific prescriptions for awakening the will, except for the presentation of the world in all its diversity by erudite education professionals who are extremely competent in teaching techniques. In well-designed learning environments and under appropriate inclusive public policies, the will arises naturally and casually in a group of students. It is human nature to be predisposed to express creativity and a will to learn and understand.

What must be clear is that things like curiosity, intuitiveness and creativity sum up random facts that define the world of human beings, as we know it. All these are emergent incitements of cognition that occur through spontaneous, complex, non-causal processes of the mind. The diversity of ideas and thoughts is only possible due to the indeterminism of the mind in its not causal dynamics. Regarding the intricate trajectory from knowledge to understanding, those three concepts are essential. Together they embody what we understand as freedom, something fundamental to awakening the will. Any political-ideological regime that restricts the principles contained in them will be an unviable institution, therefore, doomed to failure, no matter how long it lasts.

2.2. So what?

When the subject is "education and its problems", Brazil exalts the fashion of the so-called "active methodologies" — supposedly contributing to the cure of all the ills of education —, while the countries that have stood out most in education for at least the last 30 years are questioning them due to the consistent decline in the quality of teaching/learning they have been registering year after year (as far as we can see, there is no scientific evidence to prove the effectiveness of such “methodologies”). It seems that conscious actions in teaching/learning are being drastically affected by a destructive combination of technology, ideology, and precarious science.

AI technicians without scientific training (algorithms are not science!) often make exaggerated claims about how far machines can go. As a neuroscientist, I am a staunch supporter of the idea that consciousness works in a way inimitable by any advanced machine. I agree with Penrose when he states that "the hallmark of consciousness is the non-algorithmic formation of judgments"[7], that our conscious judgments depend on "facts, sensory impressions, relevant past experiences, and weighing these things

against each other — even forming ingenious and eventually inspired judgments."[7] Therefore, any hypothetical attempt to force consciousness partially functional in an algorithmic way would be a devolution. Except in the case of repetitive conscious performances under well-known rules, consciousness is, by its very nature, non-algorithmic. However, the addiction to reading on screens is transforming conscious reading into something similar to the application of a specific algorithm that controls a fragmenting process. We are reading in leaps and bounds and in a dispersed manner, without focus. This is useful in a global process of deconstructing education that favors the profit interests of large corporations, a facet of Big Tech's control over people's destinies. Recently, even the Apple co-creator Steve Wozniak, now distanced from Silicon Valley, criticized the weight of Big Techs in 'controlling our lives' when participating in the Mobile World Congress (MWC), in Barcelona, 2025 (it's curious how only after moving away from the techno-plutocratic circle do some people speak out against the ideology of Big Techs!).

In brief, the brain evolved through a random process known as "natural selection," in such a way that its successive adaptations proved more promising for survival. From then on, accordingly neuroscientific understanding several times emphasized by Nicolelis in his interviews, the brain uses the statistics configured by social behavior and facts from the outside world to establish a path of rewards that maximizes the chances of survival. If this path becomes dictated by binary logic, the brain will recognize it as the best alternative. It seems that we are subject to an algorithmic induction of binary behavioral conditioning to make choices (yes or no, without critical thinking) also as readers, not only as digital readers since such conditioning overbrims into reading on paper and gradually makes us incompetent for effective cognition. Therefore, in the current education formats, I see the idea of an education that emancipates as irreconcilable with the excessive use of technology disconnected from the emancipatory purpose. Truthfully, I could not say what is coming, but the scenario does not point to a favorable outcome for education.

Apparently, as Nicolelis highlights, our hedonic objectives, the limbic conditioning factors for obtaining immediate pleasure, have surpassed the primal objectives of survival along with the entire spectrum of choices arising from critical thinking. It is the enormous loss of interest in formal education, which began at the end of the 1960s with the strong collaboration of postmodern urban myths and pseudoscience, that needs to be discussed, not the traditional teaching that made great minds flourish until the mid-20th century. Given such reflections, it is understood that the emancipatory role of education, today so affected by ideologies, needs to be re-discussed scientifically in the fields of cognition and literacy, carefully treated without political-ideological interference. As if the natural complexity of the subject were not enough, we have to deal with the technological paraphernalia that is uncritically imposed on education, as well as the mythification of pedagogical practices still without support from the sciences of cognition, in addition to eradicating apologetic overstatements towards AI (I will deal with this topic on another occasion).

What about DL? If we take into account that in the development of cognition we must consider three critical aspects, namely (1) ability to focus, (2) creativity, and (3) critical thinking, we see that for DL the challenge becomes dangerously close to unrealizable. Despite all the setbacks, however, DL can still be useful as an adjunct resource, as long as it is applied in socio-cultural conditions for which it is prescriptible. In a positive solipsistic perspective of responsible and sustainable application, it can favor the emergence of advantageous situations for the formation of disciplined minds, namely:

A- Need for environmental isolation in order to neutralize the dispersive factors of the predominant lifestyle in today's world;

B- Eradication of the myth of "lack of time", as long as the relativistic theory of the focused mind’s proper time stretching is confirmed;

C- Configuration of uninhibiting instances that encourage creativity and critical thinking.

Undoubtedly, DL must be inclusive, however, respecting the psychological profile of the students who would benefit most from the strategy. Moreover, a DL project must also exhibit an architecture that stimulates creativity and freedom of thought — fundamental items for increasing the ability to focus — without the excessive use of media elements that could cause dispersion or enhancement of occasional cognitive deficit reflecting some genetic predisposition to ignore novel stimuli. Concomitantly, some recent studies show that it is possible to explore a particular group of "visual movement" neurons present in the lateral prefrontal cortex (LPFC) capable of repressing distractions and maintaining attention. This group of neurons has a pattern of activity in the LPFC called "beta bursts", reducing the stimulus of distractions and increasing focus on certain activities. Finding ways to galvanize the action of this particular group of neurons constitutes an interesting project within the theme of DL. Also, the activation matrix arising, when involving creativity, may be associated with the dopamine reward system, deserving more in-depth studies regarding this connection and ways to promote it in DL (if the interest were strongly commercial, we would have already made a lot of progress). These latest observations demonstrate how complex the task of building effective and responsible distance education systems is.

3. Mental health, cognition and education

In recent years, there has been a notable increase in the prevalence of mental disorders arising from a conflicting experience in the real world and in the virtual scenario imposed by Big Techs, opening up flanks to an immense collective health challenge. Mental health is directly connected to cognition. It is the ability to absorb knowledge and, above all, to extract understanding from this knowledge that enables a healthy interaction with the world, galvanizing the individual's potential, making him emancipated for a life full of goals and achievements.

To be fully realized, cognition must interconnect knowledge and understanding, which in practice occurs through literacy, a concept that transcends the simple development of the ability to read and write to define and explore the instrumental character of reading and writing as means of exercising critical reflection in different socio-cultural contexts. However, there is an issue rooted in the very core of literacy regarding a cognitive dissonance that needs to be overcome: the apparent opposition between scientific determinism and humanistic freedom (even though determinism has become an instance of restricted scope, especially after the advent of quantum mechanics). Quoting Atlan [1] and others, Levine emphasizes that "[...] the split between the two outlooks is closely related to the split between reason and emotion, and both splits are at the heart of the current crises of modern and postmodern civilization."[6] In fact, and as Atlan [1] already understood, the feeling of freedom seems to emerge from knowledge, but not just from knowledge — I would add —, but from the understanding that can arise from this knowledge. In this way, the belief in a deep feeling of freedom independent of prerequisites is broken. Undoubtedly, this feeling of freedom is closely associated with the feeling of happiness, and thus the natural cognitive chain is established, eradicating the apparent determinism/freedom dichotomy (all the more so since, as I discussed previously, the pathway that leads from knowledge to understanding seems to be neurospontaneous) and preserving a state of full mental health.

Although emotion and cognition can be separated by brief moments, emotions appear to be essential for effective thinking, or, more broadly, for conscious perception. As reported by Turner and Ralley, experiments have shown that the orbitofrontal cortex is consistently activated during emotional responses [12]. The same author, noting the strong biological connection between the amygdala and the frontal cortex, also highlights the importance of the orbitofrontal cortex consolidated by the observation of cognitive problems caused by damage to emotionality. In short, the prevailing view in modern cognitive neuroscience has completely departed from the old and prejudiced notion that emotion is irrational, although it should not be forgotten that, in all the indecipherable complexity of the human brain and its mind, there are psychological and moral problems that arise with emotion.

Evidently, there is much to learn regarding the mental associative mechanisms between reality and conscious perception, between brain and mind, but educational processes, which should have cognitive

health as a primary condition, have increasingly distanced from this foundation, mainly due to ideological agents.

4. Final comments

The approach taken shows how little we know and how far we have come on the most important questions about the human brain, its mind, and its admirable complexity. This approach raises reflections that cannot be ignored in the neoliberal dystopia in which we live, especially with respect to mental health and education. Regarding the urban cult of machines that will think like human beings, I think that the main lesson to be learned is "we need to stop listening to postmodern foolery". The functional coordination of the brain is continuous (analogical) in all its manifestations, which in itself, without discussing the non-algorithmic nature of things like intuition, empathy, creativity, etc., makes it an entity that cannot be algorithmically replicated. This has been known since Turing, Wiener and von Neumann, but it has been set aside by neoliberal technoideology whose main marketing interest is to induce the brain to function within the limits of binary logic. Let us have faith that human resilience does not want to accept this harmful cognitive reductionism.

Leaving aside all kinds of nonsense about AI in education, cognitive neuroscience is not prescriptive regarding teaching-learning, but it brings together deep aspects of brain-mind interaction that are fundamental to better understand the conscious perception, the mental processes that lead us to learn, and the ways to stimulate and control the activation of neural systems that favor a focused mind. These deep aspects are absolutely necessary in the agendas discussing mental health and education. I believe that education has a crucial role in promoting mental health. Consequently, I also believe that the worldwide collapse of education has contributed to some degree to the alarming increase in the prevalence of mental disorders and the extreme consequences of some of these disorders. Confined in a world for which the pursuit of truth so defended by Descartes has become obsolete, I very much doubt that any technology can help us disenthral education from the cognitive shadow imposed by the digital geopolitics of large corporations. By the end of this decade, we will have a clearer vision of what we can expect from the future of education, not just locally but globally. The coming years will be a test of human resilience. What is at stake is the future of human kind, although most people do not realize this.

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