

EDUCATIONAL CONSIDERATIONS ON THE EPIGENETIC DIMENSION OF ARTIFICIAL INTELLIGENCE

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Abstract: The need for greater awareness of the epigenetic dimension in which the interaction between human and artificial intelligence takes place today takes on significant value on an educational level. To survive, the species adapts to the environment according to its evolutionary advantage, walking on the legs of individuals and always building new tools. These tools in turn contribute to building the educational environment (Nurture) which modulates the phenotypic expression of the genome (Nature), including noetic ones, and therefore influencing the noetic dimension of the entire Species itself through the choices of individual individuals. The ability to calibrate the systemic feedback that derives from this interaction by monitoring its effects represents the frontier of pedagogical interest, allowing a real activity to reduce educational failure with effective effects on primary prevention (risk reduction). In fact, the emotions aroused in this interaction activate neurobiological mechanisms of gene expression or silencing such as methylation, acetylation and ubiquitination, leading to a transversal continuity which, if not understood at the level of educational practices, then becomes of neuropsychiatric and criminological interest.

Keywords: Artificial Intelligence; Education; Emotions; Epigenetics; Human species.



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1. Introduction

Since Turing (1950) proposed a test to try to establish when a machine could be considered intelligent, its efficacy and educational risk began to be considered, so much so that in 1998 the term "Artificial Intelligence" was defined as follows: "It is the science and engineering of creating intelligent machines, especially intelligent computer programs." (...) "AI is connected to activities such as using computers to understand human intelligence, but AI must not be confined to methods that are biologically observable" (McCarthy, 1998).

AI and advanced technologies belong to us viscerally in the concept of relationship that forms the Systemics of the Mind (Bateson, 1989), now also extended in the concept of the Extended Mind (Sheldrake, 2018), and therefore every pedagogical project and educational path must take this into account. Transdisciplinary transversality emerges immediately and reveals itself as an element of necessary supra-disciplinary union to achieve awareness of global understanding of educational

perspectives, trying to overcome the reductionist risk of possible fragmentation according to the various points of view with respect to the individual starting areas from the neuronal territory of interest for AI.

Therefore, the starting point cannot be the variety and level of technology, but a careful analysis and identification of the problems that one wants to address, namely: "when we ask ourselves how AI can contribute to teaching and learning, we need to start from the problems that we believe can be addressed with AI" (Luckin, 2016).

2. AI education

AI should be considered as an aid in the processes of noetic structuring (namely, the formation of Thought, specifically the psychic Function called Ideation), and although it holds centrality in such creation, much caution is still required because the risk of dehumanization occurs especially during neurodevelopment due to the neuronal fragility of childhood and adolescence, as well as in frames of emotional-affective and cognitive-relational disadvantage as a diathetic element towards the implantation of secondary risks, from feedback of self-reverberating communication.

Here, we discuss the two main dimensions regarding the interaction between AI and Education, namely the action through emotional activity on phenotypic expression according to epigenetic mechanisms, and how awareness of such phenomena can be reached, avoiding potential hyper-expression with overexposure that then takes on a life of its own beyond the intended pedagogical design, creating an unexpected communicational aberration, even epigenetic, as a rebound effect.

Regarding the qualitative emotional exposure to the environment created by various Primary Education Agencies (family; school; places of social, cultural, and religious aggregation; social and mass media; the same State in which one lives and the relationship between this and Foreign States in a geo-political system), AI quantitatively reflects the knowledge of Big Data Theory, indeed the large amount of data resulting from the use of technology must be analyzed, collected, and organized to obtain prognostic and predictive information aimed at increasing awareness and operational certainty. These advancements increasingly allow for the design of algorithms useful for structuring models to understand and anticipate interaction with technologies towards excellence, providing information on noetic structuring based on Evidence Based Education (Hattie, 2016).

While AI can improve the world of education on one hand, on the other, it is necessary to educate people to recognize the benefits of AI, but above all, to use AI consciously.

It will be necessary to build collaborations on multiple fronts:

- In a socio-educational perspective, both teachers and learners, as well as parents and all adults recognized as significant, must synergistically work with scientists, guardians of Order, and Operators of Security and Social Services in order to develop an ethical-deontological framework within which assessment and administration carried out with AI systems can actually be effective and lead to possible excellence in the functioning of the relational system;
- Regarding the technical-executive aspect, it will be necessary for both companies and academics to collaborate on the design of effective AI systems when used in the educational field;
- In the socio-political dimension, everyone, both voters and elected officials, will be required to recognize AI as a potentially positively structuring factor, with the

responsibility to facilitate accessibility to resources aimed at increasing and reinforcing the necessary resources and methodologies for sector development.

"AI has the potential to bring about huge beneficial change in education, but only if we use our human intelligence to design the best solutions to the most pressing educational problems." (Luckin & du Boulay, 2016).

Therefore, the assistance of AI in the service of human intelligence certainly has positive implications for childhood development.

3. Emotions and the epigenetic dimension

The educational modulation of the noetic trajectory in which the interaction between human and artificial intelligence occurs assumes significant value in the educational realm today more than ever. The direct and considerable emotional impact (a mathematical operator transforming a scalar quantity into a vector) influences the phenotypic expression of neurodevelopment from gamete structuring before conception, continuing throughout gestation and during the "first thousand days." Learning occurs through somatoesthetic and neurosensory interaction (Villanova, 2020) at the neuro-psycho-motor level.

Indeed, this period encompasses about nine months of pregnancy plus the first two years of life, which are crucial not only for the development and growth of the fetus and child but also for lifelong health, influencing epigenetic predisposition to various adult vulnerabilities and fragilities, including cardiovascular, psychiatric, and even oncological conditions (Barker, 1986). Epidemiologically, over forty years ago, a particular association was observed between low birth weight and the risk of developing coronary diseases such as heart attacks and diabetes. Individuals born weighing less than 2.5 kg have a higher likelihood of falling ill.

Species adapt to the environment for their evolutionary advantage, walking on the legs of individuals and continually constructing new tools. These tools, in turn, contribute to constructing the educational environment (Nurture), modulating the phenotypic expression of the genome (Nature), especially in the noetic sphere, thereby influencing the genomic dimension of the entire species through the choices of individuals that will then represent epigenetic acquisitions through mechanisms of evolutionary genomics.

The ability to calibrate the systemic feedback resulting from such interaction by monitoring its effects represents the frontier of pedagogical interest, allowing real awareness in modulating the immense force of AI.

4. Education and primary prevention (risk reduction)

Effect of AI on neurobiological mechanisms of gene expression or silencing.

Every effort to mitigate educational failure involves the construction of a reference model to be understood and transmitted as an example. The Biological Aesthetic Structural Model (BASM) (Villanova, 2006) allows understanding the relationship between form and process, with efficacy effects on the evocation of phenotypic reading through epigenetic mechanisms of gene silencing and activation. Methylation, trans-ubiquitination, and acetylation bring about changes in chromatin reading without modifying the gene sequence.

Human intelligence is a set of *psychic functions* (Perception, Attention, Memory, Ideation, Affectivity, Will, Consciousness) and *mental faculties* (Cognitive, Organizational, Predictive, Decisional, Executive) that, through processes of emotion-

al-cognitive integration and affective-relational, allow the acquisition of awareness, transcendence, and belonging to structure noetic projects (Ideas) and structured paths to modify matter according to Ideas, solve problems, and achieve objectives. Intelligence is present in living organisms, more or less complex, and even in cytoplasmic organelles, and can be described as the capacity to acquire information and retain it as knowledge to apply to adaptive behaviors in the environment.

If the Mind begins to exist in relation and not in the anatomical part of the brain and is made of Communication, which assumes a structuring value at the synaptic neuronal level from embryogenesis (according to the principle Use it or Lose it) and is then modified only by Pruning during the first year of life (the alternative being Pervasive Developmental Disorders, i.e., autistic syndromes), and by experiences of interaction with the environment that evoke epigenetic recalls from the Species Genome. In a systemic dimension, Intelligence is directly the product of synaptic neuronal connection first and relational-systemic connection later, until it reaches broader levels according to the connection of Species among individuals (Extended Mind) or even linked to the ecosystem in an ecological dimension of immanence and transcendence (Villanova, 2021). Neuronal arborizations and synaptic benches as territories of the Mind would describe energetic fractals where increasing or decreasing the order of magnitude reproduces the same morphology according to the belonging of the one to the whole in a holistic view of the Universe. Then, according to the theory of Gaia (Lovelock, 1979) inspired by the first images of the Earth taken from space, it arose the idea that it could be considered as an undivided entity rather than a set of distinct components, therefore an organism capable of maintaining homeostasis with respect to the environment in which it survives, the Cosmos.

AI in constant synergy, vigilance, and awareness with Human Intelligence assumes great value for a healthy and fair growth in effective affective and sexual maturation (Rocchi, 2022; Malavasi, 2019; Panciroli & Rivoltella, 2023; Lavanga & Mancaniello, 2022).

5. Towards a responsible interaction between Human Intelligence and Artificial Intelligence

Understanding how in a system of value reference, contents with greater synaptic reinforcement, representing an overexpression of sensory-perceptual solicitation through emotions conveyed by value systems (Primary Education Agencies, especially Social and Mass Media), helps to understand the action of possible disinvestment of value contents always lurking in the transition from human will to machine executability.

Artificial Intelligence, which should be an ancillary and beneficial prosthesis, aiding and vicariously expanding human thinking capabilities, through reverberation systems resulting from overexposure, can modify the noetic axis of entire populations and generations, confusing cause with effect in simple epistemological matters (for example, a product or a person are effective because they are highly represented, or an excellent product because it is the best-selling, or someone who defends themselves is violent and does not want peace, etc.), leading to worrying risks of noetic aberration. Just think of the constant presence of influencers on the Web and manipulative Social Media. Therefore, awareness and vigilance are indispensable and absolutely necessary. Recruitment, training, monitoring, and supervision of professionals who will provide the contents and implement their introduction methods into value genesis systems are

crucial moments that cannot be entrusted to marketing or, worse, only to profit. What seems to be of greater advantage is not always what should be considered better.

The individual limbic system, as the topographic place of the species' noetic choices, can be influenced and easily deceived. The amygdalae, in their "wisdom," identify behaviors with the highest reinforcement percentage, and the hippocampi in identifying needs with the highest need collaborate to allow a line of noetic behavioral development, drawing from the cerebral cortex as a repository of information not only from education and responses acquired from individual traumas but also from genomic memory in evolutionary genomics, where "what is not expressed is impressed" (Lipton, 2009).

Indeed, when one understands that emotions elicited in such interactions activate a different genetic reading based precisely on epigenetic stimulation, modulating the phenotypic expression of the individual and drawing through the non-spiralized genomic heritage to the Species Genome. Through reactions such as methylation, acetylation, and trans-ubiquitination, emotions lead to a transversal continuity that, if not understood at the level of educational practices, then becomes educational disinvestment, with poor or reversed value identification, of subsequent neuropsychiatric and criminological interest.

6. Conclusions

It becomes possible to establish an important hierarchy of values as the only bulwark against the risk of drift in the balance of management between Human Intelligence and Artificial Intelligence, acquiring the awareness that in order to use the latter without risk, Education comes first. This occurs during the early phase of neurodevelopment and in full neuronal plasticity, at the level of "first habits," and during the primary structuring of Personality through primary dyadic interaction with the significant adult and the human-machine symbiotic graft.

AI should be educated not only by monitoring its value contents but also through conscious vigilance, for example, discouraging giving cell phones to children, etc. Technological use should only occur at an advanced and structured cognitive-affective process, when the synaptic neuronal architectures are well organized and no longer in that dangerous state of fragility represented by neuronal plasticity (Feuerstein, Rand, Rynders, 2011), which is still so sensitive from the point of view of epigenetic stimulation. Although throughout life, we are indeed exposed to the same environmental emotions, such as the effective activation if well-oriented of "Awe" or "Deep Wonder" (Chirico and Gaggioli), which makes us learn at every age, also generating dependency (Stendhal Syndrome is a typical scenario), a sufficient level of autonomy and solidity could be identified only around 22-25 years old (Toga, Thompson, Sowell, 2006). Before then, gestation, childhood, and adolescence deserve the utmost protection and emotional respect (Villanova, 2022) because from this, in a eutrophy of phenotypic development, will derive the future parental quality but also how much it may concern the modulation of the expression trajectory of Gender Identity and Role as well as the individual's Sexual Orientation (Pembrey, Bygren, Kaati, 2006), still in full neurodevelopment until then. Education in otherness and interculturality, so important for preventive education, for the reduction of conflicts, and for social well-being (Catarci, 2016; Fiorucci, 2020), as well as overcoming Gender prejudices (Borruso, 2019), are built early in the first years of life. Educational

awareness then assumes absolute priority over any other expressed need, through the individual, for the future of the Species, to Save the World.

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