Cognitive sciences and neuroethics

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Abstract

This article starts with the discussion between the representational computational cognitive framework versus the enactive perspective of the cognitive science, which argues that knowledge is the result of the body's interaction with its environment. It discusses the consequences of this enactive perspective for the understanding of neuroethics, read not as a set of ethical parameters for scientific experiments in neurosciences, but as a neural scientific understanding of the moral action. The neural explanation of ethics comprehends neuroimaging as expressions of emotion, but reduce morality to emotions is debatable, since emotional judgments, based on affective proximity, diverge from ethical and universal norms. Another critical point of this framework is the artificiality of its tests, caused by neglecting the environmental effects on daily life, approach brought by the enactive approach.

Keywords: Cognitive science. Neurosciences. Social environment. Ethics.

Resumo

Ciências cognitivas e neuroética

O artigo parte da discussão entre a visão representacional computacional da cognição contraposta ao enfoque enativo da ciência cognitiva, que defende que o conhecimento é fruto da afetação do corpo pelo ambiente. Discute as consequências dessa visão enativa para a compreensão da neuroética, entendida não como conjunto de parâmetros éticos para as experiências científicas nas neurociências, mas como compreensão neuronal científica do agir moral. A explicação neuronal da ética parte de neuroimagens como expressões de emoção, mas reduzir a moralidade às emoções é discutível, pois juízos emocionais, baseados na proximidade afetiva, destoam de normas éticas de base universal. Outro ponto crítico dessa visão é o artificialismo de suas experimentações, devido ao esquecimento do mundo cotidiano de afetações do corpo, enfoque trazido pelo enativismo da ciência cognitiva.

Palavras-chave: Ciência cognitiva. Neurociências. Meio social. Ética.

Resumen

Ciencias cognitivas y la neuroética

El articulo parte de la discusión acerca de la visión representacional de la cognición contrapuesta a un enfoque enactivo de la ciencia cognitiva, que defiende que el conocimiento se origina de la afectación del cuerpo por el mundo ambiente. En una segunda parte discute las consecuencias de esta visión enactiva para la comprensión de la neuroética, entendida no como parámetros éticos para las experiencias científicas en las neurociencias, sino como comprensión neuronal científica del actuar moral. Interesa discutir esta segunda concepción. La explicación neuronal de la ética parte de neuroimágenes, como expresiones de emociones. Reducir la moralidad a las emociones es discutible, porque existen disonancias entre juicios emocionales, basados en la proximidad afectiva, y normas éticas de base universal. Otro punto crítico de esta visión es el carácter artificial de sus experimentaciones, causado por el olvido del mundo cotidiano de las afectaciones, enfoque traído por el enactivismo de la ciencia cognitiva.

Palabras clave: Ciencia cognitiva. Neurociencias. Medio social. Ética.

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In the late 1950s and early 1960s, small groups of researchers, mainly from linguistics, neuroscience, psychology, anthropology, philosophy of mind and, prominently, artificial intelligence, proposed to answer what constitutes the mind or cognition. In this regard, they had to overcome the boundaries of their own specific knowledge and assume a multidisciplinary perspective, laying the conceptual and methodological bases for the interdisciplinary understanding of the mind and giving rise to the so-called "cognitive science" [1,2].

The 1990s saw the contribution of Francisco Varela, Evan Thompson and Eleanor Rosch with the work *The embodied mind: cognitive science and human experience* [3]. In the book, the authors present the computational theory of mind as the origin of cognitivism, reviewing the connectionist model and introducing what emerged as a new approach to the cognitive sciences: the "enactive approach."

Based on the concept of enaction, defined as something that arises or emerges, the model questions the traditional definition of cognition as a representation of the external world completely distinct from the cognitive system, proposing its understanding as an embodied action. The authors were concerned with establishing a dialogue between the sciences, especially sophisticated cognitive science, and human experience, so as not to result in a scientific culture divided and irreconcilable with everyday self-understanding [4].

The embodied approach is inspired by Merleau-Ponty's phenomenological proposal [5], which considers bodies simultaneously as physical and lived experience structures. Several areas took this approach even before a well-defined program was established, as showed by the emergence of various terms involving the notion of body, like embodiment, embodied mind, embodied action or cognition, etc. Contemplating the semantic variety of these terms, the notion of "embodied mind" is usually more broadly used.

Given the influence of the theory of autopoiesis, developed by Maturana and Varela [6] (the latter founder of the approach), enactivism was sometimes understood as a co-extension between living and cognitive systems, by the similarity between life and cognition. Thus, a better review of the concepts of autopoiesis and the implications and modifications of its enactive reception is needed.

Another discussion, at an epistemological level, is the degree of homogeneity and integration between the enactive approach and the methodological theoretical framework of cognitive science – in other words, the compatibility between classical cognitivism and enactivism is discussed. Given this context, Clark [7] proposed to distinguish simple enactive stances, in which it is possible to combine enactive approach and cognitive sciences, more radical stances, which enable modifying the object of study, and the theoretical framework of cognitive sciences.

The diversity and increase in the number of researches from several areas focusing on the interaction between bodily, environmental and behavioral factors show the interest in this embodied approach. Therefore, it is pertinent to associate the principles of the enactive approach, which addresses the conceptual relationship between life, mind and world, as a plausible paradigm for the cognitive sciences, using its consequences to understand neuroethics.

Thus, the main characteristics of cognitivism are outlined as an approach to be overcome by enactivism, whose characteristics are then presented as a counterpoint to the previous model. Subsequently, the importance of neuroethics for the identity of ethics is explained, critically analyzing trends that reduce ethical action to brain functions, and thus enabling the enactive principle to be applied for the understanding of moral decisions in neuroethics.

Cognitivism

Cognitivism arises to understand the principles of cognition – the mechanisms that produce its functions, like memory, learning, language, etc. With the emergence of computers and the development of computer theory, *the mind came to be understood as a computation of symbolic representations of linguistic nature, representations that acquire material reality as a symbolic code in the brain or a machine* [8]. Human cognition would therefore be the mental representation, seen as the manipulation of symbols that represent the external world.

Technological advances made it possible to understand human cognitive processes similarly to computerized ones, strengthening and enhancing the classic cognitive approach. Consequently, the digital computer became the guiding metaphor for this cognitivist approach, understanding the body-mind relationship as hardware-software.

Neurosciences have contributed considerably to this computational understanding of the mind,

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since as an experimental science they aim to explain how the brain works. Using neuroimaging technologies to locate the different regions of this organ, they seek to prove how different areas specialize in certain functions, concomitantly connecting with each other. Thus, it would be possible to determine the brain bases of different types of knowledge, like economics, art, religion and morals, identifying the areas responsible for each one. This perspective underpins the emergence of neuroethics [9].

The knowledge process, or information processing, comprises three stages. In the first, perception, all information is considered and registered as an element of the external world, and then, in the second stage, recorded and stored as a mental representation. In this step, the mind calculates the data, just like a computer. Finally, the third stage, action, is the result of manipulating this symbolic processing: the resulting action is something concrete, a body's motor action in the world [10].

Cognitive psychology gave representation centrality, and philosophers of the mind such as Pylyshyn [11], Newell and Simon [12], and Fodor [13], from the field of artificial intelligence, gave rise to computationalism, representationalism, and symbolism, which agree to consider the mind as an abstract processor of symbols [10]. The concept of representation in these studies includes not only the idea that the mind builds and represents the outside world, admitting, in an ontological and epistemological sense, three fundamental assumptions: 1) *the world is predetermined;* 2) *our cognition is about this world – even if only partially and* 3) *the way in which we know this predetermined world is by representing its characteristics and then acting based on these* [14].

In the cognitive approach, the mind is understood as a different place and separate from the world. This interpretation presents a commitment, sometimes hidden, of what the world is like, how we know it and what we are. Cognitive sciences predominantly explore computational cognitivism, which has a strong and defined research program, and is consequently considered its core. However, at the end of the 1990s, this approach began to be criticized, mainly because symbols were regarded as the most appropriate means to represent the world, known as "intentionality." In other words, cognition is mental representation, because *intelligent behavior presupposes the ability to represent the world as being in certain ways* [15].

The last 30 years saw the emergence of non-objectivist approaches, which include cognition not only as a representation of a predetermined world, but as a result of interactions performed in it. They seek, in some way, to "embody," "incorporate" the mind into a world, a complex environment, defending a situated and embodied cognition. Before discussing the enactive approach, the main interest of this article, it seems appropriate to review, broadly, other concepts – like the extended mind and the embodied mind – which enactivism draws on.

For the extended mind paradigm (externalism) the mind is not in the head, but arises from interactions with the environment. Thus, cognition includes the external world, because informational and computational processes are embedded in the world and, at times, could be confused with it [10]. Externalism and cognitivism have the computational aspect in common, the perspective of the brain as a symbol processor. However, externalism distances itself from cognitivism by not recognizing an interior space where information is coded for later representational manipulation, in which cognition takes place, considering that the constitution of mental states is mediated by environmental differences.

This framework will be modified by another approach that researched the articulation of cognitive exchanges between world and cognition, the "paradigm of the embodied mind." For it, the *mind* (…) *processes daily activities, which include routines with a high degree of sensorimotor control and greater sensitivity to the conditions of each situation* [16]. For this approach, acting in the world needs more than internal models, it needs to be anchored in the world, and this happens through our body. The challenge would be to exchange a conception centered on the visual for another focused on the body's movement. This is the contribution of enactivism.

Enactive approach

"Enactive" derives from "to enact," meaning "to execute," but also "represent," "act." The Spanish [17] and Portuguese [18] editions of Varela, Thompson and Rosch's work translate "enact" by "*enacción*" and "*enacção,*" respectively, and the Brazilian edition [4] uses "*atuação*" (action). Therefore, "enactivism" means the same as "actuationism," and "enactive," "actuationistic" approach. To insist on

the originality of the term, the anglicism "enactive" may be preferable.

Used in more subjective approaches, enactivism represents the process of criticizing the initial hard cognitivism by understanding that cognitive processes encompass several causes in which the brain intervenes, in close interaction with the body and the environment, which shape its functioning. Incorporating the extended and embodied mind principles, the enactive approach goes further when considering the mind as action.

The enactive model is innovative because it sees perception as closely linked to action. This view considers, for example, that the body acts to perceive a flower in the garden as soon as the decision to do so is made. This implies that world and subject are not separated, that is, the basis of this proposal is the relationship, the continuity, the *entre-deux* (between the self and the world or the interior and the exterior) of which Merleau-Ponty speaks [5].

Essentially, this theory conceives cognition not as representation, but as action in the world, that is, context and situation would be constituent elements of cognition. Enactivism considers cognition as a continuous activity, shaped by the self-organized processes of active participation in the world and by the experience and self-interaction of the animated body. Therefore, proposes overcoming cognitivism, which sees cognition as pure projection of the world [19,20].

The term "enactive" highlights that the action is "incorporated," meaning two things: *first, cognition depends on two types of experience resulting from having a body with several sensorimotor capacities and, second, that these individual sensorimotor capacities are themselves embedded in a broader biological, psychological and cultural context* [21].

Thus, *the characteristics of enactive, embodied and extended cognition are i) that the mind is anchored in the world through the body; ii) internal representations are not abstract structures* (…)*, but pre-conceptual, resulting from bodily experience; iii) the situationality* [of knowledge] *involves the body throughout the cognitive process; iv) situationality relates to people in action; v) therefore, cognition is dependent on an organism's behavior patterns in its environment, not on manipulation of representations* [22].

The enactivist/actuationistic approach implies that 1) *perception consists of perceptually oriented action and* 2) *cognitive structures emerge from recurrent sensorimotor patterns, which enable a perceptually guided action* [21]. "Perceptually guided action" implies basing future actions on the analysis of previous actions in a specific concrete situation. When the perceptive subject constantly changes their performance in the concrete situation in which they find themselves, the reference point to understanding perception/cognition shifts from the pre-established world to the perceptual subject's body-motor structure.

This structure enables perceptual patterns that change regarding the environment, which enables the subject to act in the world, allowing themselves to be affected by surrounding events. In other words, the organism starts the process of perceiving the world and is simultaneously shaped by the environment [4,23]. What are the consequences of this definition of cognition advocated by the enactive/actuationistic approach for the conception of ethics?

Neuroethics identity and assumptions

The neuroscientific field involves ethics in two ways. First, the ethics of neurosciences discusses the casuistry of brain and nervous system research and the applicability of their knowledge in humans. Within this concept, neuroethics would be part of bioethics. Second, the neuroscience of ethics reflects on the consequences of neuroscientific knowledge for understanding ethics. The central question would be to discuss whether moral action is shaped by neurophysiological processes or, more specifically, whether morality has neuronal bases.

The first definition concerns the ethical parameters of scientific action in neurosciences, identifying the fundamental principles of researches on the individual's neuronal functioning, while the second intends to scientifically explain human moral action. This second case does not cover applied ethics, meaning instead the neuronal understanding of rationality, freedom, willingness of moral action, being the focus of this discussion. That is because it means authentic revolution, since it intends to explain the neurophysiological processes underlying ethical issues. This perspective would allow theorizing a universal ethics, biologically explained by neuronal bases, and thus enable the moral improvement of humanity through neurological intervention [24,25].

The neurophysiological foundations of ethics are based on empirical research that uses neuroimaging

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to show that certain brain regions activates during situations that require moral discernment between diverse and sometimes opposite options. The aim is to find universal ethics integrated in the brain as a set of biological responses to moral dilemmas, corresponding to an evolutionary acquisition with an adaptive surviving function [26].

This research model was at first highly acclaimed, as it helped to understand the neuronal bases of certain moral options. However, it was also criticized, because its first studies were based on moral reasoning activated by brains characterized by abnormalities, besides disregarding the cultural influences on morality and reducing it to its neuronal biological basis. This analysis highlights the need to encourage interdisciplinary dialogues on the issue, also discussing the ethical challenges of including individuals with neurological injuries in this type of research [27-29].

Neuroimaging studies that try to support the brain base of ethics assume that moral decisions have an emotional aspect, activating the brain area responsible for this performance. Therefore, in situations of solidarity option, the moral agent will decide to help the person or group with whom they identify and feels emotionally closer. This emotional dimension is defined by different authors as intuitions, instincts, senses, competencies – which have different meanings depending on the philosophical tradition [25,30].

The role of emotions in moral life has always been a central theme in Western ethics. For Aristotle [31], the ultimate end of all human activity is happiness, which can be achieved by the theoretical understanding of knowledge or by the practical mastery of passions, enabling a harmonious relationship with the natural and social world. In such task, the human being is helped by virtues, led by the virtue of practical wisdom (*phronesis*), which allows balancing excess and deficiency [31].

Epicureanism understands morality as the pursuit of happiness understood as pleasure, as satisfaction of sensitive aspect, being wise one who calculates the duration and intensity of pleasures arising from moral activities. For stoicism, morality is identified with the order of the universe and, thus, the morality of actions is defined by cosmic reason, which is the universal law that governs everything. Therefore, in Hellenistic times moral actions could be defined in two ways: pleasurable sensitive satisfaction or universal cosmic reason [32].

For Hume [33], modern morality refers to subjective feelings of pleasure or displeasure, liken the role of reason to the knowledge of the circumstances of action – without, however, being sufficient to produce practical effects in action. Since reason is not responsible for establishing moral judgments, says the author, these are delegated to other faculties, which would be less important than reason: passions and feeling [33].

In the twentieth century, with the advent of Moore's analysis of moral claims [34], Hume's position was reissued in Ayer [35] and Stevenson's [36] emotivism, who state that moral claims are apparent, because they prove nothing, expressing only approval or disapproval. These pseudo-claims have a double function: they express subjective emotions or feelings and influence the interlocutors with the intention of motivating an approved attitude. Therefore, they do not intend to describe situations, but to provoke attitudes.

For Kant [37], the influences of emotional sensitivity need to be overcome if moral decision-making is to be the result of goodwill driven by pure rationality. The moral imperative arises autonomously from rational aprioristic procedures, having as criterion the universality of transcendental maxims, beyond any situational particularity that one imposes on oneself. Therefore, for Kant, being ethical is not allowing emotions to influence the subject's moral life.

Thus, at the end of modern times diverse perspectives appear, apparently opposites, expressed in the two current models of modern ethics: utilitarianism (sensitive satisfaction) and deontology (aprioristic duties). According to Bonete [38], studies show that deontological moral judgments would be based on rational processes, while consequentialists would respond to emotional processes.

However, the history of ethics shows that morality requires contributions from sensitivity, through emotions, and rationality, through arguments and judgments. Based on neuroimaging that only study the limbic system, neuroethics cannot grasp how sensitivity and rationality interact. On the other hand, reducing certain neuronal activities to defined brain areas means forgetting their malleability and connectivity, which allows, for example, emotions to be the result of interfaces between various brain regions.

Finally, the emotional judgments gauged in the brain by affective proximity differ from the norms established in the *Universal Declaration*

of Human Rights [39] as an expression of a universal ethics of respect for human dignity. Similarly, all the secular and religious ethics currently relevant not only defend those who are emotionally close, but advocate equal respect to all human beings. These ethics are intended universal, but based on a social contract that overcomes pure emotional inclination.

Therefore, it is a question of projecting morals that are not restricted to equals and close ones, but which encompasses strangers and different people who do not awaken emotions, but whose universal rights must be respected. This type of ethics is indispensable for coexisting in the globalized world and for overcoming xenophobia and all emotional-based identity particularisms.

One must also consider the investigative model by which neuroethics intends to empirically prove its findings. In neuroethics research, the subject is submitted to controlled situations, removed from their usual environment and presented with decisions verified by instruments that do not truly express their spontaneous morality. In these scenarios, the participant's real situation is disregarded, measuring only neurophysiological processes [25,30]. To analyze this model, it should be noted that personal morality is expressed in the challenges of everyday life – not in a controlled situation, but in a sociocultural context from which the individual draws the necessary resources to decide and respond to the challenge. People's morality does not involve facing artificial dilemmas, but planning a good life [40].

Heidegger [41] refers to the artificial experiment, dispensing with the normal and routine situation, typical of modern science, as "deprived of its worldhood" (*Entweltlichung*), which compromises both researcher and subject because it modifies the usual perspective. Research participants lose their situational gaze, confronted with the other, as happens in real life, having instead a regard made artificial by the control processes of the experiment, because deprived of its worldhood. On the other hand, the researcher's gaze is restricted to the particular aspect of research interest, abstracting it from its contextual world. Deprived of its worldhood, reality is entified, still using Heidegger's nomenclature [41], reality is captured as a represented presence – in other words, reality is present by its representation. The classical understanding of cognitivism is based on this assumption [30].

The intention to give morality a scientific basis by neuroethics means accepting the metaphysical assumptions of the Entweltlichung/entification processes that characterizes all modern science. In other words, neuroethics means entifying the morality of the human being. Heidegger's philosophy sought to overcome the human being's entification through the existential analysis of their insertion in the world [30]. Hence, the enactive/actuationistic approach of cognitive sciences, previously explained, can be a way to overcome the representational understanding of reality, present in the assumptions of neuroethics.

Neuroethics and enactive approach

The enactive approach to cognition intends to overcome the internal representational perspective of reality as the basis of knowledge, defending an embodied situational understanding. According to this concept, context and situation are constituent elements of cognition, understood as action in the world and not as its representation.

To see moral decision as pure brain representation attested by neuroimaging has, at its base, the same insufficiency as the perspective questioned by enactivism. Decision is not brain representation, but the result of action situated in the world and, therefore, cannot be deprived of its worldhood and entified by representation. Just as epigenetics came to correct the exaggerations of pure genetic determination, enactive cognition can play the same role regarding reducing ethics to neurophysiological processes. The environment is essential to configure the functioning of both gene expressions and brain synapses – just as the genotype does not exist without its phenotypic expression, the brain does not function without its intellectual shaping. To exemplify, the brains of people from oral and digital cultures are biologically identical, but configured differently by the sociocultural environment that shapes them. And the relationship between brain and environment is mediated by the body [7].

The brain is the memory of the effects of the environment on the body, shaping that brain as individual, and becoming the basis of that person's own self. The brain directs the body's different functions and parts, but this body becomes its own by its insertion in the world, a particular and specific environment configured by relationships and affects [5], as well as the brain that controls it. In other words, the mind is the software of the subject body, understood as self-expression and as the basis

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of relationships with others and the world, since the brain expresses and explains its functioning and potentials. The subject's bodily experiences shape the brain, which, in turn, enables the body's performance in itself.

The nervous system belongs to the body's biological structure, but this neuronal hardware needs to be configured by a functional software dependent on the constitution of the subject body, whose brain is shaped by the effects of the environment as its own, individualized, as the basis of the body's performance [42,43]. This defines the concept of embodied mind, defended by Varela, Thompson and Rosch [4] as the foundation of the enactive principle that explains cognition.

What are the consequences of this relationship between brain and body-mediated environment for understanding moral behavior? What are the implications for the brain bases of ethics explanation? If the brain is shaped by the effects of the environment on the body, because the mind is embodied, one of the key elements of this environment is the sociocultural context. What truly configures the brain as a situated mind is culture, as in the German word *bildung*, that is, culture as formation. This explains why people of a particular culture think, reflect, and react in similar ways in certain situations: because they are part of a collective mind. The core of this mind is what Bourdieu called *ethos*, defined as

the conglomerate of evidence, symbols, myths, values and practices that underlie and regulate individual and collective life. It is the ethos which, through a process of accumulation, heritage, tradition and practices, raises and institutes, in each one, predispositions to social relations. These predispositions can be defined, with greater precision, as systems of durable and transferable disposition that, integrating all past experiences, function at each moment as a matrix of perceptions, appraisals and actions. This matrix allows fulfilling infinitely differentiated tasks thanks to the analog transfer of schemas. It allows solving problems in similar ways thanks to the incessant corrections of the obtained results, dialectically produced by these results [44].

Where is this matrix of durable predispositions that explains people's moral behavior stored? It is configured in the brain's neuronal interactions as a result of the effects of the sociocultural context on the body, shaped by the embodied mind in response to the moral challenges faced. Thus, the person's ethical brain expresses the moral culture of the collective mind to which it belongs.

Final considerations

Neuroscience studies on the neurophysiological basis of ethics can make valuable contributions to the understanding of people's moral behavior. This is because moral actions result from the execution of predispositions configured in the brain matrix, the result of the sociocultural context affecting the body as a mediation to act in the world. However, the investigative model that seeks to prove the neuronal biological foundation of ethics through controlled research on moral situations, verifiable by neuroimaging, contradicts this finding, because it disregards the cultural basis of all morality, activated by an embodied mind shaped by the environment.

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Participation of the authors

Both authors discussed and reviewed the final version of the article. Carolina Alejandra Reyes Molina developed the research and wrote about cognitive sciences. José Roque Junges investigated and wrote about neuroethics.

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