HOMO RECIPROCANS FROM THE NEUROSCIENTIFIC LITERATURE. CRITICISM FROM NEUROETHICS

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ABSTRACT: The present work has a twofold objective: firstly, to critically trace the concept of reciprocity used in neuroscientific studies, particularly from the domain of neuroeconomics; and secondly, to specify the normative frame from which human reciprocity can be defined, from which philosophical neuroethics can develop, and to identify plausible ways to promote it through brain stimulation in order to impact the epigenetic footprint by reinforcing cordial reciprocity.

KEY WORDS: Neuroethics; Reciprocity; Recognition; Cordial Ethics.

Homo reciprocans *desde la literatura neurocientífica. Criticas desde la neuroética*

RESUMEN: El presente trabajo tiene un doble objetivo. Por un lado, rastrear críticamente el concepto de reciprocidad utilizado en los estudios neurocientíficos, especialmente desde el ámbito neuroeconómico. Por otro lado, apuntar el marco normativo desde el que poder definir la reciprocidad humana de modo que desde aquí la neuroética filosófica pueda tratar de desarrollar y apuntar caminos plausibles para su potenciación a través de la estimulación cerebral con el fin de poder incidir en la huella epigenética potenciando una reciprocidad cordial.

PALABRAS CLAVE: Neuroética; reciprocidad; reconocimiento; ética cordial.

Introduction

From various disciplines, particularly economics[1] and political science[2], egoism has been regarded as the single factor motivating human behaviour. Yet as of 1950[3], the application of conventional, evolutionary and neural game theory to the study of human behaviour has revealed a broad, heterogeneous range of motives behind social interaction processes. The application and implementation of reciprocity-based behaviours in practice allows agents to specify and develop mutually beneficial projects, such as reciprocal altruism by Roberts Trivers, James Friedman and Robert Axelrod; indirect reciprocity by Richard Alexander and Robert Sugden; reciprocal egoism by Robert H. Frank; social reciprocity by Elinor Ostrom; strong reciprocity by Samuel

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1 Jevons, W., *The Theory of Political Economy* (McMillan and Co., London, 1871).

2 Schumpeter, J. A., *Capitalism, Socialism & Democracy* (New York, Harper & Brothers, 1942).

3 Flood, M. M., *Some Experimental Games* [Research Memorandum RM-789- 1] (RAND Corporation, California, 1952).

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Bowles, Herbert Gintis and Ernst Fehr, among others; inclusive reciprocity by Adam Smith; unconditional reciprocity by Luigino Bruni; transitive reciprocity by Stefano Zamagni; and others, such as institutional reciprocity or cordial reciprocity[4]. Although these studies allowed authors to identify the limitations of the concept of rationality, we consider that neuroeconomic studies have further clarified this limitation, an aspect that we present in the first part of this paper. Moreover, these studies compel theoretical neuroethics to identify horizons from which this knowledge is considered capable of guiding education and human relations by looking at the influence of the epigenetic footprint to reinforce cordial reciprocity.

1. Neuroscientific studies in the domain of neuroeconomy and the concept of reciprocity within it

Suzuki *et al.* argued that «Cooperation among genetically unrelated individuals is a fundamental aspect of society, but it has been a longstanding puzzle in biological and social sciences»[5]. Accordingly, neurosciences are contributing relevant data about the possibility of human cooperation. Let's consider that cooperation in the animal kingdom has a distinctive trait which makes it unique: the human capacity to establish and abide by social norms[6], among other important things, by clarifying the neural correlates of reciprocity.

Several papers have been published along these lines, although for reasons of space here we mention only five. The first three are related to the neural bases of cooperation —direct and indirect reciprocity, keeping promises— and the last two are concerned with *altruistic punishment*, which attempts to explain altruism even in situations in which the subject may be harmed, and where there is no kinship or possibility that subjects will meet again[7].

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[4] Calvo, P., «Ética de la reciprocidad: la dimensión comunicativa y afectiva de la cooperación humana», in: *Revista de Filosofía* 77 (2021), pp. 67-82.

[5] Suzuki, S., Niki, K., Fujisaki, S. & Akiyama, E., «Neural basis of conditional cooperation», in: *Social Cognitive & Affective Neuroscience* 3 (2011), pp. 338-47.

[6] Fehr, E. & Fischbacher, U., «The nature of human altruism», in: *Nature* 425 (2003) pp. 785-791; Tomasello, M., *Why we cooperation?* (Cambridge, Mss., MIT Press, 2009); Tomasello, M., «*The ultra-social animal*», in: *European Journal of Social Psychology* 44 (2014) , pp. 187-194.

[7] Van den Bos, W., Dijk, E. van, Westenberg, M., Rombouts, S. A. R. B. & Crone, E. A., «What motivates repayment? Neural correlates of reciprocity in the trust game», in: *Social Cognitive & Affective Neuroscience* 4/3 (2009) pp. 294-304; Suzuki, S., Niki, K., Fujisaki, S. & Akiyama, E., «Neural basis of conditional cooperation», in: *Social Cognitive & Affective Neuroscience* 3 (2011) pp. 338-47; Sakaiya, S., Shiraito, Y., Kato, J., Ide, H., Okada, K., Takano, K. & Kansaku, K., «Neural correlate of human reciprocity in social interactions», in: *Frontiers in Neurosciencies* 7 (2013) pp. 1-12; Baumgartner, T., Fischbacher, U., Feierabend, A., Lutz, K. & Fehr, E., «The Neural Circuitry of a Broken Promise», in: *Neuron* 64/5 (2009) pp. 756-770; Quervain, D. J.-F., Fischbacher, U., Treyer, V., Schellhammer, M., Schnyder, U., Buck, A. & Fehr, E., «The neural basis of altruistic punishment», in: *Science*, 305/5688 (2004), pp. 1254-1258.

The objective of the study «What motivates repayment? Neural correlates of reciprocity in the trust game»[8], is to unveil the neural correlates of reciprocity by capturing images of brain activity in people interacting in a trust game. This study shows, first, that several brain regions associated with moral judgements (aMPFC, rTPJ), reward and excitement (VS, IC) and inhibition of egoistic impulses (ACC, rDLPFC) work together when individuals reciprocate; and second, that players are more willing to reciprocate, the higher the level of trust the first player needs in order to relate with the others, and when the gains the trusting party can make by trusting are greater. This indicates that reciprocators act by taking into account the consequences not only for themselves, but also for others. Finally, individual decision-making processes are modulated by the social values of the players. For all these reasons, the study suggests that an intangible resource, namely reciprocity, is key to social interaction, and additionally, reciprocal trust is the condition in which its implementation and performance is possible.

Another paper, «Neural basis of conditional cooperation»[9], attempts to demonstrate the neural and psychological bases of conditional cooperation by combining the iterative prisoner's dilemma game with the functional magnetic resonance technique. It suggests that cooperation among people who are not family related is a basic and essential trait of today's societies, and is conditioned by the response expectancies of the related parties. That is:

a) people distinguish between cooperators and non-cooperators (response expectancy);
b) cooperators are related only with those who display a similar inclination to cooperate (conditioned cooperation);
c) this conditionality is possible because detection of a possible free-rider activates the right dorsolateral prefrontal cortex (DLPFC) —the part of the brain associated with punishment for breaking rules in social interactions— to inhibit motivation to cooperate (inhibition of motivation);
d) the activation of the DLPFC has a cognitive rather than a biological bases, as a result of direct experience of the related parties' reciprocator capacity (reputation);
e) reciprocity is shown, therefore, as a condition in which cooperation is possible.

In other words, as human beings, we are *pre-disposed* to cooperate. Yet when we detect a free-rider, our brain 'boycotts' this natural inclination to relate with fellow humans to meet commonly beneficial objectives by inhibiting the implied motivation. Therefore, cooperation is conditioned by our knowledge about the behaviour of possible collaborators. This interesting and revealing study, however, focuses on reciprocal altruism or tit-for-tat conduct, which

[8] Van de Bos, W., Dijk, E. van, Westenberg, M., Rombouts, S. A. R. B. & Crone, E. A., *op. cit.*

[9] Suzuki, S., Niki, K., Fujisaki, S. & Akiyama, E.,«Neural basis of conditional cooperation», in: *Social Cognitive & Affective Neuroscience* 3 (2011), pp. 338-47.

begins by cooperating and then repeats the other person's behaviour. It centres especially on indirect reciprocity, which entails cooperating with those who show a similar predisposition to earn a good reputation as reciprocators, allowing them to be included in future relational processes (inclusion in the group of cooperators). Nonetheless, the paths that human cooperation take are diverse and do not respond only to these two behavioural possibilities. In this line, several aspects attract our attention:

First, this activation or deactivation of inhibiting cooperation-related motivation is associated with a kind of cooperation also found in some animal species, but has nothing to do with forms which, like strong reciprocity, institutional reciprocity, unconditional reciprocity or transitive reciprocity, among others, have not been observed in non-human species[10].

Second, although we mention that the DLPFC is activated when norms linked to social interaction are broken, there is no information about the exact content of these norms, how they are built and what confers them motivational strength to cooperative or punitive action beyond *making* or *not making* a possible monetary and/or social profit. As Samuel Bowles argues in *The Moral Economy*[11], good incentives cannot replace good citizens, so material aspects can lie behind such behaviours but they should be moral aspects.

Also of note is the article «Neural correlate of human reciprocity in social interactions»[12], which attempts to show the neural correlates underlying the reciprocal social interactions that centre on reciprocal altruism through studies using the prisoner's dilemma in interactions with people and computers in situations of direct and indirect reciprocity (tit-for-tat and random, respectively). However, from the beginning of this study, as it is considered that reciprocity may be misinterpreted, further work is needed to also examine the neural coding of knowledge (perception and idea) in reciprocity patterns[13].

This study shows different brain activation throughout the circuits related with reward (e.g. the right side of the DLPFC and the dorsal caudal) and with the Theory of Mind (ToM) regions (e.g. the ventromedial prefrontal cortex —VMPFC— and the precuneus) when the reciprocity experience occurs with a person, but not with a computer. The intensity of the emotion associated with human reciprocity is represented in the amygdala[14], while the idea/perception of

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[10] Bowles, S. & Gintis, H., *A cooperative Species. Human Reciprocity and Its Evolution* (Princeton, Princeton University Press, 2011); Calvo, P., *The Cordial Economy – Ethics, Recognition and Reciprocity* (Cham, Springer, 2018).

[11] Bowles, S., *Moral economy. Why Good Incentives Are No Substitute for Good Citizens* (New Haven, Yale University Press, 2016), p. 8.

[12] Sakaiya, S., Shiraito, Y., Kato, J., Ide, H., Okada, K., Takano, K. & Kansaku, K.,«Neural correlate of human reciprocity in social interactions», in: *Frontiers in Neurosciencies* 7 (2013), pp. 1-12.

[13] «Reciprocity in social interaction, however, might plausibly be misinterpreted, so we also examined the neural coding of insight into the reciprocity of partners», *ibidem*, 1.

[14] «The result also demonstrated that correlated activation in the amygdala reflected the presence and absence of reciprocity in social interaction», *ibidem*, 8.

others' reciprocity is reflected in activation through regions related with reward and ToM[15]. Hence, it may be that subjective judgement is more important than the expectations of direct reward in the game itself. Thus according to Sakaiya *et al*.[16], mentalisation plays a critical role and is not considered equal to reward expectancy during social interactions. This study demonstrates the existence of the neural processes that underlie reciprocity in social interactions, which imply both emotion and social cognition.

The study «The Neural Circuitry of a Broken Promise»[17] examines the neural circuits underpinning behaviours linked with breaking promises that are in turn related to the behaviours the subject considered «the right thing to do»[18]. In this line, subjects are presented with a modified version of the economic trust game theory paradigm, entailing a situation of strong altruistic cooperation. A broken promise that is a dishonest act always involves an emotional conflict because the honest response is suppressed. When this occurs, studies show increased activity in the DLPFC, ACC, and amygdala, and moreover, the moment when the dishonest act is about to occur can be predicted by the activation of a perfidious brain activity pattern (anterior insula, ACC, inferior frontal gyrus)[19].

This study makes at least three important findings. First, dishonest acts are associated with greater activity in the brain regions related with cognitive control and processing conflicts, which include both the DLPFC and ACC. Second, greater brain activation takes place in the regions linked to emotion, which include the amygdala and the ventral striatum. The interpretation is that amigdala activation may be due to a guilty conscience, or fear that the act committed may be found out, whereas ventral striatum activity could be due to the motivation and forces that encourage a deceitful act to be committed. And third, the study is presented as proof of the brain's «perverse» predictive power by the activation patterns of the ACC zones, the bilateral frontoinsular cortex, and the right IFG while promise making or in the anticipation stage preceding the final decision to break a promise.

Finally, in the field of cooperation *altruistic punishment*[20] is one of the most widely studied concepts to indicate the mechanisms used to maintain group

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[15] The skill of representing one's own mental states and those of others.

[16] Sakaiya, S., Shiraito, Y., Kato, J., Ide, H., Okada, K., Takano, K. & Kansaku, K.,«Neural correlate of human reciprocity in social interactions», in: *Frontiers in Neurosciencies* 7 (2013), pp. 1-12.

[17] Baumgartner, T., Fischbacher, U., Feierabend, A., Lutz, K. & Fehr, E., «The Neural Circuitry of a Broken Promise», in: *Neuron* 64/5 (2009), pp. *756-770.*

[18] *Ibidem*, p. 756.

[19] *Ibidem*, p. 756.

[20] Altruistic punishment was defined and studied by Fehr, E. and Gächter, S. in their study «Altruistic punishment in humans», in: *Nature* 415/6868 (2002) pp. 137-140 and also by Rockenbach, B. and Milinski, M. in the study «The efficient interaction of indirect reciprocity and costly punishment», in: *Nature* 444/7120 (2006) pp. 718-723, which deals with the implication of the emotions that emanate from judgements made about what is fair and unfair in altruistic punishment.

cooperation. One of the first neuroscientific studies on this subject was «The neural basis of altruistic punishment»[21], which starts from the hypothesis that altruistic punishment of cheats provides the punisher with relief or satisfaction, and will therefore activate reward-related brain regions. The results of the study's experiments suggested that the caudate plays a highly relevant role in altruistic punishment. The caudate region has been associated with decision making and performing acts motivated by the anticipation of rewards, and that caudate activation reflects anticipated satisfaction for punishing individuals who break social norms. Just as many people seem to feel dissatisfied when the person breaking a norm goes unpunished, they also appear to experience relief and satisfaction if justice is done. The study used positron emission tomography (PET) to examine individuals subjected to economic trust games.

The authors reported a major difference in the way altruism is conceptualised in biological and psychological terms. The biological definition of an altruistic act is that it entails costs for the actor and confers benefits to others. Whether or not the act is motivated by the desire to confer benefits to others is irrelevant to this definition, since altruism is defined only in terms of the consequences resulting from the behaviour. In contrast, the psychological definition holds that an act be performed for an altruistic reason that is not based on hedonic rewards. Thus, punishment administered to those who deserted in these experiments reveals an altruistic act in the biological but not the psychological sense.

These concise conclusions from the studies described enable us to state that neuroeconomy has empirically demonstrated the human capacity to reciprocate on questions that are not merely self-interested, therefore underlining the key role of feelings and pro-social emotions in all rational decision-making processes involving some interaction with fellow human beings. Accordingly, it shows that players tend to establish cooperative relations based on reciprocity to fulfil their purposes and to punish those who do not respect social norms, which is linked to the emotions that emanate from judgements made about what is fair and unfair.

We can thus state that game theory and neuroscience (the development of which started in 2001[22]) have demonstrated the fallacy of the understanding of human beings as maximisers of material utilities promoted by their own egoistic interest, and that the boundaries of our understanding of rationality need to be extended on at least three fronts:

a) Including feelings and emotions in the rational processes involved in economic decision making.

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[21] Quervain, D. J.-F., Fischbacher, U., Treyer, V., Schellhammer, M., Schnyder, U., Buck, A. & Fehr, E.,«The neural basis of altruistic punishment», in: *Science* 305/5688 (2004), pp. 1254-1258.

[22] Calvo, P. & González-Esteban, E., *Neuroeconomía ¿un saber práctico?*, in García-Marzá, D. y Feenstra, R. (ed.), *Ética y neurociencias. La aportación a la política, la economía y la educación* (Servei de Publicacions de la Universitat Jaume I, Castelló, 2013), pp. 93-116.

b) The possibility of establishing optimum and highly beneficial equilibriums for the related parties due to intangible resources, such as trust, reciprocity and reputation.
c) Implementing requirements of reciprocity as a condition to possibly establish collaborative interpersonal relations.

The various studies on the role of feelings and emotions in decision-making processes and on the possibilities of establishing optimum equilibriums reflect reciprocity as a condition for the possibility of cooperation that is not merely strategic and is capable of maximising the benefit of all those involved. Indeed, many neuroeconomic studies have focused on specific aspects of reciprocity, such as the neural bases of the aforementioned altruistic punishment.

Through these and other matters, the neuroscientific literature on neuroeconomy offers data that corroborate the need to reconceptualise human rationality in order to orient it towards a new emotional and relational paradigm.

As we have seen, what neuroeconomy can offer are explanations for the neurophysiological bases, but not the foundations, of this rationality. Hence the need, when the time comes, to enter into dialogue with a critical view of philosophical neuroethics.

2. Extending the rationality concept from philosophical neuroethics

The task of neuroscience of ethics[23] or of theoretical neuroethics[24] involves analysing neurosciences, starting from the idea of a successful science, whose object of study is that the brain may have unforeseen consequences with regard to human beings' knowledge and their capacity to act morally.

Thus, from neuroethics it is worth analysing whether the concept of reciprocity from neuroeconomic studies is capable of providing information about the foundations of human cooperation. While neuroethics has made considerable progress in explaining the neural bases that intervene in managing and processing the relations established in human reciprocity linked to moral questions, these relations cannot be explained exclusively in neurophysiological terms, but also require knowledge about emotions and feelings; about intangible resources like reputation and trust; and about the importance of implementing reciprocity to establish collaborative interpersonal relations.

However, the difficulty lies in explaining the foundations of reciprocity; that is, why must we reciprocate? And even more difficult, why must we reciprocate not only with those who are close to us or family, but also with strangers those we do not know? The neurosciences are silent on these questions, and demand

[23] Roskies, A., «Neuroethics for the New Millenium», in: *Neuron* 35/1 (2002) pp. 21-23; Cortina, A., *Neuroética y neuropolítica. Sugerencias para la educación moral* (Tecnos, Madrid, 2011); Cortina, A. (ed.), *Neurofilosofía Práctica* (Comares, Granada, 2012).

[24] Salles, A., «Sobre la neuroética», in: *Revista Latinoamericana de Filosofía* XLII/1 (2016), pp. 7-14.

philosophically-oriented neuroethical frames because their bases provide no guidelines or knowledge on reciprocity.

Why do we reciprocate or behave altruistically? The neuroscientific literature in neuroeconomy studies sheds some light on the cerebral bases, but does not answer the fundamental question of why we are capable of reciprocating from an altruistic rather than an egoistic stance.

From the socio-biological field, this question was already defined by Darwin in 1871 as a paradox of what he termed the «biological altruism paradox»[25], and which he defined as that behaviour in which an individual invests one's own resources to favour another person's adaptation[26]. On examining this paradox, Darwin's explanation was that it is due to the selection of species, since it is in effect antinatural[27]. Years later, Hamilton explained this as *kinship altruism*[28]. Nevertheless, neither the biological explanation nor kinship could explain all the altruistic actions human beings are capable of performing. This was why the pioneering studies in this field by Trivers[29] led to what is known as *reciprocal altruism* or *direct reciprocity* (*tit-for-tat*), for which three conditions are necessary: a) low costs to be paid and large gains to be made; b) a time lag between the initial act of giving and the reciprocal act; c) many chances to interact, where giving is dependent on receiving.

However, these studies were unable to provide an explanation of cooperation behaviours during which single interaction takes place between subjects, and members have no family connections. Given this situation, in 1987 Alexander proposed the concept of *indirect reciprocity*[30] to explain acts of altruism with non-family-related individuals, and in circumstances where it is not known whether the relation would occur again when the aim is to generate reputation. However, this concept unravels when used to explain altruistic conducts in large groups.

This was the aim of Fehr and Firschbacher's study[31], centred exclusively on

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[25] Darwin, C., *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life* (John Murray, London, 1859, 1st edition); Darwin, C., *The Descent of man in Selection in Relation to Sex* (D. Appleton and Co., New York, 1871, 1st edition).

[26] Darwin, C., *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life* (John Murray, London, 1859, 1st edition); Darwin, C., *The Descent of man in Selection in Relation to Sex* (D. Appleton and Co., New York, 1871, 1st edition).

[27] Samuelson, P. A., «Altruism as a Problem Involving Group versus Individual Selection in Economics and Biology», in: *The American Economic Review*, 83/2 (1993), pp. 143-148; Rosas, A., «Selección natural y moralidad», in: *Ideas y Valores* 55/132 (2006), pp. 53-73.

[28] Hamilton, W. D., «The genetical evolution of social behaviour I & II», in: *Journal of Theoretical Biology* 7 (1964), pp. 1-52.

[29] Trivers, R. L., «The evolution of reciprocal altruism», in: *The Quarterly Review of Biology* 46 (1971), pp. 35-57.

[30] Alexander, R. D., *The Biology of Moral Systems* (Aldine, New York, 1987).

[31] Fehr, E. & Fischbacher, U., «The nature of human altruism», *Nature* 425 (2003) pp. 785-791; Fehr, E. & Fischbacher, U., «Social norms and human cooperation», *TRENDS in Cognitive Sciences* 8/4 (2004), pp. 185-190.

human altruism because, as they point out, altruism in human beings is much stronger. Hence, they coined the term *strong reciprocity* because it goes beyond cooperation based on reputation or direct reciprocity. This *strong reciprocity* consists in a combination of altruistic rewarding, norm-abiding behaviours and altruistic punishment. Cooperator behaviours are explained by strong reciprocity in cases in which interaction is not repeated, and where there is no possibility of earning a reputation. However, the reciprocator will attempt to reward whoever cooperates and will punish whoever does not, even if they may suffer some loss. The reciprocator understands that in this way, the binding norm is defended for all. Thus, punishment is motivated more by trying to maintain a norm concerning the justice and equality of the results rather than calculating personal reward (either an immediate reward or as reputation).

So what appears to be a unique aspect of human cooperation is our capacity to establish and oblige compliance with social norms[32], as we mentioned at the beginning of this paper. Thus, in this case in response to the question of why we must reciprocate, the answer suggests it is not only because we are biologically predisposed, but also because we wish to maintain the social contract with our fellow humans.

Nonetheless, neuroscientific studies about *homo reciprocans* appear to lead us to mutualism, contractualism or to the maximum calculation of (material or non-material) goods.

More sophisticated neuroscientific studies have not managed to answer questions about the foundation of some of the most complex norms present in moral terms. This is mainly because of the discord in what we learn from neuroscientific studies about the norms that could be drawn from the codes in the brain, which could be seen as the ethical proposals currently in force, such as «the Universal Declaration of Human Rights, and any of the secular and religious ethics with a minimum relevance»[33].

The explanation for this discord lies, following Cortina[34], in the need to understand cooperation from the foundations of *reciprocal recognition* that takes place in communicative human relations, which is the foundation of the discourse ethics drafted by Jürgen Habermas and Karl-Otto Apel in the 1970s.

The mutual recognition perspective as the foundation of what is moral dates back to the 18th and 19th centuries with two references to German idealism: Johann G. Fichte and Georg Wilhelm Friedrich Hegel[35]. Other thinkers later

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[32] Fehr, E. & Fischbacher, U., «The nature of human altruism», in: *Nature* 425 (2003) pp. 785-791; Fehr, E. & Fischbacher, U., «Social norms and human cooperation», *TRENDS in Cognitive Sciences* 8/4 (2004) pp. 185-190; Wilson, D. S., *Does Altruism exist? Culture, genes, and the welfare of others* (Yale Unviersity Press, New Haven and London, 2015).

[33] Cortina, A., *Neuroética: ¿bases cerebrales de una ética universal con relevancia política?* «Isegoría. Revista de Filosofía Moral y Política» 42 (2010), p. 145.

[34] *Ibidem*, pp. 146-147.

[35] Williams, R. R., *Hegel's Ethics of Recognition* (Unviersity of California Press, Berkeley & Los Angeles, 1998).

critically explored this concept in the 20th and 21st centuries, notably Georges Herbert Mead, Paul Ricoeur, Alex Honneth, Jürgen Habermas and Adela Cortina.

In his work, Jürgen Habermas[36] started not with Hegel but with Kant and his person concept as a purpose in itself, a possessor of dignity and with the autonomous capacity to have his or her own norms. These norms are moral, seek universality, and are related to and imply considering the other person as a valid interlocutor capable of speaking and acting. In the dialogue-based version of Kantian dignity (Principle D), reciprocal recognition implies not only being concerned about equality, but also about the alterity of potential or virtually related subjects. Habermas' theory of reciprocal recognition centres on the matters of justice that come into play, and on discovering the conditions that allow dialogue processes to be set up, where discourse on matters of justice can lead to understanding and cooperation among participants.

Axel Honneth began with the Hegelian conception of recognition by proposing *The Struggle for Recognition. The Moral Grammar of Social Conflicts*[37], which presents mutual recognition as a driver of social change, as well as the processes involved in fulfilling people's life projects. The spheres that Hegel identifies in human beings during their interactions seek recognition, through which self-conscience is produced. These spheres are law, love and solidarity. Hegel noted that the struggle for mutual recognition takes place when moving from one sphere to another. In line with this idea, Honneth showed the possibility of discerning the orientation that had accompanied humanity's historical process, «the ever-widening search for recognition». Honneth argued that this recognition process occurs dialectically through three dimensions: individual (love or care that generates self-confidence), social (solidarity or loyalty that generates self-esteem) and moral (law or moral respect that generates self-respect from being recognised as a person and carrier of an equal universal value) with a *telos* or normative horizon. Certain considerations can be made in line with this theory, such as, firstly, that the struggle for recognition is produced by moral feelings caused by perceiving injustice in the contempt or moral offence that an individual suffers when denied recognition, one's own identity and, consequently, practical self-fulfilment. Secondly, the moral viewpoint lies in fulfilling the three forms of reciprocal recognition, and does not necessarily lie in the search for justice.

Adela Cortina takes the Kantian roots of reciprocal recognition and attempts to combine the search for justice in Jürgen Habermas' proposal (recognising

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[36] Habermas, J., *Escritos sobre moralidad y eticidad* (Paidós, Barcelona, 1991); Habermas, J., *La inclusión del otro* (Paidós, Barcelona, 1999); Habermas, J., *Aclaraciones a la ética del discurso* (Trotta, Madrid, 2000).

[37] Honneth, A., *La lucha por el reconocimiento. Por una gramática moral de los conflictos sociales* (Crítica, Barcelona, 1997); Gil martínez, J., «El reconocimiento recíproco como base normativa del encuentro intercultural», in: *Recerca. Revista de Pensament i Anàlisi* 10 (2010), pp. 67-86.

someone else as a valid interlocutor who possesses communication skills) with the heart's reasonings (human capacities to feel, to be emotional, to love or to like someone else). For this reason, she calls her proposal the *ethics of cordial reason*[38]. Such ethics develops through dialogue, which requires these two moments: the foundations (what is fair and what is true) and experience (in compassion).

Cortina's cordial and compassionate ethics deals with two interconnected dimensions in dialogue: «the formal logic dimension of reason, the human capacity to raise aspirations of the validity of speech and to also solve them» and the cordial dimension of reason, «the human capacity to feel and acquire virtues to build an excellent character»[39]. So there is «no single reason capable of arguing, but an incarnated reason in a body, a human reason»[40]. From this perspective, Cortina attempts to demonstrate how the communication link not only has the argumentative dimension —the capacity to argue about what is true and what is fair—, but also has a cordial and compassionate dimension without which communication does not exist —moral values and feelings[41].

Perhaps it is from this proposal of cordial reciprocal recognition that a normative frame can be established to guide future research in the domain of philosophical neuroethics, and therefore the study of the *homo reciprocans*.

As the aforementioned studies have demonstrated, in both neuroeconomic and socio-biological domains human cooperation requires reciprocity, reputation and trust to develop. These aspects cannot be explained only by describing the neural bases that make it possible; rather, reference to the normative frames that guide such concepts is also needed, such as the reciprocal recognition examined here, based on the tradition according to Habermas, Honneth and Cortina.

Moreover, neuroethics shows that the moral judgements involved in these feelings and emotions —reciprocity, trust and reputation— emanate from the moral values and principles that are constructed dialogically by those affected. Therefore, strategic, emotional and moral reasons underlie them, which must be well related in order to generate cooperation[42].

Basically, philosophical neuroethics indicates the importance of both the cerebral bases of reciprocity and their philosophical foundations and relation, which are constructed by humans, and influence our epigenetic

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[38] Cortina, A., *Ética de la razón cordial. Educar en la ciudadanía en el siglo XXI* (Ediciones Nobel, Oviedo, 2007).

[39] Cortina, A., *Alianza y contrato. Política, ética y religión* (Trotta, Madrid, 2001) 15-16.

[40] *Ibidem*, p. 16.

[41] Cortina, A., *Ética de la razón* cit, p. 171.

[42] Cortina, A., *Aporofobia, el rechazo al pobre. Un desafío para la democracia* (Paidós, Barcelona, 2017) pp. 45-60.

footprint[43], for which we are responsible as humans. Hence the importance of educating in reciprocal recognition and generating cultures that recognise and reinforce it[44].

Conclusions

The neuroscientific literature helps to extend the boundaries of understanding on human rationality in cooperative settings by showing that this extension may well go from narrow egoism to stronger altruism in highly competitive situations.

> However, it is unable to explain why such a wide range of behaviours takes place because, precisely, advances in neuroscience cannot provide a reason for cerebral foundations of morals, only for neural bases. Nor does it offer satisfactory answers to the question of why we must act morally with strangers/all human beings, but remains silent on this matter. These advances can only allow us to talk about the mutualism, contractualism or maximisation of the greatest good for the greatest number, and rely on universal BENEVOLENCE to do the rest. Yet the latter is a desire, not a demand.

Thus, work must continue in philosophical neuroethics on proposing and discussing these normative frames, along the lines of Adela Cortina's cordial ethics, for which reciprocal recognition is the heart of its proposal as the foundation of morality, a recognition that suggests norms (justice and reason), evaluations and feelings (emotion).

Maybe we should ask if these aspects don'tneed furtherto be worked on in societies in both education and culture. Following this path, we could be able to influence the epigenetic footmark so that these morals reciprocal behaviours will become increasingly intuitive, and non-conscious or unreflective human response in human beings.

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