

MORAL THOUGHT AFTER ACQUIRED CEREBRAL DAMAGE

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Abstract

Introduction. Moral thinking is a mental skill that allows human beings to respect implicit and explicit social norms. One factor that can alter its functioning is acquired brain damage, as is the case with subjects who have suffered a brain injury in their frontal lobe. **Objective.** To analyse the relationship between the moral thinking process and brain functioning through the description of patient cases who have suffered acquired brain damage, with the purpose of explaining the situation of individuals that live after suffering brain damage and become unable to respect social norms. **Development.** The clinic of patients who have suffered brain damage at the frontal level, such as Phineas Gage, NN and Elliot, is shown, in which it was observed that their state after the traumatic event was characterized by going back to previous stages of thinking moral, unlike a subject who may present brain damage in later structures. **Conclusions.** We discuss the analysis of the role the frontal lobe performs in the process of respecting social norms that allow human interaction, and how it can be affected by brain damage.

Key words. Acquired brain damage. Brain function. Frontal lobe. Moral thinking. Neuropsychology. Social norms.

INTRODUCTION

The study of the cognitive and behavioral functioning in people with acquired brain damage has allowed us to understand that cognitive functions, both basic and complex, are a product of the interaction of the different structures that constitute the human brain¹.

One of the aspects that attracts most attention in this field is the understanding of how subjects, after suffering some sort of brain damage, lose mental abilities that before the damage allowed them to respect the social norms that regulate an appropriate coexistence, like moral thinking².

Nowadays, it is known that the respect to social norms encompassed in moral thinking has a relation to the frontal cortical structures, and that this type of social cognition would be one of the highest and most complex milestones of the development of the human nervous system³.

Regarding its ontogenetic development, it has been described that moral thinking follows a specific development constituted by different stages. These initiate when the human being, in a primary phase, acts impulsively and without considering the interests of other individuals, to the point of maximum development, where the individual is conscious of the existence of a

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social consensus that norms the behaviour in relation to the right to freedom and life of the agents that constitute the social system⁴.

In this sense, the aim of the current article is to analyse the relation between the process of moral thinking and the cerebral functioning through the description of cases of individuals that have suffered acquired brain damage, with the purpose of explaining the situation that they live after the damage and become unable to respect social norms.

MORAL THINKING

Moral thinking is the human capacity to perform an evaluation of the actions within a frame constituted by a set of values, thoughts and customs established in society⁵. The ontogenetic process of moral thinking has three stages: (a) pre-conventional moral level, (b) conventional-conformity moral level, and (c) level of post-conventional morality^{4,6,7}.

Pre-conventional Moral Level

In this initial stage, the interests of others are not recognized as different from one's own. Actions are considered to be solely motor, and the intentions of others are not taken into account. Moreover, the perspective of the authority is confused with one's own since subjects act by reason of their own motivation, without the mediation of what the context can expect from their behaviour. The reasons for the individual to do what is proper are to avoid punishment and to follow the power of authority figures^{4,6,7}.

Conventional-conformity Moral Level

In this level, behaviour is regulated mainly by the praises and condemnations an individual receives within the social context. Approvals and good relationships are presented, which consists in becoming aware of the situation of the other, consider their point of view and relate it with the one of other individuals. Feelings, agreements

and shared expectations gain relevance; however, there is no universalization of the agreements. What is fair, in this stage, is the coexistence with what others expect from one's behaviour. This means to adopt the role of a good friend, peer, relative, etc. Trust, loyalty, respect and gratitude are indicators of the positive aspects of the interaction with others^{4,6,7}.

Post-conventional level of morality

This third level is characterized by the understanding that each individual has about values and rights, which are previous to any social construction, and are comprehended from different individual configurations, for example, the formal mechanisms in relation to the social contract, impartiality and diverse legal procedures. The difference between the moral and the legal and the difficulty of adjusting both positions are highlighted here^{4,6,7}.

What is fair shifts to being aware of the diversity of values and judgements that can pertain to different individuals or groups. The rights to life and freedom are usually considered to be above any social agreement. The reason to act justly is the obligation to respect the social contract, in such a way that, with this compliance of the law, the individual does not only benefit himself but also the rest of the social system. For this, laws and social responsibilities oriented to benefit as many individuals as possible are created^{4,6,7}.

Fairness in this stage is to follow the ethical principles that are concordant with reason. Universal principles are equality of rights between all individuals and respect to their dignity. The motivation to act justly is rationality, which allows to discern the principles that support appropriate social development. For this reason, once this stage is reached, the individual is said to be morally autonomous, which would be the peak of human moral thinking^{4,6,7}.

ACQUIRED BRAIN DAMAGE AND MORAL THINKING

As has been observed, moral thinking has an ontogenetic development that is pro-

jected from the simple to the complex, in which, as individuals grow, they acquire more capacity to get along with the social environment through the respect for its different norms.

That said, it is true that moral thinking, once it has been developed completely or partially, remains stable. However, there is a factor which can alter its evolution by returning individuals to a previous stage of development: acquired brain damage.

Therefore, in the following section clinical case studies of acquired brain damage will be analysed, in which the zones of injury and the alteration of moral thinking functioning will be considered.

Phineas Gage

One of the most striking occurrences in the study of brain damage is what Phineas Gage experienced. Before suffering brain damage, he was an excellent worker in the railroad construction business, but then he had an accident in which the orbital area of his frontal lobe was injured⁸.

What is interesting about this case is related to the consequences of the accident in his moral thinking. People close to Gage said that, before his accident, he was very respectful to others, complied with the norms established in the social system and his language was that of a gentleman.

At work, his immediate superior declared he was the best employee, and he was even appointed as boss of a group of operators. He was characterized as being a good husband, excellent father and generally responsible with his obligations².

According to Kohlberg⁴, Gage's behaviour before the accident was typical of a person who had reached a level of post-conventional moral thinking, as he understood perfectly that each individual has his or her own values and rights that are previous to social construction, and he respected the rights to life and the integrity of the individuals that surrounded him.

This promising scenario of an exemplary human being, of an educated man, a gentleman, among other adjectives that can be applied to a man who is well inserted the social norms, was brought to ruin. On September 13, 1848, around 16h30, in a town known as Cavendish (United States of America), on a hot afternoon in a location to the south of Duttonsville, a man respectful of social norms died while a monster was born. Everything happened because the blasting powder Gage needed to prepare the roadbed exploded prematurely, blasting an iron bar that entered his left cheekbone and exited from the top of his skull⁸ (see figure 1).

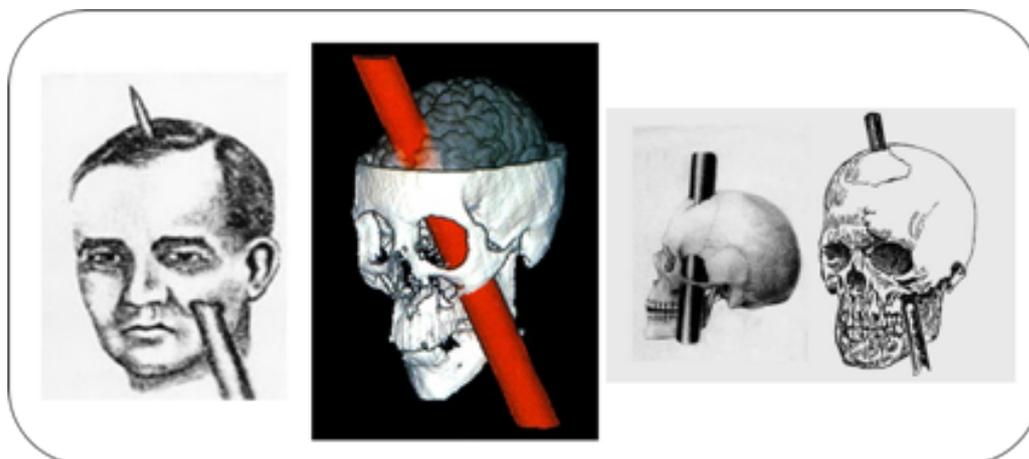


Figure 1. Trajectory of the iron bar that pierced the frontal lobe of Phineas Gage.

What is most surprising about this is that Gage survived the accident and, when he was medically stable, started to manifest highly worrying behavioural patterns to the point that his close ones declared that Gage was no longer Gage. His behavioural disorder was characterized by the inability to control automatic impulses, having a childish reaction to different situations and difficulties regarding the respect for others. Women that knew him as a gentleman no longer approached him because he exhibited a verbal disinhibition that made him externalize all kinds of vulgar and sexually inappropriate thoughts. At work he was no longer the responsible man from before the accident, leading to him being fired. In brief, after the brain damage Gage stopped being the man that respected social norms and resolved conflicts through dialogues and turned into an individual dominated by impulsiveness and aggression².

It is worth asking what happened to this exemplary man, why his behaviour changed so drastically. One approach to this complex query derives from Kohlberg's Theory of Moral Development⁴, which allows us to interpret Gage in the following manner. Before the brain damage, Gage's moral thinking had reached the highest point of development possible to a social agent; however, after surviving the boiling iron bar pierced in his brain, his moral thinking regressed to one of the earliest stages of development, identified as the pre-conventional level. To Gage, there were no social norms to abide by nor explicit and implicit social parameters to respect. In him, the impulsive animal that all human beings repress in order to act acceptably in society emerged².

On the other hand, from a neuropsychological interpretation, moral thinking is a highly complex mental ability that guides behaviour to the social norms agreed in the social contract through a conscious auto-regulation of the individual. In this process, a key role is played by regulatory functions known as executive functions⁹. This assertion has a major meaning for the neural

substrate of the executive function is the frontal lobe^{1,10,9}. Thus, it is no coincidence that Gage had lost the mental ability to respect social norms due to the damage he suffered in his frontal orbital.

NN case

Ramos y Bolaños¹¹ presented the case of a 25-year-old man that exhibited a behaviour not oriented to comply with the social parameters established in relation to the respect to others after suffering a cranioencephalic trauma that affected his frontal lobe.

The authors describe that the young man, whom they designate as NN, was an excellent student before the accident and the pride of his parents due to his good behaviour. He was even considered a propitious aspirant diplomat, and he had worked in such contexts before the accident. However, one afternoon a car hit him, and his brain took the brunt of it.

After becoming medically stable, NN's parents sought out a succession of professionals who examined his intelligence (with apparently normal results) and did psychotherapeutic and pharmacological interventions without improvements regarding NN's problems related to his respect for the integrity of others.

NN parents reported extremely catastrophic changes for the family, because when someone disagreed with him, he immediately rampaged and physically attacked the person he was arguing with. A typical situation of this medical sign, it triggered when NN heard someone talking against what he expressed.

According to Kohlberg's Theory⁴, the second level of moral thinking is the conventional one, which in its first stage is constituted by the expectations, peer relationships and interpersonal conformity. It is precisely in this stage that human beings become aware of the circumstances of others and consider their point of view and relate it to that of other individuals. At this stage social agreements are not reached yet.

Based on the above description, it can be claimed that after brain damage the deve-

lopment of moral thinking in NN regressed to the initial stage of the conventional level, in which certain difficulties arise, like taking the reality and point of view of others into account, interacting with one's own thinking and reaching an agreement after a potential debate.

At this point a preliminary conclusion starts to emerge in relation to brain damage and the development of moral thinking which invites us to reflect on the probability of human beings regressing, after frontal lobe damage, to a previous phase of development in moral thinking. As described in the two cases above, before brain damage NN's moral thinking exhibited the milestones of the highest development; however, after the damage it regressed to inferior levels of development.

Patient Elliot

Antonio Damasio² presented the interesting case of Elliot, a young man to whom a part of his anterior cingulate cortex was removed due to a tumour. Before the intervention Elliot was an excellent husband, great businessman, good father and had played a distinguished role model for his siblings. After his tumour and major parts of the frontal lobe were removed, he experienced several changes in his life. Elliot conserved his general cognitive abilities. In fact, Damasio states that his patient had normal scores in all the tests that assessed the most developed cognitive mental functions in humans. Elliot was even assessed with the moral dilemma tests based on Kohlberg's Theory⁴, where he scored the equivalent of the most complex post-conventional moral development.

However, in real life he did not achieve the social success that was evidenced in Damasio's neuropsychological assessment. Elliot seemed intelligent, diplomatic, charming, kind and a little mysterious; however, he had a highly relevant impairment in his real life: making poor decisions, which impeded him from being a socially successful being².

After the surgical intervention, Elliot lost his

wife and got involved with someone who took advantage of his economic goods, he invested (deceived) his money in businesses that brought him to bankruptcy, and he was no longer able to stay in the same job for long. Unlike Gage and NN, Elliot did not manifest an aggressive or disrespectful behaviour to others. His problem was that he made decisions based on others' intentions. That is, Elliot was no longer able to foresee nor interpret the deceptions of others, he acted with social naivety.

The regression of Elliot's moral thinking could be identified in the phases of the conventional-conformity moral level as it is in that stage of development, which belongs to pre-adolescence, where individuals act according to the praises and the censorship they receive from their social context and in which they are most interested in fitting within their surrounding context⁴. Thus, Elliot was invited to invest all his money in some absurd business, and he accepted because of his context's influence on him.

Patient HM

Henry Molaison, worldwide known as HM, was a patient that suffered from an intractable epilepsy located in the medial zones of the temporal lobes. In an attempt to eliminate the epileptogenic focus, he decided to remove great part of the medial temporal lobe (part of the hippocampus, parahippocampal gyrus and amygdala), leaving the brain structures involved with memory inoperable¹².

What is interesting about this case is that, after the brain surgery, his learning capacity was strongly affected due to an anterograde amnesia that developed. Nonetheless, his moral thinking was conserved; HM could still control the impulsive beast that dominated Gage for the rest of his life after suffering from frontal lobe damage¹².

According to Kohlberg's theory⁴, patient HM presented himself as an individual whose behaviour was framed within the rights, obligations and universal ethical principles stipulated in the social contract both before and after suffering from brain damage. This

way, HM was always an individual with a post-conventional level of moral thinking. It should be noted that HM suffered damage in the temporal instead of the frontal zone. Thus, the brain structures involved with moral thinking remained unaffected.

Brain Functioning and Moral Thinking

Luria¹ proposes that the brain is organized in three functional units (figure 2):

The first one regulates the alertness and

cortical tone required to perform activities; the second unit allows us to perceive and interpret the stimuli that surround us (occipital lobe and parieto-temporo-occipital junction), and the third unit plans, executes and verifies the mental and behavioural activity (frontal brain system).

It is important to highlight that the frontal lobe has a direct implication on the meta-cognition (dorsolateral zones), regulation of motivation and emotion (anterior cingulate cortex), the respect for social norms

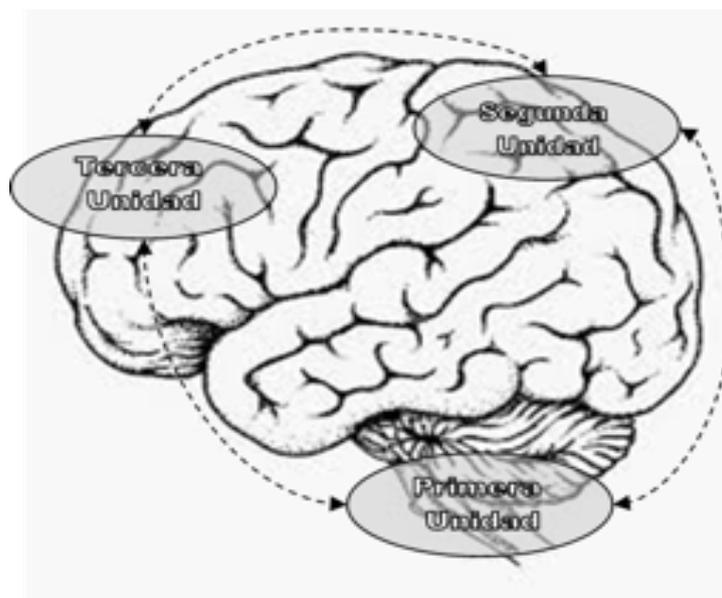


Figure 2. Anatomical description of the three functional units of the brain

Note that each unit has a different anatomic position, since in the brain neurons are not piled up doing the same thing wherever they are, but instead there is a specialization of their functions and interactions². The importance of the previous description lies in the understanding of what happened in the moral thinking of the cases described.

Gage suffered damage at a frontal orbital level and his moral thinking was affected the most. Furthermore, he completely lost his acquired functioning level of moral thinking, or as Lezak would say⁹, the executive function that allows for the respect of established social norms. NN did not present Gage's regression in moral thinking. However, his capacity to respect other individuals with whom he disagreed was affected. Elliot's brain damage was more complex. Explicit social norms were clear to him, however, implicit ones were not at all. That voice that prevents us saying "beware, this is bad business" did not exist in him. Figure 3 shows in a neuroanatomical level the damage of each one of the cases described.

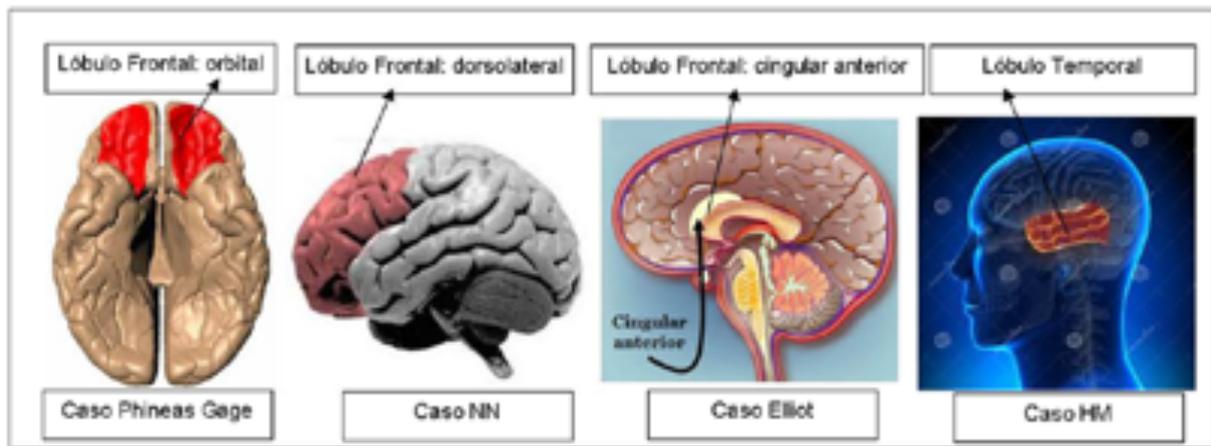


Figure 3. Description of the neuroanatomical damage of the cases cited.

and the regulation of the behaviour based on social parameters (orbital zones) 13. Thus, it should be noted that in all cases described above, with the exception of HM case (who had a temporal lobe brain damage), after the frontal lobe brain damage, they had difficulties in the performance of their moral thinking and conserved other basic brain functions, such as movement, language, perception, among others.

DISCUSSION AND CONCLUSIONS

The goal of this article was to analyse the performance of moral thinking after acquired brain damage. To this purpose, the clinical condition of numerous cases of acquired brain damage was analysed.

The analysis began with the description of the moral thinking stages of development. This would be the basis for the subsequent analysis, which explained that moral thinking is constituted by three major stages: pre-conventional, conventional-conformity morality, and post-conventional morality.

Subsequently, the moral thinking of some of the patients with acquired brain damage was analysed. In this section the cases of Phineas Gage, NN, Elliot and HM were presented. Through them, it is possible to identify that brain damage to the frontal zone produces reversals in the performance of moral thinking, while other structures, such as the temporal lobe, do not affect this mental ability. In this sense, in the structu-

ral brain damage of each of the analysed cases, the role of the frontal lobe as a neurobiological basis for moral thinking is remarkable.

This claim can be interpreted according to Anderson and Reidy¹⁴, who maintain that the ontogenetic development of the frontal lobe of human beings progresses in its complexity together with age, and so as humans grow, respect of social norms and auto-regulation increase at par. As has been observed, even though moral thinking can be completely developed in human beings, acquired brain damage at a frontal level can make the individual that suffered it regress to a previous phase of moral thinking. This way, the brain structures of an inferior organization take control of behaviour, for example as Mclean affirms: if the neocortex is damaged, the reptilian or limbic brain would lead the behaviour and cognition of the individual¹⁵; in the same way as moral thinking, in which a previous structure takes charge when the immediate superior is damaged.

Finally, it would be interesting in future research to relate the development of the brain with the one of moral thinking in longitudinal studies with control patients with acquired brain damage that could clarify this enthralling relation between behaviour, the respect of social norms, cognition and the functioning of the brain.

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