



Opinion

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# Neuroanatomical Aspects of Empathy in Decision-Making

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## Opinion

The in-depth study of empathy requires an understanding of its emotional, cognitive and motivational aspects that participate in the formation of this innate behavior [1]. Taking into account that emotion, cognition and motivation guide the capacity of human beings to act in different contexts, such as during the decision-making process, empathy emerges as a theme to be carefully understood among the different fields of knowledge. The emotional aspect of empathy is characterized by sharing of emotions along with the recognition of what belongs to you or the other [2]. This delimitation of emotions coincides with the development of brain areas functionally linked to language, such as the opercular and triangular gyri of the lower frontal gyrus (frontal lobe), responsible for the expression of language (Broca's area), and the temporo-parietal fold, involved with the perception of language (Wernicke's area).

Both areas communicate through a bundle of intra-hemispheric association axons called upper longitudinal fascicle, enabling the correct expression of language [3]. Reading and writing are also dependent on these two areas. Another function attributed to the emotional aspect of empathy is the regulation of emotions, which is associated with the development of prefrontal regions of our brain. It is said that the greater the emotional regulation of a person, the lower his level of anxiety [4]. The cognitive aspect of empathy or theory of mind, on the other hand, is the ability to project mentally in the place of the other, understanding their thoughts and feelings [5]. It is worth remembering that it is not possible to dissociate reason from emotion, because of this the prevalence of reason or emotion in certain situations happens frequently. This is extremely important when it comes to judgments and even more when they

have moral content, which are also associated with the prefrontal area of our cerebral cortex. Taken together, the emotional and cognitive aspects of empathy make possible the sense of conscience to promote the well-being of others, leading to the motivation of acting on behalf of the community [6]. Based upon this concern with the other, it becomes evident the role of empathic motivation in morality, especially by creating the awareness that it is wrong to harm others while defining which option to choose during a decision-making process. Thus, we can remark that the social behavior based on empathy is fundamental to a pluralistic and egalitarian society. The term empathy appeared among German novelists in the 19th century and originated from the German word *einfühlung*. Edward Titchener (1867-1927) translated "empathy" into English with the meaning of "feeling into"[7]. Theodore Lipps (1851-1914) introduced the term to human and social sciences, and it was first studied among art critics, philosophers and psychologists expanding then to the social, executive, medical and legal areas. Among the brain structures involved in empathy and decision-making process, we can mention the mirror neuron system, which is relevant on learning by imitation and part of a front-parietal circuit identified between monkeys in the premotor cortical area.

Cortical areas specially the prefrontal area are connected to each other and to the intrinsic and extrinsic structures of the limbic system and must be deeply understood when it comes to this subject, since emotional and rational areas work together underpinned by different neural systems. A classic example of the connection between these areas is the case of Phineas Gage, a railway worker who had his left orbital bone pierced by an iron rod

[8]. Gage was a hardworking, organized and respectful person who, after the accident, began to act in the opposite way. The interruption of connections between limbic and prefrontal cortical areas of his brain were responsible for the expression of his undesirable behaviors. Considering what was exposed, we can adopt the idea that the structures of the nervous system functionally involved with empathy and decision-making are interdependent, [9] building a complex circuit that makes us adaptable to face different situations. Besides that, the study of these relationships are crucial for the understanding of psychological and psychiatric disorders and has potential application in clinical practice.

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