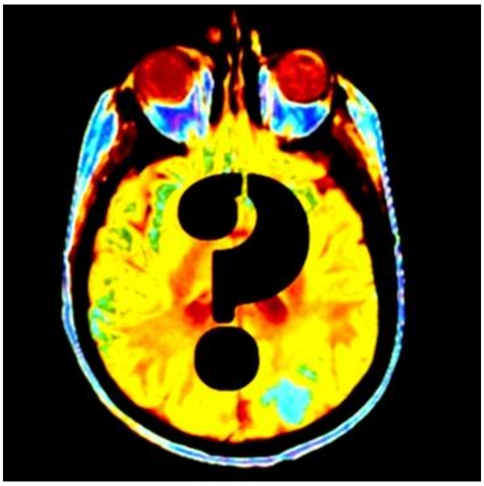
Cognitive Neuroscience of Social Behavior



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Abstract: *Explanations of social behavior widely vary depending on the point of view of given field. The current article reveals how cognitive neuroscience could help us understand social behavior of humans. The functional magnetic resonance imaging (fMRI) was used in numerous studies to see which parts of the brain are active during social behavior. Social cooperation is based on the ability to sacrifice one´s current resources in order to gain in the future and research shows that it is related to tissues linked to rewarding behavior. Therefore, it is hypothesized that cooperative behavior is labeled as rewarding which allows us to overcome our selfish impulses. Research also suggests that our decisions are influenced by both, emotions and cognition and that socially induced pain is similar to a physical pain.*

Keywords: social behavior, cognitive neuroscience, brain imaging, fMRI

Social behavior has been a subject of our interest since before anyone can remember. Where are the roots of altruism or cooperation towards common gains in people? Why do people lie and how can we distinguish lies from the truth? Even though we are able to identify and describe in detail several behaviors in humans that appear in various social situations, evolutionary psychology, social psychology or any other psychological discipline have not yet been able to solely provide us with sufficient answers on those (and many other) questions.

A crucial change in understanding social behavior comes with the cognitive neuroscience which is closely tied to modern technologies as a source of knowledge. To learn how systems of brain structures cooperate on mental processes, the functional magnetic resonance imaging (fMRI) will be the main research method used in all below mentioned studies. This technique uses quickly oscillating magnetic fields to detect moment-to-moment oxygen use and blood flow in currently active sections of the brain. The fMRI is taken while the individual engages in a task that simulates social behavior. This allows us to see a reasonable spatial and temporal resolution of the brain areas involved in investigated activity (Watson & Breedlove, 2012).

One of the most fundamental social behavior recognized in humans is social cooperation (based on reciprocal altruism- ability to sacrifice a little bit of our resources in favor of someone else with the expectation of future mutual profit), which is one of the essential principles of human social life (Rilling, Gutman, Zeh, Pagnoni, Berns, & Kilts, 2002). W.D. Hamilton provides us with an interesting theory explaining how altruistic behavior can exist in non-relatives. He states that there are two kinds of reciprocity (an evolutionary mechanism of behavior deciding whether cooperation or altruism will be preferred in social interaction in favor of future mutual interactions). With direct reciprocity individual does a favor that is expected to be returned by the recipient. If an individual performs indirect reciprocity, the favor is not supposedly returned by the recipient. It is more of "building image" of a helping person and therefore being more likely helped in the future by other people. In terms of our investigation, direct reciprocity is a subject of our interest (Trivers, 1985, as cited in Rilling at al., 2002).

But why is the cooperation based on reciprocal altruism (e.g. food sharing) rare in other species? Long story short, it is the selfishness and egocentrism that is extremely hard to overcome. I another words, it is very hard to step back and sacrifice current resources in favor of future gains acquired from social cooperation (Rilling et al., 2002; McCabe, Houser, Ryan, Smith, & Trouard, 2001). However obvious this claim may seem to us, the ability to postpone immediate gratification is not inborn to us either, as demonstrated by the Stanford Marshmallow experiment (Mischel, Ebbesen, & Raskoff Zeiss, 1972).

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Rilling et al. (2002) used the Prisoner´s Dilemma Game to investigate the neurobiological basis of emotional and cognitive correlates of social cooperation (players are rewarded based on their decision to cooperate). The fMRI results suggest that mutual cooperation is linked to orbitofrontal cortex, anteroventral striatum and rostral anterior cingulated cortex. These tissues are linked by previous research to rewarding behavior and their activity is greater for unpredicted rewards (uncertainty of the subject whether their cooperative behavior is going to be reciprocated or not). Overall these findings suggest that there might be a pattern to cooperative social behavior labeled as rewarding and therefore the selfish impulses to not reciprocate altruistic behavior are inhibited.

Similar results were demonstrated in an experiment carried out by McCabe et al. (2001) in order to study cooperation in two-person reciprocal exchange. Authors attempted to test the hypothesis that pre-frontal cortex is involved in theory-of-mind based on cooperative actions. To acquire the fMRI data the subject in the scanner played a two-person or a person-computer Trust and Reciprocity game. In conclusion, subjects performing cooperation shared a pattern of activity in the convergence zone (24) of the prefrontal cortex. This area binds joint attention to mutual gains and inhibits selfish impulses for immediate gratification and therefore mediates cooperative behavior; finding consistent with Rilling et al. (2002) indeed.

What about a little bit different social situation: not cooperation of two people but bargaining instead. What are the neural substrates of decision making? In one study (Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003) the function MRI of decision- making in the Ultimatum Game was investigated to ground the cognitive and emotional processes during fair and unfair proposals. Contrary to the utility theory (broadly accepted economic theory that even though we cannot objectively compare utility of goods and services, we can rank them based on customer´s preferences), participants often angrily reject low offers that are perceived as unfair hence a considerable financial profit is sacrificed in order to punish the partner for the disrespect. According to the fMRI scans, unfair offers truly evoked activity in brain areas associated to both, emotion (anterior insula) and cognition (dorsolateral prefrontal cortex). Implications of these findings are for obvious reasons essential in understanding decision making.

Now let us move from the interpersonal level to a social group context. A gripping hypothesis was set by Eisenberger, Lieberman and Williams (2003) arguing that social and physical pain would have similar neural basis. In terms of this study, social pain is operationalized as exclusion from a social group and simulated in playing a virtual ball-tossing game. Ultimately, the fMRI showed that anterior cingulate cortex- ACC (believed to be an “alarm system” also activated by pain) was more active during exclusion than inclusion and was positively correlated with self-reported distress. At the same time, the right prefrontal cortex- RVPC (believed to regulate or inhibit pain distress) was also active during exclusion but correlated negatively with self-reported distress. These results suggest that the RVCP inhibits the social exclusion distress by impairing ACC activity.

As we have indicated at the very beginning, the neural basis of lies and truth is also in the focus of cognitive neuroscientists. In their replication study Kozel, Padgett and George (2004) attempted to investigate the neurocircuitry of deception. In the case of deception, the fMRI was by the authors put into opposition to the polygraph which can be consciously deluded unlike the fMRI. However, it still needs improvements until it will be possible to use for revealing deception in individuals. Nevertheless, findings were consistent with the replicated study: during deception, 5 regions of the brain are significantly activated: right orbitofrontal, inferior frontal, middle frontal cortex, cingulated gyrus and left middle frontal.

How is all that helpful in understanding human social behavior? The significance of these findings for future research is undeniable for the fMRI can reveal facts about social behavior that we would not consciously identify. There is no way to deceive the fMRI; it reveals which parts of the brains are included in the activity. Additionally, if we know what these parts are responsible for, we can better understand what underlies human social behavior and the decisions we make.

PSYCHOLOGON

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Zdroj obrázku:

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