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How should I decide? The neural correlates of everyday moral reasoning

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ABSTRACT

The present fMRI study is the first that investigates everyday moral conflict situations in which a moral standard clashes with a personal desire. In such situations people have to decide between a morally guided and a hedonistic behaviour. Twelve healthy subjects were presented with verbal stories describing conflicts with either moral or neutral content. The moral stories described conflicts requiring a decision between a personal desire and a conflicting moral standard, whereas the neutral conflicts required a decision between two conflicting personal desires.

When compared to neutral conflicts, moral conflicts elicited higher activity in a wide spread neural network including the medial frontal cortex, the temporal cortex and the temporo-parietal junction and the posterior cingulate cortex. Further analyses of the moral conflicts revealed that hedonistic decisions in contrast to morally guided decisions were associated with significantly higher rankings of uncertainty and unpleasant emotions and induced significant more activation in the amygdala/parahippocampal region. The present results generalise findings on the neuroscience of moral understanding by extending it to everyday moral decisions. Furthermore, the results show that the amygdala region plays a central role in the processing of negative emotional consequences associated with immoral decisions.

1. Introduction

The last few years have seen a growing interest in the neural correlates of moral reasoning (Casebeer, 2003; Moll, Zahn, de Oliveira-Souza, Krueger, & Grafman, 2005). Neuroimaging studies investigated either judgements about morally salient claims (e.g. "The elderly are useless" Moll et al., 2002), ethical moral dilemmas (e.g. stealing one person's organs in order to distribute them to five others, Greene, Sommerville, Nystrom, Darley, & Cohen, 2001) or the transgression of moral norms (e.g. "You crash into another car and kill the passenger" (Berthoz, Armony, Blair, & Dolan, 2002; Finger, Marsh, Kamel, Mitchell, & Blair, 2006; Young & Saxe, 2008)). These studies revealed that moral decisions are associated with increased activity in a variety of brain areas including the lateral and medial frontal cortex, the anterior temporal cortex, the anterior cingulate cortex and limbic structures such as thalamus and amygdala (Casebeer, 2003; Greene & Haidt, 2002; Moll et al., 2005). Casebeer (2003) underscored that the activation of such a broad cortical network associated with moral reasoning seems to be conclusive because moral cognition necessitates the coordination of multiple cognitive processes. Among these are the planning of behaviour, decision-making, appraisal of emotions or recall of social scripts. This view is supported by Moll et al. (2005) who suggested that moral reasoning emerges from the integration of several cognitive processes like contextual social knowledge that is represented in the prefrontal cortex; social semantic knowledge, that is stored in the temporal cortex; and motivational and emotional states, that are associated with activation of the cortical-limbic circuits. Also, Greene and Haidt (2002) emphasized that there is no brain area exclusively dedicated to moral reasoning but that several areas make important contributions to moral judgements supporting both cognitive and affective processes.

Developmental research highlights the association of moral development with Theory of mind (ToM) development. For instance, Dunn, Cutting and Demetriou (2000) have shown that children's understanding of beliefs and emotions is positively correlated with explanations of why a moral transgression against a friend was or was not permissible. Children who justified their views about transgressions in terms of feelings and psychological issues were more advanced in their understanding of beliefs and emotions than children who referred to external punishment or social rules (Baird & Astington, 2004). ToM reasoning is also

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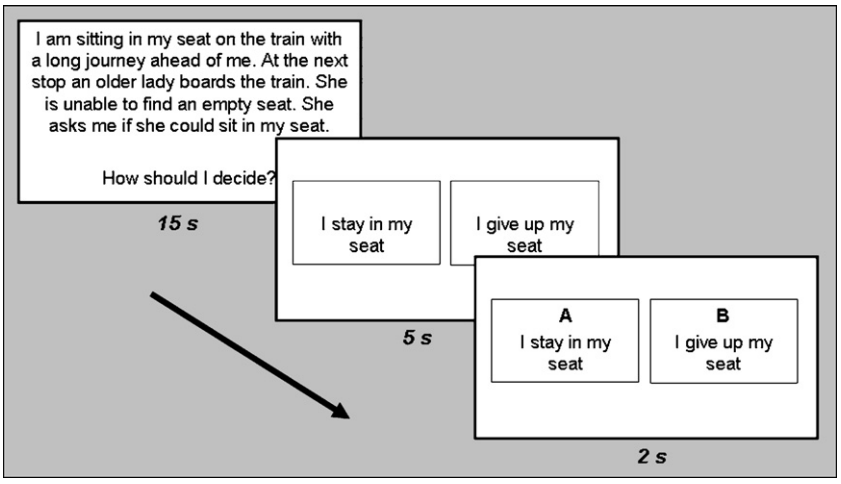

Fig. 1. Schematic depiction of a trial in the Moral Conflicts condition. In the first slide, the subjects were instructed to think about what they would do in the conflict presented to them. The two possible response alternatives were then presented, followed by the appearance of the letters "A" and "B". These letters indicated to the subjects to press a button corresponding to the previously chosen response.

related with moral reasoning on the neuronal level: Using different kind of tasks, neuroimaging studies on ToM reasoning revealed activation in the medial prefrontal cortex, the superior temporal sulcus, the temporo-parietal junction, and the precuneus. These areas subserve cognitive processes such as emotion attribution (Wicker, Perrett, Baron-Cohen, & Decety, 2003), intention attribution (Gobbini, Koralek, Bryan, Montgomery, & Haxby, 2007), and belief attribution (Sommer et al., 2007) and are also centrally involved in moral reasoning (Greene & Haidt, 2002; Moll et al., 2005).

The most paradigms used in moral neuroscience require abstract reasoning about moral dead-or-alive-dilemmas (e.g. to decide whether to allow an uncontrollable trolley kill five people or whether to actively change the trolleys' path to a track where it will kill only one person, Greene et al., 2001; Greene, Nystrom, Engell, Darley, & Cohen, 2004). In these dilemmas a moral violation is defined as personal, if someone's own actions cause serious bodily harm that befalls a particular person or set of persons (Greene et al., 2004). In some of these personal moral dilemmas the violation of the moral rule involves the risk of legal consequences (e.g. in the 'country road dilemma' you have to decide if it is appropriate to refuse help to someone, who is seriously injured to preserve your leather upholstery or in the 'architect dilemma' you have to decide if it is appropriate to kill your despicable boss who makes everyone around him miserable). In contrast to the scenarios described in these moral dilemmas, in everyday life we are often confronted with situations in which a decision between the fulfilment of a moral obligation towards another person (e.g. helping people who are in distress) clashes with personal-oriented hedonistic behaviour that would explicitly not cause serious bodily harm or legal consequences.

The aim of the present study was to investigate the neural underpinnings of moral processing in such everyday situations in which a choice is required between hedonistic, but not illegal, behaviour and the fulfilment of a moral obligation towards another person. After a long working day, for example, we may run to the bus stop to catch the waiting bus home. At the bus stop, we may see an old woman who has stumbled and needs help. Helping the woman, however, would result in missing out the bus. In situations like these we have to decide between two alternative behaviours: we can either decide to fulfil our own desire (e.g. running to the bus to catch a ride home), which may result in self-reproach and shame about our egoism, or we can inhibit our personal desire and fulfil a moral obligation (e.g. helping the old woman), thus resulting in personal disadvantages and discomfort (e.g. a boring wait for the next bus).

The study of everyday conflicts could help to generalise findings on the neuroscience of moral understanding by extending it to everyday moral decisions. Further, it could help to underpin the ecological validity of previous findings. We presented stories describing morally relevant or irrelevant (neutral) situations. In the moral conflict condition a moral behaviour clashed with a personal desire. In the neutral condition subjects had to choose between two conflicting personal desires. The participants' task was to indicate how they would decide if they were in the described situation. Additionally, after the experiment in the scanner, subjects had to indicate how they felt with their response and how sure they were about their response. Besides contrasting moral versus neutral conflicts, we were especially interested in neural processes associated with moral decision-making in the moral conflicts. Therefore, we analysed the moral conflicts in more detail and contrasted personal-oriented hedonic, but legal, versus morally guided choices.

2. Methods

2.1. Subjects

Twelve right-handed subjects (mean age 24.5 years, SD = 2.1 years; 5 male) with no history of neurological or psychiatric problems participated in the study. Written informed consent was obtained from all subjects and all procedures were conducted as approved by the local Ethics Committee.

The mean IQ as assessed with a verbal measure of intelligence (MWT-B; (Lehrl, 2005) was 128.5 (SD = 12.21)). None of the subjects reported to ever have taken a class on morality or ethics. All subjects reported being raised in Germany and speaking German as their mother tongue. 9 out of the 12 subjects reported to possess a Christian background, the remaining three subjects reported no religious background.

2.2. Experimental design

Subjects were presented with a total of 56 stories describing conflicts with either moral or neutral content. The 28 stories with moral content (*Moral Conflicts* condition) described conflicts requiring a decision between a personal desire and a conflicting moral standard (e.g. helping people in distress, being honest). The other 28 stories (*Neutral Conflicts* condition) subsequently required subjects to choose between two conflicting personal desires. Each trial in both conditions started with the presentation of a conflict in text form and the question "What should I do?". The conflicts were presented in first-person narrative and remained on the screen for 15 s. Examples of the moral and neutral conflict stories translated from German into English are presented in Table 1. In a behavioural study with 15 participants we provide evidence that people are capable of reading the scenarios within this time period and that there are no differences in average reading time between the two