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A Dual-Process Model of Moral Judgment

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Moral Cognition and Emotion: A Dual-Process Model of Moral Judgment

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I hereby certify that all material in this final year project which is not my own work has been identified and that no work is included for which a degree has already been conferred on me.

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Abstract

Cognitive and emotional processes both seem to contribute in the production of moral judgments, but how they interact is still under investigation. Greene's dual-process model suggests that these processes constitute dissociable systems in the brain, which are hypothesized to give rise to two qualitatively different ways of moral thinking characterized by two normative moral theories, consequentialism and deontology. Greene indicates that this research undermine deontology as a normative theory. The empirical investigation of moral judgments implies that the dual-process model only seems to accurately predict and explain moral judgments in moral dilemmas involving physical harmful intentions. Regardless of the models empirical support, the empirical findings in the study of moral judgments could have normative and metaethical implications.

Keywords: The dual-process model, moral cognition, moral judgment, moral reasoning, deontology, consequentialism

Moral Cognition and Emotion: A Dual-Process Model of Moral Judgment

Moral judgments are distinct from other kinds of judgments, this is because they focus on harms and depend on the interests of others, unlike, for example, economic judgments which focus on the agent's own interests. Moral judgments more precisely includes judgments of whether it is right or wrong to perform actions that knowingly cause harm to another person (Schaich Borg, Hynes, Van Horn, Grafton & Sinnott-Armstrong, 2006). How we make moral judgment have long been thought to be derived from reason and reflection alone (Kohlberg, 1969) and it is only recently the importance of emotions in making moral judgment has been considered in moral psychology (Haidt, 2001; Greene, Sommerville, Nystrom, Darley, & Cohan, 2001), a discipline investigating how humans function in moral contexts (Doris & Stich, 2008). In moral philosophy on the other hand, the emotional aspect of moral judgments has been and still is considered important. Philosophers such as David Hume have argued that human sentiments are the basis of moral judgments (see further Hume, 1739/1984), and a similar view is further defended by contemporary philosophers such as Jesse Prinz (see further Prinz, 2006). The new focus in moral psychology, on the brain's ability to unconsciously and automatically solve problems (Bargh & Chartrand, 1999), has engaged researchers under the last decades to approach the field of moral cognition in new ways and to formulate theories regarding the nature and relationship between reason/cognition and intuition/emotion, and whether they both contribute to the production of moral judgment.

Greene and colleagues' (Greene et al, 2001; Greene, Nystrom, Engell, Darley & Cohen, 2004; Greene, Morelli, Lowenberg, Nystrom & Cohen, 2008) empirical research on moral judgment contributes with interesting results regarding the potential underlying processes of moral judgment. They have, along with their results, presented a dual-process model of moral judgment (Greene et al., 2001; Greene et al., 2004; Greene et al., 2008;

Paxton & Greene, 2010). They argue that there are "two natural, ubiquitous, and qualitatively different modes of moral thinking that depend on dissociable, and in some cases competing, systems in the brain" (Paxton & Greene, 2010, p.3), namely intuitive emotional responses and controlled cognitive responses. They suggest that both emotion and cognition guide moral judgment.

Scientific research has often been regarded as irrelevant by many moral philosophers in relation to their philosophical work in normative ethics, concerned with how we ought to behave in moral situations (Greene, 2003). This has also been the case in metaethics, concerned with the attempt to understand the semantic, epistemological, metaphysical, but also psychological aspects of moral thought, practice and language (Sayre-McCord, 2008). This has been motivated by the fact that science involves what 'is' the case in contrast to ethics which involves what 'ought' to be the case (Greene, 2003). Greene agrees with there being a crucial and sharp distinction between what he calls "the 'is' of science and the 'ought' of ethics" (Greene, 2003, p.847). This acknowledgement does not undermine his conviction that science, and particularly neuroscience, can give rise to profound ethical implications with the knowledge it provides, forcing us to rethink our moral values and our concepts of morality. He does not regard scientific knowledge as potentially providing us with theories of what is right and wrong and is therefore skeptical when it comes to attempts to derive moral principles from scientific facts. Instead he believes science will provide us with an understanding of how human morality works which will help us to understand our moral nature (Greene, 2003, 2008).

The scope of this essay will include the background assumptions of their hypothesized dual-process model, its limitations, and the empirical investigation of moral judgments, together with a brief presentation of its potential philosophical implications.

Moral Judgments

With Moral Dilemmas as a Basis

Greene with colleagues (2001) applied the methods of cognitive neuroscience in their attempt to study moral cognition. What inspired them was a set of ethical dilemmas (Thomson, 1986), with a particular focus on two of them in their first study, namely the trolley and footbridge dilemma (Greene et al., 2001). These dilemmas are familiar to contemporary moral philosophers, and interesting because of the different moral judgments people make in relation to each of them. The dilemmas are similar to each other in every aspect but one. In both these dilemmas there is a runaway trolley that is heading towards five persons that will be killed if the trolley continues on its route. In the trolley dilemma the only way to save these five persons is to hit a switch that will make the trolley continue onto a side track where it will kill one person. The question is whether you ought to hit the switch and kill one person in order to save five? In the footbridge dilemma on the other hand you are standing next to a stranger on a footbridge and the only way to save the five persons on the track is to push this stranger onto the tracks in order to stop the trolley. This stranger will die but the five persons on the track will be saved. Ought you to save the five by pushing the stranger off the bridge? People tend to answer differently to these moral dilemmas despite the fact that both of them involve sacrificing one life in order to save five. The most common answer to the trolley dilemma is yes, you ought to hit the switch and kill one person in order to save the five persons on the track. The most common answer to the footbridge dilemma on the other hand is no. What makes it morally acceptable to sacrifice one life in the first dilemma but not in the second?

In order to answer this question philosophers have attempted to justify the difference in moral judgment by referring to different normative explanations. The responses to these dilemmas have been thought to have a justified explanation regarding why it is correct to

judge these two dilemmas differently (Greene, 2002, 2008). According to Greene these attempts have not been successful. He has therefore together with his collaborators proposed, in line with their scientific evidence, a descriptive solution to the problem (Greene, 2008). They hypothesized that the crucial difference from a psychological point of view between the moral judgments made in these two dilemmas, arise from the degree (Greene et al., 2001) and kind (Cushman, Young & Greene, 2010; Greene, 2008) of emotional responses that the different dilemmas produce, where dilemmas similar to the footbridge dilemma engages emotional processing to a greater extent than dilemmas similar to the trolley dilemma (Greene et al., 2001). This difference is characterized by a distinction between *personal* and *impersonal moral dilemmas* where the footbridge dilemma is a personal one. The reason why personal moral dilemmas seem to engage emotional processing to a greater extent is thought to be due to the suggested action to physically harm another person, in an up close and personal manner (Greene et al., 2001). The explanation for why these different kinds of dilemmas engage emotional processing to different degrees could be an evolutionary one (Greene, 2003, 2008; Greene et al., 2004). Contrary to our ability of complex abstract reasoning, personal violence has been around for a long time and with its primitive nature could come with innate responses triggering emotional ones (Greene, 2008). What is hypothesized is that judgments in personal dilemmas will activate areas in the brain engaged in emotional processing while judgments in impersonal dilemmas will activate higher cognitive processes (Greene, 2008).

The distinction between personal and impersonal moral dilemmas is by no means definitive. They view this distinction as a useful first step in identifying the underlying processes giving rise to the different judgments people tend to make in relation to these dilemmas (Greene et al., 2001).

Deontology and Consequentialism

The answers to the trolley and footbridge dilemmas can be connected to two characteristically different types of moral judgment which can be linked to different normative moral theories, more precisely deontology and consequentialism. Deontology puts emphasis on moral rules, and what gives an action its moral value comes from acting in accordance with one's duties (Greene, 2008) and the form of our moral duties can, according to Kant, only be determined by reason (Hondrich, 2005). In contrast, consequentialism regards the outcome, that is, the consequences of one's actions, as the only important feature that gives an action its moral value, and the aim ought to be to produce the best overall consequences for all concerned (Greene, 2008).

The most common answer in the trolley dilemma is a characteristically consequentialist judgment, while the most common answer in the footbridge dilemma is a characteristically deontological judgment (Greene, 2008). A suggested deontological explanation for why it would be inappropriate to push the stranger of the footbridge is because it always is wrong to use a person as a mean to an independent end (Greene et al., 2001). Greene (2008) is questioning the philosophical assumptions behind these normative theories and argues that they "are not so much philosophical inventions as they are philosophical manifestations of two dissociable psychological patterns, two different ways of moral thinking, that have been part of the human repertoire for thousands of years" (pp.37-38).

The hypothesized underlying processes of these two different types of moral thought are characterized by the personal/impersonal distinction (Greene et al., 2001). Greene (2008) challenges the assumption that deontological judgments are based on moral reasoning, that is, practical reasoning regarding what one morally ought to do (Richardson, 2009), and asserts that what actually is done here to a large extent more correctly should be called *moral*

rationalization, where one tries to justify ones intuitive/emotional responses (Greene, 2008). His conclusion is that deontological decisions do not arise from reasoning, but from emotions, and argues that consequentialism in contrast arise from cognitive processes and are more likely to involve genuine moral reasoning (Greene, 2008).

The Neural Correlates of Moral Judgment

Defining Cognition, Emotion and Moral Reasoning

Before presenting the results and interpretations of neuroimaging findings there are some central concepts that need to be clarified. The first concept we will look at is how the term *cognition* is defined. It is important to know what this term refers to because it can be used in two different ways. Cognition sometimes refers to information processing in general, but it is often used in a more narrow sense and then refers to processes that contrast with emotional processes. It is important to acknowledge that emotions also involve information processing. The whole brain is devoted to cognition, referring to information processing in general, but the cognitive processes, in the more narrow sense, are important for abilities such as planning, reasoning and controlling impulses (Greene, 2008).

The essential difference between cognitive and affective processes is that the affective processes are commonly considered to be the only ones automatically triggering behavioral responses (Greene et al., 2004). The term *emotion*, the affective processes, in this context therefore refers to processes that are "quick and automatic, though not necessarily conscious" (Greene, 2008, p.41), rather than stable emotional states such as moods (Greene, 2008). Cognitive representations on the other hand are neutral, thus not triggering behavioral responses automatically. The term *cognitive control* refers to the ability to guide, in accordance with one's goals or intentions, one's thought, attention and action. When one is faced with competing behavioral pressures this ability is particularly used (Greene et al.,

2004), and is therefore essential in for example, planning, reasoning or in controlling impulses (Greene, 2008).

According to Greene and colleagues, as already mentioned, deontological judgments are thought to be driven primarily by intuitive emotional responses, while consequentialist/utilitarian judgments are thought to be supported by controlled cognitive processes which Greene argues seems more like moral reasoning (Paxton & Greene, 2010). *Moral reasoning* is defined by Paxton and Greene (2010) as a "conscious mental activity through which one evaluates a moral judgment for its (in)consistency with other moral commitments, where these commitments are to one or more moral principles and (in some cases) particular moral judgment" (Paxton & Greene, 2010, p.6). What is suggested is that moral reasoning is an active process in which we can change our own or others' moral judgments by appealing to inconsistency in our moral judgments. According to Greene, moral reasoning of this kind is relatively rare compared to reasoning of an intuitive emotional character (i.e., the intuitive emotional responses) which appeals to our emotions and intuitions instead of logical consistency and the ability to reason which is suggested in Greene and Paxton's (2010) definition of moral reasoning. Despite this, Greene and colleagues hypothesize that, in relation to our moral psychology, moral reasoning, especially utilitarian reasoning, may be an important aspect to it (Paxton & Greene, 2010).

Compared to Greene's model, other models of moral judgment, such as Haidt's social intuitionist model of moral judgment, are suggesting that moral reasoning is very rare and that our moral judgment largely is guided by our intuitions (Haidt, 2001). Haidt's model indicates that the only way to change and influence others' moral judgments is by modifying their intuitions, while Greene, as mentioned, indicates that we can influence others' moral judgment by appealing to inconsistency in their moral judgments (Paxton & Greene, 2010). Greene and Paxton's definition of moral reasoning is more restricted than definitions

suggested by others, such as Haidt's, where moral reasoning is defined as a "conscious mental activity that consists of transforming given information about people in order to reach a moral judgment" (Haidt, 2001, p.818). Because this definition of moral reasoning allows any conscious process of thought about people to be counted as moral reasoning if it affects moral judgment, Greene and Paxton (2010) are suggesting that this definition is too broad. An overview of the social intuitionist model is not in the scope of this essay (see further Haidt, 2001).

The Processes Engaged in Moral Judgment

Brain imaging studies. Greene and colleagues (2001) were the first to conduct a fMRI study where they investigated the emotional engagement in moral judgments. In their fMRI study they focused on moral judgments made in dilemmas with personal, impersonal and nonmoral character. A nonmoral dilemma could include deciding whether to travel by bus or train given certain time constraints. Three criteria were designed to capture the difference between personal and impersonal moral dilemmas (Greene et al., 2001). A moral violation or moral dilemma is categorized as personal if it is "(i) likely to cause bodily harm, (ii) to a particular person, (iii) in such a way that the harm does not result from the deflection of an existing threat onto a different party" (Greene & Haidt, 2002, p.519). If a moral dilemma fails to meet these criteria it is categorized as an impersonal moral dilemma (Greene & Haidt, 2002; Greene et al., 2001).

In their fMRI study they hypothesized that the emotional response elicited in personal moral dilemmas would influence moral judgments and would show a reaction time difference in responding appropriate or inappropriate to the proposed action in the dilemma (Greene et al., 2001). Judging it appropriate to push the stranger off the bridge in the footbridge dilemma would require us to do so against a strong emotional response and thus result in longer reaction times. The behavioral data collected in their fMRI study support this theory of

emotional inference. Responses where participants judged this action to be appropriate showed significantly slower reaction times in comparison to those who judged it inappropriate. This difference in reaction time was not found in impersonal and nonmoral dilemmas, suggesting that the psychological processes behind moral judgments in impersonal moral dilemmas to some extent differ from personal moral dilemmas, and more closely resemble nonmoral judgments.

In judgments made in the moral personal dilemmas, compared to moral impersonal and nonmoral dilemmas, a significantly increased activity was observed in the medial frontal gyrus (BA 9/10), in the posterior cingulate gyrus/precuneus (BA 31) and bilaterally in the superior temporal sulcus (STS) (BA 39) (Greene et al., 2001). STS was labeled angular gyrus in this study (see review Greene & Haidt, 2002). All these areas are associated with emotional processing (Greene et al., 2001). A significantly decreased activity was observed in the right middle frontal gyrus (BA 46) and bilaterally in the parietal lobes (BA 7/40) in the moral personal dilemmas compared to the moral impersonal and nonmoral dilemmas (Greene et al., 2001). These areas are associated with working memory. In emotional, compared to cognitive processing, areas involved in working memory have been found to be less active, as could be observed in this study. This activation pattern provides support for their predictions and therefore emotional processes seem to influence moral judgment (Greene et al., 2001).

Moll, de Oliveira-Souza, Bramati et al. (2002) criticize the experimental design in the study conducted by Greene et al. (2001) mentioned above, and the conclusions drawn from it, because of the absence of an emotional nonmoral condition. The possibility cannot be eliminated that the difference in processing could be due to the emotional impact instead of being part of an underlying process of moral judgment (Moll, de Oliveira-Souza, Bramati et al., 2002). In order to investigate the role of moral and emotional impact on judgments Moll, de Oliveira-Souza, Bramati et al. (2002) divided statements into three categories. Participants

judged statements which were either emotionally neutral without moral content (e.g., he never uses the seat belt), emotionally unpleasant without moral content (e.g., he licked the dirty toilet), or emotionally unpleasant with moral content (e.g., he shot the victim to death), as right or wrong. A baseline condition was also included, involving scrambled statements (e.g., sons push use eat work).

A significant correlation was observed between moral content and emotional impact of the statements suggesting that the emotionality perceived in relation to the stimuli interacts with moral judgment (Moll, de Oliveira-Souza, Bramati et al., 2002). The nonmoral unpleasant judgments activated the left lateral orbitofrontal cortex (OFC) (BA 11/47) and the left amygdala whereas the moral unpleasant judgments activated the left medial OFC (BA 10/11) and the posterior STS (BA 21/22). These findings provide new evidence that different kinds of social judgments, with or without moral content, activate distinct networks in the brain (Moll, de Oliveira-Souza, Bramati et al., 2002). Increased activation in the medial OFC (BA 11) and the right posterior STS (BA 21/39), together with activation in the medial frontal gyrus (BA 10), have also been shown while viewing pictures with emotional moral content when contrasted to pictures with emotional nonmoral content (Moll, de Oliveira-Souza, Eslinger et al., 2002).

Suggested from these findings, the medial OFC plays a more critical role than was previously thought in mediating automatic responses; integrating emotions with moral knowledge, that motivate executing behavior and reinforcing value to behavioral actions (Moll, de Oliveira-Souza, Bramati et al., 2002; Moll, de Oliveira-Souza, Eslinger et al., 2002). It is also likely that this region receives projections from the STS which are thought to be involved in the perception of socially significant information such as emotional and intentional states of others (Greene & Haidt, 2002; Moll, de Oliveira-Souza, Bramati et al., 2002). The medial frontal gyrus is probably involved in integrating emotions into planning

and decision making, but is also thought to be involved in different social functions important to moral judgment, such as theory of mind (Greene & Haidt, 2002).

In a replication of their previous fMRI study, Greene et al. (2004) found a similar activation pattern. In the personal moral dilemmas an increased activity could be observed in the medial prefrontal cortex (PFC) (BA 9/10), in the posterior cingulate/ precuneus (BA 31/7) and bilaterally in the STS (BA 39), while in the impersonal moral dilemma an increased activation could be observed in the dorsolateral prefrontal cortex (DLPFC) (BA 46) and bilaterally in the inferior parietal lobes (BA 40). A previously unobserved difference between personal and impersonal moral dilemmas was also found; an increased activation bilaterally in amygdala could be observed in the personal compared to in the impersonal moral judgment (Greene et al., 2004).

The anterior cingulate cortex (ACC) is a brain region associated with detecting cognitive conflict in for example, the Stroop task. The DLPFC is a brain region engaged in cognitive control and processes of abstract reasoning. These two regions were hypothesized to show an increased activation in the production of utilitarian moral judgments (Greene et al., 2004), where cognitive control would be needed in order to overcome the emotional response elicited in the moral personal dilemma previously mentioned (Greene et al., 2001).

Personal moral dilemmas were divided into *difficult personal* and *easy personal* moral dilemmas (Greene et al., 2004). This distinction was based on reaction time results where judgments in a difficult personal moral dilemma had slower reaction times than those made in an easy personal moral dilemma (Greene et al., 2001). The observed reaction time difference is explained by a conflict in the difficult personal moral dilemmas. This conflict is characterized by a negative emotional response and a countervailing cognitive process where a personal violation is judged as appropriate against a strong negative emotional response in cases where the benefits of doing so outweighs the costs (Greene et al., 2004).

An example of a difficult personal moral dilemma is the crying baby dilemma where enemy soldiers have taken over your village and have orders to kill all civilians (Greene et al., 2004). You and your baby are hiding together with some of your townspeople in a cellar. Your baby begins to cry loudly and you can hear the soldiers nearby. In order to remain unnoticed and save yourself and the others you have to hold your hand over your child's mouth which will smother your child to death. An example of an easy personal moral dilemma is the infanticide dilemma where a teenage mother must decide upon whether or not to kill her unwanted newborn infant(Greene et al., 2004). This is considered easy, contrary to the difficult dilemma, because it elicit judgments that are relatively rapid and uniform among participants due to the absence of a conflict between emotional and cognitive processes (Greene et al., 2004). The absence of conflict is characterized, according to Greene and colleagues (2004), by the negative emotional response elicited by the thought of killing one's child that dominates the weak, or nonexistent, cognitive alternative in favor of this action.

The predicted activation of the ACC (BA 24) and the DLPFC (BA 10/46), together with activation in the inferior parietal lobes (BA 40/39), was observed in an fMRI study conducted by Greene et al. (2004). In this study difficult personal moral dilemmas were compared to easy personal moral ones. These increased activations in areas associated with cognitive processes are in line with their hypothesis. Greater activity was also observed in the medial PFC (BA 9/10), in the posterior cingulate cortex (BA 23/31) and bilaterally in the STS (BA 39) in the same comparison. These results confirm their hypothesis of the role of cognitive control in judgments made in difficult moral dilemmas. Despite the predicted increased activation in the ACC and the DLPFC increased activation in the posterior cingulate cortex could be observed in difficult personal moral dilemmas (Greene et al., 2004). The hypothesized explanation for why this brain region (Greene et al., 2004), previously associated with emotional processing (Greene et al., 2001), was activated is that all judgments

to some extent need to be motivational in order to produce behavior (Greene et al., 2004). This motivational force is elicited when something would be good for us or when we have reasons to act in particular ways (Rosati, 2008). Thus, even though utilitarian judgments are thought to be produced by cognitive processes, the posterior cingulate cortex is hypothesized to be needed in order to elicit this motivational force together with the ACC (Greene et al., 2004).

The hypothesis regarding the ACC conflict monitoring function, which Greene and colleagues rely on in their interpretations, is controversial and therefore questionable (see further Greene et al., 2004). These results support that moral judgment are produced by both emotional and cognitive processes. They further suggest that their results indicate that the increased activity in the DLPFC in utilitarian judgments can override emotional responses, favoring personal moral violations when the benefits of doing so outweigh the costs, thus, supporting their dual-process model (Greene et al., 2004).

Behavioral studies. Personal moral dilemmas have also been classified as *high-conflict* and *low-conflict* personal moral dilemmas (Koenigs et al., 2007; Greene et al., 2008) and these are consistent with those classified as difficult and easy personal moral dilemmas previously mentioned (Greene et al., 2004). The effect of cognitive load on utilitarian and nonutilitarian moral judgments in high-conflict personal moral dilemmas was investigated by Greene et al. (2008) in order to establish a causal relationship between utilitarian moral judgments and cognitive controlled processes.

A difference in reaction time could be observed between utilitarian and nonutilitarian judgments made under cognitive load contrary to the ones made in the absence of load. Slower reaction times were observed in utilitarian moral judgments made under cognitive load in comparison to nonutilitarian moral judgments made under cognitive load. This result is consistent with their model that utilitarian moral judgments are supported by cognitive

control processes and hence top-down moral reasoning processes. However, although reaction time difference could be observed, the cognitive load manipulation did not change the participants' judgment. Their suggested explanation is that the participants were aware of the interference the cognitive load manipulation was causing, and therefore were increasing their effort in overcoming this interference (Greene et al., 2008).

The effect of emotional context has been shown to have a causal effect on moral judgment (Valdesolo & DeSteno, 2006). Participants were presented with the footbridge and the trolley dilemma after they had been watching an emotionally positive or neutral video clip. The emotionally positive video clip is thought to induce positive feelings, which may influence and reduce the negative emotional response elicited by dilemmas such as the footbridge dilemma, which in turn is thought to increase the utilitarian judgments in these kinds of dilemmas. The participants who viewed the emotionally positive clip tended to make more utilitarian judgments, compared to the control group, in the footbridge dilemma. This indicates that the affective features of the environment could have a causal influence on moral judgment.

Cushman, Young and Hauser (2006) conducted a study in order to investigate whether moral judgment is produced by conscious reasoning or by intuition, and three principles of harm that guide moral judgment were used in order to do so. The principles investigated were the *action principle*, the *intention principle* and the *contact principle*. All moral scenarios used involved different variations of a moral dilemma, where each variation of a dilemma investigated one factor at a time (e.g., different variations of the footbridge dilemma). The first principle, the action principle, states that "harm caused by action is morally worse than equivalent harm caused by omission" (Cushman et al., 2006, p.1083). The second principle, the intention principle, states that "harm intended as the means to a goal is morally worse than equivalent harm foreseen as the side effect of a goal" (Cushman et al., 2006, p.1083). The

third principle, the contact principle, states that "using physical contact to cause harm to a victim is morally worse than causing equivalent harm to a victim without using physical contact" (Cushman et al., 2006, p.1038). Participants judged moral scenarios consistently with these principles (Cushman et al., 2006).

Their results indicate that some principles used in justifying moral judgment are available to conscious processes of moral reasoning, which provide support for the fact that moral reasoning may play a role in moral judgment (Cushman et al., 2006). This was the case when participants judged and then justified their judgments according to the action and the contact principle. This was not the case when subjects made moral judgments consistently with the intention principle and they seemed incapable, in general, of referring to the principle when justifying their judgments. This indicates that this principle plays a role in moral judgment but that it is not consciously available (Cushman et al., 2006).

These results provide support for a model where moral judgments depend on multiple systems (Cushman et al., 2006). It supports that moral judgments in some cases are driven by processes that are not accessible to conscious awareness, but also that explicit moral reasoning seem to play a role in the production of moral judgments, which is in line with the dual-process model (Cushman et al., 2010).

Lesion studies. The emotional interference in moral judgment can be supported by studies on patients with adult-onset lesions to the ventromedial prefrontal cortex (VMPC). This damage generally results in a diminished emotional responsivity and reduced social emotions associated with moral values such as shame, guilt and compassion together with otherwise intact capacities for logical reasoning, general intelligence and declarative knowledge of moral and social norms (Koenigs et al., 2007).

The dilemmas used by Greene et al. (2001) were used in an examination of the influence of VMPC lesion (BA 10/12/25/32) in the production of moral judgments

(Ciaramelli, Muccioli, Làdavas & di Pellegrino, 2007). Patients with VMPC lesions showed an increase in making utilitarian moral judgments in personal moral dilemmas compared to a control group consisting of healthy individuals. The control group showed an increase in reaction time when they approved the proposed action in personal moral dilemmas (i.e., making the utilitarian judgment) compared to when they judge it inappropriate. This reaction time difference was not observed in judgments made in impersonal moral dilemmas. VMPC patients did not show this reaction time difference neither within each set of dilemmas relating to reaction time differences in responding appropriate or inappropriate, nor between personal moral and impersonal moral judgments (Ciaramelli et al., 2007).

In another study, VMPC patients also showed, in responding to dilemmas with a personal moral, impersonal moral and nonmoral character, an increase in making utilitarian moral judgments in personal moral dilemmas contrary to two control groups with intact emotional processing (Koenigs et al., 2007). An examination within the personal moral scenarios was also conducted and judgments in high-conflict and low-conflict personal moral dilemmas were compared between groups. The comparison showed that VMPC patients' judgment only differed in high-conflict personal moral dilemmas. This suggests that VMPC is critical only in moral dilemmas in which social emotions have a critical role in resolving moral conflict and further indicates that emotional processing has a causal role in moral judgments (Koenigs et al., 2007).

A study was conducted in order to investigate why patients with bilateral damage to VMPC endorse harmful actions, leading them to make more utilitarian judgments in cases where harmful actions are suggested, than persons with normal emotional processing (Young et al., 2010). What Young and colleagues (2010) wanted to investigate was whether this is due to a failure to process harmful intentions or harmful outcomes. They used scenarios with both neutral and negative outcomes, together with neutral or negative intentions, as a method

of investigation. An example of an attempted harm is where a person is putting powder in a friend's coffee. This powder looks like sugar and is believed to be toxic, but the powder is in fact not toxic, and her friend survives. An accidental harm on the other hand is where the friend is putting powder in a friend's coffee, and the powder is thought to be regular sugar but is in fact toxic, and her friend dies.

Their results showed that VMPC patients judged attempted harms as more permissible than both control groups with intact emotional processing (Young et al., 2010). Their suggested explanation to these results are that VMPC patients may rely only on explicit outcome information when making moral judgment due to the lack of a guiding emotional response normally thought to be leading people to condemn attempted harms. In cases where attempted harms failed to achieve what was intended they led to neutral outcomes. Accidental harms, on the other hand, lead to negative outcomes, even though these were not intended. The neutral outcomes would be the explanation for why VMPC patients' judged attempted harms as more permissible than accidental harms. Further, VMPC patients judged successful attempted harms, leading to negative outcomes, as morally forbidden. This suggests that VMPC patients do have intact processing of outcome information, but have impaired processing of emotional aspects of intentions in their production of moral judgment (Young et al., 2010).

Moral Judgment and the Dual-Process Model

The findings presented above are consistent with a model in which a combination of these two processes, intuitive/emotional and conscious/rational, are involved in the production of moral judgments. Despite the large agreement about the brain regions involved in moral cognition, there is still a debate regarding the interaction between emotional and cognitive processes in the production of moral judgment (Cushman et al., 2010; Moll, de Oliveira-Souza & Zahn, 2008). Greene and colleagues consider these findings as supporting their view

where both these processes, emotional and cognitive, are crucial components of moral judgment. They emphasize their mutually competitive nature, where these processes can give rise to different types of moral judgments (Greene, 2008; Greene et al., 2008; Greene et al., 2004; Greene et al., 2001). In later publications Greene and colleagues elucidate their hope that the dual-process model eventually will be understood as part of a psychological system (Cushman et al., 2010).

McGuire, Langdon, Coltheart and Mackenzie (2009) conducted a reanalysis on the results presented by Greene and colleagues (2001). According to McGuire et al. (2009) many of the nonmoral dilemmas used in Greene's study did not involve a dilemma, and they further argues that Greene's nonmoral dilemma condition were not useful in order to compare with moral dilemmas. Their reanalysis results indicate that Greene's results are "not generalizable to other populations of moral dilemmas" (McGuire et al., 2009, p.579), because the behavioral effects related to personal and impersonal moral dilemmas were driven only by a few particular dilemmas. Thus, questioning the distinction between personal and impersonal moral dilemmas. A consequence of not matching dilemmas between the different conditions, but instead relying on completely different scenarios, question the conclusions made in Greene's study. McGuire et al. (2009) further concludes that the implications of their results indicate that there is no reason to assume that the dilemmas involving an emotional component are processed in a qualitatively different way then others, and further, that there is no reason to assume that there would be two competing systems involved in generating moral judgments.

McGuire et al. (2009) suggest that the same criticism could be directed towards other studies relying on this distinction and dilemmas such as Ciaramelli et al. (2007). McGuire et al. (2009) also direct criticism towards Valdesolo and DeSteno (2006), because they used dilemmas that not only differed in emotional engagement, but also in other factors such as

intended harm as means or side effects which have been shown to have an impact on moral judgment (Cushman et al., 2006; see further McGuire et al., 2009).

The suggested implications of these results are according to Greene (2009) dramatically overstated, even if they manage to undermine their original interpretations in this particular study. Greene argues that they ignore research providing support to the dual-process model. More recent research results supporting the dual process model do not depend on the distinction between personal and impersonal moral dilemmas and are because of this, according to Greene (2009), unaffected by these methodological implications (Ciaramelli et al., 2007; Greene et al., 2008; Greene et al., 2004; Koenigs et al., 2007; Valdesolo & DeSteno, 2006). Green (2009) indicates that even if the distinction between personal and impersonal moral dilemmas is wrong, the dual-process model could still be right, because there could be other reasons for why the footbridge dilemma elicits stronger emotional responses than the trolley dilemma. He further suggests that this seems to be explained by a combined effect of personal force and intention, where harm is intended as a means to an end (Greene et al., 2009). This is partially consistent with results regarding VMPC patient's inability to process harmful intentions (Young et al., 2010).

Greene has also been criticized for requiring participants to judge proposed actions in dilemmas as appropriate or inappropriate to perform. The critique indicates that results related to how participants respond when required to do so, do not necessarily reflect processes underlying moral judgment in particular due to the ambiguity of these words. It is therefore unclear how participants construe these words, as judging them appropriate or inappropriate according to their own moral values, what is legally appropriate, or in the light of societal standards (Schaich Borg et al., 2006).

The claim that emotional and cognitive processes are mutually competitive is not widely accepted and it is suggested that in order to give compelling support for the dual-

process model, a demonstration of a double dissociation is needed (Moll & de Oliveira-Souza, 2007). A double dissociation that could show that selective damage to the DLPFC and the lateral FPC would result in emotional judgments (Moll & de Oliveira-Souza, 2007), contrary to the utilitarian cognitive judgments that results from VMPC damage (Koenigs et al., 2007). Greene (2007) agrees with the claim that a double dissociation would provide ideal evidence for the dual-process model. However, he does not agree that an absence of a double dissociation leads to that a single dissociation would provide no evidence for the dual-process model (Greene, 2007).

Behavioral results in VMPC patients, while making economic decisions, are questioning the dual-process model and its predictions (Koenigs & Tranel, 2007). Koenigs and Tranel (2007) showed that participants with VMPC damage tend to make more emotional decisions, contrary to control groups, in the Ultimatum Game; a model for studying economic decision making. The participant, the responder, has to accept or reject an offer to split a sum of money with a second player, the proposer. If the responder accepts the offer, then the money is divided as proposed and if the responder rejects the offer both players receive nothing. Rejecting unfair offers has been explained by an inability to regulate one's emotional response to unfair offers, which is supported by a correlation between this kind of rejections and feelings of anger together with for example, increased skin conductance. This is why the ability to regulate ones emotions is thought to be essential in order to rationally accept unfair offers (Koenigs & Tranel, 2007).

The participants with VMPC damage rejected significantly more unfair offers than both control groups, indicating that emotion regulation is an important component in situations where an emotional response conflicts with financial considerations, in normal economic decision making (Koenigs & Tranel, 2007). In the light of the results from Koenigs et al. (2007) this indicates that the effects of VMPC damage on emotional processing are

context dependent. Damage to the VMPC in one context results in diminished social emotions in judging hypothetical scenarios involving the interest of others (Koenigs et al., 2007), while in another context results in poorly controlled frustration, that is, strong negative emotions in real scenarios involving self-interest (Koenigs & Tranel, 2007). These results highlight two distinct aspects of emotional impairment that are explained by damage to the VMPC (Koenigs et al., 2007; Koenigs & Tranel, 2007). Koenigs and Tranel's results cannot be explained by the dual-process model which predicts that damage to this area would give rise to cognitive utilitarian judgments (Moll & de Oliveira-Souza, 2007).

Moll and colleagues also address the importance of motivational force in order to be able to make decisions, and imply that purely cognitive choices lack this aspect (Moll et al., 2008; Moll, Zahn, de Oliveira-Souza, Krueger & Grafman, 2005). They also state that these processes continuously have to integrate with emotional processes in the production of moral judgment. This questions Greene's hypothesis that emotional and cognitive processes can give rise to different types of moral judgments respectively (Greene et al., 2008; Greene et al., 2004; Greene et al., 2001). Moll and colleagues also criticize the clear anatomical boundaries made in the dual-process model and the view of a hierarchical top-down relation between cognition and emotion (Moll et al., 2008; Moll et al., 2005). A more detailed outline of their model of moral judgment is nevertheless not in the scope of this essay (see further Moll & Schulkin, 2009; Moll et al., 2005).

Philosophical Implications

Metaethics and Neuroscience

When asking someone about what it is to be a moral person, Greene (2002) is suggesting that you could get two different answers:

> Ask a garden-variety Western what it is to be a moral person and you might get an answer like this: "A moral person is one who thinks about what's right and what's

> wrong, tries to do the right thing, and usually manages to do so." You also might get an answer like this: "A moral person is one who doesn't just think about herself, but who thinks about the interests of others and tries to take the interests of others into account in her actions." (Greene, 2002, p.15)

Greene (2002) suggests that most of us would consider these answers to be very similar, or even two different ways of expressing the very same thing, because one could say that thinking about what is right or wrong, is just a matter of taking others' interest into consideration in one's actions. Greene makes a distinction between two senses of morality. The first, which he refers to as morality$_1$, is a type of morality characterized as moral realism, the metaethical theory that there are genuine moral facts or truths; hence, morality$_1$ relates to the facts concerning right and wrong. The second, which he refers to as morality$_2$, relates to the concern for the interests in others, involving active helping and refraining from harming. If moral realism is true, there would be no problem in regarding these different answers, suggested by Greene, as two ways of expressing the same thing. If moral realism is not true, this would be a problem. What Greene (2002) indicates is that the second sense of morality does not depend on moral realism (i.e., being a moral person does not necessarily involve being a moral realist), and that this second sense of morality is what captures what is essential for being a moral person (see further Greene, 2002).

Most of us have the belief that some claims of moral character are true such as, or similar to, the claim that lying is wrong (Greene, 2002), which commonly is a deontological principle. According to Greene (2002) it is important to question what would make such a claim true. He's answer to this question is that such claims are never true, because they can neither be true nor false, and therefore he concludes that this metaphysical problem, about how such a claim could be true, has no solution. Because Homo sapiens is a social species there could, from an evolutionary point of view, be great benefits for humans to have moral$_2$

sensibilities, in the sense of being concerned with respecting the interests of other individuals than themselves. This could, in a social context, have been important for our survival as individuals. What Greene hypothesizes is that "an efficiently implemented morality$_2$, is likely to result in an illusion of morality$_1$" (Greene, 2002, p.179). Greene's (2002) highly speculative explanation for this illusion is that we feel that our ability to make moral judgments is a perceptual ability, an ability that in this case could, immediately and reliably recognize mind-independent moral facts. And this results in a mistaken belief in moral realism. Hence, our moral intuitions about what is right or wrong do not make our moral beliefs true. That we feel that something is wrong is certainly not, according to him, what makes it wrong.

As a matter of psychological fact, some may think that it is impossible to behave morally$_2$ if we do not accept moral realism; that we simply will not be motivated to act morally$_2$ if we do not believe that there is such a thing as moral realism (Greene, 2002). What Greene (2002) argues for, is that it is possible to be morally$_2$ motivated without necessarily being a moral realist. According to him, psychology can explain why we think as we do when we think about morality, and he implies that this knowledge can change our attitudes towards our moral thoughts, and this could even prevent us from thinking these thoughts. Greene believes that speaking of values in subjective and hypothetical terms, using words such as better or worse, instead of objective and categorical terms, such as right or wrong, could help us resist the illusion of moral realism. In doing this, changing the use of our language, we will avoid the conflict and the unnecessary misunderstanding and strife that the moral realist language is causing (Greene, 2002). However, although important, why and how this should be done, and a more detailed description of the background to his conclusions, is not in the scope of this essay (see further Greene, 2002). Greene (2003) further believes that "giving up on moral realism does not mean giving up on moral values" (p.850). Greene (2003) suggests

that it is one thing to care about others, and another to think that caring for others is objectively correct.

Normative Ethics and Neuroscience

What is suggested by Greene (2008) is that the relevant emotions in relation to morality exist because of their role in motivating behavior in a social evolutionary context, which has helped individuals to spread their genes. He believes that our adaptive moral behavior is driven by emotions, opposed to moral reasoning, because "emotions are very reliable, quick, and efficient responses to recurring situations, whereas reasoning is unreliable, slow and inefficient in such contexts" (Greene, 2008, p.60).

Psychologists show that when people do not know why they behave as they do, they tend to make up plausible-sounding explanations for their behavior, so called post-hoc justifications (Haidt, 2001). Greene (2008) suggests that this is why the existence of moral emotion gives rise to deontological theories. According to Greene (2008), deontology is a kind of moral confabulation, where we try to rationalize our intuitive emotional responses. He indicates there being good reasons to think that the moral intuitions underlying deontological judgments reflect the influence of factors being morally irrelevant, because they evolved as an evolutionary by-product, and would therefore be exceedingly unlikely to provide us with some independent moral facts.

The understanding of the underlying processes of our moral intuitions challenges the assumptions underlying our moral thinking, and especially, according to him, cast doubt on the normative moral thought underlying deontology. These arguments are troublesome for everyone that is searching for rationalist moral theories that can justify and explain their emotional moral intuitions, or for everyone relying on these intuitions (Greene, 2008).

Timmons (2008) believes that Greene makes a mistake when he seems to assume that moral realism is essential to deontology (see further Timmons, 2008). He also suggests that

the empirical results do not need to pose a threat to deontology at all, because there seems to be no reason for why one could not embrace a sentimentalist account of the nature of moral judgment and continue to defend deontological theories (Timmons, 2008).

Dean (2010) indicates that Greene's conclusions might not be generalizable to other moral situations, because the conclusion that all deontological principles results from emotional processing does not need to follow from Greene's empirical results. This is suggested because Greene's conclusions about the underlying processes giving rise to deontological judgments stem from studying dilemmas involving personal harm (Greene et al., 2008; Greene et al., 2004; Greene et al., 2001), but deontological theories seems to include guidance in many more situations than those investigated by Greene (Dean, 2010).

Furthermore, a study was conducted in order to establish whether there could be other factors than those presented by Greene (Greene et al., 2008; Greene et al., 2004; Greene et al., 2001), that underlie the distinction between personal and impersonal moral dilemmas (Schaich Borg et al., 2006). This study suggests that different deontological principles engage emotional processes differently, and that there seem to be deontological principles that could be associated with cognitive processes. Their study only focused on differences in overall processing when faced with moral dilemmas, rather than processing related to specific moral judgments, and will therefore not be addressed further (see further Schaich Borg et al., 2006).

As mentioned earlier, according to Greene (Cushman et al., 2010; Greene, 2008), deontological judgments arise from automatic emotional responses, in contrast to consequentialist judgments which he argues cannot be reached in this way. An important aspect to this is Greene's explanation that he does not believe deontological judgments to be strictly emotional or consequentialism to be strictly cognitive, or even that there are a sharp distinction between emotion and cognition, but believes that all moral judgments must have

some emotional component. However, he suspects this emotional component to be fundamentally different in these two kinds of judgment (Cushman et al., 2010; Greene, 2008).

Greene and colleagues suggest that the posterior cingulate cortex together with the ACC is activated in order to elicit this motivational force in utilitarian moral judgments (Greene et al., 2004). Greene and colleagues further suggest that amygdala could be a good candidate for eliciting this emotional component in deontological judgments (Cushman et al., 2010), since increased activation bilaterally in amygdala have been observed in relation to personal moral dilemmas (Greene et al., 2004). This emotional component is thought to function as an alarm that directly influences behavior. Contrary, the emotional component in utilitarian judgments is thought to function more like a currency which takes part in a process of practical reasoning, adding motivational weight to behavioral alternatives (Cushman et al., 2010; Greene, 2008). In later publications meso-limbic brain regions are suggested to support this latter emotional component (Cushman et al., 2010). These different emotional components are also suggested to operate beyond the moral domain (see further Cushman et al., 2010).

Discussion

That both emotional and cognitive processes contribute to the production of moral judgment is strongly suggested by the overviewed research. Activation in brain regions associated with emotional processing together with lesion studies is providing evidence that emotional processes have a causal role in the production of moral judgment.

The dual-process model may accurately describe how moral judgments are produced in dilemmas involving physical harmful actions affecting others (Cushman et al., 2010; Greene et al., 2009; Koenigs et al., 2007), but the observed behavior in economic decision making by VMPC patients indicate that the dual-process model do not seem to account for moral judgment made in other moral scenarios (Koenigs & Tranel, 2007). More research is

needed in order to shed light on the functional organization within the VMPC and in providing an understanding of its contribution to different aspects of moral decision-making (Young et al., 2010). Studying abnormal moral behavior, as observed in patients with psychopathy and in patients with developmental or acquired sociopathy, could provide important insight into the neural networks involved in moral judgment and moral behavior (de Oliveira-Souza & Moll, 2009). Psychopathy has been correlated with a decrease in gray matter within brain areas involved in normal moral cognition. An overview of this research is not in the scope of this essay (see further de Oliveira-Souza & Moll, 2009).

The relation between emotional and cognitive processes is not obvious. The found single dissociation, that lesions in the VMPC influence moral judgment, does not provide sufficient evidence to confirm the claim that intuitive emotional and controlled cognitive processes are "two natural, ubiquitous, and qualitatively different modes of moral thinking that depend on dissociable, and in some cases competing, systems in the brain" (Paxton & Greene, 2010, p.3). Furthermore, their cognitive load manipulation study, where the cognitive load slowed down the reaction times for utilitarian judgments in difficult moral dilemmas, did not alter participant's judgments. This indicates that reasoning only plays a role in the production of moral judgment.

As suggested by Moll and de Oliveira-Souza (2007) a demonstration of a double dissociation would provide ideal support for the dual-process model. Whether such a double dissociation can be demonstrated is a project for future research, but in light of this research it seems unlikely that there is one to be found.

Furthermore, the more narrow use of the term cognition, which contrasts with emotional processes, may not be that useful because emotional processes, like cognitive processes, involve information processing. It seems likely that emotional and cognitive processes have to continuously integrate with each other in order to motivate and produce

behavior, and thus, the distinction between emotion and cognition may not be as sharp as Greene first seemed to indicate.

To carefully design and conduct neuroimaging experiments in patients with brain lesions is needed in order to get a better knowledge and understanding of the different components of moral judgment, their function and how they interact in the production of moral judgment. Suggested functional specializations within the OFC (Moll, de Oliveira-Souza, Bramati et al., 2002), together with the different behavioral findings in VMPC patients (Koenigs & Tranel, 2007; Koenigs et al., 2007), indicate that there are functional specializations within these regions and could also be within other regions that cannot be observed due to the experimental design and methodological aspects, or constraints regarding the brain imaging method used. Therefore it is important to isolate all the different aspects of moral judgment in future studies to be able to find these potential functional specializations within brain regions involved in moral judgments, and thus providing a better understanding of the neural network involved in the production of moral judgment. This is important also in relation to the study of the underlying processes of deontological and utilitarian moral judgments.

Furthermore, a revision of the dual-process model seems to be needed in order to account for the different emotional components hypothesized to operate in deontological and utilitarian moral judgments. More research is needed in order to provide support for this suggested distinction.

Empirical research is guided by the definitions of the target of observation. What is thought to be observed is largely dependent of the definitions and this is important to consider when comparing different research results and interpretations. The methodological basis can also vary between studies, and the importance of clear definitions and controls for consistency

within each study is crucial, especially in avoiding implications such as those raised by McGuire et al. (2009) and Schaich Borg et al. (2006).

Schaich Borg et al.'s (2006) suggested implications, regarding using words as appropriate or inappropriate, could be important to take into consideration in future research regarding moral judgment in order to establish whether the underlying processes would differ due to the interpretation of the words used in responses to the different dilemmas. In order to produce reliable research results, the methodological aspects have to be acknowledged and considered in future research, especially related to the dilemmas used in the study of moral cognition. More research is needed in order to investigate the factors that underlie the distinction between personal and impersonal moral dilemmas.

Regardless of whether the dual-process model is supported by sufficient empirical evidence in relation to how emotion and cognition interacts, it still provides important normative and metaethical implications. If deontological moral judgment is dominated by emotional processes, rather than cognitive processes, this would question the assumptions on which deontological theories rely. This would demonstrate that deontological judgments arise from emotional processes, and not from cognitive processes, which is the assumption in deontological theories.

Furthermore, if moral realism is essential to deontology, and if Greene's distinction between morality$_1$ and morality$_2$ is sound, this seems to undermine deontology as a normative theory, because our moral intuitions giving rise to these judgments would not be providing us with some independent moral facts guiding us in how we ought to behave in moral situations.

Greene's bold claim is not passing by unnoticed and whether his claim about the processes giving rise to deontological judgments will be provided with sufficient empirical support is a project for future research. Whether emotional processes always guide deontological judgments have to be studied in a wider range of moral situations as suggested

by Dean (2010). At the moment, the dual-process model seems to make accurate predictions only in cases involving physical harmful intentions (Cushman et al., 2010; Greene et al., 2009; Young et al., 2010). Whether moral realism is essential to deontology, or whether it is possible to embrace a sentimentalist view and continue to defend deontology as is suggested by Timmons (2008), is important to consider, but this is not in the scope of this essay.

If there are two qualitatively different processes that produce deontological and utilitarian judgments, which seems not to be the case in all moral situations, neither of the underlying processes seems to provide us with some independent moral facts. None of these processes would be more reliable than the other in guiding us in how we ought to behave because both processes are a product of evolution. I suggest that they both would be exceedingly unlikely to provide us with some independent moral facts, because both are most likely by-products of other fitness enhancing abilities. My interpretation of Greene's statement about the factors irrelevant to morality, is that he implies that these factors are morally$_1$ irrelevant, rather than morally$_2$ irrelevant, because these moral intuitions seem to be, to the utmost extent, very morally$_2$ relevant, in order to motivate us to care about others, but not in providing us with some independent moral facts. My speculative conclusion, from overviewing this research, is that emotion and cognition do not compete, but seems to continuously integrate with each other in order to motivate and produce moral judgment.

I believe that Greene's distinction between morality$_1$ and morality$_2$ could be useful and important in the discussion regarding the empirical research's metaethical implications on philosophy. If this distinction is sound, it most likely can explain why it feels like we have a perceptual ability to perceive mind-independent moral facts, when in fact this is not the case.

Greene believes that the moral realist language is causing unnecessary conflicts and misunderstandings. I believe, in line with Greene, that using subjective and hypothetical terms when talking about morality, instead of using objective and categorical terms, could have a

positive influence on our social society, in a $moral_2$ sense, which could reduce these conflicts and misunderstandings. In order to accomplish this, people have to stop believe that there are objective moral facts and will have to reconsider their views about morality. I suspect that this is not something that would or could change overnight. Instead I believe that changes as extensive as these could take centuries, and certainly would not pass by without resistance.

Despite this, I am confident that the empirical investigation of moral cognition will inevitably change our concepts regarding morality, regardless of the time it would take. I hope that leaving moral realism behind, and instead regard morality as a social construction, would make it easier for us to live and interact with each other as social beings.

If cognitive neuroscience has taught us anything, it most certainly would be that not much is what it seems to be. More research is needed in order to identify what brain regions are involved, their function, and how they integrate in the production of moral judgment.

Conclusion

This research suggests that both emotional and cognitive processes are important in the production of moral judgments. The dual-process model only seems to predict and explain moral judgments in scenarios involving physical harmful intentions, and whether the model can be extended to other moral scenarios is a project for future research. Regardless of whether the dual-process model would correctly predict and explain how we make moral judgments, Greene's bold and provocative conclusions, I believe, have had an important impact on this field of research. He has motivated other researchers to approach the empirical investigation of moral cognition in new ways, and also fueled the philosophical discussion regarding the implications that these empirical results could have on metaethical and normative moral philosophy; a discussion that I believe is of great value, or even necessary, in our comprehension of what this research could mean to us, both in theory and practice.

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