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Research Report

Dissociable neural systems for moral judgment of anti- and pro-social lying

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ARTICLE INFO

Article history:
Accepted 4 February 2014
Available online 12 February 2014

Keywords:
Deception
Anti-social lying
Pro-social lying
Moral judgment
Ventromedial prefrontal cortex
Temporoparietal junction

ABSTRACT

Pro-social lying, which serves to benefit listeners, is considered more socially and morally acceptable than anti-social lying, which serves to harm listeners. However, it is still unclear whether the neural mechanisms underlying the moral judgment of pro-social lying differ from those underlying the moral judgment of anti-social lying. We used functional magnetic resonance imaging (fMRI) to examine the neural activities associated with moral judgment in anti- and pro-social lying. During fMRI scanning, subjects were provided with scenarios describing a protagonist's anti- and pro-social lying and were then asked to judge whether the protagonist's act was morally appropriate. The behavioral data showed that anti-social lying was mostly judged to be morally inappropriate and that pro-social lying was mainly judged to be morally appropriate. The functional imaging data revealed dissociable neural systems for moral judgment in anti- and pro-social lying. The anti-social lying, which was judged to be morally inappropriate, was associated with increased activity in the right ventromedial prefrontal cortex, right middle frontal gyrus, right precuneus/posterior cingulate gyrus, left posterior cingulate gyrus, and bilateral temporoparietal junction when compared with the control condition. The pro-social lying, which was judged to be morally appropriate, was associated with increased activity in the right middle temporal gyrus, right supramarginal gyrus, and the left middle cingulate gyrus when compared with the control condition. No overlapping activity was observed during the moral judgment of anti- and pro-social lying. Our data suggest that cognitive and neural processes for the moral judgment of lying are modulated by whether the lie serves to harm or benefit listeners.

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http://dx.doi.org/10.1016/j.brainres.2014.02.011
0006-8993

1. Introduction

Moral judgments are defined as evaluations (good vs. bad) of the actions or character of a person that are made with respect to a set of virtues held by a culture or subculture (Haidt, 2001). Moral judgments are important decision-making processes because the evaluation of our own actions or the actions of others facilitates social interactions. Recent functional neuroimaging studies of healthy subjects have explored the neural mechanisms involved in moral judgment (Berthoz et al., 2006; Greene et al., 2001, 2004; Harenski and Hamann, 2006; Heekeren et al., 2005; Moll et al., 2002a, 2002b, 2003). These studies have extended our understanding of the neural substrates of moral judgment, emphasizing the consistent involvement of the regions responsible for emotion, cognitive control, and mentalizing (for review, see Moll and Schulkin, 2009). Neuropsychological studies have also provided evidence regarding the neural substrates of moral judgment. For example, it was reported that patients with damage to the ventromedial prefrontal cortex, including those with frontotemporal dementia, show utilitarian moral judgment (Ciaramelli et al., 2007; Koenigs et al., 2007; Mendez et al., 2005).

During human social interaction, there are many types of complex social behaviors that inevitably involve moral judgment. One such behavior is deception, a psychological process by which one individual deliberately attempts to convince another person to accept as true what the liar knows to be false, typically in order for the liar, or sometimes for others, to gain some type of benefit or to avoid loss (Abe, 2009, 2011). Although many previous neuroimaging studies have shown the involvement of the prefrontal cortex in deception (Abe, 2009, 2011; Christ et al., 2009; Gombos, 2006; Hughes et al., 2005, Spence, 2004; Spence et al., 2004; Spence and Kaylor-Hughes, 2008), research into how the brain evaluates lies is of equal importance to research into the neural basis of lie generation.

We previously used positron emission tomography (PET) to explore the neural mechanisms underlying the willingness to forgive another person's moral transgression involving deception (Hayashi et al., 2010). During scanning, subjects were asked to judge the forgivability of a perpetrator's moral transgression. These transgressions were presented in four types of scenarios composed of a combination of two factors: the attitude of the perpetrator (dishonest or honest) and the severity of the moral transgression (serious or minor). We found that relative to honest responses, a perpetrator's dishonest responses were associated with right ventromedial prefrontal activity, which may reflect the subjects' identification of the perpetrator's deception. Further analysis revealed that the left ventromedial prefrontal cortex showed a significant interaction between the attitude of the perpetrator and the severity of the transgression, indicating that the right and left ventromedial prefrontal cortices play important, but somewhat different, roles in the forgiveness of moral transgressions involving deception.

It should be noted that we used only anti-social lying as the experimental stimuli in our PET study. Deception is generally thought to be an immoral, anti-social act, but it is not always an anti-social behavior. Lying can be a pro-social behavior that is intended to be altruistic. Pro-social lying is thought to be motivated by the desire to make others feel better or to spare their feelings and to facilitate smooth social relationships (DePaulo and Bell, 1996; DePaulo and Kashy, 1998). Unlike anti-social lies, which are usually made for personal gain, pro-social lies have benefits for the listener. Therefore, pro-social lying is often considered socially and morally acceptable (e.g., Bussey, 1999; Lindskold and Han, 1986; Lindskold and Walters, 1983). These findings naturally raise the question of whether the neural basis of moral judgments of pro-social lying differs from that of anti-social lying.

A study reported by Wu et al. (2011) touched on the above-mentioned question. The researchers used functional magnetic resonance imaging (fMRI) to examine the neural basis of evaluations of both lying and truth-telling in different social contexts. During fMRI scanning, they provided subjects with stories describing either lying or truth-telling about a protagonist's anti-social acts or good deeds. Their results demonstrated a differentiation between lying and truth-telling and between different types of lying in a network of brain regions. These regions included the bilateral superior frontal gyrus, bilateral inferior parietal lobule, bilateral cuneus, right lingual gyrus, right precuneus, and left postcentral gyrus. The results suggest that the judgments of lying and truth-telling involving a third party might be based on rational processing rather than emotional processing. However, Wu et al. (2011) did not find significant activation of the ventromedial prefrontal cortex, which is inconsistent with the findings of our previous study (Hayashi et al., 2010). Furthermore, the protagonist's lying in their experimental stimuli did not necessarily serve to help the listener. Thus, the neural basis of the moral judgment of pro-social lying has yet to be clarified.

The present study was designed to determine whether the moral judgment of pro-social lying differs from that of anti-social lying and how the ventromedial prefrontal cortex contributes to the two types of moral judgment. As with previous neuroimaging studies on decision-making in social settings, we used a scenario method (Greene et al., 2001; Sharot et al., 2007; Takahashi et al., 2009) (Fig. 1). During fMRI scanning, subjects were presented with scenarios in which the protagonist told the truth or a lie. Specifically, the protagonist's lying served to either harm (i.e., anti-social lying) or help (i.e., pro-social lying) the listener. The subjects were asked to judge whether the protagonist's act was morally appropriate.

Based on the previous findings described above, we tested the following two competing hypotheses: (a) if the "common currency" of basic neural activity is the functioning of the ventromedial prefrontal cortex, then ventromedial prefrontal activity is associated with the moral judgments of both anti- and pro-social lying; alternatively, and (b) if the ventromedial prefrontal cortex is sensitive to anti-social lying, then ventromedial prefrontal activity is associated with the moral judgment of only anti-social lying and not with pro-social lying. The results from our previous PET study provide no clues to favor either of these hypotheses. In that study, we observed the activation of the ventromedial prefrontal cortex, but because all of the stimuli were associated with anti-social acts, it was unclear whether the activation was specific to