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Making amends: Neural systems supporting donation decisions prompting guilt and restitution

Ambrose Ty [a], Derek G.V. Mitchell [b], Elizabeth Finger [c,*]

[a] Graduate Program in Neuroscience, Schulich School of Medicine & Dentistry, Western University, London, Ontario, Canada
[b] Graduate Program in Neuroscience, Anatomy & Cell Biology and Brain and Mind Institute, Schulich School of Medicine & Dentistry, University of Western Ontario, Lawson Health Research Institute, London, Ontario, Canada
[c] Department of Clinical Neurological Sciences, Schulich School of Medicine & Dentistry, University of Western Ontario, Lawson Health Research Institute, London, Ontario, Canada

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ABSTRACT

Guilt is a social emotion that promotes prosocial and moral behaviours. It arises as a result of harming or not-helping another individual, serving as a prompt for the guilty individual to take reparative actions, known as restitution. The neural regions involved in feelings of guilt are not completely understood, and in particular, regions associated with acts of restitution are not known. We employed a novel social decision-making fMRI paradigm involving decisions to donate to charities, with feedback designed to illicit guilt and a second opportunity to help. Whole-brain analysis demonstrated that decisions not to help an individual in need were associated with increased activity in the amygdala, insula, and middle temporal gyrus. In an exploratory analysis we observed a positive correlation between trait guilt and activity in vlPFC and mPFC during acts of restitution. These results extend models of decision making to suggest vlPFC and mPFC play important roles not only in processing aversive social cues and updating response decisions, but that their activity may support individual differences in such prosocial decisions. The results also support the role of the anterior insula in guilt-related decision making, identifying these regions as potential targets for interventions in neuropsychiatric disorders featuring deficient guilt.

1. Introduction

Guilt has been described as the "social mortar" of human society (De Hooge, Nelissen, Breugelmans, & Zeelenberg, 2011). It is involved in the evaluation of the self and occurs when behaviours or actions do not meet one's own moral standards, which ultimately motivates prosocial behaviours (Carlo, Mcginley, Davis, & Streit, 2012; Tangney & Dearing, 2002; Haidt, 2003; Carnì, Petrocchi, Del Miglio, Mancini, & Couyoumdjian, 2013). The goal of guilt is to motivate moral behaviour and guilt has been found to be highly linked to altruism (Haidt, 2003; Carnì et al., 2013). Berndsen, van der Pligt, Doosje, and Manstead (2004) concluded that guilt arises from actions that lead to negative interpersonal consequences, and as the level of interpersonal harm increases, so do feelings of guilt. Guilt is positively related to compliant behaviours, that is, helping those who request aid, altruistic behaviours, i.e. helping without expecting self-reward, dire prosocial behaviours (helping during crisis situations), and emotional helping, which is helping during "affectively evocative" contexts (Carlo et al., 2012). Guilt is linked to promoting positive moral development; individuals that are more prone to guilt have been found to have better interpersonal relationships, are less likely to react in anger to situations, and are more willing to accept wrongs that they have committed (Tangney & Dearing, 2002, Berndsen et al., 2004, Laible, Eye, & Carlo, 2008). Deficits in the experience of guilt are prominent in neuropsychiatric disorders such as psychopathy and frontotemporal dementia. Elucidation of the neural basis of the experience of guilt may identify targets for intervention to restore guilt processing with the aim of reducing antisocial behaviours.

There have been relatively few neuroimaging studies to date evaluating neural systems integrating the experience of guilt and its impact on subsequent decision making. Guilt avoidance during a financial investment game was associated with increased BOLD signal in the insula, supplementary motor area (SMA), dorsal anterior cingulate cortex (dACC), dorsolateral prefrontal cortex (dlPFC), and temporal parietal junction (TPJ) (Chang, Smith, Dufwenberg, & Sanfey, 2011). In line with this finding, during financial decisions to allocate money to oneself or a charity, increased anterior insula and anterior cingulate cortex activity were associated with a greater tendency to avoid harming the charity (avoid taking money from the charity) (Greening et al., 2013). Increased anterior insula activation was also found when participants opposed a charity in contrast to making a donation (Moll et al., 2006). The implication of a role of the anterior insula in processing of guilt was consistent with results from a PET study using scripts of memories

* Corresponding author at: Department of Clinical Neurological Sciences, Schulich School of Medicine and Dentistry, Western University, Parkwood Institute 550 Wellington Rd. S, London, ON N6C 5J1, Canada.
E-mail address: Elizabeth.Finger@lhsc.on.ca (E. Finger).

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of guilt-inducing experiences which demonstrated activation in bilateral anterior temporal poles, anterior cingulate gyrus, and left anterior insular cortex/inferior frontal gyrus (Shin et al., 2000). Other fMRI studies have evaluated neural responses during elicitation of guilt and embarrassment by presenting sentences to participants designed to elicit moral emotions. Takahashi et al. (2004) found that social emotions of guilt and embarrassment produced activation within neural regions implicated in theory of mind (ToM) processes, including the medial prefrontal cortex and left posterior superior temporal sulcus. Elicitation of guilt was also associated with higher activation in the medial prefrontal cortex (mPFC) (Takahashi et al., 2004), a region implicated in monitoring mental states and making moral judgements (Adolphs, 2001; Greene & Haidt, 2002; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001). These results were recently replicated in a German sample using this task, which also found activation of the insula and amygdala during guilt-inducing scripts (Michl et al., 2014). Finger, Marsh, Kamel, Mitchell, and Blair (2006) expanded upon the findings from Takahashi et al. (2004) by introducing the presence or absence of an audience during scripts read to elicit guilt or embarrassment. The manipulation allowed for the identification of neural regions that may prompt behavioural change following a social or moral transgression; whereas moral transgressions refer to transgressions that are considered inappropriate or wrong regardless of whether a witness is present (e.g., murder), social transgressions are considered problematic only when witnessed (e.g., burping). The study revealed that the ventrolateral prefrontal cortex (vlPFC) and dorsomedial prefrontal cortex (dmPFC) showed greater activation regardless of audience presence during moral transgressions but only in the presence of an audience for social transgressions. This finding was interpreted in the context of previous research that has found that the vlPFC and the dmPFC are important for processing aversive social cues and to resolve conflict between incompatible voluntary action plans (Blair, Morris, Frith, Perrett, & Dolan, 1999).

Together these studies suggest that the dorsomedial and ventrolateral prefrontal cortex, superior temporal sulcus, the insula, anterior cingulate cortex and amygdala are involved in the representation of guilt and guilt avoidance (i.e. avoiding an act that would harm another and produce guilt). However, the neural regions mediating decisions related to acts of restitution (i.e. acts of reparation to compensate for the loss or damage caused) in response to feelings of guilt (i.e. once an individual has been harmed) have not been confirmed. In the current study we aimed to test the hypotheses that 1) acts of restitution would be associated with dmPFC and vlPFC activity during social decision making which results in a harm to another, and 2) the emotion of guilt is represented in a network including the anterior insula, amygdala and temporoparietal junction. We used a novel social decision-making fMRI task designed to produce guilt and offer opportunities for restitution. In many of the prior studies mentioned above, the participants passively read words, sentences, or paragraphs from a screen during fMRI. Given the known links between degree of agency and intensity of guilt feelings (Berndsen et al., 2004) and activation in the anterior insula (Cracco, Desmet, & Brass, 2016), it was also important to confirm that neural activity observed during decisions producing guilt was not simply the result of passive processing of task stimuli. We therefore used a charitable decision making paradigm to capture neural activation during real-time decisions to donate or not to individuals in need. Models of charitable giving behaviour have identified that an individual's moral norms are the most powerful predictor of intentions to make charitable donations, beyond social norms which were not found to have a significant role (Manstead, 2000; Van der Linden, 2011). Evocation of guilt through pictures and anecdotes is known to prompt behavioural responses such as charitable donations to lessen the intensity of feelings of guilt (Ghingold, 1981). Further, guilt elicited by emotionally evocative charity appeals predicts charitable donation intentions (Hibbert, Smith, Davies, & Ireland, 2007). Thus, real-time charitable donations highlighting the suffering of individuals and depicting the consequences of donations vs. non-donations were used to elicit moral emotions including guilt and compassion and to explore individual differences related to these decisions and emotions. The task featured decisions made by the participants as well as matched passive trials where decisions were made by the computer, to allow for comparisons of agency to better isolate neural systems representing the participants' decisions and resulting moral emotions.

1.1. Participants

Participants were recruited through posters that were placed on Western University's campus and were also directly contacted from a participant research pool. Participants were screened prior to the study for contraindications to MRI and for handedness. Study exclusion criteria included history of neuropsychiatric disorders or current use of medication affecting cognition. In total, 23 healthy participants were recruited for the study; data was unavailable from 5 participants due to technical reasons (scanner dysfunction or lack of responses recorded by button box) during the scan. Ultimately, neuroimaging data was available for 18 participants; including 9 males and 9 females. All participants were right handed, with an average age = 20.3 years (Range: 18–23; S.D.: 1.52). All participants provided written informed consent. The procedures were approved by the Western University Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB protocol #13617).

1.2. Study overview

The participants performed a novel fMRI donation task, where they were given the opportunity to donate to individuals in need. Healthy volunteers were contacted and invited to participate in a “Social Decision Making Study”. Upon arrival, participants read a set of instructions that explained the task paradigm. They were then presented with a website featuring fictional charities presented in the task to enhance the believability of the study. Participants were told that money donated would go to these charities and would help individuals in need; however, they were also told that a portion of money that they choose not to donate would be added to their own compensation for the study. This was to increase the tension between self-rewarding vs. prosocial behaviours that is typical of real-world altruistic decisions, and to further intensify the corresponding emotions such as guilt that may be evoked by their decisions. Following study completion, participants were debriefed on the fictitious nature of the charities and informed that all participants would receive a standard additional compensation of $15 for their choices.

1.3. fMRI task design

The task paradigm consisted of short descriptive scenarios about individuals in need of help from a charity paired with a negative image of a person from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). Each trial consisted of the presentation of the individual in need followed by two choice screens and two feedback screens, together lasting 13.5 s (Fig. 1). Specifically, participants read the scenarios and in the active condition were given a choice to donate $10 or not to donate to that particular charity. Piloting of the task in a separate sample to ensure adequate numbers of each decision type led to the selection of the dollar amounts featured for each decision point, as well as the IAPS images and charities featured. A feedback screen then appeared that was designed to induce guilt after a no-donation choice where further harm to the victim was described; feedback following a donation was neutral. The participants were then given a second chance to donate. For 50% of the trials, the amount to be donated in choice 2 was halved to $5 in order to elicit decisions to donate in choice 2 following a no-donation decision in choice 1. A second feedback screen appeared after choice 2. In the passive condition, donation choices were randomly