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Cold or calculating? Reduced activity in the subgenual cingulate cortex reflects decreased emotional aversion to harming in counterintuitive utilitarian judgment

Katja Wiech [a,b,*,1], Guy Kahane [c,d,1], Nicholas Shackel [d,e], Miguel Farias [f], Julian Savulescu [c,d], Irene Tracey [a,b]

[a] Nuffield Department of Clinical Neurosciences, Nuffield Division Anaesthetics, University of Oxford, John Radcliffe Hospital, Headley Way, Oxford OX3 9DU, UK
[b] Oxford Centre for Functional Magnetic Resonance Imaging of the Brain, Nuffield Department of Clinical Neurosciences, University of Oxford, John Radcliffe Hospital, Headley Way, Oxford OX3 9DU, UK
[c] Oxford Centre for Neuroethics, University of Oxford, Littlegate House, St. Ebbes Street, Oxford OX1 1PT, UK
[d] Oxford Uehiro Centre for Practical Ethics, University of Oxford, Littlegate House, St. Ebbe's St., Oxford OX1 1PT, UK
[e] Department of Philosophy, University of Cardiff, UK
[f] Department of Experimental Psychology, University of Oxford, South Parks Road, Oxford OX1 3UD, UK

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ABSTRACT

Recent research on moral decision-making has suggested that many common moral judgments are based on immediate intuitions. However, some individuals arrive at highly counterintuitive utilitarian conclusions about when it is permissible to harm other individuals. Such utilitarian judgments have been attributed to effortful reasoning that has overcome our natural emotional aversion to harming others. Recent studies, however, suggest that such utilitarian judgments might also result from a decreased aversion to harming others, due to a deficit in empathic concern and social emotion. The present study investigated the neural basis of such indifference to harming using functional neuroimaging during engagement in moral dilemmas. A tendency to counterintuitive utilitarian judgment was associated both with 'psychoticism', a trait associated with a lack of empathic concern and antisocial tendencies, and with 'need for cognition', a trait reflecting preference for effortful cognition. Importantly, only psychoticism was also negatively correlated with activation in the subgenual cingulate cortex (SCC), a brain area implicated in empathic concern and social emotions such as guilt, during counterintuitive utilitarian judgments. Our findings suggest that when individuals reach highly counterintuitive utilitarian conclusions, this need not reflect greater engagement in explicit moral deliberation. It may rather reflect a lack of empathic concern, and diminished aversion to harming others.

1. Introduction

Most people think that it would be wrong to kill a stranger by pushing him onto the track of a runaway trolley in order to save the lives of five others. There is, however, a small minority that adopts the utilitarian view that we *should* push the stranger because this would save a greater number of lives (Cushman, Young, & Hauser, 2006). Such utilitarian views are controversial. Many people find them repugnant, and utilitarianism is often portrayed as a cold

Abbreviations: ACC, anterior cingulate cortex; DLPFC, dorsolateral prefrontal cortex; EPI, echo-planar imaging; EPQ-R, Eysenck Personality Questionnaire (revised); FWHM, full-width at half maximum; fMRI, functional magnetic resonance imaging; MNI, Montréal Neurological Institute; MR, magnetic resonance; MRI, magnetic resonance imaging; SCC, subgenual cingulate cortex; SPM, statistical parametric mapping; VMPFC, ventromedial prefrontal cortex.

* Corresponding author at: Oxford Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB), John Radcliffe Hospital, Oxford OX3 9DU, England, UK. Tel.: +44 1865 234541; fax: +44 1865 234542.
E-mail address: katja.wiech@ndcn.ox.ac.uk (K. Wiech).

[1] These authors equally contributed to this work.

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and calculating outlook that is due to a deficient affective sensibility (Hazlitt, 1824/1991). Utilitarians, however, argue that their counterintuitive conclusions are simply what results when, instead of just following our immediate gut reactions, we use moral reasoning to critically scrutinize them (Singer, 2005; Unger, 1996). They claim that utilitarians are not colder than other people; but they may appear so because they are more 'calculating' or rational.

Recent research has been taken to support for the latter view. Neuroimaging studies of affect-laden moral dilemmas have been taken to suggest that non-utilitarian or 'deontological' judgments (e.g. 'don't push the stranger') are based on a pre-potent emotional aversion to directly harming others (Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001). By contrast, utilitarian judgments (e.g. 'push the stranger to save five others') in difficult dilemmas were associated with increased activation in the dorsolateral prefrontal cortex (DLPFC) and inferior parietal lobe, areas implicated in deliberative processing, and in the dorsal anterior cingulate cortex (dACC), an area implicated in the detection and resolution of conflict (Greene et al., 2004). In addition, recent studies have reported that cognitive load increased response times in utilitarian judgments but not in deontological ones (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008), and that subjects higher on 'need for cognition' (Cacioppo, Petty, Feinstein, & Jarvis, 1996), a motivational tendency to seek and enjoy effortful cognitive activity, exhibited greater rates of utilitarian judgment (Bartels, 2008). These findings suggest that utilitarian judgments involve the use of effortful, deliberative processing to overcome an immediate emotional response (Greene, 2008; though see Kahane, 2012; Kahane & Shackel, 2010; Kahane et al., 2012).

Several recent studies, however, indicate that utilitarian judgment can also be the consequence of a lack of empathic concern. Some evidence for this comes from clinical populations. Patients with lesions in the VMPFC (Ciaramelli, Muccioli, Làdavas, & di Pellegrino, 2007; Koenigs et al., 2007; Moretto, Làdavas, Mattioli, & di Pellegrino, 2009) and with frontotemporal dementia (Mendez, Anderson, & Shapira, 2005), conditions associated with deficits in empathic concern and social emotion and with disordered social behavior, exhibit increased rates of utilitarian judgment in emotionally-loaded moral dilemmas, apparently because such patients lack the prepotent aversive response to harming. A recent study has shown that utilitarian judgments in patients with VMPFC damage were associated with weaker skin conductance responses, and with shorter reaction times, compared to healthy subjects (Moretto et al., 2009), further suggesting that in these patients utilitarian judgments do not require the overcoming of an aversion to harming others.

However, diminished social emotion can also be found in the non-clinical population. It is thus plausible that utilitarian judgments in healthy individuals might also be rooted in an atypically weak or even absent aversion to harming others. This would explain the otherwise puzzling findings that increased rates of utilitarian judgment in healthy individuals are predicted by individual differences in aversive reactivity to harming others, as indexed by peripheral vasoconstriction (Cushman, Gray, Gaffey, & Mendes, 2012), and are associated with lower response times (Greene et al., 2008) and reduced skin conductance response (Moretto et al., 2009). In addition, recent studies report that such a tendency to utilitarian judgment in healthy subjects is associated with lower rates of trait empathy (Choe & Min, 2011; Crockett, Clark, Hauser, & Robbins, 2010), and higher levels of testosterone (Carney & Mason, 2010), which has been associated with reduced empathic concern (Hermans, Putman, & Van Honk, 2006). Most importantly, several recent studies report greater rates of utilitarian judgment in individuals high on psychopathy (Bartels & Pizarro, 2011; Glenn, Koleva, Iyer, Graham, & Ditto, 2010; Koenigs, Kruepke, Zeier, & Newman, 2012), although interestingly such a relation was not observed in some studies of psychiatric patients and criminal offenders (Cima, Tonnaer, & Hauser, 2010; Glenn, Raine, & Schug, 2009).

There is thus a growing body of evidence indicating that utilitarian judgment in the healthy population may be based, not in greater deliberative effort as suggested by earlier research (Greene, 2008), but in a diminished or absent aversion to harming that is, moreover, associated with antisocial traits (Bartels & Pizarro, 2011). On this emerging picture of utilitarian judgment, utilitarians approach moral decisions in a calculating manner *because* they are 'colder' than other people.[2]

However, the neural mechanisms that underlie individual differences in utilitarian judgment remain unclear, and there has so far been no attempt to integrate these seemingly contrasting lines of evidence. One plausible hypothesis is that there are two distinct pathways to utilitarian judgement. Some individuals might make utilitarian judgments because they are more calculating or 'rational', and others because they are colder. It cannot yet be ruled out, however, that the evidence associating utilitarian judgment with greater cognitive effort at least partly reflects the more calculating form that moral decision-making takes in the absence of normal emotional input.

Here, we used functional magnetic resonance imaging (fMRI) in healthy volunteers to investigate the neural basis of reduced aversion to harming in counterintuitive utilitarian judgment. Unlike previous studies, we employed measures of individual differences both in 'coldness' and in 'calculation'. We predicted that two distinct personality traits would be associated with a greater tendency to utilitarian judgment in emotionally-loaded dilemmas: *need for cognition*, a motivational tendency to seek effortful cognitive activity (Cacioppo et al., 1996), and *psychoticism*, a subscale of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1991) that reflects lack of emotionality, diminished empathic concern, aggression and non-conformity to social

[2] The coldness in question refers to a lack of empathic concern and diminished prosocial emotion. It need not imply a general absence of emotion. Indeed, patients with VMPFC damage and psychopaths reject more unfair offers in the Ultimatum Game, a response pattern that is likely to be due to increased anger (Koenigs et al., 2007). In line with this, a recent study reports that a general disposition to feel angry was associated with greater rates of utilitarian judgment (Choe & Min, 2011).