



Individual differences in sensitivity to reward and punishment predict moral judgment

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ABSTRACT

Dual process models of moral judgment propose that such judgments are produced by interacting neural systems: a controlled cognitive system and an automatic affective system. Individual differences in moral judgment may therefore arise from variation in cognitive control ability and/or from variation in affective sensitivity. Previous research indicates that individual differences in cognitive control, indexed by working memory capacity, predict moral judgment (Moore, Clark, & Kane, 2008). Here we replicate group level findings from Moore et al. (2008) and demonstrate that individual differences in sensitivity to reward and punishment are strong predictors of moral judgment. Higher reward sensitivity positively correlates with willingness to sacrifice one life to save multiple others and moderates the impact of self-interest on participants' judgments. Higher punishment sensitivity negatively correlates with willingness to kill, particularly when negative affective information is present. These results help to revise current dual process models of moral judgment.

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1. Introduction

On Wednesday, May 11, 2005 an unidentified aircraft violated the no-fly zone established around Washington, DC in the wake of the terror attacks on September 11, 2001. Alarming, the aircraft was flying directly at the White House and the pilot was responding neither to repeated attempts at radio contact by the Secret Service, nor to repeated fly-bys of F-16 jets. The fighter pilots dropped flares in the path of the small plane to get the pilot's attention, but to no avail. Security officials were faced with a high-stakes moral dilemma: Whether or not to order the F-16s to shoot down the Cessna, killing everyone inside and possibly innocents on the ground or risk a possible terrorist strike at key government centers. Fortunately the Cessna's pilot altered course, reportedly only seconds before the decision was made to shoot it down.

Recently, cognitive scientists have been studying how people make such decisions. Of course we do not ask participants to destroy planes, but we can ask people whether or not they find it morally acceptable to perform a harmful action in the service of some greater good (e.g. Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Hauser, Cushman, Young, Jin, & Mikhail, 2007; Moore et al., 2008). The aircraft example highlights an important characteristic of the kinds of dilemmas used in moral psychology research, namely that there exists a tension between costs and benefits that subjects must

evaluate in order to form a judgment. Much can be inferred from the patterns of subjects' responses, and neuroimaging methods have begun to elucidate brain mechanisms that underpin the processing that goes into considering these types of problems (Borg, Hynes, Van Horn, Grafton, & Sinnott-Armstrong, 2006; Greene et al., 2001, 2004). A leading account of the neuroimaging findings associated with moral judgment is the Dual Process Model (DPM; Greene et al., 2004), which proposes that moral judgments can be the product of either automatically elicited emotional responses or controlled cognitive processing. Each of these components has been linked to dissociable neural circuitries and separable impacts on the responses that subjects give to certain kinds of moral dilemmas (Greene et al., 2004, 2001). A core feature of this account is that moral judgments tend to systematically vary as a function of the emotional response elicited by the problem at hand. Concomitantly, experimental manipulations have shown that moral judgments are reliably affected by emotional priming manipulations (Valdesolo & DeSteno, 2006; Wheatley & Haidt, 2005).

Though considerable progress has been made in determining what experimental factors impact moral judgment, there has been very little work on what traits, intrinsic to the subjects themselves, may influence how people evaluate the costs and benefits involved in moral dilemmas. This is interesting since a key, perhaps defining, feature of human moral judgment is the large variability between individuals' judgments. The logic of the DPM suggests that those participants with greater cognitive control should be more utilitarian in their moral judgments. Moore et al. (2008) tested this by examining the relationship between moral judgment

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and individual differences in cognitive control. They found that participants with greater cognitive control integrated abstract factors into their judgments more often, which resulted in more utilitarian responding in select cases. However, this effect was weak, and that experiment did not address individual differences in the affective component of the DPM. This latter issue is even more interesting because it may shed light on the larger question of when (or why) people engage cognitive control processes during moral judgment at all, given that there is a relatively fast, automatic affective system capable of generating such judgments independently. We address that question here by examining the role of individual differences in affective sensitivity to rewards and punishments (or, alternatively, gains and losses) and moral judgment.

1.1. Approach, avoidance, and the tradeoffs of moral judgment

The proposal that personality constructs can be formulated along functional and behavioral lines has engendered a view of brain systems as broadly organized into approach and avoidance related networks (Carver, Sutton, & Scheier, 2000; Carver & White, 1994; Gray, 2004). The overall function of these networks is thought to reflect, among other things, differences in the processing of emotional information (Gray, 1994; Gross, Sutton, & Ketelaar, 1998; Larsen & Ketelaar, 1991; Zelenski & Larsen, 1999; but see Harmon-Jones, 2003) and to underpin individual differences on two personality measures: *behavioral approach sensitivity* (BAS) and *behavioral inhibition sensitivity* (BIS; Carver et al., 2000; Carver & White, 1994; Gray, 1994). These constructs are psychometrically reliable and factor analysis supports their dissociation into two separate, but related, systems responsible for processing of (or sensitivity to) reward related/positive information (BAS) and punishment related/negative information (BIS; Carver & White, 1994; Jorm et al., 1998).

The logic of the current experiment is to determine if individual differences in the sensitivity of the BAS and BIS systems predict moral judgment in theoretically meaningful ways. Specifically, in moral dilemmas where harm to one person yields benefits to many others, the harm may be seen as a negative component of a complex stimulus (the dilemma) and the benefit as a positive component. The tradeoff of one against the other must be made within the context of the individual's sensitivity to each, and the key issue is that subjects are not equally sensitive to both kinds of information. Thus, we predict that a participant differentially more sensitive to positive gains than negative losses (i.e. high BAS but low BIS scores) should answer in a more utilitarian fashion, approving killing one to save many more often compared to one who has the reverse asymmetry. This effect should be particularly pronounced when comparing responses across personal and impersonal moral dilemmas; the former being those in which direct personal force (e.g. direct touching) must be applied to bring about the harm while the latter lack this requirement (Greene et al., 2009; Moore et al., 2008). Since the former generally have a lower moral approval rating, presumably due to the greater negativity associated with the use of personal force, the difference between moral approval of killing one to save many across personal and impersonal dilemmas should be much greater for those subjects with greater relative sensitivity to negative information (i.e. high BIS, low BAS scores).

2. Methods

2.1. Subjects

Participants were 77 undergraduates (48 female) from Princeton University who participated in exchange for partial fulfillment of course requirements.

2.2. Materials

2.2.1. BIS–BAS scales

Participants completed paper and pencil versions of Carver and White (1994) BIS–BAS scales. These consisted of 24 questions answered on a four point Likert scale and scores were computed in accordance with standard practice (see <http://www.psy.miami.edu/faculty/ccarver/scIBISBAS.html> for the full instrument, instructions, and scoring methods).

2.2.2. Moral dilemmas

We used the moral dilemma stimuli generated by Moore et al. (2008). Briefly, 24 dilemmas each had two resolutions, one personal and the other impersonal, all requiring the consideration of killing one person to save multiple others. These resolutions differed only in that personal resolutions required direct physical contact and impersonal resolutions enabled killing via a less direct, environmentally mediated route. In all other respects they were matched, including consequences of action and inaction, wording, number and length of sentences, and number of words (± 2). Half of these critical dilemmas involved threat to the life of the participant as well as hypothetical others (self) while the other half involved threat only to others (other). Factorially crossed with this was the inevitability of death for the to-be-sacrificed person (inevitable) or the dependence on the participant's choice to kill them (avoidable). Thus, the dilemmas reflected a $2 \times 2 \times 2$ design, with four types of dilemmas (self-inevitable, self-avoidable, other-inevitable, other-avoidable) divided into an introductory paragraph and two possible conclusions (personal or impersonal).

Additionally, participants also judged 14 filler dilemmas. These were similar to the critical dilemmas except that two involved killing multiple people for the sake of only one other person, and 12 did not involve killing. Two lists were created, with every dilemma appearing on both lists but with only the personal or the impersonal conclusion. We randomly assigned participants to one of the two lists. All participants saw the same resolutions to the filler problems.

2.3. Procedure

We tested all participants individually. After giving informed consent, participants filled out the BIS–BAS instrument. The experimenter then read aloud on-screen instructions directing the participants to answer each scenario seriously, to disregard legal issues, and to respond only on the basis of the moral appropriateness of the described action. Participants completed two practice dilemmas and the experimenter then answered any questions. Dilemmas were presented as black text on a grey background via computer monitor. Presentation order was randomized across participants. Each dilemma appeared as an introductory paragraph that participants read silently. When finished, a key press caused the resolution to appear one sentence at a time; each successive key press revealed another resolution sentence until the final question asked about moral appropriateness (all text remained in view until participants made their judgment). Participants responded via two keys on a standard keyboard. The screen blanked for 1 s between dilemmas. The computer recorded final responses and response times for the final resolution sentence.

3. Results

All null-hypothesis significance tests were non-directional. Alpha was set at .05. Effect sizes are reported as η_p^2 .

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