

Deontological and Utilitarian Inclinations in Moral Decision Making: A Process Dissociation Approach

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Dual-process theories of moral judgment suggest that responses to moral dilemmas are guided by two moral principles: the principle of *deontology* states that the morality of an action depends on the intrinsic nature of the action (e.g., harming others is wrong regardless of its consequences); the principle of *utilitarianism* implies that the morality of an action is determined by its consequences (e.g., harming others is acceptable if it increases the well-being of a greater number of people). Despite the proposed independence of the moral inclinations reflecting these principles, previous work has relied on operationalizations in which stronger inclinations of one kind imply weaker inclinations of the other kind. The current research applied Jacoby's (1991) process dissociation procedure to independently quantify the strength of deontological and utilitarian inclinations within individuals. Study 1 confirmed the usefulness of process dissociation for capturing individual differences in deontological and utilitarian inclinations, revealing positive correlations of both inclinations to moral identity. Moreover, deontological inclinations were uniquely related to empathic concern, perspective-taking, and religiosity, whereas utilitarian inclinations were uniquely related to need for cognition. Study 2 demonstrated that cognitive load selectively reduced utilitarian inclinations, with deontological inclinations being unaffected. In Study 3, a manipulation designed to enhance empathy increased deontological inclinations, with utilitarian inclinations being unaffected. These findings provide evidence for the independent contributions of deontological and utilitarian inclinations to moral judgments, resolving many theoretical ambiguities implied by previous research.

Keywords: decision making, dual-process theories, moral judgment, process dissociation

“As soon as men decide that all means are permitted to fight an evil, then their good becomes indistinguishable from the evil that they set out to destroy.”—Christopher Dawson, Writer (1889–1970)

“Jack Bauer saved Los Angeles . . . is any jury going to convict Jack Bauer? I don't think so.”—U.S. Supreme Court Justice Antonin Scalia (Freeze, 2007)

At one point in the television show *24*, counterterrorism agent Jack Bauer interrogates terrorist Syed Ali to find a nuclear weapon before it detonates in Los Angeles. When Ali refuses to cooperate, Bauer orders agents to kill Ali's eldest son. They do so, forcing Ali to save his younger son by revealing the location of the bomb,

which is eventually neutralized (Katz & Keller, 2003). Was it moral to kill Ali's son to save Los Angeles? Moral philosophers, writers, and even Supreme Court officials differ on the issue, because the relevant moral principles conflict. Killing Ali's son would be morally unacceptable according to the principle of *deontology*, whereby the morality of an action depends on its intrinsic nature regardless of its consequences—thus, killing an innocent person is simply immoral regardless of how many lives may be saved (Kant, 1785/1959). Conversely, killing Ali's son would be acceptable according to the principle of *utilitarianism*, whereby the morality of an action is determined by its consequences—thus, killing an innocent person is acceptable if that action minimizes total possible harm (Mill, 1861/1998). Like moral philosophers, lay people are divided—sometimes they judge actions on the basis of the deontological principle; at other times, they judge actions on the basis of the utilitarian principle (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001). This inconsistency has sparked interest among psychologists in studying the processes underlying moral judgments.

Psychologists usually investigate deontological and utilitarian judgments by examining responses to moral dilemmas designed to pit one principle against the other (e.g., Bartels, 2008; Carney & Mason, 2010; Ciaramelli, Muccioli, Ladavas, & di Pellegrino, 2007; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene et al., 2001; Hofmann & Baumert, 2010; Koenigs et al., 2007; Mendez, Anderson, & Shapria, 2005; Moore, Clark, & Kane, 2008; Nichols,

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2002; Nichols & Mallon, 2006; Pellizzoni, Siegal, & Surian, 2010; Petrinovich & O'Neill, 1996; Petrinovich, O'Neill, & Jorgensen, 1993; Valdesolo & Desteno, 2006). The classic example involves a runaway trolley that will kill five people unless participants intervene by causing the death of another individual (Foot, 1967). Participants are asked to indicate whether killing one individual to save the lives of five is acceptable or unacceptable. The former response is interpreted as a utilitarian judgment, whereas the latter response reflects a deontological judgment. Scores of deontology versus utilitarianism can be derived by calculating the relative proportion of *unacceptable* responses across multiple dilemmas. To identify the processes underlying the two kinds of moral judgments, previous research has examined correlates of each type of judgment (e.g., Greene et al., 2001) and the proportion of each judgment type across groups or conditions (e.g., Greene et al., 2008).

Although the traditional dilemma methodology has provided useful insights into moral psychology, it suffers from an important drawback. Participants must categorize a harmful action as either acceptable or unacceptable, thereby endorsing *either* the deontological *or* utilitarian principle. To behave in line with the deontological principle is to simultaneously behave in opposition to the utilitarian principle, and vice versa. Thus, the traditional approach confounds *selecting* one option with *rejecting* the other. This confound would be acceptable if the moral inclinations underlying overt deontological and utilitarian judgments were themselves inversely related (i.e., stronger inclinations of one kind are associated with weaker inclinations of the other kind). However, theorists have argued that deontological and utilitarian inclinations stem from conceptually distinct and functionally independent processes, thereby allowing for the possibility that both inclinations are active at the same time (Greene, 2007). Indeed, moral dilemma research is predicated on the assumption that *high-conflict* dilemmas arouse conflict between the two inclinations (Greene et al., 2001; Koenigs et al., 2007) and that whichever inclination is stronger drives the behavioral response (i.e., judging harm as acceptable or unacceptable). Such conflict would not occur if the two competing inclinations were inversely related.

Confounding deontological and utilitarian inclinations results in four problems for the traditional approach. First, the possibilities that the two moral inclinations are independent or positively related cannot be examined, if the data analytic strategy treats one as the opposite of the other. Second, if deontological and utilitarian inclinations were indeed inversely related, characterizing some dilemmas as *high-conflict* would be misleading, because deontological and utilitarian inclinations could never be in conflict. Third, treating deontological inclinations as the opposite of utilitarian inclinations can lead to theoretical ambiguity. For example, when experimental manipulations (e.g., induction of positive affect) alter responses to moral dilemmas, researchers may attribute the observed change to an increase in one inclination, although it might reflect a decrease in the other inclination. Similarly, in individual difference designs, correlations between dilemma judgments and other measures may reflect either a positive relation with one inclination or a negative relation with the other. Finally, although many theorists assume that deontological and utilitarian judgments are the result of two qualitatively distinct processes (e.g., Greene, 2007), there is no need to accept a dual-process account if the two outcomes are treated as opposite ends of a single continuum.

Instead, previous findings could also be explained by a single-process model in which variations in moral judgments are attributed to variations in the strength of a single moral inclination (cf. Kruglanski & Gigerenzer, 2011). Consistent with this objection, Bartels and Pizarro (2011) have argued that utilitarian judgments need not be due to a genuine moral concern for maximizing welfare but may instead result from reduced concern about causing harm. If so, utilitarian judgments would not reflect the presence of a moral inclination that is conceptually distinct from deontological concerns, but simply the *absence* of deontological inclinations.

Overcoming these issues requires an alternative approach that independently quantifies the strength of deontological and utilitarian inclinations within individuals. In the present research, we adopted Jacoby's (1991) process dissociation (PD) procedure for this purpose. The central idea underlying PD is to compare responses on *incongruent* trials, in which the underlying processes lead to divergent responses, to responses on *congruent* trials, in which the underlying processes lead to the same response. For example, the scenario involving the killing of Ali's son to prevent a deadly nuclear explosion is incongruent, because doing so is unacceptable according to the principle of deontology, but acceptable according to the principle of utilitarianism. But what if killing Ali's son would only prevent a harmless paint bomb from exploding? Such a scenario is congruent, because killing to prevent a nonlethal mess of paint is unacceptable by either deontological or utilitarian standards. By comparing responses when processes converge to responses when processes compete, the relative influence of each process can be quantified algebraically. In the current research, we used PD to delineate the independent contributions of deontological and utilitarian inclinations to responses on moral dilemmas. Toward this end, we first review the most prominent dual-process account of moral judgment and the methodological limitations of the traditional approach in testing this account. We then present our PD model of moral judgment as a possible solution for these limitations. The remainder of this article presents three studies that tested several predictions of the reviewed dual-process model, and then discusses the theoretical implications of a PD approach to measuring moral judgment.

A Dual-Process Model of Moral Judgment

Whereas some theorists have claimed that morality is a product of reasoning (e.g., Kohlberg, 1969), others have argued that morality has its primary roots in intuitive processes (e.g., Haidt, 2001). Even though consensus on this question remains elusive (Narvaez, 2008; Pizarro & Bloom, 2003; Saltzstein & Kasachkoff, 2004), Greene et al. (Green, 2007; Greene et al., 2001, 2004, 2008, 2009) tried to reconcile the two conflicting views by claiming that affective and cognitive processes jointly contribute to moral judgments. In a nutshell, their dual-process model of moral decision making states that affective reactions are immediately elicited by moral stimuli, and then—given sufficient time, motivation, and resources—sometimes overridden by cognitive processing.

According to Greene's model, when faced with a moral quandary where one person must be hurt to aid a number of others, people immediately and involuntarily experience a negative emo-

tional reaction to the prospect of causing harm.¹ If this emotional reaction is sufficiently powerful, or if there is insufficient time, motivation, or resources to engage in utilitarian deliberation, the emotional reaction will dominate the decision-making process, resulting in a deontological moral judgment: harmful action is morally unacceptable. Under more generous processing conditions, however, people may also engage in cognitive deliberation regarding the costs and benefits of harming another person. Given sufficient time, motivation, and resources, these cognitive processes may dominate decision making, resulting in a utilitarian judgment: harmful action is morally acceptable to the extent that it results in a net increase in well-being, but it is unacceptable if it does not result in a net increase in well-being (i.e., increased well-being for a larger number of people than are harmed). Thus, according to Greene's model, the psychological processes underlying deontological and utilitarian judgments are distinct and independent, rendering it possible for them to produce conflicting inclinations in difficult (high-conflict) moral dilemmas.

The available evidence is consistent with the view that deontological judgments are driven by emotional processes, whereas utilitarian judgments are driven by cognitive processes. For example, emotion centers in the brain demonstrated increased activation when participants considered personal moral dilemmas involving direct contact with the victim (Greene et al., 2001) and when participants made deontological decisions on difficult moral dilemmas (Greene et al., 2004). Participants made fewer deontological decisions when emotional distance from victims was increased (Petrinovich et al., 1993), after a humorous video clip that may have reduced negative affect by trivializing the harm dealt to victims (Valdesolo & DeSteno, 2006), or when they suffered damage to emotional brain regions (Ciaromelli et al., 2007; Koenigs et al., 2007; Mendez et al., 2005). Conversely, participants made more deontological decisions when imagining harm in vivid detail (Bartels, 2008; Petrinovich & O'Neill, 1996), while experiencing physiological stress (Starcke, Ludwig, & Brand, 2012) and after listening to a morally uplifting story that evoked warm feelings (Strohinger, Lewis, & Meyer, 2011).

Whereas deontological judgments have been linked to emotion centers in the brain, cognitive brain regions were more active when participants considered impersonal moral dilemmas in which victims are distant (Greene et al., 2001) and when participants made utilitarian judgments on difficult dilemmas (Greene et al., 2004). Facilitating rational decision making increased utilitarian judgments (Bartels, 2008; Nichols & Mallon, 2006), whereas introducing time pressure (Suter & Hertwig, 2011) reduced utilitarian decisions, and cognitive load impaired reaction times for utilitarian but not deontological judgments (Greene et al., 2008). Participants with greater working memory capacity were more likely to make utilitarian decisions (Moore et al., 2008), as were participants higher in deliberative, as opposed to intuitive, thinking styles (Bartels, 2008).

In sum, Greene's dual-process model of moral judgment suggests that two independent processes contribute to decisions in moral dilemmas. Whereas the process underlying deontological decisions is assumed to be fast, affective, and resource-independent, the process underlying utilitarian responses is assumed to be slow, cognitive, and effortful. Individual differences in proclivity toward affective or cognitive responses predict deontological and utilitarian decisions, emotional and cognitive manip-

ulations alter patterns of deontological and utilitarian decisions, and fMRI data corroborate the emerging picture of deontological and utilitarian decisions as relatively affective and cognitive, respectively.

A Conceptual Problem for the Dual-Process Model

The studies reviewed above are consistent with the view that two distinct processes contribute to moral judgment. However, the available evidence merely speaks to the conditions that influence participants' *judgments*, and these judgments should not be conflated with the moral *inclinations* underlying those judgments. Equating overt judgments with their underlying inclinations (i.e., equating deontological judgments with deontological inclinations, and utilitarian judgments with utilitarian inclinations) would imply an inverse relation between the two kinds of inclinations, in that stronger deontological inclinations imply weaker utilitarian inclinations, and vice versa. Of course, people can only make one judgment at a time, suggesting that one inclination was stronger than the other. However, such *relative* outcomes remain ambiguous with regard to the *absolute* strength of each tendency. For example, participants may select the deontological judgment due to either *strong* deontological inclinations or *weak* utilitarian inclinations. Moreover, some participants may arrive at a given judgment easily if one inclination is strong and the other is weak. Yet others may arrive at the same judgment only after experiencing extensive conflict when the strength of the two inclinations is nearly equal. The traditional approach cannot distinguish between these possibilities because deontological and utilitarian inclinations are not measured independently. As a result, the available evidence is also consistent with accounts that attribute moral judgments to variations in the strength of a single moral inclination, such as the presence versus absence of concerns about causing harm (e.g., Bartels & Pizarro, 2011).

Note that the traditional approach to studying moral dilemma responses would be perfectly valid if deontological and utilitarian inclinations were inversely related (i.e., stronger inclinations of one kind are associated with weaker inclinations of the other kind). In that case, however, the two inclinations would hardly ever be in conflict. Yet drawing on dual-process theories linking deontological judgments to affect and utilitarian judgments to cognition (e.g., Greene, 2007), it seems plausible that moral judgments do stem from two independent psychological systems. Indeed, when agreement with deontological and utilitarian principles is measured on self-report questionnaires, the respective responses tend to be uncorrelated (Tanner, Medin, & Iliev, 2008). Thus, rigorous tests of dual-process accounts require a different approach to studying responses to moral dilemmas, one that is capable of independently determining the strength of deontological and utilitarian inclina-

¹ Critics of Greene's theory have argued that negative affect alone is insufficient to produce judgments of immorality. Negative affect must be combined with an appraisal that the behavior causing negative affect is forbidden, which has been called an *affect-backed normative theory* (Bartels, 2008; Nichols, 2002; Nichols & Mallon, 2006). Otherwise, any action causing negative affect (e.g., a dentist pulling a bad tooth) would be judged immoral. Accepting appraisal processes as part of moral judgment, however, does not imply that deontological judgments are not fast, visceral, and efficient, because emotional stimuli are prioritized in perception, facilitating rapid and efficient categorization (Brosch, Pourtois, & Sander, 2010).

tions underlying moral judgments. Such an approach would provide more nuanced insights into the processes underlying responses to moral dilemmas, thereby imposing stronger empirical constraints on current debates between competing theoretical accounts (for a discussion, see Paxton & Greene, 2011).

Process Dissociation as a Solution

The problems inherent in the traditional approach can be overcome by employing Jacoby's (1991) PD procedure to independently quantify the strength of deontological and utilitarian inclinations within individuals. Jacoby originally developed the procedure to tease apart the distinct contributions of recollection versus familiarity-based guessing to memory performance. Although developed to examine memory, PD is content-agnostic and can be applied to any domain where traditional methods conflate the measurement of two psychological processes (for reviews, see Kelley & Jacoby, 2000; Payne & Bishara, 2009; Yonelinas, 2002). To our knowledge, PD has never been applied in the domain of moral psychology.

The key to PD analyses is employing both *incongruent* trials where the underlying processes lead to divergent responses, as well as *congruent* trials where they lead to the same response. To illustrate this idea, consider an application by Payne (2001), who used PD to investigate the role of racial bias in weapon identification. Using a sequential priming task, participants were briefly presented with a Black or White face, which was followed by either a gun or a harmless tool. After 200 ms, the target object was replaced by a visual mask, and participants had to indicate as quickly as possible whether the presented object was a gun or tool. Drawing on research showing automatic stereotypical associations between Black people and violence (e.g., Dovidio, Evans, & Tyler, 1986), Payne reasoned that participants' performance on this task may be jointly influenced by (a) the actual identification of the presented object, and (b) a racial bias associating Black people with guns. On stereotype-congruent trials (i.e., Black primes followed by guns; White primes followed by tools), either of these two processes will lead to a correct response. However, on stereotype-incongruent trials (i.e., Black primes followed by tools; White primes followed by guns), only identification of the presented object will lead to a correct response—racial bias will lead to an incorrect response. In other words, the two processes work in concert on congruent trials, but they work in opposition on incongruent trials. By comparing participants' performance on congruent and incongruent trials, PD allows researchers to independently quantify the relative contribution of each process. Such independent quantifications provide a more nuanced understanding of the processes underlying weapon identification compared with a simple analysis of judgments on incongruent trials. For example, in his research program on the processes underlying weapon identification (for a review, see Payne, 2006), Payne (2001) showed that the actual identification of target objects is an effortful, resource-dependent process, whereas racial bias is unaffected by momentarily available resources. Moreover, instructions not to use race as a cue in weapon identification led to ironic effects (Wegner, 1994), such that racial bias was increased rather than reduced by enhanced efforts to avoid racial bias; the actual identification of the target objects was unaffected by enhanced efforts to control racial bias (Payne, Lambert, & Jacoby, 2002).

Applied to the present question, congruent and incongruent trials refer to dilemmas where deontological and utilitarian inclinations suggest the same or different moral judgments, respectively. *Incongruent* moral dilemmas pit deontological against utilitarian inclinations. For example, in the incongruent version of the torture dilemma we asked participants if it is acceptable to torture a man to discover and disarm deadly explosives he has placed around the city, thereby saving citizens' lives: a proposition that is unacceptable according to the principle of deontology but acceptable according to the principle of utilitarianism. *Congruent* dilemmas have structure and wording identical to incongruent dilemmas, except for their outcomes: now dealing harm leads to worse outcomes overall, rendering the relevant action unacceptable by either deontological or utilitarian standards. For example, in the congruent version of the torture dilemma we asked participants if it is acceptable to torture a man to discover and disarm messy but harmless paint bombs (see Appendix A). In this case, both deontological and utilitarian inclinations should lead people to reject torturing the man.

Participants' judgments in congruent and incongruent moral dilemmas can be illustrated by means of a processing tree (see Figure 1). Each path from left to right depicts judgment outcomes on the two kinds of dilemmas as a function of distinct process. The three paths in the figure capture the three cases that (a) utilitarianism ultimately drives the response (top path), (b) deontology ultimately drives the response (middle path), and (c) neither utilitarianism nor deontology drives the response (bottom path). *U* depicts the case that utilitarianism drives the response, and *D* depicts the case that deontology drives the response. Conversely, *I - U* depicts the case that utilitarianism does not drive the response, and *I - D* depicts the case that deontology does not drive the response. Using the table on the right side of the figure, it is then possible to use these cases to identify their judgment outcomes for congruent and incongruent dilemmas. In congruent dilemmas, for example, participants will judge harm as unacceptable when utilitarianism drives the response (*U*). Alternatively, if utilitarianism does not drive the response (*I - U*), harm will still be judged as unacceptable when deontology drives the response (*D*). Harm will be judged as acceptable in congruent dilemmas only when neither utilitarianism (*I - U*) nor deontology (*I - D*) drives the response. Similarly, in incongruent dilemmas, participants will judge harm as unacceptable when utilitarianism does not drive the response (*I - U*) and, at the same time, deontology does drive the response (*D*). However, harm will be judged as acceptable either when utilitarianism drives the response (*U*), or alternatively when neither utilitarianism (*I - U*) nor deontology (*I - D*) drives the response.

By means of the processing paths depicted in Figure 1, it is now possible to create mathematical equations that delineate the probability of a particular overt judgment in congruent and incongruent dilemmas as a function of the two underlying inclinations. For example, the probability of overtly judging harm as unacceptable in a congruent dilemma is represented by the cases where (a) utilitarianism drives the response, and (b) deontology drives the response when utilitarianism fails to drive the response. In algebraic terms, this probability may be represented as

$$p(\text{unacceptable} \mid \text{congruent}) = U + [(1 - U) \times D] \quad (1)$$

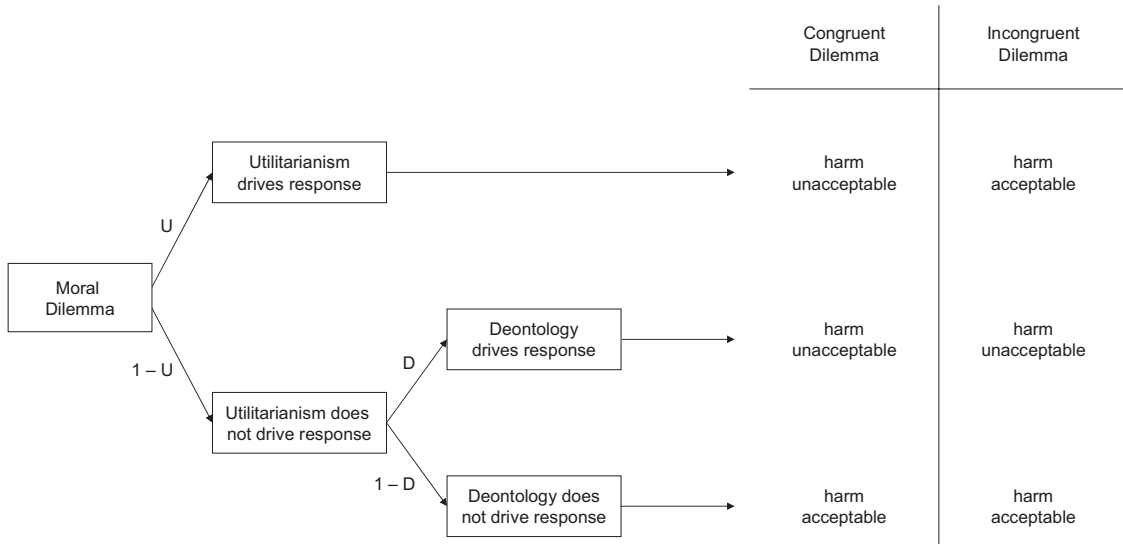


Figure 1. Processing tree illustrating the underlying components leading to judgments that harmful action is either acceptable or unacceptable in congruent and incongruent moral dilemmas. The paths from left to right depict the three cases that (a) utilitarianism ultimately drives the response, (b) deontology ultimately drives the response, and (c) neither utilitarianism nor deontology drives the response.

Conversely, the probability of judging harm as acceptable in a congruent dilemma is represented by the case that neither utilitarianism nor deontology drives the response, which can be represented algebraically as

$$p(\text{acceptable} \mid \text{congruent}) = (1 - U) \times (1 - D) \quad (2)$$

The same logic can be applied to incongruent dilemmas. For example, the probability of judging harm as unacceptable in an incongruent dilemma is represented by the case that deontology drives the response when utilitarianism does not drive the response. Algebraically, this likelihood is represented by the equation:

$$p(\text{unacceptable} \mid \text{incongruent}) = (1 - U) \times D \quad (3)$$

Conversely, the probability of judging harm as acceptable in an incongruent dilemma is represented by the cases that (a) utilitarianism drives the response, and (b) neither deontology nor utilitarianism drives the response. In algebraic terms, this probability is represented as

$$p(\text{acceptable} \mid \text{incongruent}) = U + [(1 - U) \times (1 - D)] \quad (4)$$

Using the empirically observed probabilities of participants' *acceptable* and *unacceptable* responses on congruent and incongruent dilemmas, these equations can be used to calculate numerical estimates for the two kinds of moral inclinations by solving algebraically for the two parameters representing deontology (*D*) and utilitarianism (*U*). Specifically, by including Equation 3 into Equation 1, the latter can be solved for *U*, leading to the following formula:

$$U = p(\text{unacceptable} \mid \text{congruent}) - p(\text{unacceptable} \mid \text{incongruent}) \quad (5)$$

Moreover, by including the calculated value for *U* in Equation 3, this equation can be solved for *D*, leading to the following formula:

$$D = p(\text{unacceptable} \mid \text{incongruent}) / (1 - U) \quad (6)$$

These two formulas provide researchers with a means to quantify the strength of deontological and utilitarian inclinations within a participant. For example, if a participant shows an *unacceptable* response on 7 out of 10 congruent dilemmas (i.e., probability of .70) and on 2 out of 10 incongruent dilemmas (i.e., probability of .20), the above equations would estimate this participant's utilitarian inclination with a value of .50 and his or her deontological inclination with a value of .40 (for a discussion of the metric of each score, as well as other technical details of PD, see Appendix B). Such parameter estimates can be calculated for each participant in a given sample, allowing researchers to use of them as measurement scores in experimental or individual difference designs. Critically, these scores need not be negatively correlated (i.e., stronger inclinations of one kind are associated with weaker inclinations of the other kind), as implied by the traditional bipolar treatment of moral dilemma responses. Instead, they may vary independently, so that the two parameters may demonstrate unique relationships with other variables and distinct effects of experimental manipulations.

Overview of the Current Research

The main goal of the current work was to use PD to provide a compelling test of the dominant dual-process account of moral judgment. In Study 1, we investigated whether the two parameters are meaningfully related to individual differences in emotional versus cognitive processing. On the basis of Greene's (2007) dual-process theory, we predicted that the *D*-parameter would

uniquely correlate with individual difference measures related to emotional processing (e.g., empathic concern). Conversely, we expected the U-parameter to uniquely correlate with individual difference measures of cognitive deliberation (e.g., need for cognition). In Study 2, we experimentally manipulated the amount of cognitive resources that was available to participants as they responded to moral dilemmas. We predicted that participants under cognitive load would demonstrate a selective decrease on the utilitarian parameter, with the deontological parameter remaining unaffected. In Study 3, we manipulated the emotional impact of each dilemma, predicting that enhanced emotional impact would selectively increase scores on the deontological parameter, while leaving the utilitarian parameter unaffected. In each study, we also expected the two PD parameters to provide additional information unobtainable from analyses using the traditional approach.

Study 1

Study 1 was designed to investigate how deontological and utilitarian inclinations, as measured by PD, are related to theoretically relevant individual difference variables. Participants read and responded to 10 congruent and 10 incongruent moral dilemmas, and completed self-report measures of empathic concern, perspective-taking, need for cognition, faith in intuition, religiosity, and moral identity. Participants' responses to the moral dilemmas were analyzed by means of PD, and the results were compared to those of the traditional data analytic approach. Drawing on dual-process theorizing suggesting that deontological inclinations are related to emotional reactions to harmful actions, whereas utilitarian inclinations are based on cognitive deliberation about costs and benefits (Greene, 2007), we hypothesized that deontological, but not utilitarian, inclinations would be positively related to individual difference measures of empathic concern, perspective-taking, and faith in intuition. Conversely, we predicted that utilitarian, but not deontological, inclinations would be positively related to individual differences in need for cognition.

We also tested two additional exploratory hypotheses. Because many religions unconditionally prohibit actions that cause harm, we speculated that deontological, but not utilitarian, inclinations would correlate positively with religiosity. In addition, we investigated the relationship between the two moral inclinations and participants' internalized identity as a moral person (Aquino & Reed, 2002). Although many theorists conceptualize both deontological and utilitarian inclinations as inherently moral concerns, this view has been challenged by researchers arguing that utilitarian responses may involve increased acceptance of harm, rather than a genuinely moral concern to maximize welfare (Bartels & Pizarro, 2011). If so, then only deontological, but not utilitarian, inclinations should be related to internalized moral identity. If, however, utilitarian inclinations reflect genuinely moral concerns, both deontological and utilitarian inclinations should correlate positively with moral identity. Importantly, if both kinds of moral inclinations are positively related to moral identity, the traditional scoring procedure should conceal these relations, because they should cancel each other out when deontological and utilitarian inclinations are treated as inversely related dimensions of a bipolar continuum.

Method

Participants. One hundred twelve undergraduates (30 male, 82 female) participated for partial course credit ($M_{\text{age}} = 19.23$, $SD = 5.20$). Approximately half of the sample was Caucasian ($n = 60$), one fifth East Asian ($n = 25$), and the rest reported a variety of ethnic backgrounds (three Black, three Aboriginal, eight South Asian, three Latino, five Arabic, one International, four unspecified). Over half of the sample reported an affinity with Christianity ($n = 67$), and most others reported an affinity with various other faiths (six with Judaism, seven with Islam, two with First Nations Spirituality, two with Buddhism, one with Hinduism). Five did not identify any affinity. Only a small number reported being atheist ($n = 14$) or agnostic ($n = 8$).

Procedure and materials. Participants read and responded to congruent and incongruent moral dilemmas, and then completed several individual difference measures, as well as demographic questions, before getting debriefed. All materials were presented in a laboratory setting on a desktop computer using MediaLab software (<http://www.empirisoft.com>).

Moral dilemmas. Participants read a series of moral dilemmas, each depicting participants as actors who must choose whether to perform a harmful action to achieve a particular outcome. Dilemmas were presented individually on a single screen in a fixed random order. After reading each dilemma, participants were asked to indicate whether the described action would be *appropriate* or *inappropriate* according to their personal opinion (see Greene et al., 2001). The moral dilemmas and the questions about the appropriateness of the relevant action were presented consecutively on separate screens.

There were 10 basic dilemmas in total, each being presented in two variants: one incongruent and one congruent (see Appendix A). Incongruent dilemmas were designed to pit deontological inclinations against utilitarian inclinations by depicting the outcomes of harmful action as more beneficial than the harm caused by acting. This conceptualization resembles traditional high-conflict moral dilemmas (e.g., Koenigs et al., 2007), which served as a basis in designing the dilemmas for the current study. An example is the traditional *torture dilemma* in which participants are asked to judge the appropriateness of torturing a man to discover the location of, and disarm, hidden explosives that pose a threat to a large number of people.

We also created a parallel, congruent version of each incongruent dilemma, where harmful action can prevent an undesired event without leading to a beneficial net outcome overall (i.e., the harmful action causes more harm than overall well-being). In such cases, harmful action may still be regarded as acceptable to prevent the undesired event, but it would be considered unacceptable by either deontological or utilitarian standards. For example, the congruent version of the *torture dilemma* involved torturing a man to find and disarm hidden paint bombs that will cause ugly spots on the facades of several buildings but will not harm people. Although torturing the man would prevent the paint spots, in this case torture is unacceptable by utilitarian standards because the harm of torture outweighs the harm of cleaning up paint. Thus, trivializing the benefits of harmful action renders utilitarian inclinations congruent with deontological ones.

Dilemma difficulty. Following each dilemma, participants indicated how difficult they perceived each decision to be on 5-point

scales ranging from 1 (*very easy*) to 5 (*very difficult*). The internal consistencies of the difficulty ratings were modest for both congruent and incongruent dilemmas, with Cronbach's α values of .58 and .59, respectively.

Empathy and perspective-taking. Individual differences in empathy and perspective-taking were measured via two subscales of Davis's (1983) interpersonal reactivity index (IRI). Seven items tapped empathic concern (e.g., "I often have tender, concerned feelings for people less fortunate than me") and seven items tapped perspective-taking (e.g., "Before criticizing somebody, I try to imagine how I would feel if I were in their place"). Responses were measured with 5-point scales ranging from 1 (*does not describe me well*) to 5 (*describes me very well*). Both scales showed satisfactory internal consistencies with Cronbach's α values of .81 and .77, respectively.

Need for cognition and faith in intuition. Individual differences in need for cognition and faith in intuition were measured via a short version of Epstein, Pacini, Denes-Raj, and Heier's (1996) rational-experiential inventory. The inventory consists of 10 items, five tapping need for cognition (e.g., "I prefer complex to simple problems") and five tapping faith in intuition (e.g., "I believe in trusting my hunches"). Participants were asked to indicate the extent to which each item was true of them on 5-point scales ranging from 1 (*completely true*) to 5 (*completely false*). Both scales showed satisfactory internal consistencies with Cronbach's α values of .76 and .71, respectively.

Moral identity internalization. To measure participants' self-concept as a moral person, we used the *moral identity internalization* scale developed by Aquino and Reed (2002). Participants were presented with nine moral terms (e.g., generous, helpful, honest) and asked to visualize the kind of person who has these characteristics. Participants then indicated how well each of five comparative statements described them (e.g., "It would make me feel good to be a person who has these characteristics") on 7-point scales ranging from 1 (*not true of me*) to 7 (*completely true of me*). The internal consistency of the measure was satisfactory with a Cronbach's α value of .72.²

Religiosity. Our measure of religiosity was adapted from Koenig, McGue, Krueger, and Bouchard (2005). Participants were asked to indicate whether each of 10 statements (e.g., "I seek guidance, help, or forgiveness through prayer") does or does not describe them by selecting one of two response keys labeled *yes* versus *no*. An index of religiosity was created by calculating the total number of *yes* responses for each participant (Cronbach's $\alpha = .89$).

Results

Dilemma characteristics. Overall, harmful action was judged acceptable on 58% ($SD = 18$) of the incongruent dilemmas and 28% ($SD = 17$) of the congruent dilemmas.³ The difference between the two kinds of dilemmas was statistically significant, $t(111) = 16.99, p < .001$. Participants also took longer to respond to incongruent ($M = 5.64$ s, $SD = 3.18$) than congruent dilemmas ($M = 4.61$ s, $SD = 2.26$), $t(111) = 4.90, p < .001$, and rated incongruent dilemmas as more difficult to answer ($M = 2.89$, $SD = 0.63$) than congruent ones ($M = 2.51$, $SD = 0.58$), $t(111) = 7.79, p < .001$.

Traditional analysis. Traditional bipolar scores of deontology versus utilitarianism were derived in line with previous work by calculating the proportion of *inappropriate* responses on incongruent moral dilemmas. On such dilemmas, the principle of deontology suggests that harmful action is unacceptable, whereas the principle of utilitarianism suggests that harmful action is acceptable because it increases the well-being of a greater number of people. On the basis of this antagonism, higher values on this score are typically interpreted as reflecting stronger deontological inclinations, whereas lower values are interpreted as reflecting stronger utilitarian inclinations. As depicted in Table 1, this bipolar deontology-utilitarianism index showed significant positive correlations with empathic concern, perspective-taking, and religiosity, and a marginally significant negative correlation with need for cognition. Faith in intuition was not significantly correlated with the traditional bipolar score. The traditional index also did not significantly correlate with moral identity internalization—a point we return to in our discussion of the PD results.

These correlations indicate that either deontological or utilitarian inclinations (or both) are systematically related to individual differences in empathy, perspective-taking, religiosity, and need for cognition. However, because the traditional scoring procedure treats deontological and utilitarian inclinations as inversely related dimensions of a bipolar continuum, it is not possible to determine which of the two inclinations is responsible for these correlations. Determining the precise relations underlying the obtained correlations requires a more fine-grained approach, such as PD.

PD analysis. PD scores of deontology and utilitarianism were calculated using the two algebraic formulas presented above. Toward this end, we first calculated for each participant the probability of rejecting harm in congruent and incongruent dilemmas, respectively. To obtain the utilitarian parameter, we subtracted the probability of rejecting harm in incongruent dilemmas from the probability of rejecting harm in congruent dilemmas (see Equation 5). To obtain the deontological parameter, we subtracted the U-parameter from 1 and divided the probability of rejecting harm in incongruent dilemmas by the obtained difference score (see Equation 6).

² We examined only the internalization subscale of moral identity, because it is designed to capture private moral self-perceptions rather than public self-presentation and is more predictive of prosocial behavior (Aquino & Reed, 2002).

³ A potential concern about the high proportion of participants who elected to cause harm in congruent dilemmas is that it may suggest a satisficing strategy rather than careful reading of instructions and content (Oppenheimer, Meyvis, & Davidenko, 2008). To rule out such concerns, we related participants' responses in congruent dilemmas to their average latency in providing their response (not including the time participants spent reading the dilemmas). Overall, participants took an average of 5.12 s ($SD = 2.52$) per dilemma, with a minimum of 1.55 s and maximum of 14.96 s. The proportion of *accepting harm* responses on congruent dilemmas correlated negatively with the average response latency, $r(111) = -.24, p = .009$, suggesting that at least some of these harmful selections may be due to participants rushing through the study. To avoid potential distortions of our findings due to satisficing, we reran the analyses after removing 20 participants who showed an average response latency of less than 3.00 s per dilemma. Removing these participants from analysis did not reduce the average probability of accepting harm on congruent dilemmas ($M = .26$), nor did it affect any of the obtained results (for a discussion of the theoretical meaning of accepting harm in congruent dilemmas, see Appendix B).

Table 1
Correlations Between Traditional Bipolar Deontology Versus Utilitarianism Scores, Process Dissociation Deontology Scores, Process Dissociation Utilitarianism Scores, and Theoretically Relevant Individual Difference Variables, Study 1

Variable	Traditional Score	PD Deontology	PD Utilitarianism
PD Deontology	.75***		
PD Utilitarianism	-.56***	.09	
Empathic Concern	.23**	.28**	-.01
Perspective-Taking	.31**	.32**	-.12
Faith in Intuition	-.11	-.14	-.06
Need for Cognition	-.18 [†]	-.07	.18 [†]
Religiosity	.21*	.26**	.03
Moral Identity			
Internalization	.06	.22*	.23**

Note. PD = process dissociation.

[†] $p = .06$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 1 presents the results of correlation analyses. Consistent with the assumption that deontological and utilitarian inclinations are independent, rather than inversely related, the two PD parameters were uncorrelated. Yet, confirming the confound in the traditional bipolar index, this index showed a significant positive correlation with the deontology parameter and a significant negative correlation with the utilitarianism parameter.⁴ More important for the current investigation, the deontology parameter correlated positively with empathic concern and perspective-taking, but not with need for cognition. Conversely, the utilitarian parameter showed a marginally significant positive correlation with need for cognition, but not with empathic concern or perspective taking. Faith in intuition failed to correlate with either of the two PD parameters. Although the latter finding is inconsistent with our prediction that faith in intuition should be positively related to deontological inclinations, our two exploratory hypotheses were empirically confirmed. As predicted, deontological, but not utilitarian, inclinations showed a significant positive correlation with religiosity. Moreover, both PD parameters correlated positively with moral identity internalization.

To further analyze unique relations of the two parameter estimates to the employed individual difference variables, we simultaneously regressed each individual difference variable onto both the deontology and utilitarianism PD parameters (see Table 2). Corroborating the results of our correlation analyses, deontology, but not utilitarianism, emerged as a significant predictor of empathic concern, perspective-taking, and religiosity, whereas, utilitarianism, but not deontology, showed a significant relation to need for cognition. Faith in intuition again failed to show any significant relation to either deontology or utilitarianism. Yet both inclinations independently predicted moral identity internalization.

Discussion

Results from Study 1 support the predictions derived from Greene's (2007) dual-process theory of moral judgment. Although the traditional data analytic approach revealed the expected patterns of relations to empathic concern, perspective-taking, and need for cognition, the PD approach provided a more fine-grained picture of these relations. Whereas empathy and perspective-taking

were uniquely related to deontological, but not utilitarian, inclinations, need for cognition was uniquely related to utilitarian, but not deontological, inclinations. These findings are consistent with dual-process theories of moral judgment, suggesting that deontological inclinations are related to emotional responses to harmful actions, whereas utilitarian inclinations are related to cognitive deliberation about costs and benefits (Greene, 2007). In addition, it is worth noting that the current data provide the first evidence for a link between deontological inclinations and religiosity. A possible interpretation of this link is that many religions prohibit actions that cause harm, thereby enhancing deontological inclinations in individuals with strong religious beliefs. Alternatively, it is possible that people of faith show higher degrees of empathic responding to suffering, which is consistent with findings on religiosity and prosocial behavior (e.g., Batson & Ventis, 1982; Shariff & Norenzayan, 2007).

Although there was no significant correlation between deontological and utilitarian inclinations when measured via PD, both parameters showed the expected relations to the traditional bipolar index. Whereas the D-parameter showed a significant positive relation to the traditional bipolar index, the U-parameter showed a significant negative relation. This finding not only corroborates the validity of the two PD parameters; it also suggests that the traditional bipolar index indeed confounds two distinct processes instead of reflecting the relative strength of a single moral inclination. An important finding in this context is that both deontological and utilitarian inclinations showed significant positive relations to moral identity internalization in the PD analyses, although there was no significant correlation between moral identity internalization and the traditional bipolar index. This pattern can be explained by the fact that the traditional scoring procedure treats deontological and utilitarian inclinations as negatively related dimensions of a bipolar continuum. To the extent that a given variable correlates positively with both deontological and utilitarian inclinations, these relations should cancel each other out in the traditional bipolar treatment of the two inclinations. By providing separate parameters for deontological and utilitarian inclinations, the PD approach can uncover such antagonistic relations that are concealed in the traditional bipolar index.

The obtained positive correlation between utilitarian inclinations and moral identity has important theoretical implications. To our knowledge, it is the first evidence suggesting that there is something genuinely moral about utilitarian processing. Some theorists have speculated that the processes underlying utilitarian judgments are not moral in and of themselves (e.g., Baron &

⁴ One reviewer raised concerns that the correlations between the two PD parameters and the traditional bipolar score reflect a mathematical truism rather than an empirical finding, because all three scores include the probability of showing *unacceptable* responses on incongruent dilemmas. The bipolar index is defined as $p(\text{unacceptable} \mid \text{incongruent})$. The U-parameter is defined as $p(\text{unacceptable} \mid \text{congruent}) - p(\text{unacceptable} \mid \text{incongruent})$, suggesting that, as the bipolar index increases, U may decrease. Moreover, the numerator of the D-parameter contains $p(\text{unacceptable} \mid \text{incongruent})$, suggesting that, as the bipolar index increases, D may increase. Although this concern may seem accurate at first glance, it is conceptually inaccurate, because it is based on the premise that responses to congruent dilemmas are invariant. It is also important to note that such an objection would suggest a negative correlation between the two PD parameters, which is not the case.

Table 2
Results of Multiple Regression Analyses Regressing Theoretically Relevant Individual Difference Variables Onto Process Dissociation Deontology and Process Dissociation Utilitarianism Scores, Study 1

Variable	PD Deontology			PD Utilitarianism		
	β	t	p	β	t	p
Empathic Concern	.28	3.05	<.01	-.04	-0.38	.71
Perspective-Taking	.34	3.74	<.01	-.15	-1.66	.10
Faith in Intuition	-.13	-1.42	.16	-.05	-0.52	.60
Need for Cognition	-.09	-0.97	.34	.19	2.00	.05
Religiosity	.26	2.83	<.01	<.01	0.04	.97
Moral Identity Internalization	.20	2.18	.03	.21	2.32	.02

Note. PD = process dissociation.

Spranca, 1997). Others have suggested that utilitarian judgments may reflect reduced concerns about causing harm rather than a moral imperative to maximize welfare (Bartels & Pizarro, 2011). To the extent that these concerns are accurate, there should be either no relationship or a negative relationship between utilitarian inclinations and moral identity. Thus, the obtained positive relationship suggests that utilitarian inclinations are at least partially rooted in the moral concern to maximize overall welfare.

It is important to note that one of our predictions was not confirmed in the current study. Counter to the assumption that faith in intuition would be positively related to deontological inclinations, faith in intuition did not correlate with any score derived from the moral judgment data—neither the traditional bipolar index nor the two PD parameters. Although our prediction was based on earlier evidence showing that people with a preference for intuitive thinking styles tend to prefer deontological over utilitarian judgments (Bartels, 2008), one could argue that the *faith in intuition* construct is more likely to reflect a judgmental tendency rather than a variable that is directly related to emotional responses. From this perspective, faith in intuition may influence moral judgments in a more distal manner by moderating the reliance on emotional responses. However, it may not be directly related to the emotional responses that are responsible for deontological inclinations. As such, the relation between faith in intuition and deontological judgments may be more fragile compared with the relations of other variables that are more directly related to emotional responses in moral dilemmas (e.g., empathic concern).

Although the results of Study 1 are consistent with Greene's (2007) dual-process theory of moral judgment, they suffer from the well-known ambiguities of correlational designs. Moreover, some of the obtained relations were admittedly weak, such as the marginally significant correlation between utilitarian inclinations and need for cognition (which passed the conventional level of statistical significance only in the multiple regression analysis). To overcome these shortcomings, Studies 2 and 3 employed experimental manipulations designed to alter one inclination without affecting the respective other. In Study 2, we used a cognitive load manipulation to reduce the amount of resources that are available for deliberation regarding the costs and benefits of harmful actions. On the basis of current dual-process theorizing (Greene, 2007), we expected that cognitive load would selectively reduce utilitarian inclinations, with deontological inclinations remaining unaffected.

Moreover, Study 3 manipulated the emotional impact of the moral dilemmas through enhanced empathic concern, testing the prediction that enhanced empathy should increase deontological inclinations with utilitarian inclinations being unaffected. In addition to providing converging evidence for the relations obtained in Study 1, such experimentally induced dissociations between the two PD parameters would offer stronger support for the proposed independence of the two inclinations by demonstrating that either inclination can vary independently of the respective other.

Study 2

The main goal of Study 2 was to experimentally test the deliberate roots of utilitarian inclinations. Greene's (2007) dual-process theory of moral judgment suggests that utilitarian inclinations are the result of controlled cognitive processes, whereas deontological inclinations are rooted in automatic emotional processes. Consistent with these assumptions, Greene et al. (2008) found that response latencies for utilitarian judgments were increased when cognitive resources were depleted. Similarly, Suter and Hertwig (2011) found that time pressure reduced utilitarian judgments in favor of deontological judgments using the traditional bipolar scoring. These findings are consistent with the hypothesis that utilitarian inclinations depend on cognitive resources. However, on the basis of the available evidence, it is impossible to determine whether cognitive resources are required for reduced deontological processing or enhanced utilitarian processing (or both). By providing separate parameters for deontological and utilitarian inclinations, the PD approach can resolve this ambiguity. Toward this end, we experimentally manipulated the amount of cognitive resources available while participants read and responded to congruent and incongruent moral dilemmas. Based on Greene's (2007) dual-process account, we predicted that cognitive load would selectively reduce the utilitarian inclinations, as measured by PD, without affecting deontological inclinations.

Method

Participants and design. A total of 57 undergraduates (29 female, 28 male) participated in return for partial course credit. The average age was 18.37 years ($SD = 0.96$), and approximately half self-identified as Caucasian ($n = 32$), with the remainder representing a variety of ethnic backgrounds (one Black, 14 East

Asian, two South Asian, seven East Indian, one unreported). Participants were randomly assigned to a cognitive load or control condition.

Procedure and measures. Procedures and materials were identical to Study 1, except that we dropped the individual difference measures and manipulated the availability of cognitive resources while participants read and responded to the moral dilemmas. Participants in the cognitive load condition were asked to perform a secondary task while they read and responded to the dilemmas. Specifically, they were asked to memorize a password-like digit string (e.g., *n63#m1Q*) before each dilemma, in line with other cognitive load experiments (e.g., DeShon, Brown, & Greenis, 1996). A new digit string was presented before each dilemma, and participants were asked to concentrate on the digit string, commit it to memory, and report it after reading and responding to the dilemma. Each of the 20 strings was eight characters long, and contained at least one uppercase letter, one lowercase letter, one number, and one punctuation mark. Digit strings and moral dilemmas were matched through a random procedure that was kept constant for all participants in the cognitive load condition. Participants in the control condition were presented with the same digit strings, but asked to ignore them. As with Study 1, all materials were presented in a laboratory setting on a desktop computer using MediaLab software (<http://www.empirisoft.com>).

Results

Dilemma characteristics. Overall, participants indicated that harmful action was acceptable on 61% ($SD = 15$) of the incongruent dilemmas and 27% ($SD = 17$) of the congruent dilemmas.⁵ The difference between the two kinds of dilemmas was statistically significant, $t(56) = 12.35$, $p < .001$. Participants also took longer to respond to incongruent ($M = 6.03$ s, $SD = 3.02$) than congruent dilemmas ($M = 4.72$ s, $SD = 1.91$), $t(56) = 3.47$, $p = .001$, and reported perceiving incongruent dilemmas as more difficult to answer ($M = 3.05$, $SD = 0.51$) than congruent ones ($M = 2.48$, $SD = 0.47$), $t(56) = 8.48$, $p < .001$.

Traditional analysis. The traditional bipolar score was calculated according to the procedures described in Study 1. Results showed that participants in the cognitive load condition showed a stronger preference for deontological over utilitarian judgments ($M = .43$, $SD = .16$) than participants in the control condition ($M = .34$, $SD = .14$), $t(55) = 2.30$, $p = .025$.

PD analysis. PD parameters of deontological and utilitarian inclinations were calculated according to the procedures in Study 1. Unlike Study 1, the two parameters showed a significant positive correlation ($r = .28$, $p = .038$). Correlations did not differ across the two experimental conditions ($r_s = .27$ and $.34$, respectively). Yet, despite the positive correlation between the two parameters, they showed different relations to the traditional bipolar index. Whereas the D-parameter correlated positively with the traditional bipolar index ($r = .58$, $p < .001$), the U-parameter showed a significant negation correlation ($r = -.59$, $p < .001$).

To investigate the impact of cognitive load, the two parameter scores were standardized and then submitted to a 2 (Parameter: Deontology vs. Utilitarianism) \times 2 (Processing: Cognitive Load vs. Control Condition) mixed-model ANOVA with Parameter as a within-subject factor and Processing as a between-subjects factor (see Figure 2).⁶ The analysis revealed a significant two-way inter-

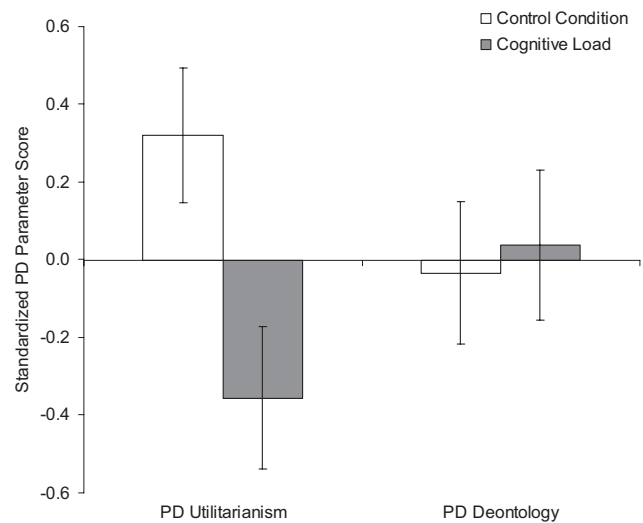


Figure 2. Mean standardized process dissociation (PD) deontology and utilitarianism scores under cognitive load and control conditions, Study 2. Error bars depict standard errors.

action between parameter and processing, $F(1, 55) = 5.98$, $p = .018$, $\eta_p^2 = .098$. Consistent with our predictions, post hoc comparisons indicated that, whereas utilitarian inclinations were significantly lower under cognitive load compared to control conditions, $F(1, 55) = 7.23$, $p = .009$, $\eta_p^2 = .116$, deontological inclinations were unaffected by cognitive load, $F(1, 55) = 0.07$, $p = .79$, $\eta_p^2 = .001$.

Discussion

Study 2 provides further support for Greene's (2007) dual-process theory of moral judgment. Although the traditional bipolar index revealed a significant difference in moral judgments as a result of cognitive load, it cannot determine whether this difference is due to increased deontological inclinations or decreased utilitarian inclinations (or both). Providing a more rigorous test of the hypothesis that utilitarian, but not deontological, inclinations depend on the availability of cognitive resources, the PD analysis indicated that cognitive load selectively reduced utilitarian inclinations while leaving deontological inclinations unaffected.

Study 3

The main goal of Study 3 was to experimentally test the emotional roots of deontological inclinations. Drawing on the correla-

⁵ As with Study 1, there was a negative, albeit nonsignificant, correlation between the proportion of *accepting harm* responses on congruent dilemmas and participants' average response latency per dilemma, $r(56) = -.12$, $p = .36$. To rule out distortions due to satisficing (Oppenheimer et al., 2008), we again reran all analyses after removing four participants who showed an average response latency of less than 3.00 s per dilemma. Removing these participants from the analysis did not affect the average probability of accepting harm on congruent dilemmas (.27), nor did it affect any of the obtained results (for a discussion of the theoretical meaning of accepting harm in congruent dilemmas, see Appendix B).

⁶ Because the two parameter scores are characterized by different measurement ranges (see Appendix B), they were standardized to obtain a common metric.

tional findings of Study 1, we investigated whether an experimental manipulation of empathic concern selectively increases the D-parameter, while leaving the U-parameter unaffected. According to Greene's (2007) dual-process theory of moral judgment, deontological inclinations are rooted in emotional responses to harmful action, whereas utilitarian inclinations depend on cognitive deliberation about the costs and benefits of such actions. Thus, to the extent that enhanced empathy with the victim of a harmful action enhances emotional responses, increased empathic concern should selectively strengthen deontological inclinations while leaving utilitarian inclinations unaffected. To test this hypothesis within the PD approach, we exposed half of the participants in Study 3 to a photograph of the victim who would be harmed in case participants judge harmful action as acceptable. The rationale for this manipulation was that photographs identify victims, thereby evoking increased empathy and more emotional distress (Amit & Greene, 2012; Kogut & Ritov, 2005). On the basis of Greene's (2007) dual-process account, we predicted that our manipulation of empathic concern would selectively increase deontological inclinations without affecting utilitarian inclinations.

Method

Participants and design. We recruited 275 American participants (156 female, 118 male, one unspecified) from the Amazon's Mechanical Turk for a compensation of \$1 for a 10-min online study.⁷ The average age was 34.08 ($SD = 11.73$). Most participants ($n = 227$) described themselves as Caucasian, and the rest represented a variety of ethnicities (16 Black, one Aboriginal, 14 Asian, one East Indian, and 16 other). Participants were randomly assigned to either an empathic concern or control condition.

Procedure and materials. Half of the participants read and responded to the same moral dilemmas employed in the first two studies, the only difference being that we dropped the measure of decision difficulty after each dilemma. Because of technical constraints, we also had to drop the latency measure for participants' responses to the dilemmas. The other half read and responded to the same dilemmas, except they were additionally presented with a picture of the potential victim who would be harmed by the action described in the dilemma. Pictures were selected to depict the supposed victim(s) of participants' actions in a setting appropriate to the dilemma (see Appendix A).⁸ For example, the picture for the *animal research dilemma* depicted a monkey receiving an injection from a person wearing a surgical mask; the picture for the *vaccine policy dilemma* depicted a thin man sitting alone in a hospital bed; and the picture for the *crying baby dilemma* depicted a crying infant. The moral dilemmas and the pictures of the victims were presented simultaneously on the screen. Each dilemma was presented with a different picture, although the same pictures were employed for congruent and incongruent versions of the same dilemma.

Results

Dilemma characteristics. Overall, participants indicated that harmful action was acceptable on 56% ($SD = 18$) of the incongruent dilemmas and on 21% ($SD = 15$) of the congruent dilemmas. The difference between the two kinds of dilemmas was statistically significant, $t(274) = 30.70, p < .001$.

Traditional analysis. The traditional bipolar score was calculated according to the procedures described in Study 1. Participants in the empathic concern condition showed a stronger preference for deontological over utilitarian judgments ($M = .47, SD = .18$) compared with participants in the control condition ($M = .42, SD = .18$), $t(273) = 2.12, p = .036$.

PD analysis. PD parameters of deontological and utilitarian inclinations were calculated according to the procedures in Study 1. As in Study 1, the two parameters were uncorrelated ($r = .04, p = .546$). Correlations did not differ across the two experimental conditions ($r_s = .02$ and $.07$, respectively). Yet, whereas the D-parameter showed a significant positive correlation with the traditional bipolar index ($r = .66, p < .001$), the U-parameter showed a significant negative correlation ($r = -.69, p < .001$).

To investigate whether empathic concern affected deontological or utilitarian processing (or both), the two parameters were standardized and submitted to a 2 (Parameter: Deontology vs. Utilitarianism) \times 2 (Processing: Empathic Concern vs. Control Condition) mixed-model ANOVA with parameter as a within-subject factor and processing as a between-subjects factor (see Figure 3). The analysis revealed a significant two-way interaction between Parameter and Processing, $F(1, 273) = 5.16, p = .024, \eta_p^2 = .019$. Consistent with our predictions, post hoc comparisons indicated that deontological inclinations were significantly higher in the empathic concern condition compared to the control condition, $F(1, 273) = 6.40, p = .012, \eta_p^2 = .023$, whereas utilitarian inclinations were unaffected by our manipulation of empathic concern, $F(1, 273) = 0.39, p = .534, \eta_p^2 = .001$.

Discussion

Our analysis using the traditional bipolar index showed a significant effect of empathic concern on moral judgments, such that participants showed a stronger preference for deontological over utilitarian judgments when they were presented with an image of the potential victim of harmful action. Yet our PD analysis provided a more fine-grained picture of this effect, showing that enhanced empathic concern selectively increased deontological inclinations, whereas utilitarian inclinations remained unaffected. These findings are consistent with Greene's (2007) dual-process theory of moral judgment, suggesting that deontological inclinations have their roots in emotional responses to harmful action.

General Discussion

Although moral dilemma research has provided important insights into the psychology of moral judgment and decision making, work in this area has been hampered by the conflation of deontological and utilitarian inclinations in a single index that treats them as inversely related dimensions of a bipolar continuum. Thus, findings in the moral dilemma literature remain ambiguous as to whether the obtained effects are due to differences in either deontological or utilitarian inclinations (or both). Jacoby's (1991) PD procedure resolves these ambiguities by providing two indepen-

⁷ A recent review of data obtained via Mechanical Turk has demonstrated psychometric properties similar to data from laboratory samples (Buhrmester, Kwang, & Gosling, 2011).

⁸ The pictures are available upon request from the first author.

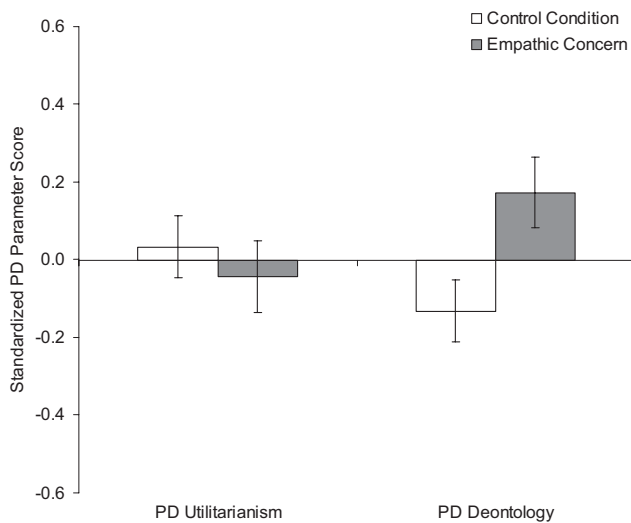


Figure 3. Mean standardized process dissociation (PD) deontology and utilitarianism scores under enhanced empathic concern and control conditions, Study 3. Error bars depict standard errors.

dent parameters: one representing the strength of deontological inclinations, and one representing the strength of utilitarian inclinations. Using PD to determine the relative strength of deontological and utilitarian inclinations, the current studies provided a compelling test of Greene's (2007) dual-process account of moral judgment, resolving many theoretical ambiguities implied by previous research.

In the current work, the traditional bipolar index was related to theoretically relevant individual difference variables (Study 1), detected significant changes in moral judgments as a result of cognitive load (Study 2), and revealed meaningful differences in moral judgments as a result of enhanced empathic concern (Study 3). Nonetheless, the traditional data analytic approach is unable to determine whether these effects were due to differences in deontological inclinations, utilitarian inclinations, or some combination of the two. Supporting both the utility of the PD approach for analyzing moral dilemma data and the proposed independence of two moral inclinations, our analysis revealed a striking pattern of differences between deontological and utilitarian inclinations in line with the predictions derived from Greene's (2007) dual-process theory of moral judgment. Consistent with the conception of deontological inclinations as rooted in emotional reactions to harmful action, individual differences in empathic concern and perspective-taking were associated with the PD parameter reflecting deontological inclinations, but not with the PD parameter reflecting utilitarian inclinations (Study 1). Moreover, an experimental manipulation designed to enhance empathic concern significantly increased the D-parameter without affecting the U-parameter (Study 3). Yet, consistent with the conception of utilitarian inclinations as the product of cognitive deliberation regarding the costs and benefits of harmful action, individual differences in need for cognition were associated with the PD parameter reflecting utilitarian inclinations, but not with the PD parameter reflecting deontological inclinations (Study 1). Furthermore, an experimental manipulation of cognitive load selectively

decreased the U-parameter, while leaving the D-parameter unaffected (Study 2).⁹

Interestingly, the PD approach was also able to uncover systematic relations that were concealed in analyses using the traditional bipolar index. Specifically, we found that both deontological and utilitarian inclinations were positively related to a measure of moral identity internalization (Aquino & Reed, 2002), although the traditional bipolar index failed to reveal any significant relation to this measure (Study 1). The absence of a significant relation with the traditional bipolar index may seem somewhat puzzling, considering that either of the two moral inclinations may be related to internalized concerns with moral issues. As we explained in our discussion of Study 1, the failure to detect these relations is due to the fact that the traditional scoring procedure treats deontological and utilitarian inclinations as inversely related dimensions of a bipolar continuum. To the extent that a given variable is positively related to both deontological and utilitarian inclinations, these relations cancel each other out in the traditional bipolar index. Thus, by providing separate parameters for deontological and utilitarian inclinations, the PD approach not only provides a more fine-grained picture of the unique properties of each moral inclination—it can also uncover empirical relations that are impossible to detect using the traditional approach.

Implications for Competing Models of Moral Judgment

Although Greene's (2007) dual-process model is one of the most prominent theories in the field of moral decision making, previous moral dilemma research cannot determine whether the obtained effects reflect differences in the relative strength of a single moral inclination, or the joint operation of two distinct inclinations. In line with this concern, previous research has been criticized for the ambiguity that utilitarian judgments may not reflect the presence of a moral inclination that is conceptually distinct from deontological concerns, but simply the absence of deontological inclinations (Bartels & Pizarro, 2011). Thus, variations in moral judgments may not result from the joint operation of two distinct processes (as implied by Greene's model), but from the relative strength of a single process underlying deontological inclinations. The current findings rule out this concern. Using PD to delineate the independent contributions of deontological and utilitarian inclinations to moral judgments, the two parameters were uncorrelated (or positively related), and they demonstrated a dissociated pattern of correlations with third variables, such as empathic concern and need for cognition. Moreover, Studies 2 and 3 demonstrated that each parameter can be manipulated independent of the other. In Study 2, cognitive load selectively reduced the parameter reflecting utilitarian inclinations, whereas in Study 3 an empathy manipulation selectively increased the parameter reflecting deontological inclination. Taken together, these findings support the contribution of two distinct inclinations to moral judgments, as suggested by Greene's dual-process model. As such, our application of PD makes a unique theoretical contribution by

⁹ Although not a central question in the current studies, we assume that the two kinds of inclinations have both dispositional and situational components.

providing the strongest evidence to date that moral judgments are jointly influenced by two distinct moral inclinations.

Implications for the Moral Status of Utilitarianism

The current research also provides another important contribution by shedding light on the theoretical debate as to whether utilitarian judgments are the result of genuinely moral concerns (see Baron & Spranca, 1997; Bennis, Medin, & Bartels, 2010; Bazerman, & Greene, 2010). Challenging the assumption that utilitarian judgments reflect a desire to maximize welfare, Bartels and Pizarro (2011) found an association between utilitarian judgments and psychopathy, Machiavellianism, and life meaninglessness. Similarly, Koenigs et al. (2007) showed that patients with damage to the ventromedial prefrontal cortex, who exhibit a callous disregard for others, also prefer utilitarian judgments. Because victims tend to elicit moral emotions unless people engage in controlled emotion regulation (Cameron & Payne, 2011), it is possible that responses to moral dilemmas are driven by the interaction of a visceral affective reaction to harm that increases deontological inclinations, coupled with a process of nonmoral emotion regulation that reduces deontological inclinations (thereby inadvertently increasing utilitarian judgments). If so, utilitarian judgments may simply reflect the absence or suppression of deontological inclinations rather than a genuinely moral concern with maximizing welfare.

The current findings provide important insights for this debate by showing that utilitarian judgments are indeed rooted in genuine moral concerns. Specifically, Study 1 demonstrated that utilitarian inclinations are positively related to moral identity, which has been shown to predict a wide range of prosocial behaviors, including volunteering and food bank donations (Aquino & Reed, 2002), donations to outgroup charities (Reed & Aquino, 2003), and fewer antisocial sport behaviors (Sage, Kavussanu, & Duda, 2006; for a review, see Shao, Aquino, & Freeman, 2008). To our knowledge, the positive relation between utilitarian inclinations and moral identity provides the first evidence that utilitarian inclinations are at least partially driven by a genuine moral concern rather than indifference to suffering. Thus, the current findings make an important contribution for the debate as to whether utilitarian responses arise from reduced concern over causing harm or a desire to maximize welfare.

Implications for the Interpretation of Previous Findings

Deconfounding deontological and utilitarian inclinations is important, because their conflation can distort the interpretation of empirical data, and thus accurate theorizing about the processes underlying moral decision making. According to Greene's (2007) dual-process theory of moral judgment, deontological inclinations are rooted in emotional reactions to harmful action, whereas utilitarian inclinations are based on a cognitive cost-benefit analysis of the outcomes of harmful action. Therefore, manipulations targeting emotional processing ought to impact deontological inclinations, whereas manipulations targeting cognitive deliberation ought to impact utilitarian inclinations. However, because the two moral tendencies are confounded in the traditional approach, it often remains ambiguous whether a given manipulation affected either deontological or utilitarian inclinations (or both).

For example, Koenigs et al. (2007) presented moral dilemmas to participants with lesions in the ventromedial prefrontal cortex, and compared their responses to the ones revealed by a healthy control group. Lesion patients showed a pattern of responses on high-conflict, personal moral dilemmas that the authors described as more utilitarian than controls. Interestingly, although the two groups responded equivalently to nonmoral dilemmas and measures of IQ, lesion patients exhibited "diminished emotional responsivity and markedly reduced social emotions" (p. 908). Thus, to the extent that deontological inclinations depend on emotional responsivity, whereas utilitarian inclinations depend on cognitive deliberation, one could argue that Koenigs and colleagues' lesion patients actually showed reduced deontological inclinations, not enhanced utilitarian inclinations. As we mentioned repeatedly in this article, the traditional approach is unable to distinguish between the two possibilities. PD can resolve these ambiguities by providing distinct parameters for deontological and utilitarian inclinations.

A similar ambiguity is implied in a study by Valdesolo and DeSteno (2006), who investigated the effect of contextually induced feelings of mirth on moral dilemma judgments. Using the traditional bipolar index, their results showed a reduced preference for deontological over utilitarian judgments after participants viewed a humorous video clip, which the authors interpreted as reflecting increased utilitarianism. According to Valdesolo and DeSteno, "feelings of positivity at the time of judgment might reduce the perceived negativity, or aversion 'signal,' of any potential moral violation and, thereby, increase utilitarian responding" (p. 476). However, to the extent that positive affect alleviates negative emotional reactions to harmful action, one could argue that Valdesolo and DeSteno's findings actually reflect reduced deontological inclinations rather than enhanced utilitarian inclinations. An application PD analysis could resolve this ambiguity.

PD may also shed light on the mechanism underlying Valdesolo and DeSteno's results. Strohminger et al. (2011) replicated their finding that mirth reduced deontological judgments. Yet, the authors also found that the positive emotion of moral elevation increased deontological judgments. They suggested that emotion affects moral judgments via appraisal processes: experiencing mirth may cause participants to appraise harm as trivial, thereby increasing the permissibility of deontological violations, whereas experiencing elevation may cause participants to appraise harm as serious, thereby reducing the permissibility of deontological violations. Interestingly, they speculated that, to the extent that mirth promotes an irreverent appraisal tendency, it may increase permissiveness of both deontological and utilitarian violations. This hypothesis cannot be tested with the traditional approach, because the predicted effects would cancel each other out in the traditional bipolar index. Yet, it can be easily tested using PD. If Strohminger and colleagues' appraisal interpretation is correct, mirth should reduce both the D-parameter and the U-parameter compared to a neutral control condition.

Limitations

The current set of experiments suffers from two limitations inherent to virtually all moral dilemma research. First, the employed dilemmas require participants to accept a *closed world assumption* by answering each dilemma as presented, rather than injecting new assumptions into the dilemma context (Bennis et al., 2010). For example, the torture dilemma requires participants to

accept the assumptions that police (a) have correctly identified the bomb planter, and (b) can obtain valid information via torture. If participants reject these assumptions, and instead assert that police may have the wrong person in custody, or that information extracted under torture is unreliable, then they may reject torture on utilitarian, rather than deontological grounds—for under such assumptions, torture will only increase net suffering in a world where bombs will inevitably hurt people. Because the problems associated with the closed world assumption are inherent to any research using moral dilemmas, they also apply to the current studies. Although the PD approach provides a more-fine grained picture of whether a given finding is due to differences in either deontological or utilitarian inclinations (or both), it does not resolve the conceptual problems associated with closed world assumptions.

Second, the scenarios employed for incongruent dilemmas involve a confound, such that the option that accords with the utilitarian principle involves accepting action, whereas the option that accords with the deontological principle involves rejecting action. This confound pertains to the entire field of moral dilemma research, so we reluctantly retained a similar dilemma structure to ensure maximum comparability between our incongruent dilemmas and the rest of the literature. Nonetheless, future work would benefit from including dilemmas where accepting action accords with deontological principles and rejecting action accords with utilitarian principles. By including such dilemmas, the impact of the nature of a given response (i.e., action vs. inaction) could also be incorporated into a PD analysis by including response type as a separate factor.¹⁰ Because harm is usually judged worse when it is caused by action than inaction (Cushman, Young, & Hauser, 2006), such an analysis would provide deeper insights into whether the strength of utilitarian and deontological inclinations depends on whether either type of inclination involves action or inaction.

Conclusion

Using PD to delineate the independent contributions of utilitarian and deontological inclinations to moral judgments, the current work provides clear support for the predictions of Greene's (2007) dual-process theory of moral judgments. As such, it represents a substantial theoretical, empirical, and methodological advance over previous research that confounded the operation of the two inclinations by treating them as inversely related dimensions of a bipolar continuum. Future moral judgment research can eliminate ambiguity and enhance clarity by employing PD rather than the traditional approach.

¹⁰ One reviewer raised the question of whether an application of PD requires two types of incongruent trials and two types of congruent trials. For example, Payne's (2001) weapon identification task includes two types of incongruent trials (i.e., White-gun, Black-tool) and two types of congruent trials (i.e., White-tool, Black-gun). Although many studies using PD to analyze responses in the weapon identification task report a single index of racial bias (A-parameter) and a single index of target identification (C-parameter), these indices confound White-tool associations and Black-gun associations in the former parameter, and target identification for White faces and target identification for Black faces in the latter parameter. In general, PD requires only one category of congruent trials and one category of incongruent trials, although it is certainly possible to multiply their number to investigate the impact of theoretically relevant variables (e.g., comparison of responses to White vs. Black faces in weapon identification; comparison of action vs. inaction in moral judgment).

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Appendix A

Table A1

Incongruent and Congruent Moral Dilemmas

Incongruent Dilemma Variant	Congruent Dilemma Variant
Time Machine	
You find a time machine and travel back to the year 1920. While checking into a hotel, you meet a young Austrian artist and veteran of the First World War. You realize this is Adolf Hitler before his rise to power in Nazi Germany. He is staying in the hotel room next to yours and the doors are not locked. It would be easy to simply smother him with a pillow in his sleep and disappear, stopping the Second World War and the Nazi party before they even start. However, he has not committed any crimes yet and it seems wrong to hurt an innocent person. Is it appropriate for you to kill an innocent young Hitler in order to prevent the Second World War?	You find a time machine and travel back to the year 1920. While checking into a hotel, you meet a young petty criminal. You realize this is George Brackman, a man who later on abducted a child and held her for a week until her family paid him some ransom money. He is staying in the hotel room next to yours and the doors are not locked. It would be easy to simply smother him with a pillow in his sleep and disappear, stopping the abduction and ransom demands before they even start. However, he has not committed any crimes yet and it seems wrong to hurt an innocent person. Is it appropriate for you to kill George Brackman in order to prevent him from taking a child hostage?
Car Accident	
You are driving through a busy city street when all of a sudden a young mother carrying a child trips and falls into the path of your vehicle. You are going too fast to break in time; your only hope is to swerve out of the way. Unfortunately, the only place you can swerve is currently occupied by a little old lady. If you swerve to avoid the young mother and baby, you will seriously injure or kill the old lady. Is it appropriate to swerve and hit the old lady in order to avoid the young mother and child?	You are driving through a busy city street when all of a sudden a young mother carrying a child trips and falls into the path of your vehicle. You are going too fast to break in time; your only hope is to swerve out of the way. Unfortunately, the only place you can swerve is currently occupied by a group of children on their way to elementary school. If you swerve to avoid the young mother and baby, you will seriously injure or kill several of them. Is it appropriate to swerve and hit the schoolchildren in order to avoid the young mother and child?
Hard Times	
You are the head of a poor household in a developing country. Your crops have failed for the second year in a row, and it appears that you have no way to feed your family. Your sons, ages eight and ten, are too young to go off to the city where there are jobs, but your daughter could fare better. You know a man from your village who lives in the city and who makes sexually explicit films featuring girls such as your daughter. In front of your daughter, he tells you that in one year of working in his studio your daughter could earn enough money to keep your family fed for several growing seasons. Is it appropriate for you to employ your daughter in the pornography industry in order to feed your family?	You are the head of a poor household in a developing country. Your sons, ages eight and ten, work on the family farm every day in order to teach them the value of hard work and providing for others. Your daughter, however, cannot work on the farm due to the heavy lifting required. You worry that she will not learn the value of money if she does not work. You know a man from your village who lives in the city and who makes sexually explicit films featuring girls such as your daughter. In front of your daughter, he tells you that in one year of working in his studio your daughter could earn enough money to keep your family fed for several growing seasons. Is it appropriate for you to employ your daughter in the pornography industry in order to teach her the value of money?

(Appendices continue)

Table A1 (continued)

Incongruent Dilemma Variant	Congruent Dilemma Variant
<p>It is war time. Enemy soldiers have taken over your village. They have orders to kill all remaining civilians. You and some of your townspeople have sought refuge in the cellar of a large house. Outside you hear the voices of soldiers who have come to search the house for valuables. A baby with no parents begins to cry loudly. You cover her mouth to block the sound. If you remove your hand from the baby's mouth her crying will summon the attention of the soldiers who will kill you and the others hiding out in the cellar. To save yourself and the others you must smother the child to death. Is it appropriate for you to smother the child in order to save yourself and the other townspeople from being killed?</p>	<p>Crying Baby</p> <p>It is war time. Enemy soldiers have taken over your village. They have orders to capture all remaining civilians to make them work quarrying stone in a mine. You and some of your townspeople have sought refuge in the cellar of a large house. Outside you hear the voices of soldiers who have come to search the house for valuables. A baby with no parents begins to cry loudly. You cover her mouth to block the sound. If you remove your hand from her mouth the crying will summon the attention of the soldiers who will capture you and the others hiding out in the cellar. To save yourself and the others from laboring in the mine you must smother the child to death. Is it appropriate for you to smother the child in order to save yourself and the other townspeople from being captured?</p>
<p>You are divorced now and your former spouse lives far away. You don't expect to see your former spouse for a very long time. However, you have recently started dating a new person that is positively wonderful. Your new partner is head over heels in love for the first time and you feel equally strong about your partner. You want to do everything in your power to keep the relationship progressing smoothly to what you believe will be a second marriage. Unfortunately, your new partner has told you many times that dating someone who is divorced is totally unacceptable. It is expressly forbidden in your partner's religion. Your partner doesn't know about your ex-spouse. You consider simply pretending that you have never been divorced so that your current relationship can continue. Is it appropriate for you to leave your new partner in the dark about your previous relationship in order to keep her/him happy and the relationship alive?</p>	<p>Relationship</p> <p>You are divorced now and your former spouse lives far away. You don't expect to see your former spouse for a very long time. However, you have recently started dating a new person that is positively wonderful. Your new partner is head over heels in love for the first time and you feel equally strong about your partner. You want to do everything in your power to keep the relationship progressing smoothly to what you believe will be a second marriage. Unfortunately, your ex-spouse gave you a very serious and incurable Sexually Transmitted Disease (STD). Your partner does not know about it. You consider simply pretending that you don't know about the STD so that your current relationship can continue. Is it appropriate for you to leave your new partner in the dark about your STD in order to keep her/him happy and the relationship alive?</p>
<p>You are a surgeon. A young woman you know becomes pregnant, but her body reacts in an unusual fashion. She develops a severe case of preeclampsia, a dangerous syndrome that leads to rapid increases in blood pressure. The only treatment is to deliver the baby. Unless the baby is delivered soon, the mother will die. However, the baby is too young to survive on its own. If it is delivered, it will die. So, although it is very difficult for her, the mother asks you to abort the baby. Is it appropriate for you to perform an abortion in order to save the mother's life?</p>	<p>Abortion</p> <p>You are a surgeon. A young woman you know becomes pregnant, but she is not yet ready for children. She has not finished high school, has no income, and was abandoned by the father. If she has the baby now, she will be stuck as a single mother on welfare for the rest of her life. This will make things very hard on her and the baby. She thinks that it would be smarter to wait and have children later. So, although it is very difficult for her, she asks you to abort the baby. Is it appropriate for you to perform an abortion in order to let the mother live a better life?</p>
<p>You are a police officer, and have recently caught a criminal you have been hunting for some time. He is allegedly responsible for rigging a series of explosive devices: some that have already gone off and some that have yet to detonate. He places explosives outside city cafes and sets them to go off at a time when people are drinking coffee on the patios. In this manner, he has injured many people and might injure many more. Now that the criminal is in custody, you want to know where the unexploded bombs are so you can defuse them. He refuses to talk, so you decide to use "aggressive interrogation techniques" like holding his head under water and beating him. Is it appropriate for you to use "aggressive interrogation techniques" in order to find and defuse the unexploded bombs?</p>	<p>Torture</p> <p>You are a police officer, and have recently caught a criminal you have been hunting for some time. He is allegedly responsible for rigging a series of explosive devices: some that have already gone off and some that have yet to detonate. He places explosives outside city cafes and sets them to go off at a time when no one is around. His explosives are inside paint cans so that they spray nearby objects with paint. In this manner, he has sprayed many cafes with paint and might spray many more. Now that the criminal is in custody, you want to know where the unexploded bombs are so you can defuse them. He refuses to talk, so you decide to use "aggressive interrogation techniques" like holding his head under water and beating him. Is it appropriate for you to use "aggressive interrogation techniques" in order to find and defuse the unexploded bombs?</p>

(Appendices continue)

Table A1 (continued)

Incongruent Dilemma Variant	Congruent Dilemma Variant
	Vaccine Policy
You are a doctor in a health clinic overrun by patients with a serious disease. You just received a shipment of drugs that can cure the disease but the drugs have their own severe side-effects. If you administer the drugs to your patients, a small number will die from the side effects but most will live. If you do not, most will die from the disease. Is it appropriate for you to administer the drug to your patients?	You are a doctor in a health clinic overrun by patients with the latest flu virus. You just received a shipment of drugs that can cure the flu but the drugs have their own severe side-effects. If you administer the drugs to your patients, a small number will die from the side effects but most will live. If you do not, most will continue to suffer from the effects of the flu virus for some time. Is it appropriate for you to administer the drug to your patients?
	Animal Research
You have been hired by a pharmaceutical company to conduct research on their products. Since products must be fit for human use, they are first tried out on animals. Your job is to find out the effects various chemicals have on rats, pigeons, rabbits, and monkeys. Most chemicals have only minor effects on the animals, but some cause them discomfort or even permanent damage. The chemicals you are researching are slated to form part of a new AIDS drug cocktail that will give new hope to millions of AIDS victims around the world. You anticipate saving many lives with the chemicals. Is it appropriate to test these chemicals on animals?	You have been hired by a pharmaceutical company to conduct research on their products. Since products must be fit for human use, they are first tried out on animals. Your job is to find out the effects various chemicals have on rats, pigeons, rabbits, and monkeys. Most chemicals have only minor effects on the animals, but some cause them discomfort or even permanent damage. The chemicals you are researching are slated to form part of a new acne facial cleanser that will give new hope to people with pimples and greasy skin. You anticipate making many people feel better about their appearance with the chemicals. Is it appropriate to test these chemicals on animals?
	Border Crossing
You are a soldier guarding a border checkpoint between your nation and one troubled by insurgent violence. You notice a young man in a cheap car approaching the checkpoint with a determined look on his face. You suspect he means to bomb the checkpoint, killing all the soldiers inside. He is rapidly approaching your station. Is it appropriate for you to shoot and kill the approaching man?	You are a soldier guarding a border checkpoint between your nation and one troubled by insurgent violence. You notice a young man in a cheap car approaching the checkpoint with a determined look on his face. You suspect he means to cross the border in order to work illegally inside your country. He is rapidly approaching your station. Is it appropriate for you to shoot and kill the approaching man?

(Appendices continue)

Appendix B

Technical Details of Process Dissociation

Process dissociation (PD) is a data analytic approach that allows researchers to quantify the contribution of two distinct processes to overt behavior by comparing the observed outcomes of binary behavioral responses on trials on which the two processes lead to the same outcome (congruent trials) to trials on which the two processes lead to opposite outcomes (incongruent trials). The application of PD to study deontological and utilitarian inclinations in moral dilemmas is described in detail in the main text of this article. In this Appendix, we elaborate on some technical details of PD. Although our PD application to moral dilemmas can be easily implemented on the basis of the descriptions in the main text, this Appendix is intended to clarify a number of aspects for readers who are interested in better grasping the underlying logic of PD.

Meaning of Processing Paths

An important aspect of PD concerns the conceptual meaning of the three paths in the processing tree (see Figure 1). These paths capture the three cases that (a) utilitarianism ultimately drives the response, (b) deontology ultimately drives the response, and (c) neither utilitarianism nor deontology drives the response. The definition of the processing paths in terms of which inclination ultimately drives the response is the reason why there is no fourth path in which both utilitarianism and deontology drive the response. After all, only one of the two moral inclinations can ultimately drive a given response. The strength of underlying moral inclinations is estimated by comparing responses on congruent and incongruent dilemmas over multiple trials, allowing researchers to calculate two independent inclination scores on the basis of observed conditional probabilities using the equations outlined in the main text of this article.

Dominance of Processes

Any application of PD requires a decision as to whether one or the other process dominates responses. In the processing tree depicted in Figure 1, utilitarianism is assumed to dominate, such that deontology may drive the response only if utilitarianism fails to drive the response (U-dominant model). However, it is also possible to construct a PD model in which deontology dominates responses, such that utilitarianism may drive the response only if deontology fails to drive the response (D-dominant model). With regard to the implied outcomes in the table on the right side of the figure, the two PD variants have the same implications for the paths in which either utilitarianism or deontology ultimately drive the response. However, the two variants differ with regard to predicted outcomes when neither utilitarianism nor deontology drives the response. Specifically, the structure of PD implies that, when neither process drives the response, the outcomes are oppo-

site to those when the subordinate process drives the response. Thus, whereas the U-dominant model implies acceptance of harm in both congruent and incongruent dilemmas (see Jacoby, 1991), the D-dominant model implies acceptance of harm in congruent dilemmas but rejection of harm in incongruent dilemmas (see Lindsay & Jacoby, 1994). Although these differences lead to somewhat different equations for the two parameters (see Payne & Bishara, 2009), the two models produced identical results in the three studies reported in the current article (with the exception that the two PD parameters of the D-dominant model evince moderate positive correlations across all three studies).

We believe that the U-dominant model reported in the current article is preferable for two reasons. First, PD models that are structurally equivalent to the U-dominant model have been validated and applied to a wide range of different tasks (e.g., recognition memory, sequential priming, heuristic judgment; for a review, see Payne & Bishara, 2009), whereas PD models that are structurally equivalent to the D-dominant model have been used in only one publication on Stroop performance (Lindsay & Jacoby, 1994). Second, and more important, the D-dominant model makes the theoretically implausible assumption that, when neither utilitarianism nor deontology drives responses, participants accept harm in congruent dilemmas, but reject harm in incongruent dilemmas. In other words, the absence of any moral concern would lead to acceptance of major harm but rejection of minor harm. Conversely, the U-dominant model makes the more plausible assumption that participants accept harm in both congruent and incongruent dilemmas when neither moral inclination drives the response. Unconditional acceptance of harm plausibly reflects the absence of moral concern, in that people simply do not care about the harm their actions are causing. Thus, we endorse the U-dominant model for the application of PD to moral dilemmas, especially considering that the U-dominant and D-dominant PD models produced almost identical results in the current work.

Undefined Cases

The fact that PD requires one process to be modeled as dominant over the other also has ramifications for the calculation of parameter estimates. Specifically, PD is unable to provide a parameter estimate for the subordinate process if the presumed dominant process drives responses on all trials of the task. In our U-dominant model, for example, it is not possible to calculate an estimate for the D-parameter if utilitarianism drives responses on all trials of the task. In this case, the probability of selecting an *unacceptable* response on congruent trials would be 1 and the probability of selecting an *unacceptable* response on incongruent trials would be 0. Hence, the estimate of U provided by Equation 5 in the main text would be 1, but it is mathematically impossible

(Appendices continue)

to estimate D on the basis of Equation 6, for doing so requires division by 0. This mathematical constraint makes our U -dominant model inapplicable to moral dilemma data when participants do not make a single nonutilitarian response. Yet, in the three studies reported in current article ($N = 444$), we did not encounter a single participant who made 100% utilitarian responses.

Metric of PD Scores

A final issue concerns the metric of the two parameter estimates. Although both the D -parameter and the U -parameter are based on conditional probabilities that can range between 0 and 1, their metric is not identical. Whereas the scores for the U -parameter can

range between -1 and $+1$, the scores for the D -parameter are constrained to values between 0 and 1. Hence, without appropriate transformation of measurement scores, direct comparisons between the two parameter estimates should be treated with caution. Note, however, that this constraint does not undermine direct comparisons of correlations with individual difference variables (as in Study 1) or comparisons of experimentally induced effects using standardized parameter scores (as in Studies 2 and 3).

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Retraction of Stapel, Koomen, and Ruys (2002)

The following article from the July 2002 issue is being retracted: Stapel, D. A., Koomen, W., & Ruys, K. I. (2002). The effects of diffuse and distinct affect. *Journal of Personality and Social Psychology*, 83, 60–74. doi:10.1037/0022-3514.83.1.60

This retraction follows the results of an investigation into the work of Diederik A. Stapel (further information on the investigation can be found here: <https://www.commissielevelt.nl/>). The Noort Committee has found evidence of fraud, leading to the conclusion that fraud is most likely in the data supplied by Diederik A. Stapel. His co-authors were unaware of his actions and were not involved in the collection of the likely fraudulent data.

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