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Cognitive Load Selectively Interferes with Utilitarian Moral Judgment

Joshua D. Greene[1], **Sylvia A. Morelli**[2], **Kelly Lowenberg**[3], **Leigh E. Nystrom**[4], and **Jonathan D. Cohen**[4]

1*Department of Psychology, Harvard University*

2*Department of Psychology, Stanford University*

3*Stanford Law School*

4*Department of Psychology, Center for the Study of Brain, Mind, and Behavior, Princeton University*

Abstract

Traditional theories of moral development emphasize the role of controlled cognition in mature moral judgment, while a more recent trend emphasizes intuitive and emotional processes. Here we test a dual-process theory synthesizing these perspectives. More specifically, our theory associates utilitarian moral judgment (approving of harmful actions that maximize good consequences) with controlled cognitive processes and associates non-utilitarian moral judgment with automatic emotional responses. Consistent with this theory, we find that a cognitive load manipulation selectively interferes with utilitarian judgment. This interference effect provides direct evidence for the influence of controlled cognitive processes in moral judgment, and utilitarian moral judgment more specifically.

Keywords

moral judgment; morality; utilitarian; cognitive control

1. Introduction

Traditional theories of moral development emphasize the role of controlled cognition in mature moral judgment (Kohlberg, 1969; Turiel, 1983), while a more recent trend emphasizes the role of intuitive or automatic emotional processes (Blair, 1995; Haidt, 2001; Mikhail, 2000; Nichols, 2002, 2004; Pizarro & Salovey, 2002; Rozin, Lowery, Imada, & Haidt, 1999; Van den Bos, 2003). Our previous work (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Greene, Nystrom, Engell, Darley, & Cohen, 2004) suggests a synthesis of these two perspectives in the form of a “dual-process” theory (Chaiken & Trope, 1999; Kahneman, 2003; Lieberman, Gaunt, Gilbert, & Trope, 2002; Posner & Snyder, 1975) according to which both automatic emotional responses and more controlled cognitive responses play crucial and, in some cases, mutually competitive roles. More specifically, we have argued that utilitarian moral judgments are driven by controlled cognitive processes while non-utilitarian

Correspondence to: Joshua D. Greene, Department of Psychology, 33 Kirkland St., Cambridge, MA 02138, jdgreene@wjh.harvard.edu (617) 495-3898.

(characteristically deontological) judgments are driven by automatic emotional responses (Greene, in press).[1] Although non-utilitarian judgments do not typically involve the application of stereotypes, we propose that their dynamics may be similar to those observed in the application of stereotypes, with utilitarian judgments requiring additional cognitive resources (Devine, 1989; Gilbert and Hixon, 1991; Wegener and Petty, 1997) and with individuals varying in their response to cognitive demands depending on their affinities for (non-)utilitarian judgment (Devine, 1989; Cunningham et al., 2004).

Utilitarian (or, more broadly, consequentialist) judgments are aimed at maximizing benefits and minimizing costs across affected individuals (Mill, 1861/1998). The utilitarian perspective contrasts with the deontological perspective (Kant, 1785/1959), according to which rights and duties often trump utilitarian considerations.[2] The tension between these two perspectives is nicely captured by the well-known footbridge dilemma (Thomson, 1986), in which a runaway trolley is about to run over and kill five people. One can save them by pushing a different person off of a footbridge and into the trolley's path, stopping the trolley but killing the person pushed. A prototypical utilitarian would (if all else is equal) favor performing this action in the name of the greater good, while a prototypical deontologist would regard this as an unacceptable violation of rights, duties, etc.[3] With respect to this case, our dual-process theory specifies that automatic emotional responses incline people to disapprove of pushing the man off of the footbridge, while controlled cognitive processes incline people to approve of this action.

The evidence in support of this theory is compelling but limited. Previous work has demonstrated that "personal" moral dilemmas[4] like the footbridge dilemma, as compared to similar "impersonal" moral dilemmas, elicit increased activity in brain regions associated with emotion and social cognition (Greene et al., 2001,2004). These data, however, are correlational and do not demonstrate a causal relationship between emotional responses and moral judgments. Three more recent studies, however, provide evidence for such a causal relationship. Mendez, Anderson, & Shapria (2005) found that patients with frontotemporal dementia, who are known for their "emotional blunting," were disproportionately likely to approve of the action in the footbridge dilemma (the utilitarian response). Koenigs et al. (2007) generated similar results testing patients with emotional deficits due to ventromedial prefrontal lesions. Finally, Valdesolo & DeSteno (2006) found that normal participants were more likely to approve of the action in the footbridge dilemma following positive emotion induction, a manipulation aimed at counteracting negative emotional responses. Together, these three experiments provide strong evidence for our claim that non-utilitarian judgments in cases such as these are driven by emotional responses. These experiments do not, however, demonstrate the involvement of opposing cognitive control processes. As Haidt's (2001) Social Intuitionist Model might suggest, these could be cases in which two equally automatic and emotional processes are competing, with one process compromised by brain damage or induced countervailing emotion.

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[1] We emphasize that this is an empirical hypothesis concerning a general trend rather than a conceptual claim. For a discussion of likely exceptions see Greene (in press).

[2] The utilitarian perspective also contrasts with the Aristotelian virtue-based tradition, which we discuss elsewhere (Greene, in press).

[3] Deontological judgments in our sense need not be driven by the conscious application of deontological principles. See Cushman et al. (2006) and Greene (in press).

[4] The present experiment focuses exclusively on "personal" moral dilemmas, and "high-conflict" personal dilemmas (Koenigs et al., 2007) more specifically. These are the dilemmas that, according to our theory, involve a tension between automatic emotional processes and controlled cognitive processes. Thus, we would not expect to see the effects reported here in "impersonal" dilemmas.
In our first study (Greene et al., 2001) we distinguished between "personal" and "impersonal" moral dilemmas/violations using three criteria. "Personal" moral dilemmas/violations are those involving (a) serious bodily harm (b) to one or more particular individuals, where (c) this harm is not the result of deflecting an existing threat. The latter criterion is aimed at capturing a sense of "moral agency." Recent work suggests that this criterion requires revision (Greene et al., submitted).

Previous reaction time (RT) data (Greene et al., 2001) suggest that controlled cognitive processes drive utilitarian judgments, but these data are inconclusive.[5] Alternative evidence comes from a subsequent neuroimaging study (Greene et al., 2004) in which brain regions associated with cognitive control exhibited increased activity preceding utilitarian moral judgments, made in response to difficult personal moral dilemmas. Nevertheless, as before, these data are correlational and thus insufficient to establish a firm causal relationship between cognitive control processes and utilitarian moral judgment. Several recent studies suggest a role for controlled cognitive processes in moral judgment (Pizarro, Uhlmann, & Bloom (2003); Cushman, Young, & Hauser, 2006; Valdesolo & DeSteno, in press), but none establish a causal relationship between controlled cognitive processes and utilitarian moral judgment. The primary aim of the present study is to do this.

2. Experiment

We presented participants with "high-conflict" (Koenigs et al., 2007) personal moral dilemmas (Greene et al., 2001, 2004) in which one can kill one person in order to save several others. These included the footbridge dilemma, as well as other more difficult dilemmas in which the non-utilitarian option involves the death of all concerned. For example, in the "crying baby" dilemma one must decide whether to smother one's own baby in order to prevent enemy soldiers from finding and killing oneself, one's baby, and several others. Participants responded under cognitive load (a concurrent digit-search task) and in a control condition. According to our theory, utilitarian moral judgments (favoring the sacrifice of one life to save several others) are supported by cognitive control processes, and therefore we predicted that increasing cognitive load by imposing another control-demanding task would interfere with utilitarian moral judgments, yielding increased RT and/or decreased frequency for utilitarian moral judgment. Crucially, our theory predicts that RT increases will be *selective for utilitarian judgments*, with no comparable increase in RT for non-utilitarian judgments.

3. Method

3.1 Participants and procedure

Eighty-two undergraduates (52 females, 30 males) participated in return for course credit under approval of Princeton University's IRB. After giving informed signed consent, participants responded to forty "personal" and "impersonal" moral dilemmas (Greene et al., 2001, 2004) presented on a computer, including twelve personal dilemmas designated as "high-conflict" by Koenigs et al. (2007). The *crying baby* dilemma is an example of a high-conflict dilemma:

> 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.
>
> Your baby begins to cry loudly. You cover his mouth to block the sound. If you remove your hand from his mouth his crying will summon the attention of the soldiers who will kill you, your child, and the others hiding out in the cellar. To save yourself and the others you must smother your child to death.

[5]The influence of cognitive control is suggested by increased RT for judgments in favor of (as opposed to against) personal moral violations (e.g. pushing the man off of the footbridge), consistent with the extra time needed for cognitive processes to compete with a countervailing emotional response (akin to the competition between color naming and word reading in the Stroop task). (No comparable effect was found for impersonal moral violations.) However, many of the dilemmas contributing to this effect have no clear utilitarian solution or are cases in which utilitarian considerations count against the action in question (e.g. killing someone because you don't like him). A closer examination of the subset of cases in which utilitarian and non-utilitarian considerations clearly compete revealed no reliable differences in RT between utilitarian and non-utilitarian judgments, providing further motivation for the present study. (Thanks to Liane Young on this point.)

> Is it appropriate for you to smother your child in order to save yourself and the other townspeople?

In all of the high-conflict dilemmas, the agent must decide whether to harm one person in order to save the lives of several people. Within this constraint, the structure of these dilemmas varies. Notably, the high-conflict dilemmas vary in terms of whether the potential victim's death is inevitable and whether the agent is among those who will be saved by the action. Only high-conflict dilemmas are suitable for examining the conflict between utilitarian and non-utilitarian judgment processes. However, because these dilemmas share a common structure, we diminished repetition by presenting them along with the remaining dilemmas in our standard battery. (Testing materials available online at [insert url].) We note that in each of the high-conflcit dilemmas, the utilitarian response is also the affirmative ("Yes") response. However, an examination of results from the "impersonal" dilemmas (See online supplementary materials) indicates that there is no general effect of affirmative vs. negative responses on RT. Dilemmas were presented as horizontally streaming text (left to right, 36 pt. courier font, approximately 16 characters per second). Participants indicated their judgments by pressing one of two buttons. There was no time limit. Dilemmas were presented in pseudorandom order in two blocks of twenty dilemmas each (control block and load block), subject to the constraint that there be five personal dilemmas in each block expected to be difficult ("high conflict") based on previous work. Order of conditions/blocks was counter-balanced across participants. In the load condition, adapted from Gilbert, Tafarodi, & Malone (1993), a stream of numbers scrolled across the screen beneath the text and during the deliberation period. Numbers appeared at a rate of approximately 3.5 per second. Participants were instructed to hit a button each time they detected the number "5" (20% of digits) and were told that they would be checked for accuracy. To counteract practice effects (observed in pilot testing), the speed of the number stream increased to 7 numbers per second halfway through the load block. Participants were instructed to perform the main task and the digit-search task simultaneously. In both the load and no-load (control) conditions, participants were instructed to read aloud and were made aware of their being recorded by a nearby microphone.

3.2 Analysis

Our analysis here focuses exclusively on dilemmas identified as "high-conflict" by Koenigs et al. (2007). (See online supplementary materials for results from other dilemmas.) This set of dilemmas is consistent with those observed to be difficult in our previous work (Greene et al., 2004). Data were trimmed based on RT to within two *SD*s of the group mean. RT data were analyzed using a mixed effects model and the restricted maximum likelihood (REML) fitting method. This model included participant as a random effect and load and judgment as fixed effects. Judgment data were analyzed using a likelihood ratio χ^2 test for the effect of load.

4. Results

There was no main effect of load ($F(1, 83.2) = 2.29$, $p = .13$). There was a marginally significant main effect of judgment ($F(1, 71.7) = 3.9$, $p = .052$), with longer RT for utilitarian judgments (LS Means (SEM) ms: utilitarian = 6130 (207), non-utilitarian = 5736 (221)). Critically, we observed the predicted interaction between load and judgment ($F(1, 62.9) = 8.5$, $p = .005$). (See Figure 1.) Planned post-hoc contrasts revealed a predicted increase in RT for utilitarian judgment under load ($F(1, 106.3) = 9.8$, $p = .002$; LS Means (SEM) ms: load = 6506 (238), no load = 5754 (241)), but no difference in RT for non-utilitarian judgment resulting from load ($F(1, 169.6) = .10$, $p = .75$; LS Means: load = 5691 (264), no load = 5781 (261)). Utilitarian judgments were slower than non-utilitarian judgments under load ($p = .001$), but there was no such effect in the absence of load ($p = .91$). This general pattern also held when item, rather than participant, was modeled as a random effect, although the results in this analysis were not as strong. There was no effect of load on judgment ($\chi^2(1, N = 82) = .24$, $p = .62$), with 61%

utilitarian judgments under load (95% CI: 57%-66%) and 60% (95% CI: 55%-64%) in the absence of load.

We conducted a follow-up analysis to explore the possibility that patterns of RT vary systematically among participants based on their tendency to make utilitarian vs. non-utilitarian judgments. We ranked participants based on the percentage of utilitarian judgments made in response to high-conflict dilemmas and divided participants into equal high-utilitarian and low-utilitarian groups based on these rankings. The high-utilitarian group averaged 80% utilitarian judgments, the low-utilitarian group 42%. Both groups exhibited the predicted interaction between load and judgment (high-utilitarian: $F(1, 39.8) = 3.0$, $p = .046$, one-tailed; low-utilitarian: $F(1, 30.8) = 4.4$, $p = .02$, one-tailed). More specifically, both groups exhibited increased RT for utilitarian judgment under load (high-utilitarian: $F(1, 43.3) = 6.0$, $p = .01$, one-tailed, LS Means (SEM) ms: load = 6247 (339), no load = 5371 (340); low-utilitarian: $F(1, 75.8) = 3.3$, $p = .04$, one-tailed, LS Means (SEM) ms: load = 6841 (331), no load = 6258 (337)), and neither group exhibited an effect of load on non-utilitarian judgment ($p > .7$). (See Figure 2) The high-utilitarian group was generally faster than the low-utilitarian group to make utilitarian judgments ($F(1, 107.3) = 3.5$, $p = .06$), but RT did not differ significantly between groups for non-utilitarian judgments ($p = .38$). Load did not have a significant effect on judgment in either group ($p > .6$). Low-utilitarian participants made 43% utilitarian judgments under load (95% CI: 37%-50%) and 41% utilitarian judgments in the absence of load (95% CI: 35%-48%). High-utilitarian participants made 79% utilitarian judgments under load and (95% CI: 73%-84%) and 78% utilitarian judgments in the absence of load (95% CI: 72%-83%).

5. Discussion

Cognitive load selectively increased RT for utilitarian judgment, yielding the predicted interaction between load and judgment type. In the full sample, load increased the average RT for utilitarian judgments by three quarters of a second, but did not increase average RT for non-utilitarian judgments at all. The predicted RT effects were observed in participants who tend toward utilitarian judgment as well those who do not. These results provide direct evidence for the hypothesized asymmetry between utilitarian and non-utilitarian judgments, with the former driven by controlled cognitive processes and the latter driven by more automatic processes. While load impacted RT, it did not reduce the proportion of utilitarian judgments, as one might have expected based on our theory. We will return to this observation below.

These RT data have broader significance because the evidence implicating controlled cognitive processes in moral judgment has been limited. Haidt's (2001) Social Intuitionist Model allows that some moral judgments may be driven by controlled cognitive processes, but this aspect of the model is not supported by positive evidence. As noted earlier, our prior RT data (Greene et al., 2001) are inconclusive and our prior neuroimaging data (Greene et al., 2004) are correlational. Pizarro et al. (2003) altered participants' judgments of moral responsibility by instructing them to make either "rational, objective" judgments or "intuitive" ones. These results implicate controlled processes, but, as the authors note, the use of explicit participant instructions may artificially induce participants to engage controlled processes and to rely on naïve theories concerning which judgments are more "rational" than others. Cushman et al.'s (2006) results suggest that people may consciously deploy some moral principles in making moral judgments, but conscious reasoning is not conclusively implicated. A recent study by Valdesolo & DeSteno (in press) used a cognitive load paradigm to demonstrate that controlled cognitive processes are involved in rationalizing one's own unfair behavior. Here, controlled cognitive processes are clearly implicated in people's moral judgments, but these judgments are, in a sense, *post-hoc* (Haidt, 2001) since these participants are evaluating actions immediately after having chosen to perform them. Thus, the present data may provide the

strongest evidence yet that controlled cognitive processes play a causal role in *ex ante* moral judgment.

As noted above, the cognitive load manipulation did not reduce the proportion of utilitarian judgments. One explanation for this is that participants were keenly aware of the interference created by the load manipulation and were determined to push through it. Like motorists facing highway construction, they may have been delayed, but not ultimately prevented from reaching their destinations. If this is the case, then other manipulations (e.g. transcranial magnetic stimulation applied to the dorsolateral prefrontal cortex) may be more successful in altering judgment. We leave this for future research, as our primary concern here is with the hypothesis that controlled cognitive processes play a special role in utilitarian judgments, as demonstrated by the RT data.

In light of this hypothesis, one might expect utilitarian judgments to be slower than non-utilitarian judgments in the absence of load. This effect was not observed in our sample as a whole, but was observed in low-utilitarian participants. (Figure 2, right.) Why didn't the high-utilitarian participants exhibit this effect? One possibility is that there are competing effects at work in these participants. On the one hand, making a counter-intuitive judgment requires additional cognitive resources, implying increased RT (as seen in the low-utilitarian participants). On the other hand, high-utilitarian participants exhibit a general bias toward utilitarian judgment, which appears to involve decreased RT for utilitarian judgment. In the absence of load, the latter effect may dominate. Consistent with this idea, we found a robust correlation ($r = -.43$, $p < .0001$) between a participant's tendency toward utilitarianism (i.e. percent utilitarian judgments made) and that participant's average RT for utilitarian judgments in the absence of load.[6] Interestingly, we found that utilitarian tendency bore no relationship to RT for utilitarian judgments under load ($r = .08$, $p = .47$) and no relationship to RT for non-utilitarian judgments ($r = -.16$ (load), $r = .04$ (no load), $p > .1$). This suggests that there is an additional process that drives down RT in high-utilitarians in the absence of load, although this process still remains susceptible to cognitive interference. To account for this process will require a significant expansion and/or modification of our dual-process theory. One possibility is that utilitarian normative principles are more consciously accessible than competing deontological principles (Cushman et al., 2006), and that they are therefore more easily routinized into a decision procedure. This hypothesis may be tested via an experiment in which one "evens the playing field" by making a competing deontological principle (e.g. "It's wrong to harm someone as a means to an end") more accessible.

Several other issues deserve attention: First, the present results do not address the appraisal mechanisms that govern the emotional responses that, according to our theory, support non-utilitarian judgments. These mechanisms may be sensitive to familiar moral distinctions, such as the distinction between harmful actions and omissions (Haidt and Baron, 1996; Cushman et al., 2006; Schaich Borg et al., 2006) and the distinction between harms that are intended and those that are merely foreseen (Aquinas, unknown/2006; Mikhail, 2000; Schaich Borg et al., 2006; Cushman et al., 2006). Other distinctions may be operative here as well (Royzman and Baron, 2002; Waldmann and Dieterich, 2007; Greene et al., submitted). For present purposes we are agnostic as to which non-utilitarian principles are operative in these judgments. We are likewise agnostic as to whether these principles are suitable normative moral rules (Nichols & Mallon, 2006). We note that neither our dual-process theory nor the present results implies that the human brain houses systems specifically dedicated to utilitarian and deontological judgment. On the contrary, we have argued that, at least in the case of utilitarian judgment, the relevant cognitive systems are somewhat domain-general (Cohen, 2005). Finally, while the present results, bolstered by previous neuroimaging data (Greene et al, 2004), indicate that

[6]Data were z-transformed separately for each participant.

controlled cognitive processes play a special role in utilitarian judgments, these results leave open many further details concerning the nature (e.g. reasoning vs. inhibitory control), sequencing (e.g. parallel vs. serial), or timing of these processes. These issues remain to be explored in future research.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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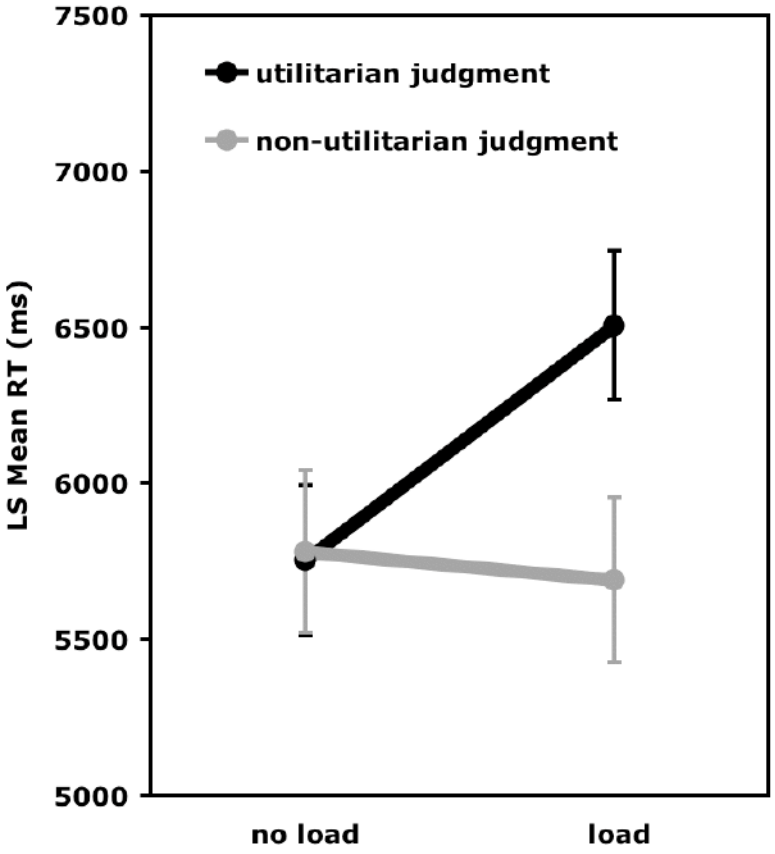

Figure 1.
The effect of cognitive load on RT for utilitarian (black) and non-utilitarian (gray) moral judgment. Data shown for the entire group (n = 82). Error bars indicate standard error of the mean.

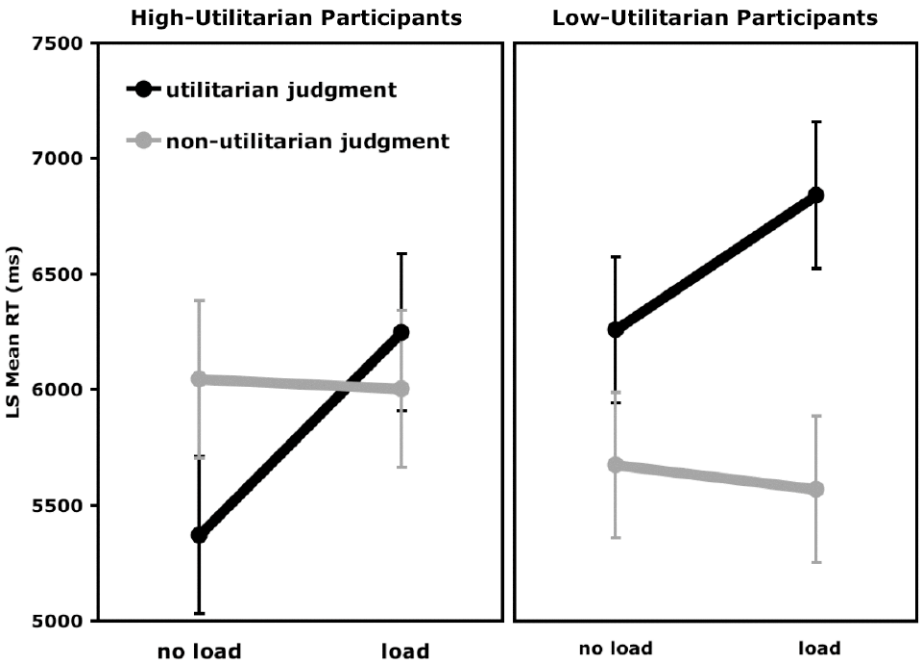

Figure 2.
Effects of load on RT for high-utilitarian (n = 41) and low-utilitarian (n =41) groups.