



ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

Cognition xxx (2008) xxx–xxx

COGNITION

[www.elsevier.com/locate/COGNIT](http://www.elsevier.com/locate/COGNIT)

Brief article

## Cognitive load selectively interferes with utilitarian moral judgment

Joshua D. Greene<sup>a,\*</sup>, Sylvia A. Morelli<sup>b</sup>, Kelly Lowenberg<sup>c</sup>,  
Leigh E. Nystrom<sup>d</sup>, Jonathan D. Cohen<sup>d</sup>

<sup>a</sup> *Department of Psychology, Harvard University, 33 Kirkland St., Cambridge, MA 02138, United States*

<sup>b</sup> *Department of Psychology, Stanford University, United States*

<sup>c</sup> *Stanford Law School, United States*

<sup>d</sup> *Department of Psychology, Center for the Study of Brain, Mind, and Behavior,  
Princeton University, United States*

Received 24 April 2007; revised 1 November 2007; accepted 2 November 2007

### 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.

© 2007 Published by Elsevier B.V.

**Keywords:** Moral judgment; Morality; Utilitarian; Cognitive control; Cognitive load

\* Corresponding author. Tel./fax: +1 617 495-3898

E-mail address: [jdgreene@wjh.harvard.edu](mailto:jdgreene@wjh.harvard.edu) (J.D. Greene).

## 27 1. Introduction

28 Traditional theories of moral development emphasize the role of controlled cog-  
29 nition in mature moral judgment (Kohlberg, 1969; Turiel, 1983), while a more recent  
30 trend emphasizes the role of intuitive or automatic emotional processes (Blair, 1995;  
31 Haidt, 2001; Mikhail, 2000; Nichols, 2002, 2004; Pizarro & Salovey, 2002; Rozin,  
32 Lowery, Imada, & Haidt, 1999; Van den Bos, 2003). Our previous work (Greene,  
33 Sommerville, Nystrom, Darley, & Cohen, 2001; Greene, Nystrom, Engell, Darley,  
34 & Cohen, 2004) suggests a synthesis of these two perspectives in the form of a  
35 “dual-process” theory (Chaiken & Trope, 1999; Kahneman, 2003; Lieberman,  
36 Gaunt, Gilbert, & Trope, 2002; Posner & Snyder, 1975) according to which both  
37 automatic emotional responses and more controlled cognitive responses play crucial  
38 and, in some cases, mutually competitive roles. More specifically, we have argued  
39 that utilitarian moral judgments are driven by controlled cognitive processes while  
40 non-utilitarian (characteristically deontological) judgments are driven by automatic  
41 emotional responses (Greene, in press).<sup>1</sup> Although non-utilitarian judgments do not  
42 typically involve the application of stereotypes, we propose that their dynamics may  
43 be similar to those observed in the application of stereotypes, with utilitarian judg-  
44 ments requiring additional cognitive resources (Devine, 1989; Gilbert & Hixon, 1991;  
45 Wegener & Petty, 1997) and with individuals varying in their response to cognitive  
46 demands depending on their affinities for (non-)utilitarian judgment (Cunningham  
47 et al., 2004; Devine, 1989).

48 Utilitarian (or, more broadly, consequentialist) judgments are aimed at maximiz-  
49 ing benefits and minimizing costs across affected individuals (Mill, 1861/1998). The  
50 utilitarian perspective contrasts with the deontological perspective (Kant, 1785/  
51 1959), according to which rights and duties often trump utilitarian considerations.<sup>2</sup>  
52 The tension between these two perspectives is nicely captured by the well-known  
53 footbridge dilemma (Thomson, 1986), in which a runaway trolley is about to run  
54 over and kill five people. One can save them by pushing a different person off of a  
55 footbridge and into the trolley’s path, stopping the trolley but killing the person  
56 pushed. A prototypical utilitarian would (if all else is equal) favor performing this  
57 action in the name of the greater good, while a prototypical deontologist would  
58 regard this as an unacceptable violation of rights, duties, etc.<sup>3</sup> With respect to this  
59 case, our dual-process theory specifies that automatic emotional responses incline  
60 people to disapprove of pushing the man off of the footbridge, while controlled cog-  
61 nitive processes incline people to approve of this action.

<sup>1</sup> 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).

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

<sup>3</sup> Deontological judgments in our sense need not be driven by the conscious application of deontological principles. See Cushman, Young, and Hauser (2006) and Greene (in press).

62 The evidence in support of this theory is compelling but limited. Previous work  
63 has demonstrated that “personal” moral dilemmas<sup>4</sup> like the footbridge dilemma,  
64 as compared to similar “impersonal” moral dilemmas, elicit increased activity in  
65 brain regions associated with emotion and social cognition (Greene et al., 2001,  
66 2004). These data, however, are correlational and do not demonstrate a causal rela-  
67 tionship between emotional responses and moral judgments. Three more recent stud-  
68 ies, however, provide evidence for such a causal relationship. Mendez, Anderson, &  
69 Shapria (2005) found that patients with frontotemporal dementia, who are known  
70 for their “emotional blunting,” were disproportionately likely to approve of the  
71 action in the footbridge dilemma (the utilitarian response). Koenigs et al. (2007) gen-  
72 erated similar results testing patients with emotional deficits due to ventromedial pre-  
73 frontal lesions. Finally, Valdesolo and DeSteno (2006) found that normal  
74 participants were more likely to approve of the action in the footbridge dilemma fol-  
75 lowing positive emotion induction, a manipulation aimed at counteracting negative  
76 emotional responses. Together, these three experiments provide strong evidence for  
77 our claim that non-utilitarian judgments in cases such as these are driven by emo-  
78 tional responses. These experiments do not, however, demonstrate the involvement  
79 of opposing cognitive control processes. As Haidt’s (2001) Social Intuitionist Model  
80 might suggest, these could be cases in which two equally automatic and emotional  
81 processes are competing, with one process compromised by brain damage or induced  
82 countervailing emotion.

83 Previous reaction time (RT) data (Greene et al., 2001) suggest that controlled cog-  
84 nitive processes drive utilitarian judgments, but these data are inconclusive.<sup>5</sup> Alter-  
85 native evidence comes from a subsequent neuroimaging study (Greene et al., 2004)  
86 in which brain regions associated with cognitive control exhibited increased activity  
87 preceding utilitarian moral judgments, made in response to difficult personal moral

<sup>4</sup> 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 for publication).

<sup>5</sup> 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 do not 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.)

88 dilemmas. Nevertheless, as before, these data are correlational and thus insufficient  
89 to establish a firm causal relationship between cognitive control processes and util-  
90 itarian moral judgment. Several recent studies suggest a role for controlled cognitive  
91 processes in moral judgment (Cushman, Young, & Hauser, 2006, Pizarro, Uhlmann,  
92 & Bloom (2003), Valdesolo & DeSteno, in press), but none establish a causal rela-  
93 tionship between controlled cognitive processes and utilitarian moral judgment.  
94 The primary aim of the present study is to do this.

## 95 2. Experiment

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

## 111 3. Methods

### 112 3.1. Participants and procedure

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

119 Enemy soldiers have taken over your village. They have orders to kill all  
120 remaining civilians. You and some of your townspeople have sought refuge  
121 in the cellar of a large house. Outside you hear the voices of soldiers who have  
122 come to search the house for valuables.

123 Your baby begins to cry loudly. You cover his mouth to block the sound. If  
124 you remove your hand from his mouth his crying will summon the attention  
125

126 of the soldiers who will kill you, your child, and the others hiding out in the  
127 cellar. To save yourself and the others you must smother your child to death.

128 Is it appropriate for you to smother your child in order to save yourself and the  
129 other townspeople?  
130

131 In all of the high-conflict dilemmas, the agent must decide whether to harm one  
132 person in order to save the lives of several people. Within this constraint, the struc-  
133 ture of these dilemmas varies. Notably, the high-conflict dilemmas vary in terms of  
134 whether the potential victim's death is inevitable and whether the agent is among  
135 those who will be saved by the action. Only high-conflict dilemmas are suitable for  
136 examining the conflict between utilitarian and non-utilitarian judgment processes.  
137 However, because these dilemmas share a common structure, we diminished repe-  
138 tition by presenting them along with the remaining dilemmas in our standard bat-  
139 Q7 tery. (Testing materials available online at [insert url].) We note that in each of the  
140 high-conflict dilemmas, the utilitarian response is also the affirmative (“Yes”)  
141 response. However, an examination of results from the “impersonal” dilemmas  
142 (see [Supplementary materials](#)) indicates that there is no general effect of affirmative  
143 vs. negative responses on RT. Dilemmas were presented as horizontally streaming  
144 text (left to right, 36 pt. courier font, approximately 16 characters per second). Par-  
145 ticipants indicated their judgments by pressing one of two buttons. There was no  
146 time limit. Dilemmas were presented in pseudorandom order in two blocks of  
147 twenty dilemmas each (control block and load block), subject to the constraint that  
148 there be five personal dilemmas in each block expected to be difficult (“high-con-  
149 flict”) based on previous work. Order of conditions/blocks was counter-balanced  
150 across participants. In the load condition, adapted from [Gilbert, Tafarodi, and](#)  
151 [Malone \(1993\)](#), a stream of numbers scrolled across the screen beneath the text  
152 and during the deliberation period. Numbers appeared at a rate of approximately  
153 3.5 per second.

154 Participants were instructed to hit a button each time they detected the number  
155 “5” (20% of digits) and were told that they would be checked for accuracy. To coun-  
156 teract practice effects (observed in pilot testing), the speed of the number stream  
157 increased to 7 numbers per second halfway through the load block. Participants were  
158 instructed to perform the main task and the digit-search task simultaneously. In both  
159 the load and no-load (control) conditions, participants were instructed to read aloud  
160 and were made aware of their being recorded by a nearby microphone.

### 161 3.2. Analysis

162 Our analysis here focuses exclusively on dilemmas identified as “high-conflict” by  
163 [Koenigs et al. \(2007\)](#). (See [Supplementary materials](#) for results from other dilem-  
164 mas.) This set of dilemmas is consistent with those observed to be difficult in our pre-  
165 vious work ([Greene et al., 2004](#)). Data were trimmed based on RT to within two *SDs*  
166 of the group mean. RT data were analyzed using a mixed effects model and the  
167 restricted maximum likelihood (REML) fitting method. This model included partic-

168 participant as a random effect and load and judgment as fixed effects. Judgment data were  
169 analyzed using a likelihood ratio  $\chi^2$  test for the effect of load.

#### 170 4. Results

171 There was no main effect of load ( $F(1, 83.2) = 2.29, p = .13$ ). There was a marginally  
172 significant main effect of judgment ( $F(1, 71.7) = 3.9, p = .052$ ), with longer RT  
173 for utilitarian judgments (LS Means (SEM) ms: utilitarian = 6130 (207), non-utilitarian = 5736 (221)).  
174 Critically, we observed the predicted interaction between load and judgment ( $F(1, 62.9) = 8.5, p = .005$ ). (See Fig. 1.)  
175 Planned post hoc contrasts revealed a predicted increase in RT for utilitarian judgment under load  
176 ( $F(1, 106.3) = 9.8, p = .002$ ; LS Means (SEM) ms: load = 6506 (238), no load = 5754 (241)),  
177 but no difference in RT for non-utilitarian judgment resulting from load  
178 ( $F(1, 169.6) = .10, p = .75$ ; LS Means: load = 5691 (264), no load = 5781 (261)).  
179 Utilitarian judgments were slower than non-utilitarian judgments under load  
180 ( $p = .001$ ), but there was no such effect in the absence of load ( $p = .91$ ). This general  
181 pattern also held when item, rather than participant, was modeled as a random  
182 effect, although the results in this analysis were not as strong. There was no effect  
183 of load on judgment ( $\chi^2(1, N = 82) = .24, p = .62$ ), with 61% utilitarian judgments  
184 under load (95% CI: 57–66%) and 60% (95% CI: 55–64%) in the absence of load.  
185

186 We conducted a follow-up analysis to explore the possibility that patterns of RT  
187 vary systematically among participants based on their tendency to make utilitarian

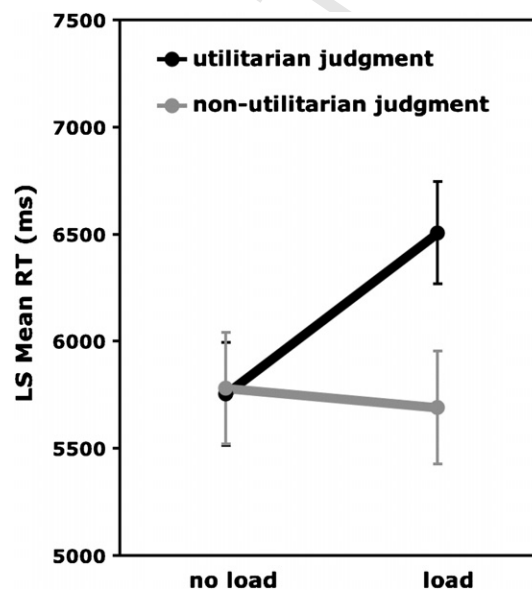


Fig. 1. The effect of cognitive load on RT for utilitarian (black) and non-utilitarian (gray) moral judgment. Data shown for the entire group ( $n = 82$ ). Error bars indicate standard error of the mean.

188 vs. non-utilitarian judgments. We ranked participants based on the percentage of utilitarian  
 189 judgments made in response to high-conflict dilemmas and divided partici-  
 190 pants into equal high-utilitarian and low-utilitarian groups based on these  
 191 rankings. The high-utilitarian group averaged 80% utilitarian judgments, the low-utili-  
 192 tarian group 42%. Both groups exhibited the predicted interaction between load and  
 193 judgment (high-utilitarian:  $F(1,39.8) = 3.0$ ,  $p = .046$ , one-tailed; low-utilitarian:  
 194  $F(1,30.8) = 4.4$ ,  $p = .02$ , one-tailed). More specifically, both groups exhibited  
 195 increased RT for utilitarian judgment under load (high-utilitarian:  $F(1,43.3) = 6.0$ ,  
 196  $p = .01$ , one-tailed, LS Means (SEM) ms: load = 6247 (339), no load = 5371 (340);  
 197 low-utilitarian:  $F(1,75.8) = 3.3$ ,  $p = .04$ , one-tailed, LS Means (SEM) ms:  
 198 load = 6841 (331), no load = 6258 (337)), and neither group exhibited an effect of  
 199 load on non-utilitarian judgment ( $p > .7$ ) (see Fig. 2). The high-utilitarian group  
 200 was generally faster than the low-utilitarian group to make utilitarian judgments  
 201 ( $F(1,107.3) = 3.5$ ,  $p = .06$ ), but RT did not differ significantly between groups for  
 202 non-utilitarian judgments ( $p = .38$ ). Load did not have a significant effect on judg-  
 203 ment in either group ( $p > .6$ ). Low-utilitarian participants made 43% utilitarian judg-  
 204 ments under load (95% CI: 37–50%) and 41% utilitarian judgments in the absence of  
 205 load (95% CI: 35–48%). High-utilitarian participants made 79% utilitarian judgments  
 206 under load and (95% CI: 73–84%) and 78% utilitarian judgments in the absence of  
 207 load (95% CI: 72–83%).

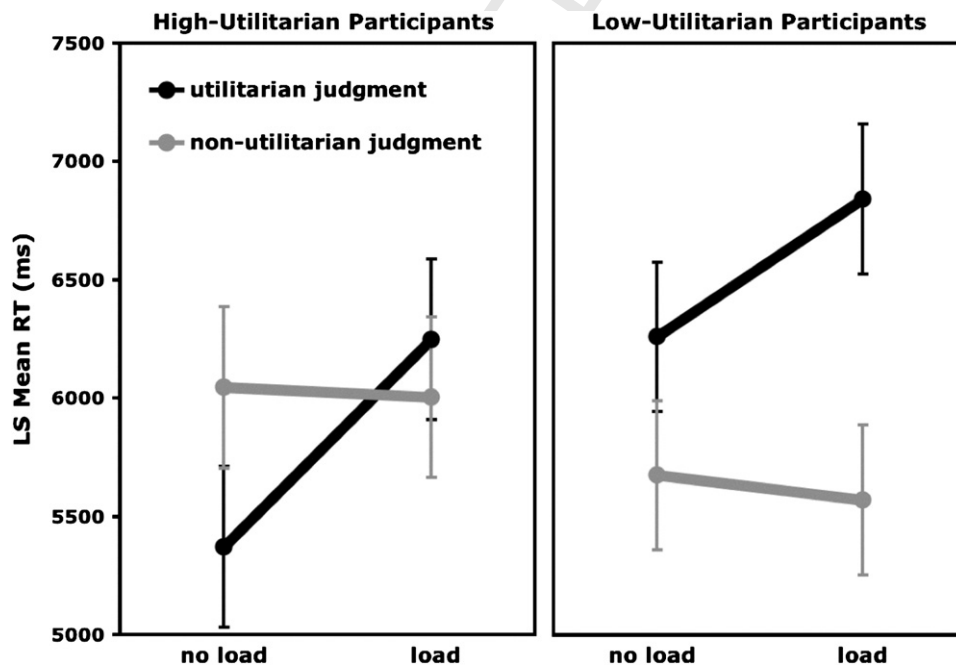


Fig. 2. Effects of load on RT for high-utilitarian ( $n = 41$ ) and low-utilitarian ( $n = 41$ ) groups.

## 208 5. Discussion

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

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

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

250 In light of this hypothesis, one might expect utilitarian judgments to be slower than  
251 non-utilitarian judgments in the absence of load. This effect was not observed in our

252 sample as a whole, but was observed in low-utilitarian participants. (Fig. 2, right.)  
253 Why did not the high-utilitarian participants exhibit this effect? One possibility is that  
254 there are competing effects at work in these participants. On the one hand, making a  
255 counter-intuitive judgment requires additional cognitive resources, implying  
256 increased RT (as seen in the low-utilitarian participants). On the other hand, high-  
257 utilitarian participants exhibit a general bias toward utilitarian judgment, which  
258 appears to involve decreased RT for utilitarian judgment. In the absence of load,  
259 the latter effect may dominate. Consistent with this idea, we found a robust correla-  
260 tion ( $r = -.43, p < .0001$ ) between a participant's tendency toward utilitarianism (i.e.  
261 percent utilitarian judgments made) and that participant's average RT for utilitarian  
262 judgments in the absence of load.<sup>6</sup> Interestingly, we found that utilitarian tendency  
263 bore no relationship to RT for utilitarian judgments under load ( $r = .08, p = .47$ )  
264 and no relationship to RT for non-utilitarian judgments ( $r = -.16$  (load),  $r = .04$   
265 (no load),  $p > .1$ ). This suggests that there is an additional process that drives down  
266 RT in high-utilitarians in the absence of load, although this process still remains sus-  
267 ceptible to cognitive interference. To account for this process will require a significant  
268 expansion and/or modification of our dual-process theory. One possibility is that util-  
269 itarian normative principles are more consciously accessible than competing deonto-  
270 logical principles (Cushman et al., 2006), and that they are therefore more easily  
271 routinized into a decision procedure. This hypothesis may be tested via an experiment  
272 in which one "evens the playing field" by making a competing deontological principle  
273 (e.g. "It's wrong to harm someone as a means to an end") more accessible.

274 Several other issues deserve attention: First, the present results do not address the  
275 appraisal mechanisms that govern the emotional responses that, according to our  
276 theory, support non-utilitarian judgments. These mechanisms may be sensitive to  
277 familiar moral distinctions, such as the distinction between harmful actions and  
278 Q3 omissions (Cushman et al., 2006; Haidt & Baron, 1996; Schaich Borg et al., 2006)  
279 and the distinction between harms that are intended and those that are merely fore-  
280 seen (Aquinas, unknown/2006; Cushman et al., 2006; Mikhail, 2000; Schaich Borg  
281 et al., 2006). Other distinctions may be operative here as well (Greene et al., submit-  
282 ted for publication; Rozman & Baron, 2002; Waldmann & Dieterich, 2007). For  
283 present purposes we are agnostic as to which non-utilitarian principles are operative  
284 in these judgments. We are likewise agnostic as to whether these principles are suit-  
285 able normative moral rules (Nichols & Mallon, 2006). We note that neither our dual-  
286 process theory nor the present results implies that the human brain houses systems  
287 specifically dedicated to utilitarian and deontological judgment. On the contrary, we  
288 have argued that, at least in the case of utilitarian judgment, the relevant cognitive  
289 systems are somewhat domain-general (Cohen, 2005). Finally, while the present  
290 results, bolstered by previous neuroimaging data (Greene et al., 2004), indicate that  
291 controlled cognitive processes play a special role in utilitarian judgments, these  
292 results leave open many further details concerning the nature (e.g. reasoning vs.

<sup>6</sup> Data were z-transformed separately for each participant.

10

*J.D. Greene et al. / Cognition xxx (2008) xxx–xxx*

293 inhibitory control), sequencing (e.g. parallel vs. serial), or timing of these processes.  
 294 These issues remain to be explored in future research.

## 295 6. Uncited reference

296 Q1 Knobe (2005).

## 297 Acknowledgement

298 We thank Jonathan Haidt, whose comments and suggestions prompted this re-  
 299 search. We also thank Andrew Conway, two anonymous reviewers, and the NIH  
 300 (MH067410, award to J.D.G.).

## 301 Appendix A. Supplementary data

302 Supplementary data associated with this article can be found, in the online ver-  
 303 sion, at doi:10.1016/j.cognition.2007.11.004.

## 304 References

- 305 Aquinas, T. (unknown/2006). *Summa Theologiae*: Cambridge University Press.  
 306 Blair, R. J. (1995). A cognitive developmental approach to mortality: Investigating the psychopath.  
 307 *Cognition*, 57(1), 1–29.  
 308 Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology*. New York: Guilford  
 309 Press.  
 310 Cohen, J. D. (2005). The vulcanization of the human brain: A neural perspective on interactions between  
 311 cognition and emotion. *Journal of Economic Perspectives*, 19, 3–24.  
 312 Cushman, F., Young, L., & Hauser, M. (2006). The role of conscious reasoning and intuition in moral  
 313 judgment: Testing three principles of harm. *Psychological Science*, 17(12), 1082–1089.  
 314 Cunningham, W. A., Johnson, M. K., Raye, C. L., Chris Gatenby, J., Gore, J. C., & Banaji, M. R. (2004).  
 315 Separable neural components in the processing of black and white faces. *Psychological Science*, 15(12),  
 316 806–813.  
 317 Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of*  
 318 *Personality and Social Psychology*, 56, 5–18.  
 319 Gilbert, D. T., & Hixon, J. G. (1991). The trouble with thinking: Activation and application of stereotypic  
 320 beliefs. *Journal of Personality and Social Psychology*, 60(4), 309–317.  
 321 Gilbert, D. T., Tafarodi, R. W., & Malone, P. S. (1993). You can't not believe everything you read. *Journal*  
 322 *of Personality and Social Psychology*, 65(2), 221–233.  
 323 Greene, J. D. (in press). The secret joke of Kant's soul. In W. Sinnott-Armstrong (Ed.), *Moral psychology:*  
 324 Q4 *morality in the brain* (Vol. 3). Cambridge, MA: MIT Press..  
 325 Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., & Cohen, J. D. (2004). The neural bases of  
 326 cognitive conflict and control in moral judgment. *Neuron*, 44(2), 389–400.  
 327 Greene, J., Lindsay, D., Clarke, A., Lowenberg, K., Nystrom, L., & Cohen, J. (submitted for publication).  
 328 Q5 Pushing moral buttons: The interaction between personal force and intention in moral judgment.  
 329 Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. (2001). An fMRI  
 330 investigation of emotional engagement in moral judgment. *Science*, 293(5537), 2105–2108.

- 331 Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment.  
332 *Psychological Review*, 108, 814–834.
- 333 Haidt, J., & Baron, J. (1996). Social roles and the moral judgment of acts and omissions. *European Journal*  
334 *of Social Psychology*, 26, 201–218.
- 335 Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *The*  
336 *American Psychologist*, 58(9), 697–720.
- 337 Kant, I. (1785/1959). *Foundation of the metaphysics of morals* (L. W. Beck, Trans.). Indianapolis: Bobbs-  
338 Merrill.
- 339 Koenigs, M., Young, L., Adolphs, R., Tranel, D., Cushman, F., Hauser, M., et al. (2007). Damage to the  
340 prefrontal cortex increases utilitarian moral judgments. *Nature*, 446(7138), 908–911.
- 341 Kohlberg, L. (1969). Stage and sequence: The cognitive-developmental approach to socialization. In D. A.  
342 Goslin (Ed.), *Handbook of socialization theory and research* (pp. 347–480). Chicago: Rand McNally.
- 343 Knobe, J. (2005). Theory of mind and moral cognition: Exploring the connections. *Trends in Cognitive*  
344 *Sciences*, 9(8), 357–359.
- 345 Lieberman, M. D., Gaunt, R., Gilbert, D. T., & Trope, Y. (2002). Reflection and reflexion: A social  
346 cognitive neuroscience approach to attributional inference. *Advances in Experimental Social Psychol-*  
347 *ogy*, 34, 199–249.
- 348 Mendez, M. F., Anderson, E., & Shapira, J. S. (2005). An investigation of moral judgement in  
349 frontotemporal dementia. *Cognitive and Behavioral Neurology*, 18(4), 193–197.
- 350 Mikhail, J. (2000). *Rawls' linguistic analogy: A study of the "Generative Grammar" model of moral theory*  
351 *described by John Rawls in A Theory of Justice*. Unpublished doctoral dissertation, Cornell University.
- 352 Mill, J.S. (1861/1998). Utilitarianism. In R. Crisp (Ed.), New York: Oxford University Press.
- 353 Nichols, S. (2004). *Sentimental rules: On the natural foundations of moral judgment*. New York: Oxford  
354 University Press.
- 355 Nichols, S. (2002). Norms with feeling: Towards a psychological account of moral judgment. *Cognition*,  
356 84(2), 221–236.
- 357 Nichols, S., & Mallon, R. (2006). Moral dilemmas and moral rules. *Cognition*, 100(3), 530–542.
- 358 Posner, M. I., & Snyder, C. R. R. (1975). Attention and cognitive control. In R. L. Solso (Ed.),  
359 *Information processing and cognition* (pp. 55–85). Hillsdale, NJ: Erlbaum.
- 360 Pizarro, D. A., & Salovey, P. (2002). On being and becoming a good person: The role of emotional  
361 intelligence in moral development and behavior. In J. Aronson (Ed.), *Improving academic achievement:*  
362 *Impact of psychological factors on education* (pp. 247–266). San Diego: Academic Press.
- 363 Pizarro, D., Uhlmann, E., & Bloom, P. (2003). Causal deviance and the attribution of moral  
364 responsibility. *Journal of Experimental Social Psychology*, 39, 653–660.
- 365 Royzman, E. B., & Baron, J. (2002). The preference for indirect harm. *Social Justice Research*, 15,  
366 165–184.
- 367 Rozin, P., Lowery, L., Imada, S., & Haidt, J. (1999). The CAD triad hypothesis: A mapping between three  
368 moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity).  
369 *Journal of Personality and Social Psychology*, 76(4), 574–586.
- 370 Thomson, J. J. (1986). *Rights, restitution, and risk: Essays in moral theory*. Cambridge, Mass: Harvard  
371 University Press.
- 372 Turiel, E. (1983). *The development of social knowledge: Morality and convention*. Cambridge, England:  
373 Cambridge University Press.
- 374 Valdesolo, P., & DeSteno, D. (2006). Manipulations of emotional context shape moral judgment.  
375 *Psychological Science*, 17(6), 476–477.
- 376 Q6 Valdesolo, P., & DeSteno, D. (in press). Moral hypocrisy: The flexibility of virtue. *Psychological Science*.
- 377 Van den Bos, K. (2003). On the subjective quality of social justice: The role of affect as information in the  
378 psychology of justice judgments. *Journal of Personality and Social Psychology*, 85, 482–498.
- 379 Waldmann, M. R., & Dieterich, J. H. (2007). Throwing a bomb on a person versus throwing a person on a  
380 bomb: Intervention myopia in moral intuitions. *Psychological Science*, 18(3), 247–253.
- 381 Wegener, D., & Petty, R. (1997). The flexible correction model: The role of naive theories of bias in bias  
382 correction. In M. Zanna (Ed.), *Advances in experimental social psychology*. Mahwah, NJ: Erlbaum.
- 383