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Conflict detection during moral decision-making: evidence for deontic reasoners' utilitarian sensitivity

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ABSTRACT

Moral dilemmas often force us to decide between deontological (harming others is wrong) and utilitarian (harming others can be acceptable depending on the consequences) considerations. Cognitive scientists have shown that utilitarian responders typically engage demanding deliberate thinking to override a conflicting intuitive deontological response. A key question is whether deontic responders also take utilitarian considerations into account and detect that there are conflicting responses at play. The present study addressed this issue by contrasting people's processing of moral dilemmas in which utilitarian and deontological considerations cued conflicting or non-conflicting decisions. Results showed that deontic responders were slower and less confident about their decision when solving the conflict (vs. no-conflict) dilemmas. This suggests that they are considering both deontic and utilitarian aspects of their decision and indicates that a deontic decision is more informed and less oblivious than it might appear.

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Moral judgment; decision-making; conflict detection; dual-process theory; moral reasoning

Introduction

In 2009 there was an outbreak of the Swine Flu or H1N1 virus which posed a serious threat to the lives of many people. At the time, US Congress was considering the use of a recently invented vaccination knowing that its side-effects could potentially harm some individuals who would take it (Munsterhjelm-Ahumada, 2012). Congress decided that the potential harm to a small number of people was outweighed by the potential benefits to the majority of the population and voted in favour of the vaccination. In terms of morality, this decision can be labelled as utilitarian. The moral principle of utilitarianism implies that the morality of an action is determined by its consequences. Here harming others is acceptable if it increases the well-being of a greater number of people. Alternatively, the moral principle of deontology implies that the morality of an action depends on the intrinsic nature of the action. Here harming others is considered wrong regardless of its consequences and potential benefits. Hence, from a deontological point of view, the Swine Flu vaccination should not have been accepted. These conflicting principles of utilitarianism and deontology are at play in a wide range of present day moral dilemmas: from the decision to spend government resources to develop treatment for fatal but rare diseases, to the acceptability of using torture to extract information from captured terrorists (Dershowitz, 2014; Gericke, Riesberg, & Busse, 2005; London, 2012).

Contemporary psychological research has focused on the cognitive mechanisms of both types of morality (e.g. Bialek, Terbeck, & Handley, 2014; Conway & Gawronski, 2013; Greene, 2015; Kahane, 2014; Moore, Stevens, & Conway, 2011; Nichols, 2004; Valdesolo & DeSteno, 2006). An influential theoretical backdrop is the popular dual-process model of thinking (Evans, 2008; Kahneman, 2011), which describes cognition as an interplay of fast, effortless, intuitive (i.e. so called "System 1") processing and slow, working-memory dependent, deliberate (i.e. so-called "System 2") processing. Inspired by this dichotomy, the framework of Greene (2014) and Greene and Haidt (2002) has associated utilitarian judgments with deliberate System 2 processing and deontic judgments with intuitive System 1 processing. The basic idea is

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that giving an utilitarian response to moral dilemmas requires that one engages in System 2 thinking and allocates cognitive resources to override an intuitively cued emotional deontic System 1 response that primes us not to harm others. Consistent with this view, it has been shown that people higher in working-memory capacity tend to be more likely to make utilitarian judgments (Moore, Clark, & Kane, 2008). In addition, experimental manipulations that limit the time (Suter & Hertwig, 2011) or cognitive resources (Trémolière, De Neys, & Bonnefon, 2012) that people can allocate to the decision also make it less likely that utilitarian judgments will be made.

Taken together one might claim that there is considerable evidence that supports the idea that utilitarian responders typically manage to recruit the deliberate System 2 to override a conflicting intuitive deontological response (but see also Baron, Scott, Fincher, & Emlen Metz, 2015; Kahane, 2014; Klein, 2011; Trémolière & Bonnefon, 2014). However, the precise nature of the cognitive processing that underlies deontic responders' decision is less clear. A key but somewhat neglected question is whether or not deontic responders also detect that there are conflicting responses at play. That is, do deontic responders blindly rely on the intuitively cued deontological System 1 response without taking utilitarian considerations into account? Or, do they also realise that there is an alternative to the cued deontological response, consider the utilitarian view but simply decide against it in the end? Bluntly put, it is clear that deontic and utilitarian responders solve the intrinsic conflict between deontological and utilitarian considerations differently. What is not clear is whether they actually experience the same conflict.

From a theoretical point of view, addressing the conflict detection issue is paramount for the development of any viable dual-process model of human cognition (De Neys, 2012; De Neys & Bonnefon, 2013; Evans & Stanovich, 2013; Handley & Trippas, 2015; Kahneman, 2011). The present paper starts to focus on this core question in the specific case of the dual-process model of moral reasoning by testing deontological responder's moral conflict detection sensitivity. To see if individuals who make deontological decisions detect conflict between utilitarian and deontic aspects of a problem, we designed a study in which participants' processing of conflict and no-conflict dilemmas was contrasted. In research on morality, participants are typically presented with dilemmas in which they are asked whether they would be willing to sacrifice a small number of persons in order to save several more (e.g. kill one to save five). In these classic scenarios utilitarian and deontological considerations cue conflicting responses (hence, conflict dilemmas). Based on utilitarian considerations one would make the sacrifice, based on deontological considerations one would not. We have reversed the dilemmas by asking participants whether they would be willing to sacrifice more people to save less (e.g. kill five to save one). In these no-conflict or control dilemmas both deontological and utilitarian considerations cue the exact same decision to refrain from making the sacrifice.

By contrasting processing measures such as response latencies and response confidence when solving both types of dilemmas, we can measure participants' conflict detection sensitivity. Indeed, basic research on conflict detection in the cognitive control and reasoning field has shown that detection of conflict between competing responses typically results in increased decision times and decreased response confidence (e.g. Botvinick, 2007; Botvinick, Braver, Barch, Carter, & Cohen, 2001; De Neys & Glumicic, 2008; De Neys, Rossi, & Houdé, 2013; Mevel et al., 2015; Pennycook, Trippas, Handley, & Thompson, 2014; Stupple, Ball, & Ellis, 2013). Bluntly put, when you are faced with competing responses, this will make you doubt and slow you down. Hence, if deontological responders to classic moral dilemmas take utilitarian considerations into account and detect that they conflict with the cued deontological response, response confidence should be lower and decision times should be longer when solving conflict vs. control no-conflict dilemmas in which utilitarian and deontological considerations do not conflict. If deontic responders do not consider utilitarian principles, then the presence or absence of intrinsic conflict between utilitarian and deontological considerations should not have an impact on their processing. In this case, response confidence and decision latencies for conflict and no-conflict problems should not differ.

Methods

Participants

A total of 174 individuals (82 female, mean age = 35.56, SD = 10.55, range 19–72) recruited on the

Amazon Mechanical Turk platform participated in the study. Only native English speakers from the USA or Canada were allowed to participate. Participants were paid a fee of $0.70.

Procedure and materials

We adopted two popular dilemmas, the trolley and plane dilemma, based on the work of Royzman and Baron (2002) and Foot (1978). Both dilemmas have the same core structure but differ in surface content (see Table 1). Each participant was presented with the two dilemmas. One dilemma was presented in a conflict version and the other one in a no-conflict version. In the conflict version, participants were asked whether they were willing to sacrifice a small number of persons in order to save several more. In the non-conflict version, participants were asked whether they were willing to sacrifice more people to save less. For each participant, it was randomly determined which dilemma was presented as conflict and no-conflict problem. Presentation order of the two dilemmas was also randomised. Each dilemma was presented in each version an equal number of times.

After participants had read the dilemma preambles, they were asked to click on a confirmation button. Next, they were presented with the critical question that asked them about their personal willingness to act and make the described sacrifice themselves. The exact same question ("Are you willing to do the described action?") was used in all versions. Hence, on the conflict version, the utilitarian response is to answer "yes" and the deontic response is to answer "no". On the no-conflict problems both utilitarian and deontic considerations cue a "no" answer. The decision question was presented below the preambles (which stayed on the screen). Decision time was defined as the time that passed between the presentation of the decision question and answer selection. Hence, while superficial item differences between the conflict and no-conflict versions might affect the initial preambles' reading time, they cannot confound the critical decision time. After participants had made their decision, they were asked to indicate their response confidence ("How confident are you in your decision?") on a 7-point rating scale ranging from 1 (not confident at all) to 7 (extremely confident).

After the two dilemmas had been presented, participants were presented with a filler task (the three items of the Cognitive Reflection Test which results were not analysed for the present study). Finally, they were presented with four open-ended verification questions (two for each dilemma) that were intended as a basic control to verify whether our online participants respected the instructions to carefully read the scenarios. Participants were asked to recall dilemma details (i.e. precise number of people on each track or in plane). Participants were clearly informed that their scenario recall would be tested to see whether they had actually read the problems. Overall, results of this control measure indicated that participants complied with the instructions. Average recall accuracy was 84% ($M = 3.34$ out of 4, $SD = 0.95$). In addition, the vast majority of participants (81%, $n = 141$) also answered at least one of the two questions for each dilemma correctly. An exploratory analysis indicated that the small subgroup of "zero recall" participants (19%, $n = 33$) who failed to do this exhibited somewhat deviant decision choices (i.e. a high proportion—39% vs. 6% in rest of sample—of "yes" responses

Table 1. Exact wording of the conflict and non-conflict version of the dilemmas that were used in the study.

Version	Exact wording of dilemma
Plane conflict	You are a U.S. military base commander. A missile has just been mistakenly fired from your base at a commercial airliner. If nothing is done, 100 passengers of the airliner will die. You can alter the course of the commercial airliner. The airliner will be safe, but the missile will destroy another commercial airliner (with 60 people on-board) flying right behind the airliner. *Would you do the described action?*
Plane non-conflict	You are a U.S. military base commander. A missile has just been mistakenly fired from your base at a commercial airliner. If nothing is done, 60 passengers of the airliner will die. You can alter the course of the commercial airliner. The airliner will be safe, but the missile will destroy another commercial airliner (with 100 people on-board) flying right behind the airliner. *Would you do the described action?*
Trolley conflict	There is a runaway trolley barrelling down the railway tracks. Ahead, on the tracks, there are five people tied up and unable to move. The trolley is headed straight for them. You are standing some distance off in the train yard, next to a lever. If you pull this lever, the trolley will switch to a different set of tracks. Unfortunately, you notice that there is one person on the side track. This person will die if you change the tracks, but five other will be saved. *Would you do the described action?*
Trolley non-conflict	There is a runaway trolley barrelling down the railway tracks. Ahead, on the tracks, there is one man tied up and unable to move. The trolley is headed straight for him. You are standing some distance off in the train yard, next to a lever. If you pull this lever, the trolley will switch to a different set of tracks. Unfortunately, you notice that there are five people on the side track. The one person will be saved if you change the tracks, but five other will die. *Would you do the described action?*

on no-conflict problems which are cued by neither deontological nor utilitarian considerations). Since this specific recall and decision pattern might indicate that these participants simply misread the scenario we ran all our analyses for each of our dependent variables both with the full sample and while excluding the subgroup of "zero-recallers". However, the pattern was completely consistent for both analyses sets. All reported data and analyses in the results section concern the full sample without any exclusion. In the Appendix, the interested reader can find a table with descriptive statistics for the sample in which both "zero-recallers" and any participant who answered "yes" on no-conflict problems were excluded.

Results and discussion

Decisions

Participants were asked to decide whether they were willing to make a sacrifice and perform the action that was described in each dilemma. Figure 1 gives an overview of participants' willingness to make a sacrifice (i.e. percentage "yes" responses) in the different dilemmas. Recall that on the conflict version the utilitarian response is to answer "yes" and the deontic response is to answer "no". On the non-conflict problems both utilitarian and deontic considerations lead to a "no" answer. As Figure 1 shows, overall, participants were willing to make a sacrifice in 62% of the cases on the conflict versions. Hence, in line with previous studies (e.g. Gold, Colman, & Pulford, 2014; Royzman & Baron, 2002), participants gave utilitarian responses to the conflict dilemmas in the majority of cases. Not surprisingly, on the no-conflict problems, the average willingness to make a sacrifice was much lower (i.e. 12%), Wilcoxon matched-pairs test, $W = 22794$, $Z = 9.64$, $p < .001$. The same pattern was observed when the Plane dilemma, Mann–Whitney $U = 2037$, $Z = 6.49$, $p < .001$, and Trolley dilemma, Mann–Whitney $U = 1713$, $Z = 7.28$, $p < .001$, were analysed separately. In summary, the decision pattern was in line with expectations.

Conflict detection measures

Obviously, our primary interest lies in the two conflict detection measures (i.e. decision time and confidence data). The key contrast concerns the decision times and confidence ratings for conflict vs. no-conflict problems. We first focus on the contrast analyses for deontic ("no") conflict responders. Next, we present the analyses for utilitarian ("yes") conflict responders. Note that we only use no-conflict response in which participants refuse to make a sacrifice (i.e. "no" responses). No-conflict decisions to sacrifice many to save few are cued by neither deontological nor utilitarian considerations. These "other" responses were rare but were excluded from the contrast analyses to give us the purest possible test of participants' conflict sensitivity. Table 2 gives a complete overview of the findings. All response time data were logtransformed prior to analysis (skewness in all conditions was >3, SE = .23).

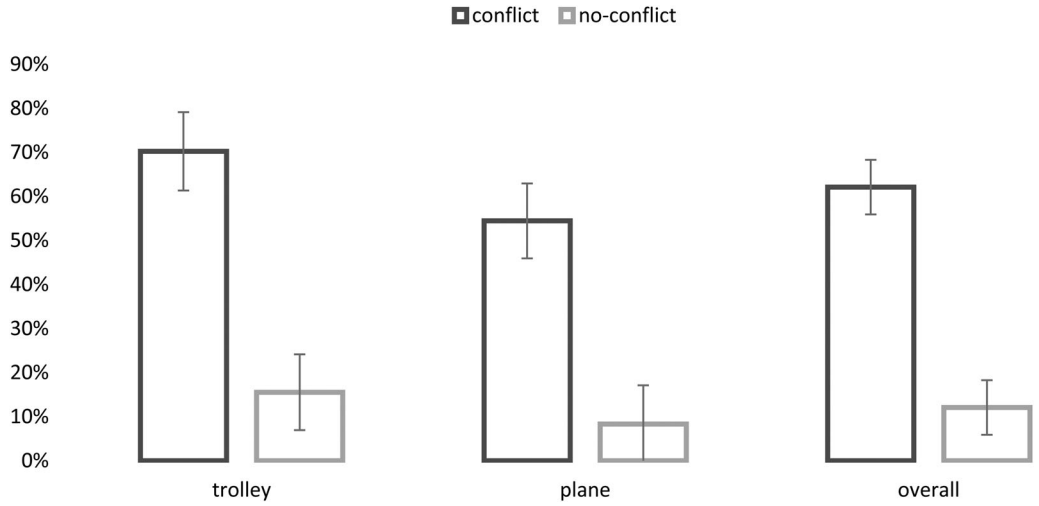

Figure 1. Average willingness to make a sacrifice (% "yes" responses) in the different dilemmas. Error bars represent 95% confidence intervals.

Table 2. Mean confidence ratings, decision time, and reading time for conflict and no-conflict dilemma versions as a function of the dilemma response decision.

		Conflict version		No-conflict version	
		Deontological response ("no")	Utilitarian response ("yes")	Deontological/utilitarian response ("no")	Other response ("yes")
Trolley	*n*	25	59	76	14
	Confidence (1–7)	4.52 (2.20)	5.39 (1.40)	6.12 (1.08)	4.71 (1.68)
	Raw decision time (s)	10.62 (14.54)	5.78 (3.29)	6.31 (8.27)	13.69 (13.27)
	Decision time (s)	7.39 (2.09)	5.21 (1.54)	5.13 (1.66)	9.38 (2.41)
	Raw reading time (s)	27.92 (10.60)	24.01 (11.90)	25.38 (13.89)	83.86 (222.61)
	Reading time (s)	26.18 (1.07)	21.83 (1.06)	22.92 (1.54)	25.06 (3.38)
Plane	*n*	41	49	77	7
	Confidence (1–7)	4.61 (1.87)	4.51 (1.65)	6.04 (1.24)	4.14 (2.34)
	Raw decision time (s)	14.98 (27.18)	10.56 (18.48)	5.64 (2.45)	6.45 (1.50)
	Decision time (s)	8.08 (2.46)	6.95 (1.98)	5.24 (1.45)	6.27 (1.31)
	Raw reading time (s)	32.54 (28.90)	40.62 (43.87)	39.03 (30.35)	23.04 (8.84)
	Reading time (s)	26.60 (1.78)	30.36 (1.98)	34.08 (1.61)	21.33 (1.57)
Overall	*n*	66	108	153	21
	Confidence (1–7)	4.58 (1.99)	4.99 (1.57)	6.08 (1.16)	4.52 (1.89)
	Raw decision time (s)	13.33 (23.18)	7.95 (12.84)	5.97 (6.07)	11.27 (11.29)
	Decision time (s)	7.82 (2.31)	5.93 (1.78)	5.19 (1.56)	8.20 (2.12)
	Raw reading time (s)	30.79 (23.67)	31.40 (31.70)	32.25 (24.55)	63.59 (181.92)
	Reading time (s)	26.46 (1.65)	25.36 (1.79)	27.98 (1.64)	23.75 (2.76)

Notes: Standard deviations in parentheses. Decision and reading times were logtransformed prior to analysis. Raw latencies and anti-logged latencies are presented here. Confidence rating scale ranged from 1 (not confident at all) to 7 (extremely confident). The critical contrast to examine deontic responders' conflict detection sensitivity is highlighted in grey.

Deontic responders

Each participant solved one conflict and one no-conflict dilemma. Univariate within-subject ANOVA analyses on the decision time and confidence data indicated that deontic conflict responders tended to process the conflict problems differently than no-conflict responses. Decision times increased (with about 1.71 s in anti-logged units; raw latencies = 6.82 s), $F(1, 65) = 12.49$, $p = .001$, $\eta_p^2 = .16$, and response confidence decreased with 17.6% (i.e. a 1.23 point decrease on a 7-point scale), $F(1, 65) = 28.74$, $p < .001$, $\eta_p^2 = .31$, when solving the conflict dilemmas. In summary, the decision time and confidence data are consistent with the claim that deontic responders are sensitive to conflict between deontic and utilitarian considerations of a moral dilemma. This implies that they are considering both deontic and utilitarian aspects of their decision.

Table 2 also present the dilemma reading times (i.e. the time it took people to read the preambles before they were questioned about their personal willingness to act and make a personal moral decision). It is important to note that the dilemma reading times for the conflict and no-conflict items did not differ significantly, $F(1, 65) < 1$. Hence, the longer decision latencies we observed do not simply result from superficial item characteristics that could have made the conflict problems harder to read. Although drawing a strict distinction between reading and decision-making is always somewhat arbitrary, this pattern at least suggests that the differential response times seem to be specifically tied to the moral decision-making process rather than mere reading per se.

Participants solved problems based on the Plane and Trolley dilemma. Table 2 also gives an overview of the findings for each dilemma separately. This readily indicates that the overall decision time and confidence contrast pattern is observed for both dilemmas. To test this directly we also ran a univariate between-subjects ANOVA[1] for each dilemma separately. As suggested by visual inspection of Table 2, confidence decreased for deontic conflict responses vs. no-conflict responses on both the Trolley, $F(1, 99) = 23.31$, $p < .001$, $\eta_p^2 = .19$, and Plane, $F(1, 116) = 24.70$, $p < .001$, $\eta_p^2 = .18$, dilemmas. Likewise, decision times for deontic conflict responses increased both on the Trolley, $F(1, 99) = 7.66$, $p < .01$, $\eta_p^2 = .07$, and Plane dilemma, $F(1, 116) = 15.58$, $p < .001$, $\eta_p^2 = .11$. Reading times for the Trolley dilemma did not differ, $F(1, 99) = 2.01$, $p = .16$. For the Plane dilemma, there was a slight difference in reading times but in the direction of

[1]Given the smaller *n* in the group of deontic conflict responders vs. no-conflict responders, some might want to question the use of a between-subjects ANOVA. For completeness, all between-subject analyses here were also run with non-parametric statistics (Mann–Whitney *U*) and the results were fully consistent.

longer reading times for no-conflict responses, $F(1, 116) = 6.26$, $p < .05$, $\eta_p^2 = .05$. Hence, by and large the overall trends are replicated when both dilemmas are analysed separately. The consistent nature of the findings across the two different dilemmas supports the robustness of the observed detection trends and indicates that they are not driven by one peculiar item type.

Utilitarian responders

Our main theoretical interest concerned the conflict detection findings for deontic conflict responders. For completeness, we also analysed the conflict contrasts for utilitarian conflict responders. It should be noted that these findings face a fundamental methodological problem (e.g. Conway & Gawronski, 2013). Deontic considerations cue "no" responses on the conflict and no-conflict problems. Utilitarian considerations cue a "no" response on no-conflict problems, but a "yes" response (i.e. willingness to make a sacrifice) on conflict problems. Hence, in the case of utilitarian responses conflict and no-conflict responses not only differ in the presence or absence of conflict but also in terms of the decision made (i.e. willingness to take action or not). Consequently, when contrasting the conflict and no-conflict detection indexes, results might be confounded by the decision factor. Any potential processing difference might be attributed to the differential decision rather than to conflict sensitivity. Therefore, we present the utilitarian conflict contrast for completeness here but refrain from drawing any further conclusions.

Results showed that just as with deontic responses, confidence overall decreased for utilitarian conflict vs. no-conflict responses, $F(1, 91) = 48.77$, $p < .001$, $\eta_p^2 = .35$. This pattern was also observed when the Trolley, $F(1, 133) = 10.99$, $p < .001$, $\eta_p^2 = .08$, and Plane dilemma, $F(1, 124) = 37.05$, $p < .001$, $\eta_p^2 = .23$, were analysed separately. Decision times did not differ significantly in the overall within-subjects analysis, $F(1, 91) < 1$. For the Plane dilemma separately the decision time contrast reached significance, $F(1, 124) = 9.24$, $p < .01$, $\eta_p^2 = .07$, but this was not the case for the Trolley dilemma, $F(1, 133) < 1$. Reading times differed significantly in the within-subject analysis, $F(1, 91) = 4.92$, $p < .05$, $\eta_p^2 = .05$, but this trend was not significant when the Trolley, $F(1, 133) < 1$, and Plane, $F(1, 124) = 1.13$, $p = .29$, dilemma were analysed separately.

General discussion

The present study established that deontic responders to classic moral dilemmas are sensitive to conflict between their deontological decisions and utilitarian aspects of the dilemma. Deontic responders were slower and less confident about their decision when solving moral dilemmas in which utilitarian and deontic considerations cued conflicting responses than when solving control problems in which both cued the same decision. This implies that they are considering both deontic and utilitarian aspects of their decision. If deontological responders were not considering utilitarian principles or did not experience conflict between both viewpoints, then the presence or absence of intrinsic conflict between utilitarian and deontological considerations should not have had an impact on their decision-making process.

In terms of the dual-process model of moral cognition (e.g. Greene, 2014; Greene & Haidt, 2002), this implies that deontic reasoners do not blindly rely on the intuitively cued deontological System 1 response. They also consider utilitarian aspects and realise that there is an alternative to the cued deontological response. The key difference with deontological responders seems to be that they decide against the utilitarian response afterwards. Hence, this suggests that the difference between deontological and utilitarian reasoner does not necessarily lie in the principles they consider or conflict they experience but rather in the way they resolve this conflict. Deontic and utilitarian reasoners may have different preferences in this respect and/or deontic reasoners might not have sufficient resources to override the deontic response. However, what is important is that deontic responders at least seem to realise that there is an alternative. This is the critical contribution of the present work. It suggests that a deontic decision is more informed and less oblivious than some might expect at first sight. Utilitarian and deontic reasoners might make a different final decision but the conflict detection findings imply that this does not result from a simple failure to consider utilitarian aspects of the dilemma.

As we noted, because of possible methodological complications, the present approach does not allow us to interpret the conflict data for utilitarian responders unequivocally. With this limitation in mind one might nevertheless want to remark that the conflict contrast pattern for utilitarian responders is broadly consistent with the one we observed for

deontological responders: confidence decreased and decision time tended to increase for conflict vs. no-conflict problems. Given the fact that the dual-process model of moral cognition (e.g. Greene, 2014; Greene & Haidt, 2002) postulates from the outset that utilitarian responders manage to override a conflicting deontological response, one could interpret these findings as support for the model (e.g. Baron et al., 2015). In addition, one might note that the lowered confidence on the conflict problems indicates that although utilitarian responders manage to override the conflicting deontological response (and, in this sense, resolve the initial conflict), the mere presence of this conflict continues to affect their final decision confidence. Bluntly put, this suggests that even utilitarian responders are not completely sure that their utilitarian response is indeed unquestionably "right". However, as we noted, caution is needed when interpreting the conflict contrast for utilitarian responders and one should refrain from drawing any strong conclusions in this respect.

The present paper is the first to empirically test the conflict question during moral judgment. Obviously, it will be important to validate and generalise the findings in future work and address some limitations. First, although the Trolley and Plane dilemmas that we adopted had a different content, they both involved a scenario that implied death (i.e. killing). People's reasoning might be affected by the severity of harm that is involved in the scenario (e.g. Trémolière & De Neys, 2013) and it will therefore be important to test the generalisability of the present findings to dilemmas that involve non-lethal harm (e.g. Gold, Pulford, & Colman, 2013). Second, in our study we questioned participants directly about their willingness to act (i.e. would you pull the switch?) and not about their beliefs about the moral acceptability of the act (i.e. is it acceptable to pull the switch?). Given that people's responses to these questions might dissociate, future studies might want to use both questions prompts to test this directly and further validate the generalisability of the findings. Third, our decision time prediction is based on the core finding in cognitive control and reasoning studies that conflict between competing responses results in a processing slow-down (e.g. Botvinick, 2007; Botvinick et al., 2001; De Neys & Glumicic, 2008; Pennycook et al., 2014; Stupple et al., 2013). The observed increased decision time for conflict dilemmas in the present study supports the hypothesis that reasoners are detecting conflict between deontological and utilitarian considerations. However, the precise nature of this additional processing time remains to be characterised. For example, it might result from a mere weighing of the utilitarian and deontological considerations. But one might also argue that instead of (or in addition to) this weighing participants rather engage in some post response rationalisation during which they generate justifications for their response (e.g. Haidt, 2001). To be clear, even if the decision time increase for conflict problems (partially) reflects such rationalisation, the fact that it is specifically observed in the conflict case would still demonstrate conflict sensitivity. However, it underscores the point that it will be interesting for future studies to try to characterise the nature of the additional processing time in more detail.

We hope that this paper illustrated the importance of focusing on the conflict detection process in the dual-process framework of moral cognition. We believe that just as in general dual-process models in the reasoning and decision-making field (e.g. De Neys, 2015; Handley & Trippas, 2015; Pennycook, Fugelsang, & Koehler, 2015) a continuation of these research efforts will be paramount for the development and fine-tuning of the framework.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix

Table A1 presents the descriptive statistics for a screened sample in which both "zero-recallers" and "other" responders (i.e. participants who answered "yes" on no-conflict problems) were excluded. Total *n* in this screened sample was 133 (vs. 174) in full sample.

Table A1. Mean confidence ratings, decision time, and reading time for conflict and no-conflict dilemma versions as a function of the dilemma response decision in screened sample.

		Conflict		No-conflict
		Deontological	Utilitarian	Utilitarian
Trolley	*n*	20	46	67
	Confidence	4.10 (2.25)	5.46 (1.39)	6.08 (1.12)
	Raw decision time	12.03 (16.00)	5.85 (3.55)	6.53 (8.77)
	decision time	8.25 (2.17)	5.20 (1.58)	5.24 (1.69)
	Raw reading time	27.874 (9.02)	23.18 (10.65)	25.45 (14.43)
	Reading time	26.57 (1.37)	21.34 (1.49)	22.87 (1.55)
Plane	*n*	31	36	66
	Confidence	4.73 (1.88)	4.51 (1.65)	6.08 (1.25)
	Raw decision time	11.86 (23.58)	6.89 (3.96)	5.74 (2.57)
	decision time	7.26 (1.58)	6.21 (1.07)	5.32 (1.45)
	Raw reading time	29.85 (16.90)	42.29 (47.06)	37.40 (14.95)
	Reading time	26.44 (1.09)	32.03 (1.12)	34.58 (1.50)
Overall	*n*	51	82	133
	Confidence	4.49 (2.03)	5.04 (1.57)	6.08 (1.18)
	Raw decision time	11.93 (20.76)	6.31(3.75)	6.12 (6.47)
	decision time	7.64 (2.13)	5.63 (1.57)	5.26 (1.57)
	Raw reading time	29.18 (14.26)	31.52 (33.33)	31.41 (15.82)
	Reading time	26.54 (1.52)	25.53 (1.77)	28.16 (1.60)

Notes: Standard deviations in parentheses. Decision and reading times were logtransformed prior to analysis. Raw latencies and anti-logged latencies are presented here. Confidence rating scale ranged from 1 (not confident at all) to 7 (extremely confident).