Cognitive Load Reduces Reason-Giving in a Moral Dumbfounding Task

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Author note

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Abstract (139 words)

Moral dumbfounding occurs when people defend a moral judgment, without reasons in support of this judgment. Based on the notion that cognitive load enhances biases and shortcomings in human judgment when elaboration is beneficial, we hypothesized that under cognitive load, people would be less likely to provide reasons for a judgment and more likely to be dumbfounded. We tested this prediction across six studies (total $N = 2312$) using three different cognitive load manipulations. Our findings suggest that cognitive load reduces reason-giving, leading to increases in dumbfounding, though we note some variability across studies and manipulations. By way of exploration, we also examined the extent to which moral dumbfounding relates to need for cognition as a motivational component driving the effect. Our results provide new insights into the phenomenon of moral dumbfounding while also advancing theory in moral psychology.

Keywords: moral dumbfounding, morality, cognitive load, dual-processes

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Statement of Relevance (149 words):

Moral judgments guide our own behavior and our interactions with others. At a societal level, moral judgments inform policy decisions on various issues of public interest (e.g., abortion, euthanasia, gun control, foreign policy, etc.). Evidence indicates that moral judgments are not consistently justifiable or grounded in reasons. Indeed, *moral dumbfounding* can occur when people cannot provide reasons for their firmly-held moral judgments. Moral dumbfounding has been demonstrated in the lab, but is also evident in everyday life where commentators (e.g., politicians, activists, campaigners, etc.) appeal to emotion or to “moral duty”, in support of a position, without providing further reasons or argument. Despite recent advances, the underlying causes of moral dumbfounding remain poorly understood. Across six studies, we find some evidence for a cognitive capacity explanation of dumbfounding. By continuing to study dumbfounding, we can begin to understand its causes and potentially even mitigate its influence on public discourse.

Cognitive Load Reduces Reason-Giving in a Moral Dumbfounding Task

Moral dumbfounding occurs when people defend a moral judgment even though they cannot provide a reason in support of this judgment (Haidt, 2001; Haidt et al., 2000; see also McHugh et al., 2017, 2020). It has traditionally been seen as evidence for intuitionist and dual-process theories of moral judgment (Crockett, 2013; Cushman, 2013; Cushman et al., 2010; Greene, 2008; Haidt, 2001; Prinz, 2005; c.f. Guglielmo, 2018; Royzman et al., 2015). Despite the influence of moral dumbfounding on the morality literature, the phenomenon is not well understood. We present six studies testing predictions of a dual-processes explanation of moral dumbfounding.

Moral Dumbfounding: A Dual-Process Perspective

Drawing on dual-process theories of reasoning and moral judgment (Bago & De Neys, 2019; Brand, 2016; Cushman, 2013; Evans, 2010; Greene, 2008), we propose that moral dumbfounding occurs as a result of a conflict in dual-processes (Bonner & Newell, 2010; De Neys, 2012; De Neys & Glumicic, 2008; Evans, 2007; see also De Neys & Pennycook, 2019). In classic dual-process reasoning accounts, conflicts occur when a habitual/intuitive response is different from a response that results from deliberation (Bonner & Newell, 2010). Examples of such conflicts include base rate neglect problems (Bonner & Newell, 2010; De Neys, 2012; De Neys & Glumicic, 2008; Evans, 2007), the conjunction fallacy (De Neys, 2012; Tversky & Kahneman, 1983), and perhaps most relevant to the current discussion, a seemingly irrational but persistent unwillingness to contact various symbolically “contaminated” objects, despite assurances these items are sanitary (Lerner & Goldberg, 1999; Rozin et al., 1994). We note that the original, unpublished dumbfounding manuscript included tasks closely resembling this final example (Haidt et al., 2000).

In line with the above, we propose that dumbfounding occurs when a habitual (moral judgment) response is in conflict with a deliberative response. In studies of moral dumbfounding, following an initial judgment, there are typically three responses available to participants: (1) providing a reason or justification for a judgment (henceforth reason-giving); (2) accepting counter-arguments and rating particular behaviors as “not wrong” (nothing-wrong); (3) maintaining a judgment without justification or reasons (dumbfounding). Both reason-giving and nothing-wrong can be accounted for by existing approaches to moral judgment (e.g., Cushman, 2013), and while reason-giving is the most common response, dumbfounding is reliably observed (see McHugh et al., 2017, 2020) and remains an anomaly.

Drawing on existing theorizing (e.g., Cushman, 2013; Haidt, 2001; McHugh et al., 2022), we assume that making a moral judgment is an intuitive/habitual response involving relatively little deliberation, while reason-giving requires greater deliberation (a deliberative response). In this view, conflict occurs when deliberation fails to identify reasons for a judgment, and its resolution depends on the availability of cognitive resources for deliberation – further deliberation may identify relevant reasons. Alternatively, participants may resolve the conflict by accepting the arguments presented and changing their judgment (nothing-wrong). We propose that dumbfounding is observed when this conflict cannot be resolved. We hypothesize that nothing-wrong involves more deliberation than dumbfounding but less deliberation than reason-giving. The hypothesized relative amounts of deliberation for each response are outlined in Figure 1. We note that this explanation is not unique to dual-process approaches, but is also consistent with a unimodal (Kruglanski & Gigerenzer, 2011) or categorization (McHugh et al., 2022) approaches, both of which predict that lower processing capacity reduces reason-giving, and increases dumbfounding

Figure 1

Hypothesized relationship between deliberation and responses in the dumbfounding paradigm.

This account of moral dumbfounding affords a clear testable hypothesis: under manipulations that affect the availability of resources for deliberation, responses in the moral dumbfounding paradigm should evidence variation in frequency of deliberative versus habitual responses. Cognitive load manipulations – such as completing an attention/memory task simultaneously with a primary task – have been shown to inhibit deliberative responding (De Neys, 2006; Evans & Curtis-Holmes, 2005; Evans & Stanovich, 2013; Schmidt, 2016). We have identified reason-giving as involving more deliberation than alternative responses in the dumbfounding paradigm. Thus, we predict that a cognitive load manipulation should inhibit reason-giving in a moral dumbfounding task, leading to an increase in habitual responding, such as dumbfounding or nothing-wrong.

The Current Studies

Our primary prediction is that a cognitive load manipulation will inhibit people's ability to provide reasons for their judgment, leading to greater habitual responses (either dumbfounding or nothing wrong or both). To test this, we employed three different cognitive load manipulations across six studies.

An additional secondary prediction is that responding may vary depending on individual differences in tendencies to engage in deliberation. The need for cognition scale (NFC) provides a measure of a person's tendency engage in deliberation (Cacioppo & Petty, 1982; Evans & Stanovich, 2013; Forsterlee & Ho, 1999). We hypothesize that people who show a greater tendency to engage in deliberation (higher NFC scores) will be more likely to provide reasons for their judgment, while people who score low on NFC will be more likely to provide a dumbfounded response. We include a measure of NFC across five studies to test this.

Open Practices Statement

The data for all studies are publicly accessible at https://osf.io/juq4t/?view_only=d365253e233747aab9669f892093c69e. The analysis code for all studies is also publicly accessible https://osf.io/juq4t/?view_only=d365253e233747aab9669f892093c69e. The materials for Studies 1-5 are not publicly available beyond what is contained in the Supplementary Materials; full materials for Study 6 including jsPsych script is available at https://osf.io/juq4t/?view_only=d365253e233747aab9669f892093c69e. Studies 1-5 were not pre-registered. Study 6 was pre-registered and the pre-registration is available at https://aspredicted.org/XZP_UHW.

Study 1: Number-Letter Task (College Sample)

The aim of Study 1 was to test the hypothesis that under cognitive load, reason-giving will be reduced, leading to greater rates of dumbfounding and/or nothing-wrong. We adapted existing methods for evoking moral dumbfounding (McHugh et al., 2017) to include a cognitive load manipulation in the form of a memory task. Participants in the experimental condition were required to memorize a number-letter-string while completing the task. We expect that rates of reason-giving will be lower in the experimental condition than in the control condition (no memory task). To test our secondary prediction, we measured NFC (Cacioppo & Petty, 1982; Petty et al., 1984) as an additional potential predictor variable. We expect NFC to be positively associated with reason-giving.

Method***Participants and Design***

Study 1 was a between-subjects design. The dependent variable was rates of reason-giving/dumbfounding (measured using the critical slide with 3 response options: 1: reason-giving; 2: nothing-wrong; 3: dumbfounded response - admission). The independent variable was cognitive load with two levels: high versus low. Individual differences in need for cognition (Cacioppo & Petty, 1982; Petty et al., 1984) was included as an additional potential predictor.

A total sample of 66 participants (55 female, 11 male; $M_{\text{age}} = 22.42$, min = 18, max = 57, $SD = 6.86$) took part. Participants in this sample were undergraduate students, postgraduate

students, and alumni from Mary Immaculate College (MIC) and the University of Limerick (UL). Participation was voluntary.^{1,2}

Procedure and Materials

Data were collected using an online questionnaire. Data collection took place in a designated computer laboratory in MIC. The experimenter remained in the laboratory for the duration of the study. Participants were first presented with an information sheet and consent form. The main study proceeded when participants had signed the consent form.

Participants in the experimental condition were presented with an eight-digit number-letter-string and asked to memorize the sequence. After 30 seconds, the experiment progressed to the next slide. Participants had the option to click “ok” and progress to the next slide after 15 seconds.

Participants were then presented with the *Julie and Mark* vignette (Haidt et al., 2000; see Supplementary Materials for full text). Participants rated on a 7-point Likert scale how right or wrong the behavior of Julie and Mark was (where 1 = *Morally wrong*; 4 = *neutral*; 7 = *Morally right*) and were given an opportunity to provide reasons for their judgement. Following this, participants were presented with a series of counter-arguments, which refuted commonly used justifications for rating the behavior as “wrong.”

¹ A priori power analysis indicated that, for the primary research question (the influence of cognitive load on dumbfounded responding), to detect a large effect ($V = .35$) with 80% power, a sample of $N = 79$ participants was required; for a medium effect ($V = .21$) with 80% power a sample of $N = 218$ participants was required; for a small effect ($V = .07$) with 80% power a sample of $N = 1966$ was required.

² A priori power analysis indicated that, for the secondary research question (the relationship between dumbfounded responding and need for cognition), in order to detect a large effect size ($OR = 9$) with 80% power, a sample of $N = 11$ participants was required; in order to detect a medium effect size ($OR = 3.45$) with 80% power a sample of $N = 32$ participants was required; in order to detect a small effect size ($OR = 1.49$) with 80% power a sample of $N = 309$ was required.

Dumbfounding was measured using the critical slide (developed by McHugh et al., 2017). This contained a statement defending the behavior and a question as to how the behavior could be wrong (“Julie and Mark’s behavior did not harm anyone, how can there be anything wrong with what they did?”). There were three possible answer options: (a) “It’s wrong, and I can provide a valid reason” (reasons); (b) “It’s wrong, but I can’t think of a reason” (an admission of not having reasons); (c) “There is nothing wrong”. The order of these response options was randomized. Participants who selected (a) were prompted to type a reason. The selecting of an option (b), the admission of not having reasons, was taken to be a dumbfounded response.³ We note that this measure provides a conservative measure of dumbfounded responding (see McHugh et al., 2017 for discussion).

Following the critical slide, participants in the experimental condition were required to reproduce the eight-digit number-letter-string sequence presented previously. Following this a post-discussion questionnaire in which participants rated their response to the scenario across various dimensions (Haidt et al., 2000).

Need for cognition was measured using the short form of the need for cognition scale (Cacioppo & Petty, 1982; Petty et al., 1984). This is an 18 item scale containing questions relating to motivation to engage in thinking (e.g., “I would prefer complex to simple problems”). Responses were recorded on a Likert-type scale (where -4 = *very strong disagreement* and +4 = *very strong agreement*).

³ This measure avoids the potential confounding influence of qualitative differences between different response types; that is, participants *indicate* whether they can provide reasons for their judgments or not, and this is our measure (not whether or not they actually provide reasons, as this different type of response would not be comparable to a dumbfounded response).

Results

Inspection of the judgment measures indicated that 46 participants (69.70%) rated the behavior of Julie and Mark as wrong initially, and 41 participants (62.12%) rated the behavior as wrong at the end of the task. Initial ratings ($M = 2.38$, $SD = 1.87$) were significantly more severe than revised ratings ($M = 2.82$, $SD = 1.91$), $t(65) = -3.03$, $p = .004$, $d = 0.37$. Inspection of the binned judgments revealed that 12 participants changed the valence of their judgments, and all but one of these involved included a “neutral” response for either the initial judgment or revised judgment (see Supplementary Materials Table S1).

Participants who selected the admission of not having reasons on the critical slide were identified as dumbfounded. A total of 13 participants (19.70%) selected “It’s wrong but I can’t think of a reason”; 33 participants (50%) selected “It’s wrong and I can provide a valid reason”; and 20 participants (30.30%) selected “There is nothing wrong.”

Figure 2

Study 1: Responses to critical slide and for the experimental group (N = 33) and the control group (N = 33)

Regarding the cognitive load manipulation, nine participants (27.27%) successfully remembered the sequence of numbers and letters in full, and five participants (15.15%) indicated they found the memory task easy. Of these, four participants both found the task easy and got the answer right. All participants correctly remembered at least two digits, indicating at least some level of engagement with the cognitive load manipulation. There were no differences in either initial judgement, $t(63.90) = 1.26, p = .214; d = 0.31$, or revised judgment, $t(63.99) = 1.16, p = .250; d = 0.29$, depending on cognitive load.

To test our primary hypothesis, we conducted a chi-squared test of independence, which revealed a significant association between the experimental variation and the response to the

critical slide, $\chi^2(2, N = 66) = 7.53, p = .023, V = 0.34$, the observed power was 0.69. Under cognitive load, fewer participants (12; 36.36%) provided reasons than in the control condition (21; 63.64%). Similarly, under cognitive load, more participants (15; 45.45%) selected “There is nothing wrong” than in the control group (5; 15.15%). The responses to the critical slide for the experimental group ($N = 33$) and the control group ($N = 33$) are displayed in Figure 2. The observed counts, expected counts, and standardized residuals are displayed in Table 1.

Table 1

Study 1 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load

		Cognitive Load	Control
Observed count	Reasons	12	21
	Dumbfounded	6	7
	Nothing Wrong	15	5
Expected count	Reasons	16.5	16.5
	Dumbfounded	6.5	6.5
	Nothing Wrong	10	10
Standardized residuals	Reasons	-2.22*	2.22*
	Dumbfounded	-0.31	0.31
	Nothing Wrong	2.68*	-2.68*

Note. * = sig. at $< .05$; ** = sig. at $< .001$

To test our secondary hypothesis, we conducted a multinomial logistic regression. This revealed no significant association between need for cognition and response to the critical slide, $\chi^2(2, N = 66) = 4.86, p = .088$, the observed power was 0.49 (see Supplementary Materials, Figure S1 for relative probabilities of selecting each response depending on need for cognition).

The results of Study 1 supported our primary hypothesis that under cognitive load reason-giving would be inhibited. Reason-giving was not associated with NFC, thus we did not find support for our secondary hypothesis.

Study 2: Dot-Pattern Task (Online Sample)

Study 1 demonstrated interesting variability in responses to the critical slide depending on cognitive load. The aim of Study 2 was to assess the replicability of the results of Study 1 using an online sample and a different cognitive load manipulation. An alternative cognitive load manipulation was taken from De Neys and Schaeken (2007), whereby a dot-pattern is briefly presented to participants, and participants are required to reproduce the dot-pattern at a later stage. Our primary hypothesis is that reason-giving would be reduced under cognitive load. We additionally measured NFC (Cacioppo & Petty, 1982; Petty et al., 1984) to test the secondary hypothesis, that reason-giving would be positively associated with NFC.

Method

Participants and Design

Study 2 was a between-subjects design. The dependent variable was the response to the critical slide. The independent variable was cognitive load (high vs. low). Need for cognition (Cacioppo & Petty, 1982; Petty et al., 1984) was included as an additional potential predictor.

A total sample of 100 participants (56 female, 44 male; $M_{\text{age}} = 38.38$, $\text{min} = 19$, $\text{max} = 72$, $SD = 12.41$) took part. Participants in this sample were recruited using Amazon's MTurk (<https://www.mturk.com/>). Participants were paid \$0.50 for their participation. Participants were recruited from English-speaking countries or from countries where residents generally have a high level of English (e.g., The Netherlands, Denmark, Sweden).

Procedure and Materials

Data were collected using an online questionnaire. Materials were largely the same as in Study 1, with a change to the cognitive load manipulation. Cognitive load was manipulated using a dot-pattern memory task (De Neys & Schaeken, 2007).

Participants were presented with a 3 x 3 grid containing a dot-pattern. This image disappeared after one second. Participants then answered a question relating to the moral judgment task. Following this, participants were asked to reproduce the dot-pattern. All participants took part in the memory task, and cognitive load was manipulated by varying the complexity of the patterns presented (De Neys & Schaeken, 2007). Participants in the control group were presented with simple patterns, containing three dots in a line, while the experimental group were presented with more complex dot-patterns containing 4 dots, see Figure 3.

Figure 3

Sample dot-patterns - more simple for the control group (a) and higher complexity for the experimental condition (b)

Study 2 proceeded in much the same way as Study 1. There were four target questions during which participants were engaged in the memory task. A different pattern was presented before each of the following: the initial judgment, the initial opportunity to provide reasons, the critical slide, and the revised judgment. After each of these questions, participants were required to reproduce the pattern. As in Study 1, dumbfounding was measured using the critical slide.

Results

Seventy-seven participants (77%) rated the behavior of Julie and Mark as wrong initially, and 70 participants (70%) rated the behavior as wrong at the end of the task. Initial ratings ($M =$

2.13, $SD = 1.54$) were significantly more severe than revised ratings ($M = 2.35$, $SD = 1.65$), $t(99) = -2.85$, $p = .005$; $d = 0.28$. Inspection of the binned judgments revealed that 10 participants changed the valence of their judgments, and all but one of these involved one judgment that was neutral (see Supplementary Materials, Table S3).

Participants who selected the admission of not having reasons on the critical slide were identified as dumbfounded. Twenty-six participants (26%) selected “It’s wrong, but I can’t think of a reason”; 50 participants (50%) selected “It’s wrong, and I can provide a valid reason”; and 24 participants (24%) selected “There is nothing wrong.”

A chi-squared test for independence revealed no association between experimental condition and response to the critical slide, $\chi^2(2, N = 100) = 0.74$, $p = .690$, $V = 0.09$, the observed power was 0.11. The responses to the critical slide for the experimental group ($N = 51$) and the control group ($N = 49$) are displayed in Figure 4 (left panel).

Figure 4

Study 2: Responses to critical slide for (left) the experimental group ($N = 51$) vs the control group ($N = 49$); and (right) depending on engagement ($N = 56$) or non-engagement ($N = 44$) with the memory task

It is possible that the difference in results observed between Study 1 and Study 2 is due to the alternative manipulation of cognitive load employed. In Study 1, the control group did not engage in any task; however, adopting De Neys and Schaeken's procedure (2007), participants in the control group of Study 2 engaged in a memory task. It is possible that simply engaging in a memory task led to differences in responses, and that difficulty level (the manipulation employed) was irrelevant. Indeed, the responding to the critical slide in the control group in Study 2 is more similar to the responding in the experimental group in Study 1 than to the control group in Study 1. Furthermore, rates of successful reproduction of the dot-patterns in Study 2 were much lower than reported by De Neys and Schaeken (2007). Likely, engagement with the memory task in Study 2 was not comparable to that observed by De Neys and Schaeken (2007), which impacted the results. We propose that not engaging appropriately with the memory task undermines its efficacy as a cognitive load manipulation and hypothesized that the effect of the cognitive load manipulation is related to the degree to which people engage with the manipulation.

To test this claim, we developed a measure of engagement with the memory task. The memory task involved correctly placing dots in a 3 x 3 grid. For the scoring of this task, each of the nine places in the grid could be marked/not marked correctly or incorrectly, making 9 the total possible number of correct responses. If a person misplaced one dot in the pattern, this would count for 2 incorrect places in the grid: the mark in the incorrect place and the absence of a mark in the place it should have been. A participant who received a score of 7, could reasonably be taken to have engaged with the task, and simply made a slip. As such, this was taken as the cut-off point for identifying engagement. This resulted in 56 participants being identified as engaging with the memory task, and 44 being identified as not engaging with the task.

Using this engagement threshold, we tested if responses to the critical were associated with engagement with the memory task. A chi-squared test for independence revealed a significant association between engagement in the memory task and response to the critical slide, $\chi^2(2, N = 100) = 6.68, p = .035, V = 0.26$, the observed power was 0.11. The responses to the critical slide for the engaged group ($N = 51$) and the not engaged group ($N = 49$) are displayed in Figure 4. The observed counts, expected counts, and standardized residuals are displayed in Table 2.

Table 2

Study 2 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load

		Engaged	Not Engaged
Observed count	Reasons	23	27
	Dumbfounded	20	6
	Nothing Wrong	13	11
Expected count	Reasons	28	22
	Dumbfounded	14.56	11.44
	Nothing Wrong	13.44	10.56
Standardized residuals	Reasons	-2.01*	2.01*
	Dumbfounded	2.5*	-2.5*
	Nothing Wrong	-0.21	0.21

Note. * = sig. at $< .05$; ** = sig. at $< .001$

A multinomial logistic regression revealed no significant association between need for cognition and response to the critical slide, $\chi^2(2, N = 100) = 2.19, p = .334$, the observed power was 0.24 (see Supplementary Materials, Figure S2 for relative probabilities of selecting each response depending on need for cognition).

Study 2 suggests that the effect of cognitive load on reason-giving may be sensitive to the type of load manipulation employed and that it may depend on participants' engagement with the load manipulation. Our initial analysis did not show support for our primary hypothesis, however,

in follow-up analyses, we found that when controlling for engagement with the task, our hypothesis appeared to be supported. That is, reason-giving was reduced when participants were engaged with a secondary task. Below we describe a follow-up study to test this directly. Study 2 did not provide support for our secondary hypotheses; that is, reason-giving was not associated with NFC.

Study 3: Dot-Pattern - Controlling for Engagement (Online Sample)

In Study 2, the role of engagement with the memory task emerged as an important moderator of the effectiveness of the cognitive load manipulation. Study 3 was conducted in order to test if cognitive load affects participants' ability to identify reasons for their judgment, when accounting for engagement with the memory task. We, therefore, only included participants in our analysis who engaged with the memory task while completing the critical slide (evidenced by a score of 7 or higher). As above, our hypothesis is that participants engaging in this memory task will be less likely to provide reasons than participants in the control group.

Methods

Participants and Design

Study 3 was a between-subjects design. The dependent variable was the response to the critical slide. The independent variable was cognitive load with two levels: high and control. Need for cognition (Cacioppo & Petty, 1982; Petty et al., 1984) was included as an additional potential predictor.

Following the exclusion of 34 participants who scored less than 7 on the memory task, we were left with a final sample of 129 participants (74 female, 55 male; $M_{\text{age}} = 40.26$, $\text{min} = 20$, $\text{max} = 72$, $SD = 13.04$). Participants in this sample were recruited through MTurk (under the same conditions as Study 2).

Procedure and Materials

Study 3 was the same as Study 2 with two changes. The control group did not take part in a memory task, and to avoid task fatigue in the experimental group, the dot-patterns presented alternated between the easy 3-dot-patterns and the complex 4-dot-patterns.

A score of 7 or higher on the memory task that accompanied the critical slide was selected as the measure of engagement with the memory task. Only participants who engaged with the task were eligible for analysis.

Results

Ninety-five participants (73.64%) rated the behavior of Julie and Mark as wrong initially, and 94 participants (72.87%) rated the behavior as wrong at the end of the task. Initial ratings ($M = 2.27$, $SD = 1.75$) were significantly more severe than revised ratings ($M = 2.35$, $SD = 1.74$), $t(128) = -1.15$, $p = .253$; $d = 0.10$. Inspection of the binned judgments revealed that 13 participants changed the valence of their judgments, and all but three of these involved one judgment that was neutral (see Supplementary Materials Table S5).

Turning to responses to the critical slide, 22 participants (17.05%) selected “It’s wrong but I can’t think of a reason.”, 77 participants (59.69%) selected “It’s wrong and I can provide a valid reason”; and 30 participants (23.26%) selected “There is nothing wrong.”

Figure 5

Study 3: Responses to critical slide for the cognitive load group (N = 68) and the control group (N = 61)

Table 3

Study 3 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load

		Cognitive Load	Control
Observed count	Reasons	36	41
	Dumbfounded	17	5
	Nothing Wrong	15	15
Expected count	Reasons	40.59	36.41
	Dumbfounded	11.6	10.4
	Nothing Wrong	15.81	14.19
Standardized residuals	Reasons	-1.65	1.65
	Dumbfounded	2.53*	-2.53*
	Nothing Wrong	-0.34	0.34

Note. * = sig. at < .05; ** = sig. at < .001

A chi-squared test for independence revealed a significant association between experimental condition and response to the critical slide, $\chi^2(2, N = 129) = 6.51, p = .039, V = 0.22$, the observed power was 0.62. The responses to the critical slide for the experimental group ($N = 68$) and the control group ($N = 61$) are displayed in Figure 5. The observed counts, expected counts, and standardized residuals are displayed in Table 3.

A multinomial logistic regression revealed a significant association between NFC and response to the critical slide, $\chi^2(2, N = 129) = 6.43, p = .040$, the observed power was 0.62. Need for cognition explained between 2.80% (Cox and Snell R square) and 3.78% (Nadelkerke R squared) of the variance in responses to the critical slide. As need for cognition increased, participants were significantly more likely to provide reasons than to present as dumbfounded, Wald = 6.08, $p = .014$, odds ratio = 0.69, 95% CI [0.51, 0.93] (see Supplementary Materials, Figure S3 for relative probabilities of selecting each response depending on need for cognition).

Study 3 provided some support to our primary hypothesis. Cognitive load significantly influenced responding to the critical slide, and while rates of reason-giving were not significantly reduced (see Table 3), rates of dumbfounding were significantly higher under cognitive load. Study 3 also provided support for our secondary hypothesis. Need for cognition was positively associated with reason-giving.

Study 4: Dot-Pattern with Manipulation Check (Online Sample)

Study 3 found a significant relationship between cognitive load and response to the critical slide and a significant relationship between need for cognition and response to the critical slide. The aim of Study 4 was to replicate these findings. In addition, Study 4 included a manipulation check to assess the effectiveness of the cognitive load manipulation employed.

Method

Participants and Design

Study 4 was a between-subjects design. The dependent variable was the response to the critical slide. The independent variable was cognitive load with two levels: high and control. Need for cognition (Cacioppo & Petty, 1982; Petty et al., 1984) was included as an additional potential predictor.

Following the exclusion of 29 participants who scored less than 7 on the memory task we were left with a final sample of 127 participants (84 female, 43 male; $M_{\text{age}} = 41.19$, $\text{min} = 21$, $\text{max} = 74$, $SD = 13.91$). Participants in this sample were recruited through MTurk (under the same conditions as Studies 2 and 3).

Procedure and Materials

Study 4 was the same as Study 3 with one change, the inclusion of a manipulation check. A prose paragraph was included after participants made their revised judgments. Participants were then asked three comprehension questions relating to the prose paragraph. It was expected that participants in the control group would perform better at this task than participants under cognitive load (Just & Carpenter, 1992).

Results

Ninety-eight participants (77.17%) rated the behavior of Julie and Mark as wrong initially, and 92 participants (72.44%) rated the behavior as wrong at the end of the task. Initial ratings ($M = 2.09$, $SD = 1.62$) were significantly more severe than revised ratings ($M = 2.31$, $SD = 1.79$), $t(126) = -3.14$, $p = .002$; $d = 0.28$. Inspection of the binned judgments revealed that 13 participants changed the valence of their judgments, and all but two of these involved one judgment that was neutral (see Supplementary materials Table S7).

Figure 6

Study 4: Responses to critical slide for the cognitive load group (N = 64) and the control group (N = 61)

Investigation of the responses to the manipulation check questions revealed no difference in the number of correct answers to these questions between the cognitive load group and the control group $t(123.91) = 0.57, p = .569; d = 0.10$. There was also no difference in time taken to read the vignette between the groups $t(63.40) = 1.62, p = .111; d = 0.28$.

On the critical slide, 20 participants (15.75%) selected “It’s wrong but I can’t think of a reason.”, 76 participants (59.84%) selected “It’s wrong and I can provide a valid reason”; and 31 participants (24.41%) selected “There is nothing wrong.”

Table 4

Study 4 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load

		Cognitive Load	Control
Observed count	Reasons	35.00	41.00
	Dumbfounded	10.00	10.00
	Nothing Wrong	19.00	12.00
Expected count	Reasons	38.30	37.70
	Dumbfounded	10.08	9.92
	Nothing Wrong	15.62	15.38
Standardized residuals	Reasons	-1.19	1.19
	Dumbfounded	-0.04	0.04
	Nothing Wrong	1.40	-1.40

Note. * = sig. at < .05; ** = sig. at < .001

A chi-squared test for independence revealed no significant association between experimental condition and response to the critical slide, $\chi^2(2, N = 127) = 2.05, p = .359, V = 0.13$, the observed power was 0.23. The responses to the critical slide for the experimental group ($N = 64$) and the control group ($N = 63$) are displayed in Figure 6. The observed counts, expected counts, and standardized residuals are displayed in Table 4.

A multinomial logistic regression revealed no statistically significant association between need for cognition and response to the critical slide, $\chi^2(2, N = 127) = 1.5, p = .472$, the observed power was 0.18 (see Supplementary Figure S4 for relative probabilities of selecting each response depending on need for cognition).

Study 4 did not provide support for our hypotheses. There were no significant differences in responses to the critical slide under cognitive load. There was no significant association between NFC and responding to the critical slide. However, we note that responses to the manipulation check did not vary with cognitive load. This may suggest the cognitive load

manipulation may be unreliable or inconsistent. To address this, we conducted a follow-up study with the same design as Study 1.

Study 5: Number-Letter Task (College Sample)

Across Studies 1-4, we found some evidence in support of our primary hypothesis that responses in the dumbfounding paradigm would be influenced by cognitive load, though this effect was not consistently observed (Study 4) and appeared to be sensitive to task type and level of engagement (Study 2). As with the previous studies, the aim of Study 5 was to test if cognitive load influenced reason-giving in a dumbfounding task. We adopted the same manipulation and sampling procedure as Study 1.

Method

Participants and Design

Study 5 was a between-subjects design. The dependent variable was the response to the critical slide. The independent variable was cognitive load with two levels: high and control. Need for cognition (Cacioppo & Petty, 1982; Petty et al., 1984) was included as an additional potential predictor.

A total sample of 204 participants (144 female, 59 male; $M_{\text{age}} = 20.56$, min = 18, max = 48, $SD = 3.86$) took part. Participants in this sample were undergraduate students, postgraduate students, and alumni from Mary Immaculate College (MIC), and the University of Limerick (UL). Participation was voluntary and participants were not reimbursed for their participation.

Procedure and Materials

Data were collected using an online questionnaire. Data collection took place in a designated computer laboratory in either MIC or UL. The experimenter remained in the laboratory for the duration of the study. Participants were first presented with an information sheet and consent form.

There were two sections of the online survey: the moral judgment task, and the need for cognition scale. The order of presentation of these was randomized. At the beginning of the moral judgment task, participants in the experimental condition were presented with an eight-digit number-letter-string and asked to memorize the sequence. After 30 seconds, the experiment progressed to the next slide. Participants had the option to click “ok” and progress to the next slide after 15 seconds.

Participants were then presented with the *Julie and Mark* vignette (Haidt et al., 2000). Participants rated how right or wrong the behavior of Julie and Mark was and were given an opportunity to provide reasons for their judgment. Following this, participants were presented with a series of counter-arguments, which refuted commonly used justifications for rating the behavior as “wrong.” Dumbfounding was measured using the critical slide. Following the revised judgment, participants were required to reproduce the number-letter-string.

Results

One hundred and sixty-five participants (80.88%) rated the behavior of Julie and Mark as wrong initially, and 159 participants (77.94%) rated the behavior as wrong at the end of the task. Initial ratings ($M = 2.01$, $SD = 1.82$) were significantly more severe than revised ratings ($M = 2.20$, $SD = 1.77$), $t(203) = -3.42$, $p < .001$; $d = 0.24$. Inspection of the binned judgments revealed that eleven participants changed the valence of their judgments, and all but two of these involved one judgment that was neutral (see Supplementary Materials Table S9).

Figure 7

Study 5: Responses to critical slide and for the experimental group (N = 98) and the control group (N = 106)

Table 5

Study 5 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load

		Cognitive Load	Control
Observed count	Reasons	51.00	68.00
	Dumbfounded	25.00	20.00
	Nothing Wrong	22.00	18.00
Expected count	Reasons	57.17	61.83
	Dumbfounded	21.62	23.38
	Nothing Wrong	19.22	20.78
Standardized residuals	Reasons	-1.75	1.75
	Dumbfounded	1.14	-1.14
	Nothing Wrong	0.98	-0.98

Note. * = sig. at < .05; ** = sig. at < .001

Next we examined responses to the critical slide. Forty-five participants (22.06%) selected “It’s wrong, but I can’t think of a reason.” 119 participants (58.33%) selected “It’s wrong, and I can provide a valid reason”; and 40 participants (19.61%) selected “There is nothing wrong.”

Initial check of responses to the memory task revealed that 42 participants (42.86%) successfully remembered the sequence of numbers and letters. Responses to the manipulation check question revealed that 22 participants (22.45%) found the memory task easy. Of these, 20 participants both found the task easy and got the answer right. All participants correctly remembered at least two digits suggesting engagement with the manipulation.

The cognitive load manipulation took place before the presenting of the vignette describing the behavior to be judged. This procedure allowed for the possibility that participants under cognitive load may not have engaged fully with the vignette compared to the control group. An independent samples t-test revealed no significant difference in initial rating in the cognitive load group, ($M = 2.15$, $SD = 1.97$), and the control group, ($M = 2.05$, $SD = 1.66$), $t(191.10) = 1.04$, $p = 0.30$; $d = 0.15$. An independent samples t-test revealed no significant difference in initial confidence in the cognitive load group, ($M = 5.51$, $SD = 1.55$), and the control group, ($M = 5.83$, $SD = 1.49$), $t(199.05) = -1.50$, $p = 0.14$; $d = 0.21$. In view of this, one can conclude that both groups engaged equally with the task.

To test our hypothesis, we conducted a chi-squared test for independence that revealed no significant association between experimental condition and response to the critical slide, $\chi^2(2, N = 204) = 3.08$, $p = .215$, $V = 0.12$, the observed power was 0.33. The predicted relationship between cognitive load and dumbfounded responding was not observed in Study 5. The responses to the critical slide for the experimental group ($N = 98$) and the control group ($N = 106$)

are displayed in Figure 7. The observed counts, expected counts, and standardized residuals are displayed in Table 5.

A multinomial logistic regression revealed no significant association between need for cognition and response to the critical slide, $\chi^2(2, N = 204) = 5.83, p = .054$, The observed power was 0.57 (see Supplementary Figure S5 for relative probabilities of selecting each response depending on need for cognition).

The results of Study 5 did not support the hypothesis that cognitive load would inhibit reason-giving in a dumbfounding task. They also did not support our secondary hypothesis that NFC would predict reason-giving.

Study 6: Video Task (Online Sample - Pre-registered)

The results of Studies 1-5 provided mixed support for our primary hypothesis. That is, we found some evidence that reason-giving is inhibited when engaging in a secondary task, but this evidence was not consistent. Two possible explanations for this inconsistency are (a) task-type: it is possible that a memory task is not sufficiently cognitively demanding across participants to reliably reduce reason-giving; (b) sample size and power: our a-priori power analyses suggest that the samples collected across Studies 1-5 are sufficiently powered to detect a large to medium-large effect with 80% power (large effect, $V = .35$, required sample of $N = 79$; medium effect, $V = .21$, required sample of $N = 218$). To address these limitations, the aim of Study 6 was to test if cognitive load influences participants' ability to justify their judgments, using an alternative load manipulation and a larger sample providing greater statistical power to detect smaller effects (a-priori power analysis indicated that a small effect, $V = .07$, required a sample of $N = 1966$). Study 6 was pre-registered (see https://aspredicted.org/XZP_UHW).

Method

Participants and design.

Study 6 was a between-subjects design. The dependent variable was rates of providing reasons/dumbfounding (measured using the critical slide as in previous studies). The primary independent variable was cognitive load with two levels: high and control. To manipulate cognitive load, a stream of numbers scrolled across the screen above the question text, and participants were required to pay attention to how many times they saw a given number. The scenario served as a secondary independent variable; we used four scenarios: *Julie and Mark*, *Jennifer*, *Trolley*, *Heinz* (see Supplementary Materials for full text of each).

A total sample of 1899 participants (984 female, 876 male, 17 non-binary, 1 other, 5 prefer not to say; $M_{\text{age}} = 43.22$, $\text{min} = 18$, $\text{max} = 84$, $SD = 15.85$) started the survey. Participants in this sample were recruited from Prolific ($N_{UK} = 963$, $N_{US} = 936$).

Participants who failed both manipulation checks ($n = 7$) or who had missing data for the measures of interest were removed, leaving a total sample of 1686 participants (867 female, 799 male, 14 non-binary, 1 other, 5 prefer not to say; $M_{\text{age}} = 43.81$, $\text{min} = 18$, $\text{max} = 83$, $SD = 15.76$), $n_{UK} = 842$, $n_{US} = 844$.

Procedure and Materials

Data were collected using an online questionnaire developed with *jsPsych* and distributed with *cognition.run*. Participants were presented with one of four moral scenarios (*Julie and Mark*, *Jennifer*, *Trolley*, *Heinz*, see Supplementary Materials for full wording), previously used in studies of moral dumbfounding (McHugh et al., 2017). The sequence of responses was similar to previous studies, but with content of questions and counter arguments updated to match the relevant scenarios (see Supplementary Materials).

We included a video stream of numbers scrolling above the question text for our cognitive load manipulation, drawing on Greene et al., (2008). The video was wide enough to display 3 numbers at a time, and the numbers scrolled past at a speed of 2 numbers per second. Participants were asked to attend to and report (on a subsequent page) how many times a particular number appeared in the stream while answering the target question. Following an initial training task, the video was presented while participants made their initial judgments, while they responded to the critical slide, and while they were providing their revised judgments.

Two attention check tasks were included for all participants; these included a brief paragraph of text where instructions for the correct response were embedded within the text. The wording of the text was misleading such that if participants skimmed or only read some of the text, they would likely provide an incorrect response (see Figures S10 and S11 in the Supplementary Materials).

Participants clicked on the survey link and were randomly assigned to either the experimental condition or the control condition, within which they were randomly presented with one of the four scenarios. The study was complete within 5 minutes.

Results

One thousand three hundred sixty-five participants (80.96%) rated the behavior described as wrong initially, and 1,343 participants (79.66%) rated the behavior as wrong at the end of the task. Initial ratings ($M = 2.26$, $SD = 1.63$) were significantly more severe than revised ratings ($M = 2.34$, $SD = 1.66$), $t(1685) = -2.69$, $p = .007$; $d = 0.07$. Inspection of the binned judgments revealed that 200 (11.86%) participants changed the valence of their judgments. Breakdown of the changes in judgments is in Table S11 (full sample) and Table S12 (by scenario) in the Supplementary Materials.

A 2×2 factorial ANOVA revealed significant differences in initial judgments depending on both condition $F(1, 1678) = 26.65, p < .001$, partial $\eta^2 = .016$, and scenario $F(3, 1678) = 69.30, p < .001$, partial $\eta^2 = .110$. Participants under cognitive load were significantly ($p < .001$) less harsh in their judgments ($M = 2.46, SD = 1.75$) than those in the control condition ($M = 2.07, SD = 1.49$). Participants rated *Jennifer* as the most wrong ($M = 1.53, SD = 1.13$), followed by *Julie and Mark* ($M = 2.05, SD = 1.65, p < .001$), then *Heinz* ($M = 2.49, SD = 1.65, p < .001$), with *Trolley* receiving the least severe judgment ($M = 2.98, SD = 1.69, p < .001$). There was no significant condition $\times$ scenario interaction $F(3, 1678) = 0.46, p = .708$, partial $\eta^2 < .001$.

A 2×2 factorial ANOVA revealed significant differences in revised judgments depending on both condition $F(1, 1678) = 12.82, p < .001$, partial $\eta^2 = .008$, and scenario $F(3, 1678) = 80.69, p < .001$, partial $\eta^2 = .126$. Participants under cognitive load were significantly ($p < .001$) less harsh in their judgments ($M = 2.47, SD = 1.71$) than those in the control condition ($M = 2.20, SD = 1.59$). Participants rated *Jennifer* as the most wrong ($M = 1.54, SD = 1.12$), followed by *Julie and Mark* ($M = 2.15, SD = 1.73, p < .001$), then *Heinz* ($M = 2.52, SD = 1.58, p = .003$), with *Trolley* receiving the least severe judgment ($M = 3.14, SD = 1.72, p < .001$). There was no significant condition $\times$ scenario interaction $F(3, 1678) = 1.34, p = .260$, partial $\eta^2 = .002$.

Dumbfounding was recorded using the critical slide, participants who selected the admission of not having reasons on the critical slide were identified as dumbfounded. A total of 417 (24.73%) selected “It’s wrong, but I can’t think of a reason.”, 1,032 participants (61.21%) selected “It’s wrong, and I can provide a valid reason”; and 237 participants (14.06%) selected “There is nothing wrong.”

A chi-squared test for independence revealed a significant association between experimental condition and response to the critical slide, $\chi^2(2, N = 1686) = 25.48, p < .001, V = 0.12$, the observed power was 0.997. As predicted, under cognitive load, fewer participants (458;

55.45%) provided reasons than in the control condition (574; 66.74%), and more participants (245; 29.66%) selected “It’s wrong, but I can’t think of a reason.” than in the control group (172; 20%). The responses to the critical slide for the experimental group ($N = 826$) and the control group ($N = 860$) are displayed in Figure 8. The observed counts, expected counts, and standardized residuals are displayed in Table 6.

Figure 8

Study 6: Responses to critical slide depending on cognitive load across all scenarios.

Table 6

Study 6 – Observed counts, expected counts, and standardized residuals for each response to the critical slide depending on cognitive load (full sample)

		Cognitive Load	Control
Observed count	Reasons	458	574
	Dumbfounded	245	172
	Nothing Wrong	123	114
Expected count	Reasons	505.59	526.41
	Dumbfounded	204.3	212.7
	Nothing Wrong	116.11	120.89
Standardized residuals	Reasons	-4.76**	4.76**
	Dumbfounded	4.6**	-4.6**
	Nothing Wrong	0.97	-0.97

Note. * = sig. at < .05; ** = sig. at < .001

This pattern was observed for all scenarios individually with the exception of *Julie and Mark*, which showed no association between experimental condition and cognitive load, $\chi^2(2, N = 418) = 0.49, p = .783, V = 0.25, \text{power} = 0.601$. The association was significant for *Jennifer* $\chi^2(2, N = 418) = 17.33, p < .001, V = 0.24, \text{power} = 0.623$, *Trolley* $\chi^2(2, N = 418) = 10.95, p = .004, V = 0.25, \text{power} = 0.614$, and *Heinz*, $\chi^2(2, N = 418) = 7.16, p = .028, V = 0.25, \text{power} = 0.608$, see Figure 9. Supplementary Tables S15-S18 show the direction of the effect for each scenario. Under cognitive load, fewer participants provided reasons and more participants provided a dumbfounded response for *Jennifer*, *Trolley*, and *Heinz*.

Figure 9

Study 6: Responses to critical slide and for the experimental group and the control group for each scenario

A chi-squared test for independence revealed a significant association between scenario and response to the critical slide, $\chi^2(6, N = 1686) = 61.34, p < .001, V = 0.19$, the observed power was 1. Participants were significantly more likely to select “There is nothing wrong” for *Julie and Mark* ($p = .002$), more likely to provide reasons ($p = .002$), and less likely to select “There is nothing wrong” ($p < .001$) for Jennifer, and more likely to be dumbfounded by *Trolley* ($p = .031$).

A multinomial logistic regression was conducted to test the effects of cognitive load and scenario on dumbfounded responses. Overall, the model was significant, $\chi^2(8, N = 1686) = 95.9, p < .001$, and explained between 6.07% (Cox and Snell R square) and 7.22% (Nadelkerke R squared) of the variance in responses to the critical slide, the observed power was $>.99$.

Participants in the control condition were significantly less likely to provide a dumbfounded response than to provide reasons, Wald = 25.04, $p < .001$, $OR = 0.55$, 95% CI [0.44, 0.70], in addition, participants in the control condition were also significantly less likely to select “There is nothing wrong,” than to provide reasons, Wald = 5.23, $p = .022$, $OR = 0.71$, 95% CI [0.54, 0.95]. For *Jennifer*, participants were significantly less likely to select “There is nothing wrong” than to provide a reason, Wald = 30.87, $p < .001$, $OR = 0.23$, 95% CI [0.13, 0.38]; while for *Trolley* participants were significantly more likely to present as dumbfounded than to provide a reason, Wald = 6.89, $p = .009$, $OR = 1.55$, 95% CI [1.12, 2.14].

Combined Analyses

The combined results for Studies 1-6 are displayed in Figures 10 and 11. When engagement with the memory task was accounted for ($N = 2312$; 1145 experimental, 1167 control), a significant association between cognitive load and responses to the critical slide was found, $\chi^2(2, N = 2312) = 39.78$, $p < .001$, $V = 0.13$, the observed power was $>.99$. The observed counts, expected counts, and standardized residuals are displayed in Table 7.

Table 7

Studies 1-6 – Observed counts, expected counts, and standardized residuals for each response depending on cognitive load

		Cognitive Load	Control
Observed count	Reasons	615	772
	Dumbfounded	323	220
	Nothing Wrong	207	175
Expected count	Reasons	686.9	700.1
	Dumbfounded	268.92	274.08
	Nothing Wrong	189.18	192.82
Standardized residuals	Reasons	-6.1**	6.1**
	Dumbfounded	5.31**	-5.31**
	Nothing Wrong	2*	-2*

Note. * = sig. at $< .05$; ** = sig. at $< .001$

A mini meta-analysis was conducted and found that cognitive load significantly influenced responding across all studies $\chi^2(12) = 52.37, p < .001$ (Fisher's method); or when weighting for sample size, $z = 5.373, p < .001$ (Stouffer's Z-score method).

Despite the mixed findings across individual studies, the results of both the combined analyses, and the meta-analyses suggest a meaningful effect of cognitive load on reason-giving in a moral dumbfounding task. Inspection of the standardized residuals in Table 7 indicates that a reduction in reason-giving under cognitive load leads to an increase in both dumbfounding and nothing-wrong. Furthermore, the effect appears to be stronger for dumbfounding than for reason-giving, consistent with our hypothesis that nothing-wrong involves more deliberation than dumbfounding (recall Figure 1).

Figure 10

Studies 1-6: Responses to critical slide for the cognitive load groups ($N = 1,145$) and the control groups ($N = 1,167$) controlling for engagement

Figure 11

Rates of declaring reasons and cognitive load across each study

A multinomial logistic regression revealed a statistically significant association between need for cognition and response to the critical slide, $\chi^2(2, N = 654) = 12.15, p = .002$. The observed power was 0.89. Need for cognition explained between 1.95% (Cox and Snell R square) and 2.62% (Nadelkerke R squared) of the variance in responses to the critical slide. As need for cognition increased, participants were significantly more likely to provide reasons than to present as dumbfounded, Wald = 11.01, $p < .001$, odds ratio = 1.27, 95% CI [1.10, 1.45]. As need for cognition increased, participants were also significantly more likely to select there is nothing wrong than present as dumbfounded Wald = 7.86, $p = .005$, odds ratio = 1.00, 95% CI [1.07, 1.49]. The relative probabilities of selecting each response depending on need for cognition are displayed in Figure 12.

Figure 12

Studies 1-5: Probability of selecting each response to the critical slide depending on need for cognition

General Discussion

The present research aimed to add to the literature on moral judgments by offering new insights into factors that prompt moral dumbfounding. We hypothesized that under cognitive load, participants would be less likely to provide reasons and more likely to present as dumbfounded (or to select nothing-wrong). Across six studies, we tested the effect of three different cognitive load manipulations on responses in a dumbfounding task. Asking participants to memorize a single number-letter-string reduced reason-giving in Study 1, but not in Study 5. The dot-pattern memorization task reduced reason-giving (when controlling for engagement) in Studies 2 and 3, but not Study 4. The video attention task in Study 6 inhibited reason-giving for

three out of four scenarios. Despite some variation, we find overall evidence that in situations where the resources available for deliberation are limited (as when cognitive load is high), reason-giving is reduced, and moral dumbfounding is more likely. This key finding is consistent with previous work demonstrating that cognitive load inhibits deliberative responding (e.g., De Neys, 2006; Evans & Curtis-Holmes, 2005). The observed variability

As a secondary hypothesis, we also tested if reason-giving was associated with individual differences in need for cognition (Cacioppo & Petty, 1982; Forsterlee & Ho, 1999; Petty et al., 1984, 1996). We found evidence for this prediction in Study 3 and in the combined analysis; however, Studies 1, 2, 4, and 5 did not support this. Together, this suggests that responses in the dumbfounding paradigm may be weakly predicted by NFC; that is, individual studies were not sufficiently powered to detect this small effect (our power analysis indicated a sample of $N = 309$ was required to detect a small effect), future research should further investigate potential individual-level predictors of dumbfounding.

Implications, Limitations, and Future Directions

These studies offer new understandings of the phenomenon of moral dumbfounding. While our studies illustrate the complexity of attempting to understand moral judgments, we do demonstrate some reliable patterns that offer support to our core theoretically-informed hypotheses. Furthermore, these studies showcase a methodology for measuring dumbfounding under different empirical conditions, offering a path for future researchers to explore the role of other contextual and individual difference variables in influencing moral dumbfounding.

From a theoretical perspective our findings are consistent with a dual-process explanation of moral dumbfounding, whereby dumbfounding occurs when an intuitive/habitual response is in conflict with a deliberative response (Evans, 2007; again we note that the assumption of dual-processes is not necessarily required, and that this prediction is also consistent with the unimodel,

Kruglanski & Gigerenzer, 2011; or categorization approaches McHugh et al., 2022). In line with existing theorizing on moral judgments (Cushman, 2013; McHugh et al., 2022; Railton, 2017), we propose that an individual may make an intuitive judgment and that subsequent attempts to identify reasons for this judgment occur through deliberation. If deliberation is unsuccessful and the individual does not revise their judgment, dumbfounding is observed. In support of this explanation, our studies demonstrated that by reducing the cognitive resources available for deliberation, reason-giving was reduced and dumbfounding increased. We also provide preliminary evidence for an association between a tendency to engage in deliberation (as measured by NCF) and reason-giving (albeit a weak effect). Future research should assess individual level predictors of dumbfounding in more detail.

These findings have relevance for society more broadly. Moral considerations inform a range of behaviors and decisions, both at the individual level and at the societal level (Sinnott-Armstrong et al., 2010). It is likely that moral dumbfounding may be a contributing factor to moral disagreement on contentious issues. Our studies provide evidence that dumbfounding may be more prevalent in situations that constrain people's ability to engage in deliberation. In practice, this suggests that when discussing contentious moral issues, disagreement through dumbfounding may be reduced by ensuring conditions suitable for deliberation (e.g., avoiding emotionally charged, high-pressure environments).

We found non-trivial variability and inconsistency across our studies. It is possible that this occurred as a result of methodological limitations. Classic studies of dual-process conflict are characterized by binary response options (an intuitive response contrasted with a deliberative response; Evans, 2007), whereas our studies included three response options that varied in their relative amount of deliberation. Interestingly, inconsistencies were observed for each cognitive

load manipulation, while Study 6 additionally showed variability between the scenarios. It may be possible to attribute this inconsistency to a lack of statistical power to detect a small effect.

However, it is also possible that these results provide evidence that the conflict in dual-process explanation tested here is only part of the story, illustrating that moral dumbfounding displays high variability and context dependency (as with moral judgment more generally, see McHugh et al., 2022). A further complication is that responses in the dumbfounding paradigm may involve competing intuitions. For example, participants may have intuitions relating to the nature of moral knowledge, such as *moral judgments should be justifiable by reasons*, that may become salient during the course of the study. This means that, in addition to experiencing a conflict between habitual and deliberative responding, participants may also experience competing intuitions. Future research should unpack the influences of these competing intuitions.

While the studies presented here were in line with our theoretical predictions, we note that our samples were either student or online participants from Westernized countries, limiting the generalizability of our findings. While emerging research suggests that dumbfounding is observed in certain non-WEIRD populations (McHugh et al., 2021), future research should test if the explanation tested here generalizes beyond Western contexts.

Conclusion

Moral dumbfounding occurs when people stubbornly maintain a moral judgment, even without reasons to support their judgments. To date, there are few studies that consider the causes of moral dumbfounding. Here, we test the idea that moral dumbfounding is more likely to occur when an individual is experiencing greater demands on their cognitive system, leaving less cognitive resources available for reasoning in complex moral dilemmas. The findings from the present research show that moral dumbfounding is more likely to occur under cognitive load, at least in some contexts. Furthermore, by way of exploration, we also found preliminary support

for a relationship between an individual's need for cognition and dumbfounded responding.

While these findings add new knowledge to the literature on moral dumbfounding, they also highlight complexities and inconsistencies in moral judgments. Further research will need to identify specific causes of the inconsistencies observed and to better understand the factors that lead to dumbfounding, and, ultimately, how it might be reduced.

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Supplementary Materials

Study Materials

Scenarios

Julie and Mark

Julie and Mark, who are brother and sister are travelling together in France. They are both on summer vacation from college. One night they are staying alone in a cabin near the beach. They decide that it would be interesting and fun if they tried making love. At very least it would be a new experience for each of them. Julie was already taking birth control pills, but Mark uses a condom too, just to be safe. They both enjoy it, but they decide not to do it again. They keep that night as a special secret between them, which makes them feel even closer to each other.

Jennifer

Jennifer works in a medical school pathology lab as a research assistant. The lab prepares human cadavers that are used to teach medical students about anatomy. The cadavers come from people who had donated their body to science for research. One night Jennifer is leaving the lab when she sees a body that is going to be discarded the next day. Jennifer was a vegetarian, for moral reasons. She thought it was wrong to kill animals for food. But then, when she saw a body about to be cremated, she thought it was irrational to waste perfectly edible meat. So she cut off a piece of flesh, and took it home and cooked it. The person had died recently of a heart attack, and she cooked the meat thoroughly, so there was no risk of disease.

Trolley

A Trolley is hurtling down a track towards five people. It will kill them all on impact. Paul is on a bridge under which it will pass. He can stop it by putting something very heavy in front of it. As it happens, there is a very fat man next to him. Paul's only way to stop the trolley is to push him over the bridge and onto the track, killing him to save five. Paul decides to push the man.

Heinz

In Europe, a woman was near death from a very bad disease, a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium for which a Druggist was charging ten times what the drug cost him to make. The sick woman's husband, Heinz, went to everyone he knew to borrow the money, but he could only get together about half of what it cost. He told the Druggist that his wife was dying, and asked him to sell it cheaper or let him pay later. But the Druggist said, 'No, I discovered the drug and I'm going to make money from it.' So, Heinz got desperate and broke into the man's store to steal the drug for his wife. The Druggist had Heinz arrested and charge.

Measures***Julie and Mark***

- How would you rate the behaviour of Julie and Mark? (1 = Morally Wrong; and 7 = Morally Right)
- How confident are you about your judgement? (1 = Not at all Confident; 7 = Extremely Confident)
- Do you agree that any concerns regarding reproductive complications are eased by their using of two forms of contraception? (Yes/No)
- And do you accept that they are both consenting adults, and that they both consented and enjoyed it? (Yes/No)
- And do you concede that nobody else was affected by their actions? (Yes/No)
- Julie and Mark's behaviour did not harm anyone or negatively affect anyone. How can there be anything wrong with what they did?

Jennifer

- How would you rate the behaviour of Jennifer? (1 = Morally Wrong; 7 = Morally Right)

- How confident are you about your judgement? (1 = Not at all Confident; 7 = Extremely Confident)
- The body had been donated for research, it was to be discarded the next day. You must agree then that it had obviously fulfilled its purpose?
- Do you accept that the body was already dead?
- And do you accept that there was no risk of disease?
- Jennifer's actions did not harm anyone, or negatively affect anyone. How can there be anything wrong with what she did?

Trolley

- How would you rate the actions of Paul? (1 = Morally Wrong; and 7 = Morally Right)
- How confident are you about your judgement? (1 = Not at all Confident; 7 = Extremely Confident)
- Do you accept that five people would have died if Paul didn't push the man?
- And this man is the only way available to stop the trolley? (Paul does not weigh enough)
- Do you agree that in stopping the trolley Paul saved the lives of five people?
- Paul's actions saved the lives of five people! How can saving lives be wrong?

Heinz

- How would you rate the actions of the Druggist?(1 = Morally Wrong; and 7 = Morally Right)
- How confident are you about your judgement?(1 = Not at all Confident; 7 = Extremely Confident)
- Do you agree that the druggist has to make a living?
- And do you accept that Heinz broke into the druggist's store?

- And do you accept that he stole from him?
- The druggist was only protecting his livelihood. How can that be wrong?

Figure S10

Screenshot of attention check

Recent research on decision making shows that choices are affected by context. Differences in how people feel, their previous knowledge and experience, and their environment can affect choices. To help us understand how people make decisions, we are interested in information about you. Specifically, we are interested in whether you actually take the time to read the directions; if not, some results may not tell us very much about decision making in the real world. To show that you have read the instructions, please ignore the question below about how you are feeling and instead check only the “none of the above” option as your answer. Please check all the words that describe how you are currently feeling.

Please select a word that describes how you are currently feeling:

☐ Happy ☐ Satisfied ☐ Enthusiastic ☐ Sad ☐ Anxious ☐ Self-Conscious ☐ Grumpy ☐ Thankful ☐ none of the above

Figure S11*Screenshot of attention check*

Everyone likes to watch television programs. Recently, sports television programs have seen a major increase in ratings. Many sports start with the letter 'B.' However, we ask that from the list below you select a sport that does not start with the letter 'B.' Thank you for doing this task.

Supplementary Tables**Table S1***Study 1 – Changes in Judgment*

Initial Judgment	Revised Judgment	Total Changed
neutral	right	1
neutral	wrong	3
wrong	neutral	7
wrong	right	1

Table S2*Study 1 – Response to the critical slide depending on cognitive load*

	N	%	N	%
It's wrong and I can provide a valid reason.	12	36%	21	64%
It's wrong but I can't think of a reason.	6	18%	7	21%
There is nothing wrong.	15	45%	5	15%

Table S3*Study 2 – Changes in Judgment*

Initial Judgment	Revised Judgment	Total Changed
neutral	right	2
right	neutral	1
wrong	neutral	6
wrong	right	1

Table S4*Study 2 – Response to the critical slide depending on cognitive load/engagement*

Measure	Response	N	%	N	%
Manipulation Only	Reasons	25	49%	25	51%
	Dumbfounded	15	29%	11	22%
	Nothing Wrong	11	22%	13	27%
Engagement	Reasons	23	41%	27	61%
	Dumbfounded	20	36%	6	14%
	Nothing Wrong	13	23%	11	25%

Table S5*Study 3 – Changes in Judgment*

Initial Judgment	Revised Judgment	Total Changed
neutral	right	2
neutral	wrong	2
right	neutral	4
right	wrong	1
wrong	neutral	2
wrong	right	2

Table S6*Study 3 – Response to the critical slide depending on cognitive load/engagement*

	N	%	N	%
It's wrong and I can provide a valid reason.	36	53%	41	67%
It's wrong but I can't think of a reason.	17	25%	5	8%
There is nothing wrong.	15	22%	15	25%

Table S7*Study 4 – Changes in Judgment*

Initial Judgment	Revised Judgment	Total Changed
neutral	right	4
right	neutral	1
right	wrong	1
wrong	neutral	6
wrong	right	1

Table S8

Study 4 – Response to the critical slide depending on cognitive load/engagement

	N	%	N	%
It's wrong and I can provide a valid reason.	35	55%	41	65%
It's wrong but I can't think of a reason.	10	16%	10	16%
There is nothing wrong.	19	30%	12	19%

Table S9

Study 5 – Changes in Judgment

Initial Judgment	Revised Judgment	Total Changed
neutral	right	1
right	neutral	2
right	wrong	1
wrong	neutral	6
wrong	right	1

Table S10

Study 5 – Response to the critical slide depending on cognitive load/engagement

N	%	N	%
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It's wrong and I can provide a valid reason.	51	52%	68	64%
It's wrong but I can't think of a reason.	25	26%	20	19%
There is nothing wrong.	22	22%	18	17%

Table S11

Study 6 – Changes in Judgment (full sample)

Initial Judgment	Revised Judgment	Total Changed
neutral	right	8
neutral	wrong	19
right	neutral	10
right	wrong	61
wrong	neutral	29
wrong	right	73

Table S12*Study 6 – Changes in Judgment for each Scenario*

Scenario	Initial Judgment	Revised Judgment	Total Changed
Julie and Mark	neutral	right	1
	neutral	wrong	4
	right	wrong	6
	wrong	neutral	9
	wrong	right	8
Jennifer	neutral	right	1
	neutral	wrong	3
	right	neutral	2
	right	wrong	10
	wrong	neutral	2
	wrong	right	11
Trolley	neutral	right	4
	neutral	wrong	7
	right	neutral	4
	right	wrong	18
	wrong	neutral	14
	wrong	right	26
Heinz	neutral	right	2
	neutral	wrong	5
	right	neutral	4
	right	wrong	27
	wrong	neutral	4
	wrong	right	28

Table S13*Study 6 – Response to the critical slide depending on cognitive load (full sample)*

	N	%	N	%
It's wrong and I can provide a valid reason.	113	56%	143	67%
It's wrong but I can't think of a reason.	55	27%	36	17%
There is nothing wrong.	35	17%	36	17%

Table S14*Study 6 – Response to the critical slide depending on cognitive load, for each scenario*

Scenario	Response	N	%	N	%
Julie and Mark	Reasons	106	54%	123	57%
	Dumbfounded	51	26%	51	24%
	Nothing Wrong	40	20%	41	19%
Jennifer	Reasons	142	65%	173	81%
	Dumbfounded	67	31%	30	14%
	Nothing Wrong	9	4%	11	5%
Trolley	Reasons	97	47%	135	62%
	Dumbfounded	72	35%	55	25%
	Nothing Wrong	39	19%	26	12%
Heinz	Reasons	113	56%	143	67%
	Dumbfounded	55	27%	36	17%
	Nothing Wrong	35	17%	36	17%

Table S15

Study 6 – Observed counts, expected counts, and standardised residuals for each response to the critical slide depending on cognitive load (Julie and Mark)

		Cognitive Load	Control
Observed count	Reasons	106	123
	Dumbfounded	51	51
	Nothing Wrong	40	41
Expected count	Reasons	109.5	119.5
	Dumbfounded	48.77	53.23
	Nothing Wrong	38.73	42.27
Standardised residuals	Reasons	-0.69	0.69
	Dumbfounded	0.51	-0.51
	Nothing Wrong	0.32	-0.32

Note. * = sig. at < .05; ** = sig. at < .001

Table S16

Study 6 – Observed counts, expected counts, and standardised residuals for each response to the critical slide depending on cognitive load (Jennifer)

		Cognitive Load	Control
Observed count	Reasons	142	173
	Dumbfounded	67	30
	Nothing Wrong	9	11
Expected count	Reasons	158.96	156.04
	Dumbfounded	48.95	48.05
	Nothing Wrong	10.09	9.91

Standardised residuals	Reasons	-3.67**	3.67**
	Dumbfounded	4.16**	-4.16**
	Nothing Wrong	-0.5	0.5

Note. * = sig. at < .05; ** = sig. at < .001

Table S17

Study 6 – Observed counts, expected counts, and standardised residuals for each response to the critical slide depending on cognitive load (Trolley)

		Cognitive Load	Control
Observed count	Reasons	97	135
	Dumbfounded	72	55
	Nothing Wrong	39	26
Expected count	Reasons	113.81	118.19
	Dumbfounded	62.3	64.7
	Nothing Wrong	31.89	33.11
Standardised residuals	Reasons	-3.28*	3.28*
	Dumbfounded	2.06*	-2.06*
	Nothing Wrong	1.92	-1.92

Note. * = sig. at < .05; ** = sig. at < .001

Table S18

Study 6 – Observed counts, expected counts, and standardised residuals for each response to the critical slide depending on cognitive load (Heinz)

		Cognitive Load	Control
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Observed count	Reasons	113	143
	Dumbfounded	55	36
	Nothing Wrong	35	36
Expected count	Reasons	124.33	131.67
	Dumbfounded	44.19	46.81
	Nothing Wrong	34.48	36.52
Standardised residuals	Reasons	-2.27*	2.27*
	Dumbfounded	2.56*	-2.56*
	Nothing Wrong	0.14	-0.14

Note. * = sig. at < .05; ** = sig. at < .001

Table S19

Responses to critical slide for all cognitive load studies (raw)

Study	Response	N	percent	N	percent
Study 1*	Reasons	12	36%	21	64%
	Dumbfounded	6	18%	7	21%
	Nothing wrong	15	45%	5	15%
Study 2	Reasons	25	49%	25	51%
	Dumbfounded	15	29%	11	22%
	Nothing wrong	11	22%	13	27%
Study 3*	Reasons	54	53%	41	67%
	Dumbfounded	27	26%	5	8%
	Nothing wrong	21	21%	15	25%
Study 4	Reasons	35	55%	41	65%
	Dumbfounded	10	16%	10	16%
	Nothing wrong	19	30%	12	19%
Study 5	Reasons	51	52%	68	64%
	Dumbfounded	25	26%	20	19%

	Nothing wrong	22	22%	18	17%
Study 6	Reasons	458	55%	574	67%
	Dumbfounded	245	30%	172	20%
	Nothing wrong	123	15%	114	13%
All Studies*	Reasons	635	54%	770	66%
	Dumbfounded	328	28%	225	19%
	Nothing wrong	211	18%	177	15%

Note. *significant variation at $< .05$; **significant variation at $< .001$

Table S20

Responses to critical slide for all cognitive load studies (controlling for engagement)

Study	Response	N	percent	N	percent
Study 1*	Reasons	12	36%	21	64%
	Dumbfounded	6	18%	7	21%
	Nothing wrong	15	45%	5	15%
Study 2 (engaged)*	Reasons	23	41%	27	61%
	Dumbfounded	20	36%	6	14%
	Nothing wrong	13	23%	11	25%
Study 3 (engaged)**	Reasons	36	53%	41	67%
	Dumbfounded	17	25%	5	8%
	Nothing wrong	15	22%	15	25%
Study 4 (engaged)	Reasons	35	55%	41	65%
	Dumbfounded	10	16%	10	16%
	Nothing wrong	19	30%	12	19%
Study 5	Reasons	51	52%	68	64%
	Dumbfounded	25	26%	20	19%
	Nothing wrong	22	22%	18	17%
Study 6	Reasons	458	55%	574	67%

	Dumbfounded	245	30%	172	20%
	Nothing wrong	123	15%	114	13%
All studies (engaged)**	Reasons	615	54%	772	66%
	Dumbfounded	323	28%	220	19%
	Nothing wrong	207	18%	175	15%

Note. *significant variation at $< .05$; **significant variation at $< .001$

Supplementary Figures

Figure S1

Study 1: Probability of selecting each response to the critical slide depending on Need for Cognition

Figure S2

Study 2: Probability of selecting each response to the critical slide depending on Need for Cognition

Figure S3

Study 3: Probability of selecting each response to the critical slide depending on Need for Cognition

Figure S4

Study 4: Probability of selecting each response to the critical slide depending on Need for Cognition

Figure S5

Study 5: Probability of selecting each response to the critical slide depending on Need for Cognition

Figure S6

Study 6: Responses to critical slide depending on cognitive load (Julie and Mark)

Figure S7

Study 6: Responses to critical slide depending on cognitive load (Jennifer)

Figure S8

Study 6: Responses to critical slide depending on cognitive load (Trolley)

Figure S9

Study 6: Responses to critical slide depending on cognitive load (Heinz)