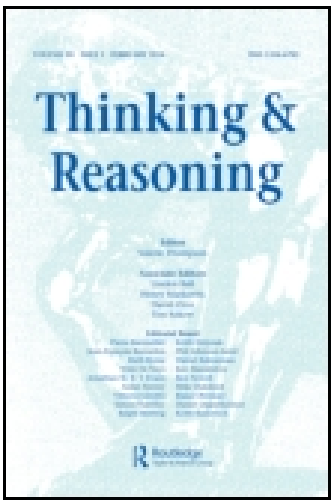

Thinking & Reasoning
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ptar20

Dual processes of emotion and reason in judgments about moral dilemmas

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Published online: 05 Feb 2014.

To cite this article: Eoin Gubbins & Ruth M. J. Byrne (2014) Dual processes of emotion and reason in judgments about moral dilemmas, Thinking & Reasoning, 20:2, 245-268, DOI: 10.1080/13546783.2013.877400

To link to this article: http://dx.doi.org/10.1080/13546783.2013.877400

Thinking & Reasoning, 2014
Vol. 20, No. 2, 245–268, http://dx.doi.org/10.1080/13546783.2013.877400

Dual processes of emotion and reason in judgments about moral dilemmas

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We report the results of two experiments that show that participants rely on both emotion and reason in moral judgments. Experiment 1 showed that when participants were primed to communicate feelings, they provided emotive justifications not only for personal dilemmas, e.g., pushing a man from a bridge that will result in his death but save the lives of five others, but also for impersonal dilemmas, e.g., hitting a switch on a runaway train that will result in the death of one man but save the lives of five others; when they were primed to communicate thoughts, they provided non-emotive justifications for both personal and impersonal dilemmas. Experiment 2 showed that participants read about a protagonist's emotions more quickly when the protagonist was faced with a personal dilemma than an impersonal one, but they read about the protagonist's decision to act or not act equally quickly for personal and impersonal dilemmas.

Keywords: Moral reasoning; Emotions; Moral dilemmas; Inferences; Dual processes.

Reports of the lives lost and injuries sustained during the Costa Concordia cruise ship's sinking off the west coast of Italy in 2012 include many tragic stories of moral dilemmas that faced the passengers and crew on board. Initial attention focused on the captain, not least because he abandoned the ship before the passengers in his care had succeeded in doing so. However, prosecutors subsequently drew attention to other transgressions—the youngest victim, aged 5 years, drowned with her father after they were told by the crew that there was no space for them in a lifeboat; prosecutors also drew attention to sacrifices—a musician working on the ship died after he gave up

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The research was supported by a PhD scholarship from the Irish Research Council for the Humanities and Social Sciences to Eoin Gubbins. We thank Laura Deighan, Gemma Gordon, Hannah Jellings, and Jessica Stanley for their help with the experiments. The results of Experiment 1 were presented at the 17th Conference of the European Society for Cognitive Psychology in San Sebastian in September 2011 and of Experiment 2 at the 4th International Conference on Thinking in London in July 2012.

his seat in a lifeboat for someone else (Davies, 2013). People often find it genuinely difficult to decide what is the right thing to do when they are confronted with a moral dilemma, particularly when they must decide whether to violate or adhere to core societal principles about avoiding harm or maintaining fairness (e.g., Haidt, 2001; Kohlberg, 1984; Mikhail, 2009).

The captain of the Costa Concordia ship is reported as saying, "In the moment the floor started to become steeper, you have no other option: To die or to swim. I regret nothing" (Kosinski, 2013). Our aim in the two experiments we report is to test whether people provide emotions or reasons as persuasive justifications for their moral decisions, and whether information about the emotion a protagonist experienced as they were faced with a moral dilemma affects how people consider their subsequent decision.

DUAL PROCESSES IN MORAL REASONING

There is no clear demarcation between moral and non-moral issues; a rule that is a moral principle in one culture may be merely a social convention in another (e.g., Bucciarelli, Khemlani, & Johnson-Laird, 2008). Many moral obligations differ from society to society, although some moral principles appear universal and present in all cultures (e.g., Mikhail, 2007; Moore, Lee, Clark, & Conway, 2011; see also Morris, Sim, & Girotto, 1998). We take as our starting point the view that reasoning about moral matters may be based on the same general processes as reasoning about other contents (e.g., Cushman & Young, 2011; Stich 2006; Sunstein, 2005; Uttich & Lombrozo, 2010). There is no current consensus on the cognitive processes that underlie reasoning: people may calculate the probability of outcomes based on their beliefs (e.g., Evans & Over, 2004; Handley, Evans, & Thompson, 2006; Oaksford & Chater, 2007), they may deploy inference rules that are domain-general (e.g., Braine & O'Brien, 1998; Rips, 1994) or domain-specific (e.g., Cheng & Holyoak, 1985; Cosmides, Tooby, Fiddick, & Bryant, 2005), or they may imagine alternative possibilities or "mental models" (e.g., Byrne & Johnson-Laird, 2009; Johnson-Laird & Byrne, 1991). However, the evidence that content and context affect reasoning is robust (e.g., Manktelow, 2012), and so all theories of reasoning try to explain it. Reasoning about moral content may be prone to similar effects as reasoning about other contents, such as framing effects (Rai & Holyoak, 2010; Shenhav & Greene, 2010).

Reasoning may depend on a system of fast, intuitive, automatic processes or a system of slower, controlled, rational processes that depend on working memory resources, or it may depend on both (e.g., Evans & Stanovich, 2013; Kahneman, 2011). The exercise of a reasoning algorithm—whether based on probabilities, inference rules, or possibilities—is vulnerable to factors such as the limitations of working memory (e.g., Johnson-

Laird, 2006). Hence, people may develop heuristics as shortcuts of a fuller algorithm (e.g., Espino & Byrne, 2013) or even heuristics that are independent of any algorithm (Gigerenzer & Hug, 1992). It remains controversial whether reasoning relies on a single system or on such dual processes (e.g., Keren, 2013; Osman, 2013).

For reasoning about moral content, the conflict between intuitive and rational processes also remains contentious (e.g., McGuire, Langdon, Coltheart, & Mackenzie, 2009; Moore et al., 2011; Shenhav & Greene, 2010). Reasoning about moral content appears to be particularly susceptible to reliance on immediate intuitive responses, particularly emotional reactions (e.g., Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Haidt, 2001). The idea that morality is based on passions and sentiments (Hume, 1739–1740/2004) continues in contemporary claims that many moral judgments are made via emotional processes without substantial conscious reflection (e.g., Haidt, 2001; Haidt & Graham, 2007). Moral "reasoning" on this account is the post-hoc justification of intuitions rather than a deliberative consideration of different options. Evidence for this view comes from observations that people have nearly instant implicit reactions to stories of moral violations (e.g., Luo et al., 2006). The activation of brain areas associated with emotion is a good predictor of people's judgments in response to fair and unfair offers to share a sum of money (e.g., Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003). People are also sometimes "dumbfounded" and cannot articulate the principle underlying their moral judgment (e.g., Cushman, Young, & Hauser, 2006; Haidt, 2001). They judge as wrong violations of emotionally charged moral norms, such as committing incest, even when they cannot rationally defend their judgment (e.g., Haidt, Bjorklund, & Murphy, 2000). Their judgments are also affected by changes in their mood, for example, after watching an amusing video (e.g., Valdesolo & DeSteno, 2006), or after induced anger or disgust (e.g., Ugazio, Lamm, & Singer, 2012), or after smelling unpleasant odours (e.g., Schnall, Haidt, Clore, & Jordan, 2008). Hence, there is evidence that in some circumstances people make moral judgments by relying on their emotional reactions.

An alternative view is that morality depends on reason, including deontological principles that people should act from duty with good will (Kant, 1788/2002), and utilitarian principles that people should make whatever judgment would lead to the best consequences (Mill, 1863/2007). The idea of moral reason continues in modern claims that conscious cognitive deliberation can affect moral judgments (e.g., Kohlberg, 1984). Evidence for the role of reason in moral judgments includes the demonstration that intuitive reactions can be suppressed when participants are explicitly instructed to provide rational responses (e.g., Pizarro, Uhlmann, & Bloom, 2003). Cognitive control processes can overturn immediate emotional reactions and lead to more utilitarian judgments, e.g., to sacrifice one person to save five (e.g., Greene,

Nystrom, Engell, Darley, & Cohen, 2004), and individuals who engage in greater reflection make such utilitarian judgments more often (e.g., Paxton, Ungar, & Greene, 2012). When people must devote cognitive resources to completing another task, they make such judgments more slowly (e.g., Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008). People with higher working memory capacity make different moral judgments compared to those with lower working memory capacity (e.g., Moore, Clark, & Kane, 2008). Hence, there is also evidence that in some circumstances people make moral judgments by trying to reason about the situation.

Overall, the evidence indicates that when people reason about moral matters, just as when they reason about other sorts of content, in some circumstances they may rely on immediate intuitions, perhaps driven by emotional responses, to reach a heuristic judgment; in other circumstances, they may deploy a cognitive mechanism to engage in deliberative reasoning to a considered choice. The idea that moral decisions engage dual processes of emotional responses and cognitive deliberation has been pursued especially through the study of "up close and personal" moral dilemmas (e.g., Greene et al., 2004).

Dual processes in "up close and personal" moral dilemmas

Different sorts of moral dilemmas appear to evoke reason and emotion differently (e.g., Monin, Pizarro, & Beer, 2007). As an illustration, consider the following well-known fictional dilemma, one of several we gave to participants in the experiments we report:

> You are on a bridge above a runaway train quickly approaching a fork in the tracks. On the tracks extending to the left is a group of five railway workmen. On the bridge standing near to you is a single stranger. The train is on the point of proceeding to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is for you to push the stranger off the bridge that will cause the train to come to a stop, leading to the death of the stranger.

The story is an example of a "personal" dilemma in which you are faced with a choice to engage in direct physical contact with another person that will cause the person harm. Many people judge that it is *not* morally appropriate to decide to carry out such an action (e.g., Greene et al., 2004; Mikhail, 2007). Consider instead a different version of the story in which the decision is described as follows:

> You are at the wheel of a runaway train quickly approaching a fork in the tracks. On the tracks extending to the left is a group of five railway workmen. On the tracks extending to the right is a single railway workman. The train is

on the point of proceeding to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is for you to hit a switch on your dashboard that will cause the train to proceed to the right, leading to the death of the single workman.

This version is an example of an "impersonal" dilemma, in which the action that causes harm does not require direct physical contact with another person. Many people judge that it *is* morally appropriate to decide to carry out the action (e.g., Greene et al., 2004; Mikhail, 2007).

Dilemmas categorised as "personal" appear to evoke emotions more than those categorised as "impersonal." They engage brain areas associated with emotional processing—the medial frontal gyrus, posterior cingulate gyrus, and angular gyrus—more so than impersonal dilemmas, as functional magnetic resonance imaging (fMRI) studies have demonstrated (e.g., Greene et al., 2001). Individuals with impairments to the ventromedial prefrontal cortex, a brain area associated with social emotions, are more likely to judge as appropriate the decision to act in a personal dilemma, e.g., pushing the man off the footbridge, compared to controls (e.g., Ciaramelli, Muccioli, Làdavas, & di Pellegrino, 2007; Koenigs et al., 2007).

The impact of emotion in personal dilemmas has led to the conclusion that participants may rely on dual processes to judge the appropriateness of a moral decision: judgments in personal dilemmas may depend on fast, intuitive emotional reactions, whereas judgments in impersonal dilemmas may be reached by slower, deliberative reason (e.g., Cushman et al., 2006; Greene et al., 2008; Moore et al., 2008; Paxton & Greene, 2010). Evidence for this view comes from observations that people respond faster to personal moral dilemmas than to impersonal ones (e.g., Moore et al., 2008). They answer emotion questions faster than moral questions for dilemmas that are "emotion-prevalent," akin to personal dilemmas, whereas they answer moral questions faster than emotion questions for dilemmas that are "evaluation-prevalent," akin to "impersonal" dilemmas (e.g., Bucciarelli et al., 2008). Mood changes induced by watching an amusing or elevating video affect judgments of appropriateness for action in personal dilemmas, but not for impersonal ones (e.g., Strohminger, Lewis, & Meyer, 2011; Valdesolo & DeSteno, 2006).

Our aim in the two experiments we report is to examine further the relative contribution of emotion and reason in moral judgments for personal and impersonal dilemmas. We report the results of two experiments that provide converging evidence—from post-hoc justifications for decisions participants themselves have made, and from participants' latencies to read about decisions others have made—that moral judgments are influenced by both emotion and reason, in impersonal dilemmas as well as personal ones. We consider whether emotions can be an addition to reason, rather than a replacement of it.

EXPERIMENT 1

The experiment examined justifications based on emotion and on reason for personal and impersonal dilemmas. Its aim was to assess whether participants can be primed to provide justifications based on emotions not only for personal but also for impersonal dilemmas, and justifications based on reasons not only for impersonal but also for personal dilemmas. People attempt to persuade each other of the morality of their decisions in various ways (e.g., Haidt, 2001). When participants think aloud, they sometimes appear to reason to their moral judgment and other times appear to have an immediate moral intuition and provide a subsequent justification for it (Bucciarelli et al., 2008). Participants can provide reasons for hitting the switch in the trolley problem, but those asked to provide more reasons (seven vs. two) were more likely to judge that the action should *not* be taken (Rai & Holyoak, 2010). Participants can provide reasonable justifications for their judgments that an action is more forbidden when it is based on action vs. inaction, or on contact vs. no-contact (e.g., Cushman et al., 2006), but their justifications for the difference in their decisions between problems such as the trolley and footbridge problems often fail to identify a factual difference between the two (e.g., Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007).

We test instead whether participants can provide justifications that invoke not only emotions but also reasons to defend their decision in personal dilemmas, and conversely whether they can provide justifications that invoke not only reasons but also emotions to defend their decision in impersonal dilemmas. Participants were asked to imagine themselves in the situation depicted by the runaway train or footbridge dilemmas, and they were given the following context:

> Later that evening at home, you go over and over the situation in your mind. Your friends and family rally around and do everything they can to help you. When your closest friend arrives, you talk things over in private. You recollect as best you can how the situation arose and how it unfolded. But you are distressed to see that your friend appears genuinely shocked at the decision you made, although they try to hide it.

The participants' task was to complete a sentence, primed towards reasons in a "reason-primed" task:

> You decide to try your best to describe in detail to your friend *what thoughts were in your mind* in the moments before you made your decision. You say, "I knew I had to make a decision fast. This is what I experienced in those seconds, *the reasons and thoughts I had. . .*."

or primed towards emotions in the "emotion-primed" sentence completion task:

> You decide to try your best to describe in detail to your friend *what feelings were in your heart* in the moments before you made your decision. You say, "I knew I had to make a decision fast. This is what I experienced in those seconds, *the feelings and emotions I had. . .*"

A third group of participants completed a sentence that was "unprimed" towards emotions or reasons:

> You decide to try your best to describe in detail to your friend your personal experience in the moments before you made your decision. You say, "I knew I had to make a decision fast. This is what I experienced in those seconds. . .."

Our predictions are as follows:

(1) In the unprimed baseline condition, we expect participants to focus on emotions to justify their decision more often in the personal dilemma about whether to push the man than in the impersonal dilemma about whether to hit the switch, in line with previous research that shows that emotions are elicited more by personal than by impersonal dilemmas (e.g., Greene et al., 2001).
(2) We make the novel prediction, previously unexamined, that in the emotion-primed condition, participants can access emotion when they justify their decisions about whether to hit the switch for the impersonal dilemma, just as they do for the personal dilemma.
(3) In the reason-primed condition, we expect that participants can suppress emotion when they justify their decision about whether to push the man in the personal dilemma, just as they do for the impersonal dilemma, and in line with previous research showing that blame judgments can be influenced when participants are asked for a "most rational, objective judgment" rather than an "intuitive gut feeling" (Pizarro et al., 2003).

Method

Participants. 180 volunteers, 86 women and 93 men were recruited from Trinity College Dublin. Their ages ranged from 18 to 55 years, with an average age of 25 years. They were assigned at random to one of three groups: unprimed, reason-primed, and emotion-primed ($n = 60$ in each group).

Design and materials. Participants in the three groups (unprimed, reason-primed, or emotion-primed) each received a personal and an impersonal dilemma, the runaway train and footbridge problems (see the Appendix). Half were given the personal dilemma first, and the other half the impersonal

dilemma first, and no order effects were observed for the decision participants made. They carried out a decision task first: "Would you hit the switch/push the man?" They were asked to circle their answer: "(a) I would hit the switch/push the man. (b) I would not hit the switch/push the man." Then they carried out the justification task: they were asked to provide a justification for their decision as if to a friend, elicited by the prompts described earlier, primed towards either a reason-based justification or an emotion-based justification, or unprimed.

Procedure. Participants were recruited individually and were provided with a booklet, which contained, on a separate page each, instructions, each problem, its decision task and justification task, and a debriefing paragraph. The instructions informed them that they should answer the problems in the order they were given and they should not change any answers.

Results and discussion

We note first that participants judged that they would act in the impersonal dilemma, i.e., hit the switch, more than that they would act in the personal dilemma, i.e., push the man, 83% vs. 13% overall "yes" responses: $\chi^2 = 176.596$, $p < .001$, $\varphi = -.700$. (All p values are two-tailed). The result is consistent with previous research (e.g., Mikhail, 2007) and it occurred in each group: unprimed, $\chi^2 = 67.972$, $p < .001$, $\varphi = -.753$; emotion-primed, $\chi^2 = 50.714$, $p < .001$, $\varphi = -.650$; and reason-primed, $\chi^2 = 58.865$, $p < .001$, $\varphi = -.700$.

We coded justifications into two broad categories, emotive justifications and non-emotive justifications. Justifications were categorised as emotive if they contained emotive content, that is, a direct reference to emotions, e.g., "shock," an indirect reference to emotions, e.g., "the choice was horrid," or a reference to other people's emotions, e.g., the grieving of the workmen's families.[1]

Note that we coded the emotive content of the justification regardless of the *type* of reason it contained—an emotive justification could make reference to a "utilitarian" reason, e.g., one participant said, "I experienced complete terror and confusion but I reasoned that one life lost is better than 5 lives lost," or to a "direct killing" reason, e.g., another participant said, "Shock, anxiety and stress. Being the one to actually cause a death like that I couldn't do. Physically pushing him would be too much, I wouldn't be

[1] All responses were coded by the first author and an independent rater and the agreement was 100%. A second independent rater coded a random selection of 20% of responses, and the agreement between the independent raters was 83% for the trolley problem and 86% for the footbridge problem, Cohen's Kappa = .557, $p < .001$ and .706, $p < .001$, that is, moderate agreement (.41 to .60) and substantial agreement (.61 to .80), respectively (Viera & Garrett, 2005). Disagreements were resolved by discussion.

able to live with myself." Conversely, a non-emotive justification could make reference to a utilitarian reason, e.g., a participant said, "I had to choose between 2 bad outcomes, one involved less loss of life. So I chose it," or to a "direct killing" reason, e.g., a participant said, "The lives of the 5 men were more directly in my hands so I would have been responsible for 5 deaths as opposed to 1." We provide more information on the types of reasons below, after reporting our primary analysis of whether the justification contained emotive content or not.

Justifications with emotive content comprised about one-third of all justifications and they were provided as often for the personal and impersonal dilemmas overall, $\chi^2 = .113$, $p = .737$. Three comparisons, with a Bonferroni corrected alpha of $p < .017$, tested our predictions:

(1) Emotive justifications were provided more often for the personal than for the impersonal dilemma in the baseline unprimed condition, $\chi^2 = 6.604$, $p < .017$, $\varphi = .235$, as Figure 1 shows. The result adds further support to previous research showing that personal dilemmas evoke emotion more than impersonal dilemmas (e.g., Greene et al., 2001; Valdesolo & De Steno, 2006).
(2) The difference was eliminated in the emotion-primed condition, $\chi^2 = .034$, $p = .855$. Participants accessed emotive justifications and so produced as many for the impersonal dilemma as for the personal one. The result corroborates our novel suggestion that decisions to act in impersonal dilemmas can be justified by appeals to emotions.

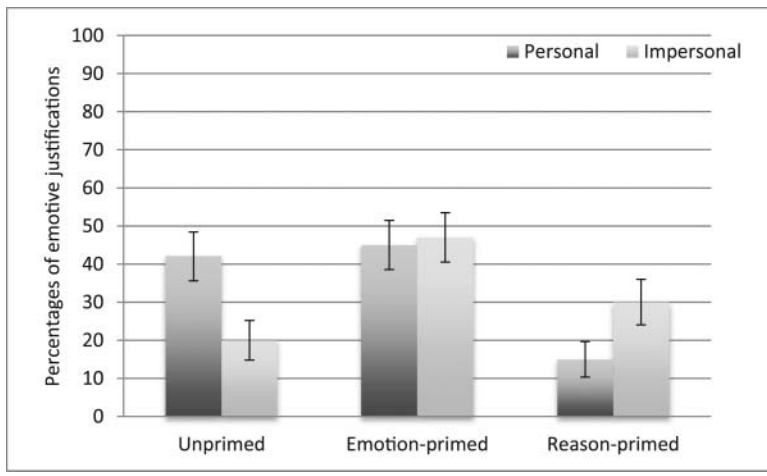

Figure 1 Percentages of emotive justifications in Experiment 1. Error bars are the standard error of the mean.

(3) The difference was also eliminated in the reason-primed condition, $\chi^2 = 3.871$, $p = .049$, $\varphi = -.180$. Participants inhibited emotive justifications and so produced as few for the personal dilemma as for the impersonal one (and even somewhat fewer). The result is consistent with previous research showing that participants can inhibit emotive responses to personal dilemmas in their blame judgments (Pizarro et al., 2003).

The results go further than previous studies of justifications to show that participants can provide emotive justifications for impersonal dilemmas, and they can provide reasoned justifications for personal dilemmas, when primed to do so. The experiment shows that although impersonal dilemmas naturally elicit reasoned justifications, they can be overridden; and although personal dilemmas naturally elicit emotional justifications, they too can be overridden.

We also note that, consistent with previous research (e.g., Hauser et al., 2007), participants produced several different *types* of reasons, which we categorised into the following eight different types[2]:

(1) Utilitarian justifications that referred to saving multiple lives rather than just one life were the most common type of justification overall (37%). An example provided by a participant is: "My conscience would destroy me if I did nothing to save 5 than to save them by risking one." They were generated more often for the impersonal than for the personal dilemma overall, $\chi^2 = 109.555$, $p < .001$, $\varphi = -.552$, and within each group: unprimed, $\chi^2 = 34.660$, $p < .001$ $\varphi = -.537$; reason-primed, $\chi^2 = 42.254$, $p < .001$, $\varphi = -.593$; emotion-primed, $\chi^2 = 33.611$, $p < .001$ $\varphi = -.529$.

(2) "Direct killing" justifications referring to the death being caused directly by the action were the next most common justification overall (21%). An example provided by a participant is: "If I hit the switch I would be intentionally killing the man. If I did nothing, it would be horrible but I could shout at the men to try and get them to move but I would not be killing anyone." They were generated more often for the personal than for the impersonal dilemmas

[2] All responses were coded by the first author and an independent rater and the agreement was 69% overall, 79% for the trolley problem and 59% for the footbridge problem, Cohen's Kappa = .62, $p < .001$ and .501, $p < .001$, that is, substantial agreement (.61 to .80) and moderate agreement (.41 to .60), respectively. A second independent rater coded a random selection of 20% of responses, and the agreement between the independent raters was 72% for the trolley problem, and 42% for the footbridge problem, Cohen's Kappa = .559, and .311, i.e., moderate agreement (.41 to .60) and fair agreement (.21 to .40), respectively. Disagreements were resolved by discussion.

overall, $\chi^2 = 60.044$, $p < .001$, $\varphi = .408$, and in each condition: unprimed, $\chi^2 = 14.602$, $p < .001$, $\varphi = .349$; reason-primed, $\chi^2 = 27.184$, $p < .001$, $\varphi = .476$; and emotion-primed, $\chi^2 = 19.440$, $p < .001$, $\varphi = .402$.

(3) Some participants referred to the individual's personal responsibility in the situation (11%), e.g., a participant said, "I don't want to be the cause of the death of another individual. It's not my fault that those five people died but it would have been my fault if that one person died."
(4) Some participants referred to whether individuals considered themselves involved in the situation (6%), e.g., a participant said, "I would do nothing, so that the event would unfold without my participation and so I would not feel guilty for pushing the man to his death as I decided not to take part in events."
(5) Some participants provided deontological justifications about whether the action was right or wrong or referred to the impossibility of putting a value on someone's life (7%), e.g., a participant said, "I couldn't value somebody's life more than others. It's not right to say one life is less important than five."
(6) "Dumbfounded" responses or "non-explanations" (4%), e.g., a participant said, "I felt sorry for the 5 workmen, but couldn't do anything to save them."
(7) Expressions of doubt (4%), e.g., a participant said, "I doubted my ability to push the man over the bridge. I doubted that this would stop the train in any case."
(8) The expression of an emotion only rather than a justification (7%), e.g., a participant said, "Uncertainty, doubt, scary, frightened, empowerment, apprehension.."

The experiment shows that participants naturally provide justifications with emotive content more often for personal dilemmas than they do for impersonal dilemmas, that is, in the baseline unprimed condition. However, it shows that the difference can be eliminated: when participants were primed to tell a friend about their feelings, "This is what I experienced in those seconds, *the feelings and emotions I had...*," they produced as many emotive justifications for the impersonal dilemma as for the personal one. The difference was also eliminated when they were primed to tell a friend about their thoughts, "This is what I experienced in those seconds, *the reasons and thoughts I had...*," they produced as few emotive justifications for the personal dilemma as for the impersonal one. The finding indicates that participants can access emotion-based justifications for impersonal dilemmas just as they can for personal dilemmas. The result provides some support for our suggestion that emotions can be an addition to reason, rather than a replacement of it.

EXPERIMENT 2

The aim of the experiment was to examine whether people read about the emotion experienced by a protagonist more quickly for a personal dilemma than for an impersonal one, and to examine whether reading about the emotion affects reading about the decision the protagonist made, in a personal or impersonal dilemma. In this experiment, we relied on describing the emotions experienced by a protagonist, because they can be readily manipulated, e.g., we described a protagonist in the personal dilemma making a decision about whether to push the man, and included the information, "Facing this choice, Luke experienced some strong emotions"; we also described a protagonist in the impersonal dilemma making a decision about whether to hit the switch and included the information, "Facing this choice, Luke experienced some strong emotions."

Participants' assessments of the appropriateness of another person's decision, e.g., "Was it is appropriate for Luke to push the man from the footbridge?" (e.g., Hauser et al., 2007), are similar to their assessments of what they would do if faced with a dilemma, e.g., "Would you push the man from the footbridge?" (e.g., Greene et al., 2001; Moore et al., 2008, 2011). The similarity suggests that just as participants judge that they would not push the man in the first-person case because they experience an immediate emotional response at the prospect of violating a core moral principle, so too they judge that it is not appropriate for Luke to push the man in the third-person case because they experience an emotional response at the prospect of someone else violating a core moral principle, and they may expect the protagonist to experience an emotional response too.

We gave participants various different stories (see the Appendix), of the following sort:

> Luke is at the wheel of a runaway train quickly approaching a fork in the tracks. On the tracks extending to the left is a group of five railway workmen. On the tracks extending to the right is a single railway workman. The train is on the point of proceeding to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is for him to hit a switch on his dashboard that will cause the train to proceed to the right leading to the death of the single workman. Facing this choice, Luke feels some strong emotions. He decides he will do it. Was Luke's decision appropriate?

The stories were presented one sentence at a time on a computer screen. Participants pressed a key to read the next sentence and the length of time they spent reading each sentence was recorded. We report the length of time participants spent reading the emotion sentence (e.g., "Facing this choice, Luke feels some strong emotions") and the decision sentence (e.g., "He decides he will do it"), for personal and impersonal dilemmas.

We examined moral dilemmas based on violations of principles of harm and fairness that varied on diverse dimensions (adapted from Greene et al., 2004). The defining characteristics of a "personal" or "impersonal" dilemma are disputed, for example, the set of 64 dilemmas (Greene et al., 2001) upon which many subsequent experimental studies have drawn contains dilemmas that vary on several important dimensions (e.g., Cushman & Young, 2011; Cushman et al., 2006; Moore et al., 2011; Nakamura, 2013; Royzman & Baron, 2002). The dilemmas in this earlier set differ in the moral principle violated—harm, fairness, honesty (e.g., killing, stealing, lying, corrupting), and in their outcomes being accidental or intentional as a means or a side-effect; they differ in the severity of the outcome, in whether it contains a benefit to oneself or to one other person, or to many other people, and in whether the protagonist has some responsibility or involvement in the unfolding events or is a bystander (e.g., Moore et al., 2008; Nakamura, 2013; Trémolière & De Neys, 2013). A key difference (which we will rely on in our experiments) is the presence of face-to-face or physical contact between people, e.g., pushing a man off a footbridge, vs. indirect contact, e.g., hitting a switch (e.g., Cushman & Young, 2011; Cushman et al., 2006; Royzman & Baron, 2002). In our experiment, personal dilemmas depended on direct bodily contact in harm violations, such as killing a man by pushing him from a footbridge vs. by hitting a switch, keeping a baby quiet by pressing your hand over his mouth vs. by giving him a soother, or blocking fumes with your body vs. with a vent cover, and by "face-to-face" contact in fairness violations, such as falsifying qualifications by telling lies to the people on an interview panel vs. by ticking a box on a questionnaire, stealing cash from a wallet as you hand it to its owner vs. as you leave it on a police station desk, or cheating on tax returns by speaking to a revenue officer vs. filling in an online form.

Our aim was to communicate that the protagonist experienced emotion rather than to identify specific emotions, and so we described protagonists as experiencing strong or mild emotions. We measured the length of time participants took to read a sentence describing the protagonist's emotion. Given that personal dilemmas have been identified as more emotive than impersonal ones, we anticipated that participants will *expect* protagonists to experience emotion when faced with a personal dilemma, such as pushing a man from a footbridge, compared to an impersonal one, such as hitting a switch to change train tracks. Thus, in line with previous research showing that participants appear to rely on emotions more in personal dilemmas (e.g., Greene et al., 2004), we predicted that participants will read sentences about the emotions experienced by a protagonist, e.g., "Facing this decision, Luke feels some strong/mild emotions," faster for personal than impersonal dilemmas.

We also measured the length of time participants took to read a sentence describing the protagonist's decision after they were "primed" by a sentence

describing the protagonist's emotion. The logic of priming studies is that the provision of some information, in this case, a description of an emotion, enables a participant to make an inference, for example, that the protagonist will act, and so when they subsequently read a sentence describing that the protagonist did in fact act, they will be able to read this sentence quickly (i.e., they are "primed" to read it) because the information has already been mentally represented (e.g., Espino, Santamaría & Byrne, 2009; Frosch & Byrne, 2012; Santamaría, Espino, & Byrne, 2005). We tested whether participants read sentences about the decision made by the protagonist, e.g., "He decides he will/won't do it" faster for personal than impersonal dilemmas when they have been primed by information about the emotion experienced by the protagonist.

Method

Participants. The participants were 23 students from Trinity College Dublin, 18 women and 5 men, whose ages ranged from 18 to 46 years with an average age of 23 years, who participated in return for course credits.

Design and materials. Participants acted as their own controls and received four personal and four impersonal moral dilemmas, as well as two non-moral filler stories (see the Appendix). The content of the dilemmas concerned harm violations such as deaths and injuries, and fairness violations such as stealing and lying. The dilemmas were based on some of the dilemmas in Greene et al. (2004), but they were adapted to ensure that the primary difference between matched personal and impersonal pairs was the direct personal contact of the protagonist's action in relation to another person (e.g., Cushman & Young, 2011; Cushman et al., 2006; Royzman & Baron 2002). The syntactic structure was also modified to ensure the dilemmas were matched for features such as the number of sentences and the length of the target sentences (see the Appendix). Each scenario served in both personal and impersonal conditions, although no participant saw both versions of any scenario, to ensure that any latency differences cannot be attributed to artifacts of features of a scenario (e.g., McGuire et al., 2009; Moore et al., 2011).

Participants read the stories in a self-paced manner, pressing a key to read each new sentence. After a brief description of the dilemma, participants read a sentence describing the emotion experienced by the protagonist, e.g., "Facing this choice Luke experiences some strong/mild emotions," and then a sentence describing the protagonist's decision, "Luke decides he will/won't do it." To ensure that they were paying attention to the scenarios, participants were also asked to judge the moral appropriateness of the protagonist's decision, and half of the dilemmas contained the decision to act,

whereas the other half contained the decision not to act. The eight contents were assigned to the eight types of dilemma (personal vs. impersonal, strong vs. mild emotion, decision to act vs. not act) in a Latin-square design, and presented in a different randomised order for each participant.

Procedure. Participants were tested individually. The materials were presented using SuperLab software running on an Apple MacBook laptop. Participants were instructed that the task was not a test of intelligence and that the aim was to examine the responses made by most people. They were asked to read each story carefully, to take as much time as they required, and to answer the question before moving on to the next story. Each dilemma was presented one sentence at a time on screen; participants progressed to the next sentence by pressing the spacebar key, labelled "continue." The time they took to read the target sentences was recorded from key press to key press. They responded to the question about whether the protagonist's decision was appropriate or not by pressing the keys labelled "yes" and "no" (the "y" and "h" keys, respectively). Participants first completed three practice trials using materials unrelated to those in the experiment, to familiarise themselves with the set-up. Participants took on average about 12 minutes to complete the experiment.

Results and discussion

Based on previous studies (Frosch & Byrne, 2012; Santamaría et al., 2005), we identified an outlier as any latency that was greater than the individual's mean latency plus 2 standard deviations or less than their mean latency divided by 3. These outliers were replaced by the individual's mean latency.

Participants read the emotion sentence, e.g., "Luke experienced a strong/mild emotion," more quickly following a personal dilemma such as the footbridge problem, $M = 1291.12$ msec, $SD = 263.61$, than an impersonal one, such as the trolley problem, $M = 1424.47$ msec, $SD = 426.19$, Wilcoxon's signed ranks test, $z = -2.768$, $p < .006$, $r = .41$, as shown by an analysis of the latencies to read the emotion sentences, with outliers (4.3%) replaced. The result suggests that participants expect others to experience emotions in personal dilemmas more than impersonal ones. It is consistent with previous research that participants are more inclined to experience emotions for personal dilemmas than for impersonal ones (e.g., Greene et al., 2001). It also provides some validation that the distinction between personal and impersonal materials operationalised in this study is broadly consistent with previous studies.

Participants read the decision sentence, e.g., "He decides he will/won't do it," equally quickly following a personal dilemma, $M = 2095.25$ msec, $SD = 1042.8$, and an impersonal one, $M = 2040.9$ msec, $SD = 910.53$, Wilcoxon's

signed ranks test, $z = -.487$, $p = .627$, as shown by an analysis of the latencies to read the decision sentences, with outliers (4.9%) replaced. The result suggests that a description of a protagonist's emotions has the same effect on participants' reading of the protagonist's decision, in impersonal dilemmas just as in personal ones. The result is consistent with the view that even impersonal moral dilemmas are affected by emotions (e.g., Nakamura, 2013).

Our interpretation follows the logic of priming studies that the provision of information about the emotion enables a participant to make an inference, e.g., that the protagonist will or will not act, and they are then primed to read a subsequent sentence describing that the protagonist did or did not act because they have already mentally represented the information. An alternative interpretation is that reading emotional words may induce an affective state or increase arousal which in turn might speed up processing, particularly of emotion-congruent information. However, the difference in reading about the emotion experienced by the protagonist for personal and impersonal dilemmas goes against this alternative view. The results suggest that participants expect others to experience emotions in personal dilemmas more than impersonal ones, but that any priming effect of reading about the emotion experienced by a protagonist is the same for personal and impersonal dilemmas.

GENERAL DISCUSSION

Some moral dilemmas seem to evoke emotions readily, perhaps because of their "up close and personal" nature, e.g., pushing a man off a footbridge. For such dilemmas, an immediate emotional aversion to the action may subsequently be overridden by reasoned consideration of the consequences. Other moral dilemmas appear to be less emotive, perhaps because of the impersonal or remote nature of the action, e.g., hitting a switch on a runaway train. For such dilemmas, the reduced emotion may allow reasoned deliberation to operate unhindered. However, the results of the experiments reported here suggest some additional nuances in the interplay between emotion and reason in moral judgment.

Participants provided emotive justifications for their decisions to act in impersonal dilemmas, e.g., hitting the switch, when they were primed to do so, just as they do for their decisions not to act in personal dilemmas, e.g., not pushing the man; conversely, they provided reasoned justifications for their decisions in personal dilemmas, when they were primed to do so, just as they do for impersonal dilemmas, as Experiment 1 showed. The result suggests that although impersonal dilemmas naturally elicit reasoned justifications, people can access emotive justifications and construct appeals to emotions as a persuasive defence of their action, and although personal

dilemmas naturally elicit emotive justifications, people can access reasoned justifications and construct appeals to reason as a persuasive defence of their decision not to act. Participants read more quickly that a protagonist experienced emotions in a personal dilemma, e.g., pushing a man from a footbridge, than in an impersonal dilemma, e.g., hitting a switch on a runaway train; however, they read about the protagonist's decision equally quickly for the personal dilemma as the impersonal one, as Experiment 2 showed. The two experiments suggest that emotions may be an additional input to a process of reason, rather than a replacement of it.

Alternative views of the role of emotion in moral reasoning

One implication of the results of the two experiments is that people reason about moral matters, not by relying primarily on emotions (e.g., Haidt, 2001) or primarily on reason (e.g., Kohlberg, 1984) but by relying on dual processes of both emotive intuitions and reasoned choice (Bucciarelli et al., 2008; Greene et al., 2001, 2004; Moore et al., 2008). Another implication of the results is that people rely on dual processes of both emotion and reason when they are confronted with moral dilemmas not only of an "up close and personal" nature, but also when they consider moral dilemmas of an impersonal nature (e.g., Nakamura, 2013). The results imply that reasoning about moral matters shares commonalities with reasoning about other sorts of contents (e.g., Rai & Holyoak, 2010; Royzman & Baron, 2002; Shenhav & Greene, 2010).

How does information about a protagonist's emotions affect the inferences people make about whether the protagonist will decide to act or not to act? We conjecture that when people reason about moral content, information about the emotions that a protagonist experiences affects the alternatives that people can readily imagine. A complete reasoning algorithm would consider all of the alternatives, but it is likely to exceed working memory capacity (e.g., Johnson-Laird & Byrne, 2002). Instead, people may rely on heuristics devised as shortcuts through the complete algorithm (e.g., Espino & Byrne, 2013). When people think about whether to violate a moral principle, to harm someone, to lie, or to steal, they may attempt to think through the alternative options, e.g., "If I act then I harm one person but I save five people", and "If I do not act, I do not harm one person but I do not save five people." However, some alternatives are clearly more salient than others: for impersonal dilemmas, e.g., hitting a switch, the salient alternative is to act and harm one person but save five others; for personal dilemmas, e.g., pushing a man, the salient alternative is to not act and not harm one person but not save five others. We consider that the initial salience of one alternative rather than another may be affected by emotional reactions. The immediate experience of aversion may be relied on as a shortcut heuristic that obviates the need to consider further alternatives in order to reach a

decision. However, we speculate that information about emotions may also affect whether people retrieve or inhibit alternatives to the immediately salient possibility: emotions may act as a prompt in some circumstances to consider further alternatives.

The suggestion is consistent with observations that deontic content such as obligations, permissions, and social regulations makes some counterexamples more available than others (e.g., Bucciarelli & Johnson-Laird, 2005; Quelhas & Byrne, 2003; see also Byrne, Espino, & Santamaria, 1999). Moral norms constrain the consideration of different alternatives (e.g., Byrne, 2005). For example, when an individual arrives home too late to save his sick wife because he was delayed by several actions, people imagine how the bad outcome could have been avoided "if only. . .." They tend to imagine he had not carried out an action within his control, e.g., stopping at a bar for a drink, rather than an action outside his control, e.g., getting struck in heavy traffic (Girotto, Legrenzi, & Rizzo, 1991), but not if the action within his control adheres to moral norms, e.g., stopping to check on elderly parents (McCloy & Byrne, 2000). Emotions may provide additional information that modulates the counterexamples that people consider, to the decisions that protagonists take in moral dilemmas.

The two experiments reported here provide converging evidence to suggest that emotion does not necessarily win out over reason. Emotions may be part of a fast, intuitive, automatic system responsible for some responses to moral dilemmas. However, the experiments reported here suggest a nuanced role for their interaction with a slower, more controlled deliberative process of reasoning about moral matters.

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APPENDIX

The materials used in Experiment 2 are adapted from Greene et al. (2004). The "impersonal" version is given (with the modification for "personal" in parentheses). The key sentence distinguishing between the impersonal and personal versions is given in italics. The modifications for the emotion (strong, mild) and decision (will, won't) conditions are presented as alternatives. Experiment 1 relied on versions of the first problem phrased in the first person.

1. Train

Luke is at the wheel of (on a bridge above) a runaway train quickly approaching a fork in the tracks. On the tracks extending to the left is a group of five railway workmen. On the tracks extending to the right (On the bridge standing near to him) is a single railway workman (a stranger). The train is on the point of proceeding to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is for him to *hit a switch on his dashboard (push the stranger off the bridge)* that will cause the train to proceed to the right (come to a stop) leading to the death of the

single workman (stranger). Facing this choice, Luke feels some strong/mild emotions. He decides he will/won't do it. Was Luke's decision appropriate?

2. Baby

Late one night while Pat's family is sleeping burglars break into her house. There has been a spate of very violent robberies in the area where families have been attacked and beaten badly. Pat and her mother are hiding in a wardrobe in the bedroom and her mother is on the mobile phone to the police whispering her address to them. Pat's baby brother in her arms begins to cry and she *holds his soother in his mouth firmly (presses her hand over his mouth)* to block the sound. His crying will soon attract the attention of the burglars who will harm the family. The only way for Pat to keep the family safe from the burglars is to *hold his soother in his mouth firmly (keep her hand pressed over the baby's mouth)* even though he is struggling in her arms, clearly panicking and distressed. Facing this choice, Pat feels some strong/mild emotions. She decides she will/won't do it. Was Pat's decision appropriate?

3. Fumes

Paul is the late-night watchman in a hospital in which mildly toxic fumes are rising up through the hospital's ventilation system. There are 30 patients in wards on the first floor of the hospital. There are 10 patients in wards on the ground floor. The fumes are about to rise up into the wards on the first floor containing the 30 patients and cause them severe breathing discomfort all night. The only way to avoid the discomfort to these patients is for *Paul to close a vent to the first floor so that the closed vent cover (to lie across a vent to the first floor so that his body)* will cause the fumes to remain on the ground floor leading to severe breathing discomfort all night for the 10 patients there. Facing this choice, Paul feels some strong/mild emotions. He decides he will/won't do it. Was Paul's decision appropriate?

4. Vaccine

Ann is a senior officer in charge of a government agency attempting to contain a serious viral epidemic. Many people who catch the virus suffer long-term illnesses from it. A minority of people who are vaccinated against the virus are allergic to the vaccine and suffer long-term illnesses from the side effects. An epidemic is predicted in which many people will catch the virus and suffer illnesses from it. The only way to avoid the illnesses from the virus

is *to launch the vaccine for the whole population (to inject allergic volunteers to refine the vaccine*) which will cause the illnesses of allergic people. Facing this choice, Ann feels some strong/ mild emotions. She decides she will/ won't do it. Was Ann's decision appropriate?

5. Lifeboat

Jill is on a cruise ship when there is a fire on board and the ship has to be abandoned. The lifeboat Jill is in charge of is overcrowded and begins to fill with water as the seas get rougher. The lifeboat is about to sink, forcing everyone in it into the water. The only way to stop the lifeboat from sinking is for Jill *to ask some of the other occupants to go overboard (to push some of the other occupants overboard)* into the freezing seas to float alongside it. Facing this choice, Jill feels some strong/mild emotions. She decides she will/ won't do it. Was Jill's decision appropriate?

6. CV

Jen has been trying to find jobs without much success, when she is called for an interview for a great job for which she is very well qualified. While completing detailed questionnaires before her first interview, she discovers from the other candidates that they all have the experience that is required in the particular setting specified. Jen has the best qualifications for the job and plenty of experience but not in the particular setting specified. The decisions are about to be made about which candidates will be called for a second interview. The only way for her to get a second interview is *to tick the box on the questionnaire (to tell lies to the interview panel during her interview)* that she has the required experience in the setting specified. Facing this choice, Jen feels some strong/mild emotions. She decides she will/won't do it. Was Jen's decision appropriate?

7. Taxes

John is the owner of a small business completing his end of year tax return. His business has not done well this year and he is now trying desperately to make ends meet. He has just received a large tax bill that could lead to his business having to close down. It occurs to him that he could pretend that some of his personal expenses are business expenses when he *fills in the online form on his computer (speaks to the revenue officer on the telephone).* Facing this choice, John feels some strong/mild emotions. He decides he will/won't do it. Was John's decision appropriate?

8. Wallet

Mike is walking down the street when he comes across a wallet lying on the ground and close-by several 20 euro notes that have most likely fallen out of the wallet. From the credit cards and other items in the wallet it's clear that the wallet's owner is wealthy. Mike, on the other hand, has been hit by hard times recently and could really use some extra money. Mike sees that he will shortly pass by *the police station where he could leave the wallet at the desk (the owner in her garden where he could hand the wallet to her himself*). As he is walking, he considers leaving the wallet at the police desk (handing the wallet to the owner) and keeping the 20 euro notes for himself (hiding the 20 euro notes in his pocket). Facing this choice, Mike feels some strong/mild emotions. He decides he will/won't do it. Was Mike's decision appropriate?

Filler 1: Turnips

Tom is a farm worker driving a turnip-harvesting machine. He is approaching two diverging paths. By choosing the path on the left, Tom will harvest ten bushels of turnips. By choosing the path on the right, Tom will harvest twenty bushels of turnips. Tom's turnip-harvesting machine is on the point of turning to the left. The only way for Tom to harvest twenty bushels of turnips instead of ten is to turn his machine to the right. Facing this choice, Tom feels some strong (mild) emotions. He decides he will (won't) do it. Was Tom's decision appropriate?

Filler 2: Brownies

Jess has decided to make a batch of brownies for herself. She opens her recipe book and finds a recipe for brownies. The recipe calls for a cup of chopped walnuts. Jess doesn't like walnuts, but she does like macadamia nuts. As it happens, she has both kinds of nuts available to her. The only way for Jess to really enjoy the brownies is to replace the walnuts with macadamia nuts. Facing this choice, Jess feels some strong (mild) emotions. She decides she will (won't) do it. Was Jess' decision appropriate?