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Age Differences in Moral Judgment: Older Adults are More Deontological than Younger Adults

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Age Differences in Moral Judgment:

Older Adults are More Deontological than Younger Adults

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Abstract

In two studies, an older and a younger age group morally evaluated dilemmas contrasting a deontological judgment (do not harm others) against a utilitarian judgment (do what is best for the majority). Previous research suggests that deontological moral judgments are often underpinned by affective reactions and utilitarian moral judgments by deliberative thinking. Separately, research on the psychology of aging has shown that affect plays a more prominent role in the judgments and decision making of older (vs. younger) adults. Yet, age remains a largely overlooked factor in moral judgment research. Here, we therefore investigated whether older adults would make more deontological judgments on the basis of experiencing different affective reactions to moral dilemmas as compared to younger adults. Results from two experiments indicated that older adults made significantly more deontological moral judgments. Mediation analyses revealed that the relationship between age and making more deontological moral judgments is partly explained by older adults exhibiting significantly more negative affective reactions, and having more morally idealistic beliefs as compared to younger adults.

Keywords: Moral judgment, Aging; Emotion; Judgment and Decision Making; Individual differences.

AGE DIFFERENCES IN MORAL JUDGMENT: OLDER ADULTS ARE MORE DEONTOLOGICAL THAN YOUNGER ADULTS

Moral decisions pervade public and professional life. Topics such as abortion, assisted suicide for the terminally ill, and the death penalty remain highly contentious and morally-charged. Many studies have investigated people's moral choices in sacrificial scenarios, where human lives are at stake. A widely-studied problem is Foot's (1967) trolley dilemma, a thought experiment in which five people are about to be killed by a runaway trolley unless action is taken. In the original version, the action involves pressing a *switch* to redirect the trolley onto a different track where only one person is standing. In an alternative version, the action involves pushing a person from a *footbridge* onto the tracks to stop the trolley (Thomson, 1985). Although these dilemmas may seem similar, most people agree to kill one to save five in the 'switch' version but not in the 'footbridge' version. That is, people give *utilitarian* judgments (do what is best for the majority) for the switch dilemma, but *deontological* judgments (do not harm others) for the footbridge dilemma (e.g. Greene, Nystrom, Engell, Darley, & Cohen, 2004; Hauser, Cushman, Young, Kang-Xing, & Mikhail, 2007). This finding has been replicated for different types of moral dilemmas (e.g. Gold, Pulford, & Colman, 2013). Theories have focused on the affective and cognitive processes underlying moral judgments (Cushman, Young, & Hauser, 2006; Moore, Clark & Kane, 2008).

A limitation of research on moral judgments in footbridge- and switch-like dilemmas is that it typically recruited undergraduate students with mean ages below 30 years (e.g. Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Lotto, Manfrinati, & Sarlo 2013; Suter & Hertwig, 2011). Yet, there is evidence of age differences in decision making, possibly resulting from age-related changes in affective and cognitive processing (Hess,

Strough, & Lockenhoff, 2015). Understanding age differences in moral judgment is important because older adults occupy some of the highest power positions that involve important moral judgments. For example, the average age of current G20 world leaders is 62.1 years, and that of Fortune 100 CEOs 57 years (Myatt, 2013). The present study therefore aimed to examine whether older and younger adults diverge in their moral judgments and to uncover the mechanisms underlying any existing differences.

Deliberative and Affective Processes In Moral Judgment

Utilitarian moral judgments, or choices to sacrifice one person to save a larger number of people, have typically been attributed to deliberative reasoning (Cushman et al., 2006; Greene, Sommerville, Nystrom, Darley, & Cohen., 2001; Greene et al., 2004; Moore et al., 2008). Indeed, factors that hinder people's ability to deliberate, such as time pressure and cognitive load, generally suppress utilitarian judgments (Greene et al., 2008; Suter & Hertwig, 2011). Additionally, utilitarian judgments are more likely when emotional reactivity is reduced. For instance, utilitarian judgments are more common among individuals with damage in brain regions involved in emotional responsivity (Koenigs et al., 2007); those with lower degrees of trait empathy (i.e. the ability to actively consider other's emotional perspectives) (Choe & Min, 2011; Conway & Gawronski, 2013); and those with higher degrees of sub-clinical psychopathy, which is characterised by having no empathy for others (Kahane, Everett, Earp, Farias, & Savulescu, 2015). Presumably, dampened affect yields less cognitive-affective conflict about intervening (Koenigs, Kruepke, Zeier, & Newman, 2011). Evidence suggests, then, that utilitarian moral judgments are more likely when deliberation is engaged, or when emotional reactivity is reduced.

In contrast, deontological moral judgments are often associated with relatively elevated affective reactions. For instance, people report higher levels of negative affect when facing trolley-type dilemmas, and are more likely to choose to not intervene, thus avoiding to kill anyone to save others (Lotto et al., 2013). Moreover, brain imaging studies have found that increased activation in brain areas associated with negative affective states is related to more deontological judgments (e.g., Greene et al., 2001, 2004). Recent research has begun to shed further light on such effects, determining a key role for emotional *valence* (whether the emotional experience is positive or negative), as opposed to emotional *arousal* (the magnitude of emotional activation). For example, negatively-valenced affect leads students to condemn moral transgressions (e.g. eating your dead dog), independent of arousal (de la Viña, Garcia-Burgos, Okan, Cándido, & González, 2015). Instead, positive affect can increase utilitarian responses to moral dilemmas such as the footbridge dilemma (Valdesolo & DeSteno, 2006). Taken together, these findings suggest that affective reactions with the same level of arousal may affect moral judgments differently depending on their valence. Specifically, deontological moral judgements may be more likely among individuals who rely more on affective rather than deliberative processing – but only if they experience more *negative* emotions. Distinguishing these emotional mechanisms is particularly relevant in the context of aging, as there is evidence suggesting that younger and older adults differ with respect to how arousal (e.g. Kensinger, 2008), and valence (e.g. Leighland, Schulz, & Janowsky, 2004) influence affective processing.

Age Differences in Affective and Deliberative Processing

Research on judgment and decision making across the lifespan has indicated age-related shifts in the relative influence of affective and deliberative processes (Hess et al.,

2015; Peters & Bruine de Bruin, 2012). Older age has been associated with declines in deliberative abilities such as working memory (Reuter-Lorenz & Sylvester, 2005; Verhaeghen, Marcoen & Goossens, 1993), executive functioning (Amieva, Phillips, & Della Sala, 2003), and processing speed (Salthouse, 2004). Although deliberative abilities tend to decline with age, affective processing may improve (Mikels, Larkin, Reuter-Lorenz, & Carstensen, 2005). According to research on the affect heuristic, decisions may rely more on affect particularly when deliberation becomes difficult, or affective reactions are strong (Slovic, Finucane, Peters, & MacGregor, 2002). Perhaps as a result, emotional cues are more likely to be noticed and remembered by older adults (Carstensen & Turk-Charles, 1994; Fung & Carstensen, 2003). As compared to younger adults, older adults can also find it difficult to resist the effect of affective cues on judgments (Hess, Waters, & Bolstand, 2000). Further, while there is contrasting evidence concerning age differences in performance on risky decisions for the Iowa Gambling Task (Kovalchik, Camerer, Grether, Plott, & Allman, 2005; Mata, Josef, Samanez-Larkin, & Hertwig, 2011), it has been observed that older adults rely more on emotional cues for this task whereas younger adults' performance is contingent on their deliberative skills (Wood, Busemeyer, Koling, Cox, & Davis, 2005).

Additionally, Socioemotional Selectivity Theory (Carstensen, 2006) posits that older adults become especially motivated to maximize their *positive* emotional experiences, so as to make the best of the limited time they perceive to have left. Older adults may therefore be more likely to seek and remember positive than negative information (Mather & Carstensen, 2005). This so-called 'positivity effect' plays a role in a wide range of older adults' decisions (Carstensen & Mikels, 2005; Mather & Carstensen, 2005). Older age has also been associated with less neural reactivity to negative stimuli (Wood & Kisley, 2006), and less negative affect in the face of adverse experiences (Bruine de Bruin, van Putten, van Emden, & Strough, in

press). Older adults tend to be better than younger adults at avoiding preoccupation with negative thoughts about adverse events, which helps them to maintain better overall emotional well-being (Kessler & Staudinger, 2009; Torges, Stewart, & Nolen-Hoeksema, 2008). As a result, older age is potentially associated with experiencing less negative affect, perhaps especially when experiencing adverse outcomes (Bruine de Bruin, van Putten, van Emden, & Strough, in press; Mikels et al., 2005).

Research Questions

Taken together, the findings reviewed suggest two potential mechanisms underlying age-related differences in moral judgments. On the one hand, older adults' increased reliance on affect rather than deliberation could lead to *more* deontological moral judgments. On the other hand, older adults tend to experience less *negative* affect, which could instead result in *less* deontological judgments. As noted above, reduced negative affect is associated with making less deontological moral judgments (Greene et al., 2001, 2004). Here, we aimed to shed light on age-related differences in moral judgments and the underlying role of emotions. Across two experiments, we presented older and younger participants with validated moral dilemmas. We asked for two moral judgments (following Lotto et al., 2013): whether they would intervene to save a larger group of people at the expense of one or two individuals, and how morally acceptable they perceived the intervention to be. In both experiments, we also assessed participants' emotional reactions, including valence and arousal (following de la Vina et al., 2015, and Lotto et al., 2013). In Experiment 2, we also assessed individual differences potentially relevant to age differences in moral judgment.

Specifically, our research questions were:

1. Do older and younger adults differ in their propensity towards deontological versus utilitarian moral judgements?
2. Do older and younger adults differ in their affective reactions when making moral judgments?
3. Are any age differences in moral judgments mediated by age differences in affective reactions?

In both experiments we also controlled for sociodemographic factors, given previous findings concerning differences in moral judgments contingent upon gender (see Walker, 2014), ethnicity (Carlos, Alsua, & Carneiro, 2012), education level (e.g. Pratt, Diessner, Pratt, & Hunsberger, 1996), and political orientation (e.g. Piazza & Souza, 2013).

EXPERIMENT 1

In Experiment 1 we presented older and younger participants with 26 moral dilemmas where peoples' lives were at stake, taken from Lotto et al. (2013). Half of the dilemmas entailed an "instrumental" intervention (i.e., the proposed intervention would cause the death of one or two people as an intended means to save a larger number of people) while the other half entailed "incidental" interventions (i.e. the proposed intervention would cause their death as a foreseen but unintended consequence). Furthermore, half referred to other people as beneficiaries of the intervention ("other" dilemmas), and half also benefited oneself ("self" dilemmas). Moral judgments and affective reactions can vary across these instrumental versus incidental and self versus other dimensions (Lotto et al., 2013; Moore et al., 2008). Including dilemmas that varied along those two dimensions allowed us to examine whether eventual age-related effects depend on dilemma type.

Method

Participants

Participants were 150 middle-aged and older adults (55-81 years, M_{age}=62, *SD*=5.7) and 152 emerging younger adults (18-25 years, M_{age}=22.4, *SD*=1.9), recruited from US residents using Amazon's Mechanical Turk. They had been screened in an initial questionnaire that tested whether they met our age criteria. Although both age groups have been characterized in the literature, life-span developmental processes are typically thought of as continuous rather than limited to discrete age ranges (Arnett, 2007; Baltes & Smith, 2003; Lachman, 2004). Yet, extreme age group designs are commonly used to increase statistical power (e.g., Isaacowitz, Toner, Goren, & Wilson, 2008; Strough, Mehta, McFall, & Schuller, 2008). For brevity, we will henceforth refer to the first age group as 'younger' and the second age group as 'older' (following Isaacowitz et al., 2008; Strough et al., 2008).

The older group comprised 63% females, 55% with University degrees, and 10% non-Whites. The younger group comprised 64% females, 41% with University degrees, and 20% non-Whites. Chi-square tests indicated significant age group differences in having a University degree, χ^2 (1, *N*=302)=5.27, *p*=.032, and ethnic group, χ^2 (1, *N*=302)=5.65, *p*=.042. A chi-square test indicated that Age Group was also marginally-significantly associated with political attitude (Left, Centre, Right): χ^2 (2, *N*=302)=5.19, *p* =.08. Post-hoc tests indicated a significant difference in the number of Older adults (*N*=55) identifying as political right-leaning compared to Younger adults (*N*=35): *t*(300)=2.00, *p* = .038. All analyses for Experiment 1 included dummy variables to control for these sociodemographic factors (University Degree: 0=no, 1=yes; Ethnic Group: 0=non-white, 1=white; Politically-

Right: 0=no, 1=yes.) Participants received $1 for completing the experiment. Those who did not meet the age criteria (i.e. were neither 18-25, or 55+ years old) were thanked and received $.05.

Materials

Moral dilemmas. Participants viewed 26 scenarios, including 2 versions of the classic trolley scenarios (Foot, 1967; Thomson, 1985), and 24 taken from Lotto et al. (2013). Each scenario described a hypothetical situation in which a number of people would die unless an intervention resulted in the death of one or two people. Scenarios were selected according to two criteria. First, we selected an equal number of scenarios from Lotto et al.'s (2013) four categories, which crossed instrumental versus incidental intervention types with self versus other involvement (Table 1). Secondly, within each category, we selected six scenarios that yielded good variability in the number of accepted interventions (as reported by Lotto et al., 2013). We avoided scenarios for which interventions were accepted or rejected by most participants (following Suter & Hertwig, 2011). Full texts for all scenarios, and accompanying introductions, are presented in Supplementary Materials. The order of presentation of scenarios was randomized across participants.

Table 1 here

Moral judgments. After each scenario, participants answered two moral judgment questions taken from Lotto et al. (2013). The first asked "Would you perform the stated action (yes/no)." For each of the incidental/instrumental x self/other dilemma types we computed the total number of scenarios for which respondents chose to intervene. Totals were out of six for Incidental-Self and Instrumental-Self dilemmas (Cronbach's α=.83, and .81 respectively), and out of seven for both Incidental-Other and Instrumental-Other

dilemmas (Cronbach's α=.81, and .80 respectively) on account of the additional trolley dilemmas, both Other. The second question asked "How morally acceptable did you find the proposed action?" followed by a scale from 1 ("not at all acceptable") to 7 ("totally acceptable"). For each of the four dilemma types, we computed the average rating. Cronbach's alpha for each type of dilemma ranged from .89 to .92. For both measures, higher scores reflected more utilitarian and less deontological moral judgments.

Affect. Participants indicated their affective valence and arousal, by respectively rating how "calm or agitated" and how "unpleasant or pleasant" they felt "when deciding whether or not to do the proposed action in the scenario you just read?" (following Lotto et al., 2013). Ratings were given on a pictorial scale of nine figures transitioning along the relevant affective dimension (following Bradley & Lang, 1994; Figure 1). For each of the four dilemma types, we computed average arousal and valence ratings. For each of the four dilemma types, we computed average arousal and valence ratings, as analyses indicated high internal consistency (for all, Cronbach's a ≥ .88). Scores on both affective measures ranged from 1 – 9, with higher scores representing more positively-valenced reactions, and higher emotional arousal.

Figure 1 here

Procedure

After reading each moral dilemma, participants clicked a button when ready. The proposed intervention was presented on a separate screen, where participants indicated whether or not they would perform the action (yes/no). A subsequent screen asked how morally acceptable the action was, followed by valence and arousal ratings. No time limits were imposed on participants.

Results

Analysis plan

We conducted 2 (older vs. younger age group) × 2 (instrumental vs. incidental intervention type) × 2 (self vs. other risk involvement) ANCOVAs for each of the four dependent variables, controlling for sociodemographic differences (education, ethnicity, political right). To answer Research Question 1, we examined ANCOVAs for the two moral judgment measures. To answer Research Question 2, we examined ANCOVAs for the two affect measures. To answer Research Question 3, we performed mediational analyses that examined whether any relationships between age group and moral judgment measures could be statistically explained by affect measures.

Do Older and Younger adults differ in their propensity towards deontological versus utilitarian moral judgments?

Accepted interventions. A main effect of age group for total accepted interventions indicated that older adults accepted significantly fewer interventions: $F(1, 297)=18.73$, $p <.001$, $\eta_p^2 = .06$ (Table 2). There was a significant main effect of intervention type, $F(1, 297) =12.95$, $p<.001$, with fewer instrumental than incidental interventions accepted (M=5.07, SD=4.09 vs. M=7.36, SD=4.11, respectively). All remaining tests yielded $F< 2.20$, $p >.14$ (Table S2, Supplementary Materials).

Moral acceptability judgments. A significant main effect of age group emerged, $F(1, 297)=14.12$, $p <.001$, $\eta_p^2=.05$, whereby older adults rated interventions as less morally acceptable (Table 2). A main effect of intervention type, $F(1, 297)=16.52$, $p<.001$, $\eta_p^2=.05$, showed lower acceptability ratings for instrumental (M=2.77, SD=1.45) compared to

incidental interventions (M=3.22, SD=1.48). All remaining tests yielded $F< 1.95$, $p >.16$ (Table S2, Supplementary Materials).

Do Older and Younger adults differ in their affective reactions when making moral judgments?

Valence. A main effect of age group emerged: $F(1, 297)=13.11$, $p <.001$, $\eta_p^2 = .04$ with older adults giving lower ratings (indicating more negative affect), as compared to younger adults (Table 2). All remaining tests yielded $F <1.69$, $p > .19$ (Table S3, Supplementary Materials)

Arousal. There was a marginal age group × risk involvement interaction for arousal: $F(1, 297)=3.69$, $p=.054$, $\eta_p^2=.02$. Specifically, moral dilemmas were rated as more arousing when the beneficiary included the self, rather than only others. Differences linked to risk involvement, however, were small both among younger (Cohen's d=.15) and older adults (Cohen's d=.08)[1]. All remaining tests yielded $F<.60$, $p>.44$ (Table S3 in Supplementary Materials).

Are any age differences in moral judgments mediated by age differences in affective reactions?

Mediational analyses collapsed across instrumental versus incidental intervention type and self versus other involvement, because we found no significant interactions between age group and these categories.

Table 3 here

[1] Reported Cohen's d effect sizes accounted for dependence between variables.

We first computed partial correlations, controlling for significant sociodemographic differences (Table 3). More negative affect (indicated by lower valence scores) was related to both moral judgment measures, including (a) accepting fewer proposed actions and (b) rating actions as less morally acceptable. Zero-order correlations were similar to partialed equivalents (Table S4 in Supplementary Materials). Subsequently, two models examined whether relationships between age group and each of the moral judgment measures were mediated by age-related variations in affect measures. This line of inquiry followed the suggested directionality from affect to moral judgment (Greene et al., 2001; Koenigs et al., 2007). In each model, age group (0=Younger, 1=Older) was the predictor, with affective valence and arousal included as mediators. Models controlled for significant sociodemographic differences between age groups. We used version 2.13 of PROCESS (Hayes, 2013), and generated 95% confidence intervals for indirect effects using 5,000 bootstrap samples. As noted by Hayes (2013), when bootstrap confidence intervals do not contain zero, there is clear evidence that the indirect effect is significant.

Figure 2 here

Accepted interventions. Older adults accepted fewer interventions and exhibited more negative affect (seen in lower valence) as compared to younger adults, corresponding with ANCOVA results (see Figure 2).[2] More negative affect, in turn, predicted fewer accepted interventions. The indirect effect of age group on accepted interventions via valence was -.77 (95% CI: [-1.60, -.27])[3] Thus, older adults' stronger negative affect mediated the link between older age and fewer accepted interventions. Coefficients for sociodemographic covariates indicated significant predictive value for being political right-leaning (*B*=-2.34,

[2] Unstandardized coefficients are presented. Standardized coefficients are available in Supplementary Materials.
[3] All results held when participants who failed an attention check (Maniaci & Rogge, 2014) (*N*=29) were removed from analyses.

p=.041), but not for being university educated (B=-.28, p =.737) or ethnicity (B=-1.34, p =.144).

Figure 3 here

Moral acceptability judgments. Older adults also rated interventions as less acceptable. More negative affect (seen in lower valence) was associated with lower acceptability judgments (Figure 3). The indirect effect of age group via valence was -.24 (95% CI: [-.42, -.12]), suggesting that the relationship between older age and lower moral acceptability judgments was also mediated by older adults' stronger negative affect. Coefficients for sociodemographic covariates indicated significant predictive value for being university-educated (B=.37, p=.044), but not for being political right-leaning (B=-.21, p = .282), or ethnicity (B=.05, p =.825).

Discussion

Experiment 1 indicated that older adults made more deontological moral judgments than younger adults. Specifically, older adults accepted fewer interventions, and rated them as less morally acceptable. Older adults also reported more negative affect about moral judgments than did younger adults, which accounted for older adults' greater propensity towards deontological moral judgments.

To our knowledge, this is the first report that affective valence mediates age differences in moral judgment. However, other factors could also account for older adults' tendency towards more deontological judgments. For example, older adults may have deficits in fluid cognitive ability (e.g. Hess, 2014; Salthouse, 2004), or lack motivation to deliberate (measured as Need for Cognition; Bruine de Bruin, McNair, Taylor, Summers, & Strough, 2015). Older adults also tend to ruminate less (Sütterlin, Paap, Babic, Kübler, & Vögele,

2012), which can explain why they are better able than younger adults to cut their losses when making decisions involving "sunk costs" (Bruine de Bruin, Strough, & Parker, 2014). Older adults may also exhibit more morally idealistic beliefs, reflecting greater concern for deontological principles (Carlos et al., 2012; Rawwas & Singhapakdi, 1998). Finally, older adults may use a less "rational" style of decision making (Finucane et al., 2002). Because each of these individual-differences factors may lead older adults to make more deontological moral judgments, we assessed them in Experiment 2.

Additionally, it is possible that Experiment 1's findings were limited to moral dilemmas involving death. Gold et al. (2013) note that, in terms of emotional severity, "death would be at the extreme end of the spectrum, and extreme cases may be treated very differently from intermediate ones" (p. 217). Experiment 2 therefore included moral dilemmas involving less extreme forms of trauma, such as loss of privacy or control, or material loss.

EXPERIMENT 2

Experiment 2 tested the same three research questions as Experiment 1. It involved more diverse moral dilemma scenarios that did not exclusively entail the risk of death. It also included individual-differences measures potentially relevant to age differences in moral judgment.

Method

Participants

We recruited the same age groups as in Experiment 1, from among US residents on Amazon's Mechanical Turk, including 136 older adults (55-75 years, M_{age}=60.5, SD=4.2) and 150 younger adults (18-25 years, M_{age}=22.9, SD=1.8). The older group comprised 60%

females, 60% had University degrees, and 21% were non-white. The younger group included 47% females, 43% had University degrees, and 31% were non-white. Chi square tests indicated significant age group differences in gender, χ^2 (1, N=286)=4.76, p=.040; having a University degree, χ^2 (1, N=286)=8.14, p=.013; and being religious, χ^2 (1, N=286)=24.70, p<.001. A chi-square test indicated that age group was also significantly associated with political attitude (Left, Centre, Right): χ^2 (2, N=286)=18.73, p=.001. Post-hoc tests indicated significant differences in the number of older adults (N=51) identifying as political right-leaning compared to younger adults (N=23): t(284)=4.40, p<.001. There was also a significant difference in the number of older adults identifying as political left-leaning (N=62) compared to younger adults (N=87): t(284)=2.81, p<.04. All analyses included dummy variables to control for significant sociodemographic factors (Gender: 0=male, 1=female; University Degree: 0=no, 1=yes; Religious: 0=no, 1=yes; Politically-Right: 0=no, 1=yes; Politically-Left: 0=no, 1=yes). Participant compensation was the same as in Experiment 1.

Materials

Moral dilemmas. Participants viewed eight scenarios, including four scenarios from Experiment 1 that yielded the largest age-group differences in judgments (Table S1, Supplementary Materials). Three additional dilemmas (from Gold et al., 2013) did not involve death but rather financial loss (Gameshow), material loss (Rucksack), or embarrassment (Sauna). The final non-death scenario from Waldmann and Dieterich (2007) involved physical health (Virus). Full texts for all scenarios are presented in Supplementary Materials. The order of presentation of scenarios was randomized across participants.

Moral judgment. These measures were the same as in Experiment 1. For accepted actions, Cronbach's α=.65 across death scenarios, and .44 across non-death scenarios. For

average acceptability ratings, Cronbach's α=.86 across death scenarios, and .62 across non-death scenarios.

Affect. As in Experiment 1, participants indicated their affective valence and arousal. For death scenarios, Cronbach's α=.87 for both valence and arousal ratings. For non-death scenarios, Cronbach's α=.70 for valence ratings, and .81 for arousal ratings.

Individual-differences measures.

Numeracy. We used the four-item Berlin Numeracy test (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012) as a proxy for general cognitive ability (Peters, 2012). Numeracy decreases with age (Salthouse, 2012), and is associated with deep elaborative processing of information (Cokely & Kelley, 2009) as well as less reliance on irrelevant affective cues when reasoning (Peters et al., 2006). Scores could range from 0 to 4, reflecting correctly solved items (Cronbach's α=.84).

Need for cognition. An 18-item scale (Cacioppo, Petty, & Kao, 1984) assessed motivation to engage in deliberation (e.g. "Thinking is not my idea of fun"). Responses ranged from 1 ("Extremely uncharacteristic of me") to 5 ("Extremely characteristic of me"). Higher numbers represented more need for cognition. Need for cognition mediates age differences in numeracy performance (Bruine de Bruin et al., 2015). Cronbach's alpha was .93.

Rumination. Eight items from the Disengagement versus Preoccupation subscale of the Action Control Scale (Diefendorff, Hall, Lord, & Strean, 2000) assessed ruminative thoughts. This subscale has been identified as relevant for understanding age differences in responses to adverse events (Bruine de Bruin et al., 2014; in press). Participants were asked to imagine how they might feel *after* having made a decision in the scenarios they read, and

rated several statements for accuracy. An example item asked "When I'm in a competition and lose every time: (a) I can soon put losing out of my mind; (b) The thought that I lost keeps running through my mind."). Ratings ranged from 1 ("Definitely false") to 5 ("Definitely true"). Higher scores indicated more ruminative thoughts (Cronbach's α=.84).

Moral idealism. The 10-item moral idealism subscale of Forsyth's (1980) Ethics Position Questionnaire measured participants' deontological moral principles (e.g. "If an action could harm an innocent other, then it should not be done"). Items ranged from 1 ("Completely disagree") to 9 ("Completely agree"). Higher numbers indicated higher moral idealism (Cronbach's α=.90). Rawwas and Singhapakdi (1998) observed significantly greater moral idealism in adults (M_{age}=56 years) compared to a teenage group (M_{age}=19 years), suggesting this is a characteristic that strengthens with age.

Decision-making style. Given the deliberative/affective distinction in moral judgments (e.g. Greene et al., 2008), we assessed preferences for deliberative and affective decision making, using the Rational (5 items, e.g. "My decision making requires careful thought", Cronbach's α=.80) and Intuitive subscales (5 items, e.g. "I generally make decisions that feel right to me", Cronbach's α=.85) of Scott and Bruce's (1985) Decision Making Styles battery. Responses ranged from 1 ("strongly disagree") to 5 ("strongly agree"), with higher numbers indicating stronger preferences for the decision-making style.

Procedure

The procedure in Experiment 2 was identical to that used in Experiment 1, with the exception that individual differences were assessed following the completion of the moral dilemmas.

Results

Analysis plan

A 2 (older vs. younger age group) × 2 (death vs. non-death scenario type) ANCOVA was conducted for moral judgment and affective measures, with sociodemographic covariates (gender, education, religious, politically-left, politically-right). To answer Research Question 1, we examined ANCOVAs for the two moral judgment measures. To answer Research Question 2, we examined ANCOVAs for the two affect measures. We also conducted ANCOVAs on each individual-differences measure, to examine age differences for each, while including the same sociodemographic controls. Table 4 presents descriptive statistics concerning these ANCOVAs. To answer Research Question 3, we performed mediational analyses that examined whether any relationships between age group and moral judgment measures were statistically explained by affect measures while also accounting for individual differences.

Do Older and Younger adults differ in their propensity towards deontological versus utilitarian moral judgments?

Accepted interventions. A significant main effect of age group, $F(1, 279)=7.94$, $p=.005$, $\eta_p^2=.03$, suggested that older adults accepted significantly fewer interventions (Table 4). All remaining tests yielded $F<.49$, $p>.48$ (Table S5, Supplementary Materials).

Moral acceptability judgments. There was a main effect of scenario type, $F(1, 279)=35.62$, $p=.006$, $\eta_p^2=.11$, whereby acceptability ratings were significantly lower for death dilemmas ($M=3.55$, $SD=1.58$) compared to non-death dilemmas ($M=4.64$, $SD=1.19$). All remaining effects yielded $F<1.17$, $p>.28$ (Table S5, Supplementary Materials).

Do Older and Younger adults differ in their affective reactions when making moral judgments?

Valence. There was a main effect of age group, $F(1, 279)=4.24$, $p=.038$, $\eta_p^2=.02$, with older adults giving significantly lower ratings (i.e. more negative affect) compared to younger adults (Table 4). A main effect of scenario type, $F(1, 279)=47.83$, $p<.001$, $\eta_p^2=.15$, indicated more negative affect for dilemmas involving death ($M=3.15$, $SD=1.71$) compared to non-death dilemmas ($M=4.78$, $SD=1.28$). There was no significant interaction between age group and dilemma type, $F(1, 279)=1.45$, $p=.234$, $\eta_p^2=.01$.

Arousal. There was a main effect of scenario type, $F(1, 279)=24.21$, $p<.001$, $\eta_p^2=.08$, with death dilemmas yielding significantly higher arousal ratings than non-death dilemmas (Table 4). All remaining effects yielded $F<2.81$, $p>.11$ (Table S6, Supplementary Materials).

Table 4 here

Individual-difference measures. Age group differences were found in moral idealism, $F(1, 279)=9.19$, $p=.018$, $\eta_p^2=.03$, with older adults ($M=63.40$, $SD=17.29$) reporting more morally idealistic views compared to younger adults ($M=57.61$, $SD=12.78$). A significant age group difference also emerged for intuitive decision making, $F(1, 279)=6.17$, $p=.031$, $\eta_p^2=.02$, with older adults ($M=15.23$, $SD=10.29$) scoring higher than younger adults ($M=13.99$, $SD=9.58$). There were no other significant age differences in individual-differences measures (all ps$>.07$).

Are any age differences in moral judgments mediated by age differences in affective reactions?

Table 5 here

Table 5 presents partial correlations (controlling for sociodemographic differences) that echo those for Experiment 1. Negative valence was related to accepting fewer interventions, and rating such interventions as less morally acceptable. Accepting more interventions was negatively related with rumination and moral idealism, and positively related with intuitive decision-making styles. Zero-order correlations were similar to partialed equivalents (Table S7, Supplementary Materials).

As in Experiment 1, we collapsed across scenarios when conducting mediation analyses, because there were no interactions of scenario type with age group. As ANCOVAs indicated age differences only for accepted interventions, we confined our mediation analyses to this dependent variable. The model was the same as in Experiment 1, with the exception that all individual differences measures from Experiment 2 were entered as mediators.

Figure 4 here

Age group predicted both the number of accepted interventions and valence, with older adults accepting fewer interventions, and exhibiting more negative affect, in line with ANCOVA results (see Figure 4). Older age predicted being more morally idealistic, and a more intuitive decision maker. As in Experiment 1, negative affect was associated with fewer choices to intervene. Additionally, higher moral idealism also predicted fewer interventions. We again assessed mediation by generating 95% confidence intervals for indirect effects using 5,000 bootstrap samples. There were indirect effects of age group on accepted actions via affective valence, -.09 (95% [CI: -.26, -.03]), and via moral idealism, -.12 (95% [CI: -.29, -.03])[4]. No further factors yielded significant indirect pathways between age group and accepted interventions. Coefficients for the sociodemographic covariates in the model

[4] All but one of the reported significant findings (mediation by Valence) remained after removing 42 respondents who failed an attention check. Removing these participants likely reduced the statistical power to detect this effect, which was small for the full sample.

indicated significant predictive value for gender (B=-.79, p=.006), but not for being religious (B=-.14, p=.942), being political right-leaning (B=-.18, p=.674) or left-leaning (B=-.28, p=.344), or being university-educated (B=.04, p=.861).

Discussion

Like Experiment 1, Experiment 2 indicated that older adults were more morally deontological than younger adults. Older adults again accepted fewer interventions. The trend for moral acceptability judgments also followed that reported in Experiment 1, where older adults gave lower acceptability ratings, although differences in Experiment 2 were not significant. In line with Experiment 1, we also found that older adults experienced more negative affect when making moral judgments, and that such affective differences mediated the link between age and accepted interventions. It should be noted, however, that the mediating effect of negative affect in Experiment 2 was weaker than in Experiment 1. Additionally, in Experiment 2 we found that age differences in moral judgments are also due to older adults holding more morally idealistic principles. Results held when controlling for a range of relevant individual-difference measures, as well as sociodemographic factors that varied with age.

Interestingly, we found no significant age differences in deliberative capacities such as numeracy, rational decision style, or need for cognition. Possibly, our older respondents were of above-average ability, with 60% reporting university degrees (compared to US national average of 45%, Ryan & Bauman, 2016). Additionally, the Berlin Numeracy Test in particular tends to yield positively-skewed distributions in Mechanical Turk samples (e.g. Cokely et al., 2012). Indeed, 80% of our sample were unable to answer more than 50% of the items correctly, which may have tempered our ability to detect age differences in numeracy.

While this leaves us unable to determine to what extent such deliberative factors may contribute to age differences in moral judgments, our findings nonetheless shed light on the nuances of why older adults might act more deontologically.

Finally, the absence of interactions between age and dilemma type (death vs. non death), suggests that age-related differences in moral judgment also hold for less extreme forms of trauma, which produce less negative affective reactions. This could suggest that both types of scenarios were sufficiently distressing so as to trigger deontological behavior. One interpretation of this, and related findings by Gold et al (2013), could be that the deontological influences of negative affect, and moral idealism, are triggered by the idea of harm itself, rather than by the specific form or severity of harm. However, the finding that the mediating effect of negative affect was weaker in Experiment 2 (vs. Experiment 1) suggests that the size of this effect may depend to some extent on scenario extremity. Future work could investigate this issue.

GENERAL DISCUSSION

Taking cue from moral judgment research indicating associations between affective processing and deontological moral judgments (Greene et al., 2001; 2004), and from lifespan developmental research observing greater reliance on affect in the decision making of older adults (e.g. Carstensen, 2006), we investigated age differences in moral judgments and their underlying affective mechanisms. In two experiments, older adults made more deontological judgments than younger adults, which was accounted for by older adults' more negative affective reactions. In Experiment 2, the link between age and moral judgments was also accounted for by older adults' more morally idealistic principles.

Increased Deontological Judgments In Older Age Due To Affective Reactions

Deontological moral judgments tend to be driven by negative affect (Greene et al., 2001, 2004, 2009), whereas positive affect can instead lead to more utilitarian judgments (Valdesolo & DeSteno, 2006). Across two experiments, we observed that older adults' increased propensity for deontological moral judgments could be statistically explained by their more negative affective reactions. Affective factors may play a larger role in both deontological and utilitarian moral judgments than previously considered (Conway & Gawronski, 2013; Duke & Begue, 2015; Kahane et al., 2015).

Our finding that affect is relevant for understanding age differences in moral judgment dovetail with lifespan developmental studies that highlight older adults' increased reliance on affect (e.g. Mikels et al., 2005; Wood et al., 2005). Such research has also shown that older adults are *more likely* to act in situations involving sunk cost decisions (e.g. Bruine de Bruin, Parker, & Fischhoff, 2012; Bruine de Bruin et al., 2014). This implies that it is unlikely that older adults' increased propensity for deontological judgments merely reflects a general tendency towards inaction.

The psychological aging literature also suggests older adults experience a "positivity effect" (e.g. Carstensen, 2006), and exhibit less neural reactivity to negative stimuli (Wood & Kisley, 2006). Our findings indicate that moral judgments may be a special case of especially adverse negative stimuli, however, where older adults experience *greater* responsivity (Charles, 2010). As moral dilemmas are designed to evoke strong negative affect, we assume that such dilemmas trigger an affect heuristic (Slovic, et al., 2002) that influences subsequent judgments. Other research has shown that older adults, when faced with more negative emotional stimuli, engage more automatic cognitive processes (Sanda Dolcos, Katsumi, & Dixon, 2014). Our findings demonstrate that, in the context of moral judgments, older adults'

more negative affective reactions subsequently yield more deontological moral judgments (Greene et al., 2001, 2004).

Relatedly, Hess et al. (2000) report that older adults struggle to disregard affective cues when making judgments. For moral judgments, then, older adults' greater negative affect could drive them towards deontological responses. It may be that older adults choose a deontological course of action (i.e. not intervening) as a means of avoiding further negative feelings associated with sacrificing an individual by intervening (e.g. Lotto et al., 2013). Isaacowitz, Wadlinger, Goren, and Wilson (2006) have indicated that older adults tend to distinctly avoid negative stimuli if they can. Moral dilemmas, however, generally task people with choosing between two upsetting courses of action. In such a context, if older adults' behaviors are motivated towards maximizing positive affect (Carstensen, 2006), then a deontological response may be their best option.

An interesting question that remains is what underpins the more negative reactions experienced by older adults. One possibility concerns how people frame the interventions. In a trolley dilemma, interventions could be framed as a *gain* of, for example, five lives that would otherwise be lost, or as a *loss* of one life. Older adults prefer to avoid losses more than do younger adults (Depping & Freund, 2011). Older adults' more saliently negative affective reactions to moral choices may reinforce this preference. Another interesting question relates to the robustness of the mediating role of affective reactions. As noted earlier, this mediating effect was weaker in Experiment 2, which included moral dilemmas that involved potential harms, albeit not always as aversive as the risk of death. Future research could examine age-related differences in moral judgments and affective reactions in response to scenarios that differ in context and aversiveness.

Increased Deontological Judgments In Older Age Due To Moral Idealism

Our findings also revealed that that older adults' moral principles were more strongly characterized by morally idealistic thinking (see Carlos et al., 2012; Hannikainen et al., 2018; Rawwas & Singhapakdi, 1998), which in turn also accounted for age differences in moral judgment. An idealistic perspective places greater weight on strict adherence to societally-defined codes (e.g. "If an action could *harm* an innocent then it should not be done", Forsyth, 1980). In such light, older adults' relative focus may be on the individual who will be harmed, rather than on the aggregate benefit of intervening. Older adults may be less willing to contravene these stronger idealistic beliefs, which manifests as a deontological decision to not intervene.

Upholding the authority of law represents a further cornerstone of moral idealism. Ma (1985) reports that older adults are less willing to break the law to benefit strangers than they

are to benefit loved ones. Although in our study we instructed participants to consider that there would be no legal consequences for proposed interventions, older adults may still have been somewhat reluctant to break the law to benefit the strangers described in our scenarios. However, the question remains as to whether any particular facet of older adults' moral idealistic principles exerted greater influence on their decisions to behave deontologically.

These principles concerning harm and authority make up two out of five of proposed intuitive moral foundations in Graham et al.'s. (2013) Moral Foundations Theory. However, it has yet to be established whether these foundations vary with age. Assessing how older and younger adults differ in moral foundations concerning harm and authority could further identify the specific idealistic moral beliefs that may drive younger and older adults to differ in their moral decisions.

Limitations and Future Research

Like any study, ours is subject to limitations that might be addressed by future research. Firstly, given our cross-sectional design, it is possible that the age differences reported may reflect a cohort effect driven by generational differences (see Hannikainen et al., 2018). While a longitudinal study of moral reasoning would of course be ideal, experimental priming manipulations could also offer further substantiations of the current findings. For example, evidence suggests that younger adults can be primed to respond like older adults through manipulating time horizons (Strough, Schlosnagle, Karns, Lemaster, & Pichayayothin, 2014).

Secondly, owing to general limitations of Mechanical Turk samples (Ipeirotis, 2010), our older groups reported higher levels of University level education compared to the US population (Ryan & Bauman, 2016). Yet, our finding that older adults still made

predominantly affect-based moral judgments invites the contention that such findings may be stronger in more general older samples, where deliberative capacities may be more heterogenous. Our study may also have been limited in operationalizing deliberative reasoning, where we used numeracy as a proxy of cognitive ability. We thus encourage future research to determine the robustness of our findings using more varied samples of older adults, and employing a different measures of cognitive ability such as working memory and processing speed (e.g., Del Missier et al., 2017) and more outright measure of deliberation such as reaction times (see Ghazal, Cokely, & Garcia-Retamero, 2014).

Finally, follow-up work should also explore whether younger and older adults experience different discrete emotions when faced with moral dilemmas. While disgust is an emotion related specifically to deontological moral judgments (e.g. Ugazio et al., 2012), there is also evidence that older adults experience less disgust (Kunzmann, Kupperbusch, & Levenson, 2005), but more sadness (Kunzmann & Grühn, 2005). More nuanced assessments of both deliberation and emotional responses would allow building a more comprehensive model of the factors that can account for age-differences in moral judgments, beyond the ones documented in the current work.

REFERENCES

Amieva, H., Phillips, L., & Della Sala, S. (2003). Behavioral dysexecutive symptoms in normal aging. *Brain and Cognition*, *53*(2), 129–132.

Arnett, J. J. (2007). Emerging adulthood: What is it, and what is it good for?. *Child development perspectives*, *1*(2), 68-73.

Baltes, P. B., & Smith, J. (2003). New frontiers in the future of aging: From successful aging of the young old to the dilemmas of the fourth age. *Gerontology*, *49*(2), 123-135.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*(1), 49–59.

Bruine de Bruin, W., Parker, A.M., & Fischhoff, B. (2012). Explaining adult age differences in decision-making competence. *Journal of Behavioral Decision Making, 25*(4), 352-360.

Bruine de Bruin, W., Strough, J., & Parker, A. M. (2014). Getting older isn't all that bad: better decisions and coping when facing "sunk costs". *Psychology and Aging*, *29*(3), 642–7.

Bruine de Bruin, W., McNair, S. J., Taylor, A. L., Summers, B., & Strough, J. (2015). "Thinking about numbers is not my idea of fun": Need for cognition mediates age differences in numeracy performance. *Medical Decision Making*, *35*(1), 22-26.

Bruine de Bruin, W., van Putten, M., van Emden, R., & Strough, J. (In press). Age differences in emotional responses to monetary losses and gains. *Psychology and Aging*.

Cacioppo, J. T., Petty, R. E., & Kao, C. F. (1984). The efficient assessment of need for cognition. *Journal of Personality Assessment*, *48*(2), 306-307.

Carlos, J., Alsua, C. J., & Carneiro, J. (2012). Moral philosophies and ethics across borders : A study of Brazil, Chile, China, Estonia and the United States. *Academia Revista Latinoamericana de Administracion, 49,* 30-44.

Carstensen, L. L. (2006). The influence of a sense of time on human development. *Science (New York, N.Y.)*, *312*(5782), 1913–5.

Carstensen, L. L., & Mikels, J. A. (2005). At the intersection of emotion and cognition: Aging and the positivity effect. *Current directions in psychological science*, *14*(3), 117-121.

Carstensen, L. L., & Turk-Charles, S. (1994). The salience of emotion across the adult life span. *Psychology and Aging*, *9*(2), 259–264.

Charles, S.T. (2010). Strength and Vulnerability Integration (SAVI): A model of emotional well-being across adulthood. *Psychological Bulletin*, *136*(6), 1068-1091.

Choe, S. Y., & Min, K. (2011). Who makes utilitarian judgments? The influences of emotions on utilitarian judgments. *Judgment and Decision Making*, *6*(7), 580–592.

Cokely, E. T., & Kelley, C. M. (2009). Cognitive abilities and superior decision making under risk : A protocol analysis and process model evaluation. *Judgment and Decision Making*, *4*(1), 20–33.

Cokely, E., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk literacy: The Berlin numeracy test. *Judgment and Decision Making*, *7*(1), 25–47.

Conway, P., & Gawronski, B. (2013). Deontological and utilitarian inclinations in moral decision making: a process dissociation approach. *Journal of Personality and Social Psychology*, *104*(2), 216–35.

Cushman, F., Young, L., & Hauser, M. (2006). The role of conscious reasoning and intuition in moral judgment: Testing three principles of harm. *Psychological science*, *17*(12), 1082-1089.

de la Viña, L., Garcia-Burgos, D., Okan, Y., Cándido, A., & González, F. (2015). Disentangling the effect of valence and arousal on judgments concerning moral transgressions. *The Spanish Journal of Psychology*, *18*, 1–9.

Del Missier, F., Hansson, P., Parker, A.M., Bruine de Bruin, W., Nilsson, L.G., & Mäntylä, T (2017). Unraveling the aging skein: Disentangling the effects of sensory and cognitive predictors on decision making. *Journal of Behavioral Decision Making, 30*(1)*,* 123-139.

Depping, M. K., & Freund, A. M. (2011). Normal Aging and Decision Making: The Role of Motivation. *Human Development*, *54*(6), 349–367.

Diefendorff, J. M., Hall, R. J., Lord, R. G., & Strean, M. L. (2000). Action-state orientation: construct validity of a revised measure and its relationship to work-related variables. *Journal of Applied Psychology*, *85*(2), 250–263.

Duke, A. A., & Bègue, L. (2015). The drunk utilitarian: Blood alcohol concentration predicts utilitarian responses in moral dilemmas. *Cognition*, *134*, 121–127.

Finucane, M. L., Slovic, P., Hibbard, J. H., Peters, E., Mertz, C. K., & MacGregor, D. G. (2002). Aging and decision-making competence: An analysis of comprehension and consistency skills in older versus younger adults considering health-plan options. *Journal of Behavioral Decision Making*, *15*(2), 141–164.

Foot, P. (1967). The problem of abortion and the doctrine of the double effect. *Oxford Review*, (5), 5–15.

Forsyth, D. R. (1980). A taxonomy of ethical ideologies. *Journal of Personality and Social Psychology*, *39*(1), 175–184.

Fung, H. H., & Carstensen, L. L. (2003). Sending memorable messages to the old: age differences in preferences and memory for advertisements. *Journal of Personality and Social Ssychology*, *85*(1), 163.

Ghazal, S., Cokely, E. T., & Garcia-Retamero, R. (2014). Predicting biases in very highly educated samples: Numeracy and metacognition. *Judgment and Decision making*, *9*(1), 15.

Gold, N., Pulford, B. D., & Colman, A. M. (2013). Your money or your life: Comparing judgements in trolley problems involving economic and emotional harms, injury and death. *Economics and Philosophy*, *29*(2), 213–233.

Graham, J., Haidt, J., Koleva, S., Motyl, M., Iyer, R., Wojcik, S., & Ditto, P. H. (2013). Moral Foundations Theory: The pragmatic validity of moral pluralism. In P. Devine & A. Plant (Eds.), Advances in experimental social psychology (Vol. 47, pp. 55–130). San Diego, CA: Academic Press.

Greene, J. D., Morelli, S. a, Lowenberg, K., Nystrom, L. E., & Cohen, J. D. (2008). Cognitive load selectively interferes with utilitarian moral judgment. *Cognition*, *107*(3), 1144–54.

Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., & Cohen, J. D. (2004). The neural bases of cognitive conflict and control in moral judgment. *Neuron*, *44*, 389–400.

Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. (2001). An fMRI investigation of emotional engagement in moral judgment. *Science*, *293*(5537), 2105–2108.

Hannikainen, I. R., Machery, E., & Cushman, F. A. (2018). Is utilitarian sacrifice becoming more morally permissible? *Cognition*, *170*, 95-101.

Hauser, M., Cushman, F., Young, L., Kang-Xing, J., & Mikhail, J. (2007). A dissociation between moral judgments and justifications. *Mind & Language*, *22*(1), 1–21.

Hayes, A.F. (2013). *Introduction to Mediation, Moderation, and Conditonal Process Analysis.* New York: Guilford Press.

Hess, T. M. (2014). Selective engagement of cognitive resources: Motivational influences on older adults' cognitive functioning. *Perspectives on Psychological Science*, *9*(4), 388–407.

Hess, T. M., Waters, S. J., & Bolstad, C. A. (2000). Motivational and cognitive influences on affective priming in adulthood. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *55*(4), P193-P204.

Hess, T.M., Strough, J., & Lockenhoff, C.E. (Eds.). (2015). *Aging and Decision Making: Empirical and Applied Perspectives.* London, UK: Academic Press.

Ipeirotis, P. G. (2010). Analyzing the amazon mechanical turk marketplace. *XRDS: Crossroads, The ACM Magazine for Students*, *17*(2), 16-21.

Isaacowitz, D. M., Toner, K., Goren, D., & Wilson, H. R. (2008). Looking while unhappy: Mood-congruent gaze in young adults, positive gaze in older adults. *Psychological Science*, *19*(9), 848-853.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. *Psychology and aging*, *21*(1), 40.

Kahane, G., Everett, J. A. C., Earp, B. D., Farias, M., & Savulescu, J. (2015). "Utilitarian" judgments in sacrificial moral dilemmas do not reflect impartial concern for the greater good. *Cognition*, *134*, 193–209.

Kensinger, E. A. (2008). Age differences in memory for arousing and nonarousing emotional words. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *63*(1), 13-18.

Kessler, E. M., & Staudinger, U. M. (2009). Affective experience in adulthood and old age: The role of affective arousal and perceived affect regulation. *Psychology and aging*, *24*(2), 349-362.

Koenigs, M., Young, L., Adolphs, R., Tranel, D., Cushman, F., Hauser, M., & Damasio, A. (2007). Damage to the prefrontal cortex increases utilitarian moral judgements. *Nature*, *446*.

Koenigs, M., Kruepke, M., Zeier, J., & Newman, J. P. (2011). Utilitarian moral judgment in psychopathy. *Social cognitive and affective neuroscience*, *7*(6), 708-714.Kunzmann, U., & Grühn, D. (2005). Age differences in emotional reactivity: the sample case of sadness. *Psychology and Aging*, *20*(1), 47–59.

Kovalchik, S., Camerer, C. F., Grether, D. M., Plott, C. R., & Allman, J. M. (2005). Aging and decision making: A comparison between neurologically healthy elderly and young individuals. *Journal of Economic Behavior and Organization*, *58*(1), 79–94.

Kunzmann, U., Kupperbusch, C. S., & Levenson, R. W. (2005). Behavioral inhibition and amplification during emotional arousal: a comparison of two age groups. *Psychology and Aging*, *20*(1), 144–158.

Lachman, M. E. (2004). Development in midlife. *Annual Review of Psychology*, *55*, 305-331.

Leigland, L. A., Schulz, L. E., & Janowsky, J. S. (2004). Age related changes in emotional memory. *Neurobiology of Aging*, *25*(8), 1117-1124.

Lotto, L., Manfrinati, A., & Sarlo, M. (2013). A New Set of Moral Dilemmas: Norms for Moral Acceptability, Decision Times, and Emotional Salience. *Journal of Behavioral Decision Making*, *27*(1), 57–65.

Ma, HK, (1985). Cross-cultural study of the development of law-abiding orientation. *Psychological Reports, 57*(3), 967-974.

Mata, R., Josef, A. K., Samanez-Larkin, G. R., & Hertwig, R. (2011). Age differences in risky choice: A meta-analysis. *Annals of the New York Academy of Sciences*, *1235*(1), 18-29.

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in cognitive sciences*, *9*(10), 496-502.

Mikels, J. A., Larkin, G. R., Reuter-Lorenz, P. A., & Carstensen, L. L. (2005). Divergent trajectories in the aging mind: Changes in working memory for affective versus visual information with age. *Psychology and Aging*, *20*(4), 542–553.

Moore, A. B., Clark, B. a, & Kane, M. J. (2008). Who shalt not kill? Individual differences in working memory capacity, executive control, and moral judgment. *Psychological Science*, *19*(6), 549–57.

Myatt, M. (2013). *DNA of Fortune 100 CEOS*. Retrieved from: http://www.forbes.com/sites/mikemyatt/2013/08/13/infographic-dna-of-fortune-100-ceos/

Peters, E., Västfjäll, D., Slovic, P., Mertz, C. K., Mazzocco, K., & Dickert, S. (2006). Numeracy and decision making. *Psychological Science*, *17*(5), 407–13.

Peters, E. (2012). Beyond Comprehension: The Role of Numeracy in Judgments and Decisions. *Current Directions in Psychological Science*, *21*(1), 31–35.

Peters, E., & Bruine de Bruin, W. (2012). Aging and decision skills. *Judgment and decision making as a skill: Learning, development, and evolution*, *5*, 113-1139.

Piazza, J., & Sousa, P. (2014). Religiosity, political orientation, and consequentialist moral thinking. *Social Psychological and Personality Science*, *5*(3), 334-342.

Pratt, M. W., Diessner, R., Pratt, A., Hunsberger, B., & Pancer, S. M. (1996). Moral and social reasoning and perspective taking in later life: A longitudinal study. *Psychology and Aging*, *11*(1), 66.

Rawwas, M. Y. A., & Singhapakdi, A. (1998). Do Consumers' Ethical Beliefs Vary with Age? A Substantiation of Kohlberg's Typology in Marketing. *Journal of Marketing Theory and Practice*, *6*(2), 26–38.

Reuter-Lorenz, P. A., & Sylvester, C. Y. C. (2005). The cognitive neuroscience of working memory and aging. In R. Cabeza, L. Nyberg, & D. Park (Eds.),*Cognitive Neuroscience of Aging: Linking Cognitive and Cerebral aging* (pp. 186-217). New York: Oxford University Press.

Ryan, C. L., & Bauman, K. (2016). Educational attainment in the United States: 2015 (United States Census Bureau Publication No. P20–578). Washington, D.C.: US Government Printing Office.

Sanda Dolcos, Y. K., & Dixon, R. A. (2014). The role of arousal in the spontaneous regulation of emotions in healthy aging: a fMRI investigation. *Frontiers in psychology*, *5*.

Salthouse, T. A. (2004). What and When of Cognitive Aging. *Current Directions in Psychological Science*, *13*(4), 140–144.

Salthouse, T.A. (2012). Consequences of age-related cognitive declines. *Annual Review of Psychology*, *63*, 201-226.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2002). Rational Actors or Rational Fools? Implications of the Affect Heuristic for Behavioral Economics. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.) *Heuristics and Biases: The Psychology of Intuitive Judgment* (pp. 397–420). Boston: Cambridge University Press.

Strough, J., Schlosnagle, L., Karns, T., Lemaster, P., & Pichayayothin, N. (2014). No time to waste: Restricting life□span temporal horizons decreases the sunk□cost fallacy. *Journal of Behavioral Decision Making*, *27*(1), 78-94.

Strough, J., Mehta, C. M., McFall, J. P., & Schuller, K. L. (2008). Are older adults less subject to the sunk-cost fallacy than younger adults?. *Psychological Science*, *19*(7), 650-652.

Suter, R. S., & Hertwig, R. (2011). Time and moral judgment. *Cognition*, *119*(3), 454–8.

Sütterlin, S., Paap, M. C. S., Babic, S., Kübler, A., & Vögele, C. (2012). Rumination and age: some things get better. *Journal of Aging Research*, *2012*, 267-327.

Torges, C. M., Stewart, A. J., & Nolen-Hoeksema, S. (2008). Regret resolution, aging, and adapting to loss. *Psychology and aging*, *23*(1), 169.

Thomson, J. J. (1985). The Trolley Problem. *Yale Law Journal*, *94*(6), 1395-1415.

Ugazio, G., Lamm, C., & Singer, T. (2012). The role of emotions for moral judgments depends on the type of emotion and moral scenario. *Emotion*, *12*(3), 579.

Verhaeghen, P., Marcoen, A., & Goossens, L. (1993). Facts and fictions about memory and aging: a quantitative integration of research findings. Journal of Gerontology, 48,157-171.

Waldmann, M. R., & Dieterich, J. H. (2007). Throwing a Bomb on a Person versus Throwing a Person on a Bomb: Intervention Myopia in Moral Intuitions. *Psychological Science*, *18*(3), 247–253.

Walker, L. J. (2014). Sex differences in moral reasoning. In W.M. Kurtines & J.L. Gewitz (Eds.), *Handbook of moral behavior and development* (pp. 333-364). New York: Psychology Press.

Wood, S., Busemeyer, J., Koling, A., Cox, C. R., & Davis, H. (2005). Older adults as adaptive decision makers: evidence from the Iowa Gambling Task. *Psychology and Aging*, *20*(2), 220–5.

Wood, S., & Kisley, M. A. (2006). The negativity bias is eliminated in older adults: age-related reduction in event-related brain potentials associated with evaluative categorization. *Psychology and aging*, *21*(4), 815.

Table 1: *Examples of moral dilemma scenarios used in Experiment 1.*

Category	Moral dilemma scenario	Proposed intervention
Incidental, Self	You are a fireman trying to save five people from inside a burning building. The only window from which the people can be evacuated is jammed and will not open. The fire will reach you in a short time. Outside on the window ledge of the floor below there is a person who is waiting to be saved.	With an axe you smash the window to get out. You know that when it falls, the heavy glass will kill the person on the lower floor, but you and the five people in danger will be able to escape.
Instrumental, Self	You are travelling in the middle-east. You and another six tourists are taken hostage by a group of terrorists. The terrorists think that one of you is a spy, even though this is not true. You are held hostage for days. One of the terrorists comes to you and reveals that they intend to kill you all at sunset.	While he is resting, you kill one of the tourists in the group so that you can tell the terrorists that you identified and eliminated the spy. The person will die, but you and the other five will be freed.
Incidental, Other	You are a nurse who is in charge of a machine which controls drug dosage levels in patients' blood. Because of a technical failure, the machine is supplying a lethal dose of a drug to four patients. Another patient, in a single room, is hooked up to the same machine and has not undergone any variation in dosage.	You press the button to block the drug supply to the four patients. You know that the overdose of drug will be redirected to the patient in the single room, who will die, but the other four will be saved.
Instrumental, Other	You are the head zoo keeper and you are doing the rounds with another keeper. You realise that one of the cleaners has left the lions' cage open by mistake. You see that a lion is coming towards the open gate and you do not have time to close it. There are three visitors right in front of the gate.	You push the keeper next to you against the gate to stop the lion getting out. You know that the man will be attacked and killed, but the three visitors will be saved.

Table 2: *Means (SDs) for measures of moral judgment and affect by type of moral dilemma scenario and age group in Experiment 1*

	Type of moral dilemma scenario									
	Incidental Self		Instrumental Self		Incidental Other		Instrumental Other		Overall	
	Younger	Older	Younger	Older	Younger	Older	Younger	Older	Younger	Older
Moral judgment measures										
Accepted interventions	4.07 (1.80)	3.16 (2.24)	2.91 (2.06)	1.85 (2.10)	3.59 (1.79)	2.68 (2.03)	2.70 (1.85)	2.03 (2.03)	14.29 (6.76)	10.38 (8.20)
Moral acceptability	3.55 (1.35)	2.96 (1.63)	3.01 (1.33)	2.39 (1.61)	3.50 (1.31)	2.88 (1.61)	3.06 (1.32)	2.59 (1.58)	3.26 (1.24)	2.69 (1.53)
Affective measures										
Valence	3.08 (1.31)	2.45 (1.31)	2.90 (1.24)	2.39 (1.25)	3.17 (1.29)	2.60 (1.30)	3.08 (1.31)	2.53 (1.29)	3.07 (1.22)	2.51 (1.23)
Arousal	5.40 (2.05)	5.66 (2.35)	5.45 (2.01)	5.69 (2.36)	5.06 (1.95)	5.48 (2.30)	5.15 (2.08)	5.50 (2.31)	5.25 (1.96)	5.56 (2.26)

Table 3*: Partial correlations between measures of moral judgment and affect in Experiment 1*

	1	2	3	4
Moral judgment				
1. Accepted interventions	--			
2. Moral acceptability	.56***	--		
Affect				
3. Valence	.18**	.28***	--	
4. Arousal	.07	.10	-.52***	--

*=p<.05, **=p<.01, ***=p<.001.

Table 4: *Means (SDs) for measures by type of moral dilemma scenario and age group in Experiment 2*

	Type of moral dilemma scenario					
	Death		Non-Death		Overall	
Moral judgment	Younger	Older	Younger	Older	Younger	Older
Accepted interventions	2.42 (1.27)	1.88 (1.40)	2.72 (.91)	2.42 (1.09)	5.14 (1.81)	4.03 (2.14)
Moral acceptability	3.65 (1.41)	3.43 (1.74)	4.17 (1.58)	4.21 (2.02)	4.14 (1.07)	4.05 (1.46)
Affect						
Valence	3.32 (1.66)	2.96 (1.74)	4.87 (1.18)	4.67 (1.39)	4.09 (1.27)	3.81 (1.43)
Arousal	5.39 (1.73)	5.66 (2.21)	4.18 (1.59)	4.21 (2.03)	4.78 (1.46)	4.94 (1.99)
Individual differences	Younger				Older	
Numeracy	1.36 (1.22)				1.28 (1.27)	
Need for cognition	62.97 (13.04)				62.32 (15.62)	
Rumination	28.01 (6.42)				28.33 (6.05)	
Moral idealism	57.60 (12.79)				63.38 (17.29)	
Rational decision style	25.27 (2.99)				25.42 (2.67)	
Intuitive decision style	22.87 (3.55)				22.13 (4.47)	

Table 5: *Partial Correlations between measures of moral judgments, affect, and individual differences in Experiment 2*

	1	2	3	4	5	6	7	8	9	10
Moral judgment										
1. Accepted interventions	--									
2. Moral acceptability	.44***	--								
Affect										
3. Valence	.23***	.49***	--							
4. Arousal	.19**	.14*	.02	--						
Individual differences										
5. Need for cognition	-.12	.01	-.1	.03	--					
6. Rumination	-.16**	-.25***	-.37***	.07	-.05	--				
7. Numeracy	-.09	-.01	-.16*	-.14*	.19**	.03	--			
8. Rational decision style	-.03	-.07	-.17**	.14*	.17**	.12*	.05	--		
9. Intuitive decision style	.17**	.08	.09	.14*	-.10*	-.05	-.25***	.09	--	
10. Moral idealism	-.14*	-.12	.06	.18**	-.02	.02	-.18**	.20**	.17**	--

*=p<.05, **=p<.01, ***=p<.001.

Author Biographies

Simon McNair is a Leverhulme Early Career Research Fellow at Leeds University Business School, University of Leeds, UK. His research interests are in individual differences in judgment and decision making in domains such as consumer behavior, moral judgment, and ageing.

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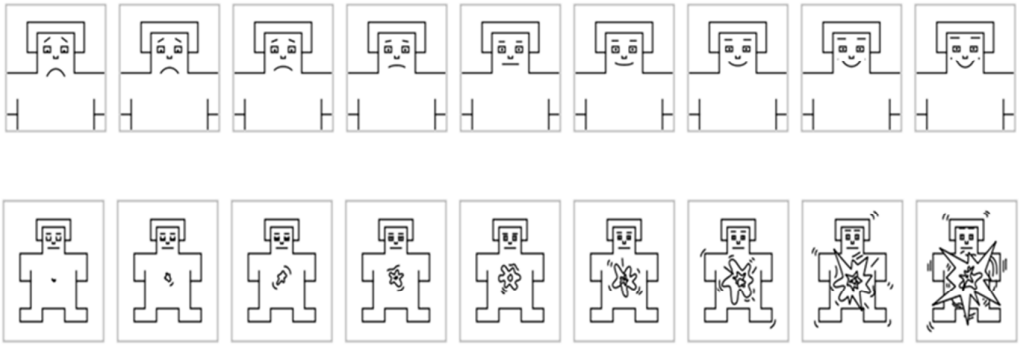

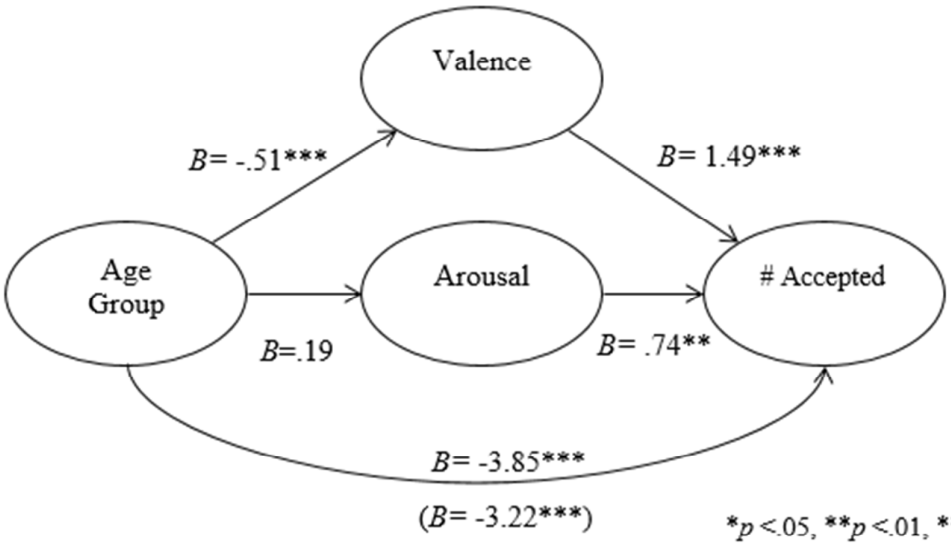

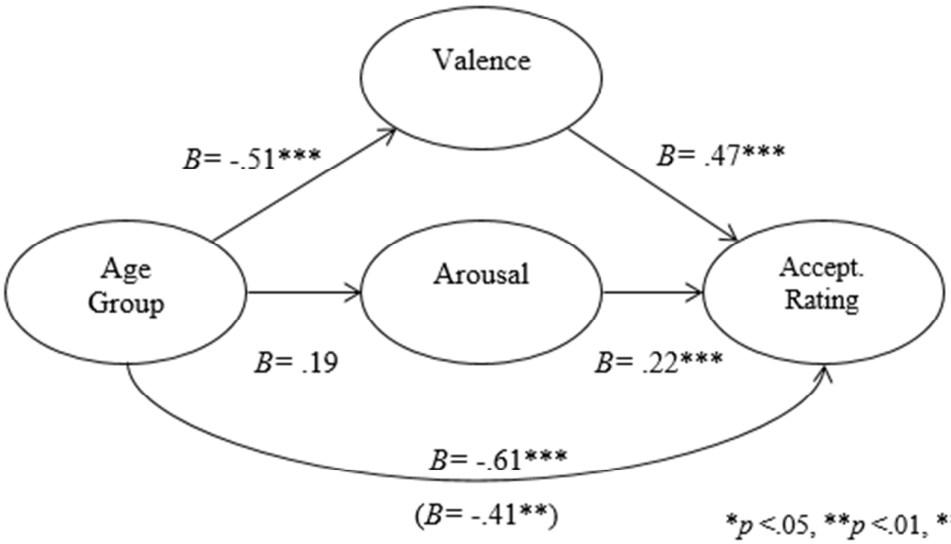

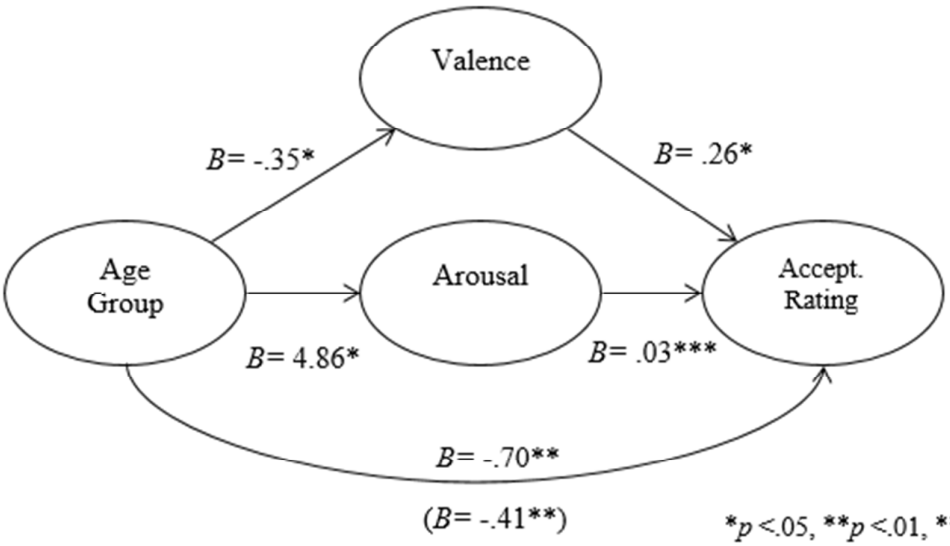

Experiment 1 Instructions & Materials

Instructions

"During the experiment you will read 26 short hypothetical scenarios. Each scenario will describe a scene in which an unfortunate event is unfolding which will result in death. In each hypothetical situation you are presented with an action which will change the outcome of the situation. You will be asked to indicate whether you would conduct the action or not. After each scenario you will also answer a few short questions about how the scenario made you feel, and how morally acceptable you think the action was. The full study will take 20-25 minutes to complete.

Please note: the hypothetical scenarios contained in this study require you to imagine yourself in potentially distressing situations, and to think about how you would act in situations which may result in harm to others. The choices you make are submitted anonymously, so you cannot be personally identified. The study is not interested in judging you by your choice of actions, so if you choose to continue please respond to the scenarios honestly.

After you have completed the final hypothetical scenario you will then be asked to rate a series of 30 short statements in terms of how much you feel they describe you.

It is very important that you imagine the following scenarios exactly as they are described, even if you feel they are in some cases unrealistic.

In all hypothetical scenarios you must assume that (1) there are no other possible actions you could perform apart from the ones described in the text, and (2) it is guaranteed that the actions will lead to the consequences described in each case. It is also important that you assume that the actions will have no legal consequences.

You are free to stop your participation at any time by simply closing the webpage, however, your submitted responses cannot be withdrawn at a later date given the anonymity of your participation.

If at any point whilst reading the scenarios you become uncomfortable or upset and wish to stop your participation, simply close this webpage. In such cases, should you wish you can contact the Requester to discuss your experience and receive further support."

Experiment 1 Moral Dilemmas

(Taken from Lotto, Manfrinati, & Sarlo, 2013, except Footbridge and Trolley, taken from Foot, 1967).

In each instance, participants first received the premise of the dilemma scenario, before clicking a button to advance to the next screen. The next screen described the intervention available, and presented a binary Yes/No choice along with the statement "Would you do the proposed action?" The first example dilemma below illustrates this process; all other dilemmas were presented in this two-step process.

A) **Other, Instrumental dilemmas**

Motocross

[Screen 1 – Premise]: You are a motorcyclist and you are taking part in a motocross race. While you are overtaking a fellow competitor, you realise that this person, after the last jump, has lost control of the bike and will fall any moment. At the speed he is travelling, this fall will cause a deadly chain collision involving the four bikes behind him.

Please click "Continue" when you have read the scenario.

[Screen 2 – Intervention]: You move alongside the motorcyclist and push him off the track with your foot. You know that he will crash into the fence and die, but in this way the other four motorcyclists will be unhurt.

Would you do the proposed action? [Yes/No].

Zoo

You are the head zoo keeper and you are doing the rounds with another keeper. You realise that one of the cleaners has left the lions' cage open by mistake. You see that a lion is coming towards the open gate and you do not have time to close it. There are three visitors right in front of the gate.

You push the keeper next to you against the gate to stop the lion getting out. You know that the man will be attacked and killed, but the three visitors will be saved.

Ranch

You have a small horse stud in Australia. You are heading towards the nearby town in a four-wheel drive together with a new client when you notice a bolting wild horse which is galloping like mad. It is heading towards three people who are walking near the edge of a gorge and soon it will run into them. You immediately follow and are able to catch up with it.

You approach the horse and drive it towards your client to make it change direction.

You know that the client will be trampled by the horse and will be killed, but the other three people will be saved.

Vitamins

You are in charge of a medical team which is taking part in an expedition that will be isolated in the Sahara Desert. In the group, there is a family of five people who suffer from a serious genetic disease which causes vitamin deficiency. You have no drugs with you that can guarantee their survival, and rescue will not arrive in time.

You remove the kidney of one of the group to extract the indispensable vitamins. You know that this person will die, but the five family members will be saved.

Circus

You are a lion-tamer on tour with a show of wild animals used in circus acts. During the show, you notice that one of the lions has suddenly become aggressive. You see that it is not responding to your commands, is baring its teeth and is about to launch into the front row audience. Near you there are two assistants.

You push the two assistants towards the lion so that it will attack them. You know that they will die mauled, but the audience will have time to escape to safety.

Press

You are in charge of the division of a factory where wood panels are made. Because of a malfunction in one of the main machines, three workers have been caught up in a

roller which is pulling them quickly into a very large press. The emergency system which blocks the machine has not activated and time is running out.

You push the worker next to you into the cogs of the machine which operates the press to block the system. You know that this worker will die crushed, but the other three workers will be unhurt.

Footbridge

You are crossing a bridge that passes over a railway line and you see a train moving on the track below. You notice that the driver has lost control and the locomotive will continue its course and end up running into five men who are working on the adjacent track. On the bridge next to you is a person you do not know.

You throw this person off the bridge in such a way that their body blocks the oncoming train. You know this person will die, but the five workers will be unhurt.

B) Self, Instrumental dilemmas

Climbers

You are the fourth in a team of five mountaineers involved in a climb. The head of the team has just secured himself to the rock face when the second in the team starts to slide, pulling you, and the others, with him. You all fall for tens of metres and stop suspended above a crevasse. Your weight is too much and the rope is not going to resist for long.

To lighten the load, you cut the rope which links you to the last climber. You know

that he will fall into the crevasse and die, but you and the other two climbers will survive.

Trail of Blood

You are part of a team of six bomb disposal experts who are detonating an underwater mine. While you are underwater, a cable snaps causing a deep gash in one of the expert's hand. The blood in the water starts to attract some sharks which are in the area. The injured expert starts to swim towards the only shark-proof cage available, while the rest of you are some way behind.

You shoot the injured expert before he reaches the cage. You know that the sharks will all pounce on him, but you and the other four experts will be able to reach the cage and safety.

Sacrifice

You are the head of a group of five travellers who are exploring the remote regions of South America. During the trip, you inadvertently camp in the sacred cemetery of a local tribe. The members of the tribe capture you and condemn you all to death. After some negotiation, they propose a possible alternative in the form of a human sacrifice that will pacify their god who has been offended.

You accept the tribe's proposal, and during the ceremony, you kill one of the travellers in the group. This person will die, but you and the other four travellers' lives will be spared.

Lifeboat

You are in a ship which is crossing the Atlantic Ocean in the direction of South America. A fire has just broken out on board and everyone must immediately go to the lifeboats to be rescued. In the rush, too many people have climbed aboard some of the lifeboats, which are sinking. The life-boat you are on quickly starts to take on water.

You throw into the sea the two people closest to you on the lifeboat to avoid it sinking. You know that they will drown, but you and the others will be saved.

Kidnap

You are travelling in Yemen. You and another six tourists are taken hostage by a group of terrorists. The terrorists think that one of you is a spy, even though this is not true. You are held hostage for days. One of the terrorists comes to you and reveals that they intend to kill you all at sunset.

While he is resting, you kill one of the tourists in the group so that you can tell the terrorists that you identified and eliminated the spy. The person will die, but you and the other five will be freed.

Fireworks

You own a shop which sells fireworks. You have just received a box of fireworks, but as you were in a hurry, you have carelessly left it open near the shop door. Five customers are waiting. Another customer enters the shop. Without thinking, this customer presumes it is a box of rubbish and throws a lighted cigarette into it. The box is about to explode.

You push the customer closest to you against the box of fireworks to deaden the

impact of the explosion. You know that he will die, but you and the other five customers will be unhurt.

C) Other, Incidental dilemmas

Cargo

You are in charge of the Maritime Police. You have received a message that the captain and a seaman of a cargo ship are healthy carriers of a lethal and contagious virus. They do not know that they are infected, and are travelling towards a small gulf where fishermen live. The communications system of the cargo ship is not working and, therefore, they cannot be contacted.

You launch a missile and sink the cargo ship to avoid it mooring and thus spreading the virus. You know that the captain and seaman will die, but the fishermen will be saved.

Nurse

You are a nurse who is in charge of a machine which controls drug dosage levels in patients' blood. Because of a technical failure, the machine is supplying a lethal dose of the drug to four patients. Another patient, in a single room, is hooked up to the same machine and has not undergone any variation in dosage.

Press the button to block the drug supply to the four patients. You know that the overdose of drug will be redirected to the patient in the single room, who will die, but the other four will be saved.

Torpedo

You are the commander of a naval submarine which is currently navigating in the North Atlantic. The sonar reveals the presence of a torpedo which is heading at great speed towards a small boat with six people on board, which is offshore. Close by, there is also a naval patrol boat with two people on board.

You launch false targets to change the trajectory of the torpedo. You know that it will hit the patrol boat killing the two people on board, but the six people in the boat will be unhurt.

Agent

You are a secret service agent on a mission overseas. You have discovered that a terrorist group is attempting to assassinate three diplomats. They are travelling in a car towards the embassy. They are being followed by one of the terrorists who will take advantage of the first red traffic light to kill them. As you follow, a tanker carrying oil slips between your car and the terrorist's.

You shoot at the tanker, which will injure the terrorist when it explodes so that he will not be able to complete his mission. You know that the explosion will kill the tanker driver, but the three diplomats will not be injured.

Motorboat

You are driving your motor boat in a small bay when your attention is drawn to cries of help from five people who are drowning at the end of a very narrow channel which

is right in front of you. Between you and the people who are drowning, to one side of the channel, is another person who is calmly swimming.

You steer towards the end of the channel at high speed. You know that the person who is swimming will be hit by the motorboat, but the other five people will be saved.

Ferris Wheel

You are the safety officer in charge of a fun park. One of the metal arms of the ferris wheel suddenly breaks because of a structural defect. Four people are stranded in a cabin 80 metres up in the air. Another person is in a cabin just a few metres from ground level and is able to get off alone. The whole structure is falling down.

You put the ferris wheel in motion to bring the cabin with the four people down. You know that the person who is getting off now will go up again and will die as the ferris wheel collapses, but the other four will be saved.

Trolley

You are in charge of a work crew who are doing repair work for the railways. In the distance you see a trolley and realise that the driver has lost control of it. If the trolley continues on it will end up running into five workers who are working on the tracks. On a secondary track there is one worker.

You pull a lever on the interchange which will divert the trolley onto the secondary track. You know that it will run into and kill the worker, but the other five workers will be unhurt.

D) Self, Incidental dilemmas

Window

You are a fireman and you are trying to save five people from inside a burning building. The only window from which the people can be evacuated is jammed and will not open. The fire will reach you in a short time. Outside on the window ledge of the floor below, there is a person who is waiting to be saved.

With an axe you smash the window to get out. You know that when it falls, the heavy glass will kill the person on the lower floor, but you and the five people in danger will be able to escape.

Space Station

You are the commander of a group of astronauts in a space station orbiting the earth. Because of a breakdown, you have discovered a serious loss of pressurisation which in a short time will lead to the oxygen supply running out in the control cabin, where you and five other astronauts are. The emergency system is broken down and cannot be repaired immediately.

You activate the bulkheads manually to isolate the depressurisation to just one cabin. You know that there are two astronauts there, and they will suffocate from a lack of oxygen, but you and the other five will be saved.

Taxi

You are a taxi driver and you are carrying two passengers at night. It has been snowing already for a couple of hours and the roads are dangerously icy. You turn into a very narrow street and suddenly you find yourself in front of a truck which has

overturned in the middle of the road. You start to brake, but you lose control of the taxi and it begins to slide on the icy road.

You swerve to direct the car towards the edge of the road. You see that there is a passer-by who will be hit by the car and will die, but you and the two passengers will be unhurt.

Electric Cable

A car accident causes a devastating explosion inside a long tunnel. You and another four survivors are finding your way through the debris to get out of the tunnel. Because of structural damage, a high tension electric cable has snapped and is beginning to swing towards you. The asphalt is soaked with petrol. In the opposite direction you see another survivor coming towards you.

You use a rubber-soled shoe to divert the electric cable in the opposite direction. You know that the person coming towards you will be electrocuted, but you and the other four will be unhurt.

Theatre

You and another five actors are taking part in rehearsals for a stage show. The lighting technician is adjusting the spotlights and is on the catwalks several meters above. Suddenly, a criminal armed with a gun comes into the theatre and threatens to kill you and the other actors. He is standing right under the catwalk.

You activate the opening of a trapdoor in the catwalks in which there is heavy scenery and other material which will fall on top of the criminal. You know that the technician

will also fall, and will die, but you and the other five will be unhurt.

Control Tower

You are an Air Force commander and you are in the control tower with another two officers to check some documents. During an exercise that is taking place in the surrounding air space, a plane has engine problems and is about to crash into the control tower. The pilot communicates by radio that he is about to eject from the plane.

You give orders that the plane must be immediately shot down. You know that the pilot will not have time to eject and will die, but you and the other two officers will escape injury.

After deciding Yes/No whether to intervene, the next screen presented the statement "How morally acceptable did you find the action proposed in the scenario you just read?", with a 1-7 rating scale running from 1 – Not at All Acceptable, to 7 – Completely Acceptable.

The next screen presented the following statement along with the Self-Assessment Manikin for Valence (see Figure 1 in paper, pg. 11):

"Below are 9 figures which represent how unpleasant or pleasant you may have felt when you were deciding whether or not to do the proposed action in the scenario you just read. Figure 1 represents a strong feeling of unpleasantness, while figure 9 represents a strong feeling of pleasantness.

> Please select the image below which you feel best depicts how unpleasant or pleasant you felt when you were deciding whether you would do the action in the scenario you just read."

The next screen presented the following statement along with the Self-Assessment Manikin for Arousal (see Figure 1 in paper, pg. 11):

> "Below are 9 figures which represent how calm or excited you may have felt when you were deciding whether or not to do the proposed action in the scenario you just read. Figure 1 represents a strong feeling of calm, while figure 9 represents a strong feeling of excitement.
>
> Please select the image below which you feel best depicts how calm or excited you felt when you were deciding whether you would do the action in the scenario you just read."

The above five-screen trial process was administered for each individual dilemma.

Experiment 2 Instructions & Materials

Instructions

"This survey is split into 4 sections, and is interested in understanding how people think in certain situations when deciding whether or not to intervene.

You will read 8 hypothetical scenarios in which an unfortunate event is unfolding that will

result in a bad outcome. In each scenario you are presented with an action which will change the outcome of the situation. You will be asked to indicate whether you would do the action or not. After each scenario you will also answer a few short questions about how the scenario made you feel, and how acceptable you think the action was.

After the last scenario, there will be a series of short questionnaires designed to understand how you think and feel about the kinds of decisions that feature in the scenarios. We estimate that the entire survey will take 25 minutes to complete.

Please note: the hypothetical scenarios contained in this study require you to imagine yourself in potentially distressing situations, and to think about how you would act in situations which may result in harm to others. The choices you make are submitted anonymously, so you cannot be personally identified. The study is not interested in judging you by your choice of actions, so if you choose to continue please respond to the scenarios honestly.

It is very important that you imagine the following scenarios exactly as they are described, even if you feel they are in some cases unrealistic.

In all hypothetical scenarios you must assume that (1) there are no other possible actions you could perform apart from the ones described in the text, and (2) it is guaranteed that the actions will lead to the consequences described in each case. It is also important that you assume that the actions will have no legal consequences.

Next we will present the first of the 8 hypothetical scenarios."

Experiment 2 Moral Dilemmas

All eight dilemmas were presented using the same five-screen process described for Experiment 1.

Death Dilemmas

The four death dilemmas were taken from Experiment 1: Ranch, Torpedo, Kidnap, and Theatre.

We selected these particular scenarios on the basis that they yielded the largest differences in moral judgments between age groups in Experiment 1. To determine this, for each of the 26 dilemmas used in Experiment 1 we calculated the absolute differences between age groups in terms of 1) overall number of accepts, and 2) average moral acceptability rating. We then added these two differences together for each moral dilemma, and selected the top four dilemmas with the largest composite absolute difference. Table 1 below shows the overall descending ranking of the 26 moral dilemmas in these terms.

Table S1

Differences in moral judgements between age groups for Experiment 1 dilemmas

Dilemma	Younger Accepts	Older Accepts	Younger Avg. Acceptability	Older Avg. Acceptability	Composite Difference
Kidnap	75	32	2.86	2.13	43.73
Torpedo	90	47	3.64	2.99	43.65
Theatre	111	71	3.60	2.83	40.77
Ranch	95	58	3.53	2.69	37.84
Trolley	98	63	3.65	2.84	35.81
Sacrifice	105	70	3.09	2.36	35.73
Ferris	76	45	3.25	2.61	31.64
Vitamins	79	50	3.3	2.61	29.69
Motorboat	83	54	3.18	2.57	29.61
Space	111	85	3.65	2.85	26.80
LifeBoat	70	44	3.03	2.25	26.78
Taxi	88	62	3.34	2.81	26.53
Cable	114	89	3.55	2.81	25.74
Fire	123	98	3.85	3.21	25.64
Trail of Blood	65	42	3.01	2.41	23.60
Motocross	73	55	3.20	2.79	18.41
Nurse	86	69	3.16	2.45	17.71
Footbridge	44	28	2.63	2.29	16.34
Fireworks	57	42	2.73	2.44	15.29
Climbers	85	71	3.34	2.77	14.57
Agent	106	95	3.95	3.29	11.66

Press	34	23	2.45	2.22	11.23
Cargo	89	79	3.80	3.35	10.45
Zoo	67	59	3.11	2.68	8.43
Missile	85	77	3.32	3.24	8.08
Circus	63	60	2.78	2.53	3.25

Non-Death

Gameshow (taken from Gold, Pulford, & Colman, 2013)

You are a member of the studio audience watching a game show. Five contestants have each earned £100 prize money, and their game tokens are nearing the winning side of the game board. A ball is suddenly released and is rolling towards the tokens of the five contestants and, if nothing is done, they will be knocked out of the game and lose their prize money. You see that a button on your armrest has just lit up to indicate that you have been randomly selected by the studio computer to take part in the show. Your random selection has earned you £100.

You now have the option to press a button and knock the ball onto another path, away from the five contestants' tokens. But another contestant, who has also earned £100 prize money, has a token on the new path and will be knocked out of the game and lose their prize money. By knocking this one contestant out of the game you will get to keep your £100.

Thus you can press the button, in which case the one contestant will lose their prize money but neither the five contestants nor you will lose their money; or you can refrain from pressing the button, in which case the five contestants and you will lose their prize money but the one contestant will not. Would you press the button?

Rucksacks (Gold et al., 2013)

You are part of a group visiting a mine when you see an out-of-control trolley that is full of coal approaching. There are five rucksacks on the trolley track, through no fault of the owners, each containing personal items such as phones and laptops of other people in your group. It is not possible to get the rucksacks off the track in time. If nothing is done, they will all be destroyed.

You are standing next to a lever as this is happening. If you pull the lever, the trolley will turn onto a side track and the five rucksacks on the main track will not be destroyed. But there is one other rucksack on the side track, containing items such as a phone and a laptop, through no fault of its owner. If the trolley goes onto the side track, then this one rucksack will be destroyed. Would you pull the lever?

Sauna (Gold et al., 2013)

Five strangers are having a nude sauna in a spa in Finland. They all have strict principles of modesty but have each made an exception to their usual rule because nude saunas are the norm in Finland.

The spa keeps a surveillance camera in the sauna for security purposes, but it has malfunctioned and is about to feed live to the saunas webpage. There will be five seconds of internet feed before the camera automatically switches off. Those in the sauna will be exposed publicly, which will cause each to suffer extreme emotional distress.

You are a security person at the sauna, but you cannot turn off the camera or the internet feed any faster than it will turn off by itself.

But, there is a sixth man, who is nude and waiting just outside the sauna. You could push this man into the sauna so that he obscures the other five people for the five seconds of internet feed, saving the five from emotional distress. However, the sixth man also has a strict principle of modesty and will suffer extreme emotional distress because he will discover that his nudity was publicly broadcast online. Would you push the sixth man?

Virus (taken from Waldmann & Dieterich, 2007)

You are a doctor in an emergency department. Four patients have suddenly been admitted who are suffering from a virus that could leave each of them paraplegic. The patients are deteriorating fast, and there is no time to consult them on the course of action to be taken. As the acting doctor, you alone must decide how to proceed.

You know that there is still enough time to operate and remove some bone-marrow from one patient that could then be transfused into the remaining three patients and save them from becoming paraplegic, but the required procedure would mean the patient who is operated on will become paraplegic. Would you perform the operation?

Experiment 2 Individual Differences Measures

A) **Need for Cogniton (Cacioppo, Petty, & Kao, 1984)**

The instructions read "Please indicate your response in each of the following cases by choosing one of the available options". Each of the 18 items was presented with a five-point scale where the options read:

1. Extremely Uncharacteristic of Me
2. Somewhat Uncharacteristic of Me
3. Unsure
4. Somewhat Characteristic of Me
5. Extremely Characteristic of Me.

I would prefer to think about complex rather than simple issues

I like to have the responsibility of handling a situation that requires a lot of thinking

Thinking is not my idea of fun

I would rather do something that requires little thought than something that is sure to challenge my thinking abilities

I try to anticipate and avoid situations where there is a likely chance I will have to think in-depth about something

I find satisfaction in deliberating hard and for long hours

I only think as hard as I have to

I prefer to think about small, daily projects rather than long-term ones

I like tasks that require little thought once I have learned them

The idea of relying on thought to make my way to the top appeals to me

I really enjoy a task that requires coming up with new solutions to problems

Leaning new ways to think doesn't excite me much

I prefer my life to be filled with puzzles I must solve

The notion of thinking abstractly appeals to me

I would prefer a task that is intellectual, difficult, but important to one that is somewhat important but does not require much thought

I feel relief rather than satisfaction after completing a task that requires a lot of mental effort

It's enough for me that something gets the job done; I don't care how or why it works

I usually end up deliberating about issues even when they do not affect me personally

B) **Numeracy (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012)**

Four-item Berlin Numeracy Test. The instructions read "The following four items ask you to make numerical judgments using the information provided."

Item 1

Out of 1000 people in a small town 500 are members of a choir.

Out of these 500 members of the choir, 100 are men.

Out of the 500 town inhabitants who are not in the choir, 300 are men.

What is the probability that a randomly selected man in the town is a member of the choir?

Please enter your percentage probability estimate in the space below:

Item 2

Imagine we throw a loaded six-sided die. The probability that the die shows a 6 is twice as high as the probability of each of the other numbers. Now imagine you throw this die 70 times.

On average out of these 70 throws, how many times would the die show a 6?

Please enter your response below as a number out of 70 (e.g. "3 out of 70").

Item 3

Imagine we throw a five-sided die fifty times. On average, out of these 50 throws how many times would the die show an odd number (i.e. 1, 3, or 5)?

Please enter your response below as a number out of 50 (e.g. "3 out of 50").

Item 4

In a forest 20% of mushrooms are red, 50% are brown, and 30% are white. A red mushroom is poisonous with a probability of 20%. A mushroom that is not red is poisonous with a probability of 5%.

What is the probability that a poisonous mushroom in the forest is red?

Please enter your percentage probability estimate in the space below:

C) **Rumination (Diefendorff, Hall, Lord, & Strean, 2000).**

Disengagement vs. Preoccupation subscale of Diefendorff et al's (2000) Action-Control Scale. Instructions read: "The next series of questions asks you to consider in a little more detail how you think you would feel in real life if you had to make the kinds of decisions that were presented during Section 2. Try to imagine how you would feel after having made a decision in the kinds of scenarios you read in Section 2, where you were asked whether you would act or not to change the outcome of the scenario. How do you think you would feel after having made a decision in these kinds of situations? Please indicate the extent to which you would feel the following by choosing one of the available options".

Each of the eight items was presented with a five-point scale where the options read:

1. Definitely False
2. Probably False
3. Neither True nor False
4. Probably True

5. Definitely True

It would take me a long time to adjust to it

I would manage to get over it quickly

I would easily forget it

I would quickly forget about it and do something else

I would feel paralyzed

I would have trouble doing anything at all

I wouldn't know how to deal with it

D) **Decision Style (Scott & Bruce, 1995)**

Rational, and Intuitive subscales of Scott & Bruce's (1995) Decision Making Style Inventory. Instructions read: "Listed below are statements describing how individuals might go about making importance decisions. Please indicate the extent to which you feel the following statements represent you by choosing one of the available options." Each item was presented with a five-point scale (1 – Strongly Disagree to 5 – Strongly Agree).

I double-check all my information sources to be sure I have the right facts before making a decision

I make decisions in a logical and systematic way

My decision making requires careful thought

When making a decision I consider various options in terms of a specific goal

I explore all my options before making a decision

When making decisions I rely on my instincts

When I make decisions I tend to rely on my intuition

I generally make decisions that feel right to me

When I make a decision it is more important for me to feel the decision is right than to have a rational reason for it

When I make a decision I trust my inner feelings and reactions

E) **Moral Idealism (Forsyth, 1980).**

10-item moral idealism subscale of Forsyth's (1980) Ethics Position Questionnaire. Instructions read: "The following statements represent commonly held opinions and beliefs. Please indicate the extent to which you feel each statement represents you by choosing one of the available options". Each item was presented with a 9-point scale where the options read:

1. Completely Disagree
2. Largely Disagree
3. Moderately Disagree
4. Slightly Disagree
5. Neither Agree nor Disagree
6. Slightly Agree
7. Moderately Agree
8. Largely Agree
9. Completely Agree

It is never necessary to sacrifice the welfare of others

Moral behaviors are actions that closely match the ideals of the most "perfect" action

Risks to another should never be tolerated, irrespective of how small the risks may be

People should make sure that their actions never intentionally harm another even to a small degree

One should never psychologically or physically harm another person

The dignity and welfare of the people should be the most important concern in any society

The existence of potential harm to others is always wrong, irrespective of the benefits to be gained

If an action could harm an innocent other, then it should not be done

One should never perform an action that might in any way threated the dignity and welfare of another individual

Deciding whether or not to perform an act by balancing out the positives and negatives is immoral

Experiment 1 Additional Results

Table S2: *Additional ANCOVA analyses of moral judgments by type of moral dilemma and age group in Experiment 1*

	df	F	η_p^2	*p*
Interventions Accepted				
Risk Involvement	1	.07	.01	.80
Age Group x Intervention Type	1	.41	.01	.53
Age Group x Risk Involvement	1	2.20	.01	.14
Age Group x Risk x Intervention	1	1.65	.01	.20
Moral Acceptability Ratings				
Risk Involvement	1	.07	.01	.77
Age Group x Risk Involvement	1	.56	.01	.45
Age Group x Intervention Type	1	.79	.01	.38
Age Group x Risk x Intervention	1	1.95	.01	.16

N.B. Analyses controlled for significant demographic differences between Older and Younger groups: University Degree (0 = No, 1 = Yes); Ethnic Group (0 = Non-white, 1 = White); and Politically-Right (0 = No, 1 = Yes).

Table S3: *Additional ANCOVA analyses of affective measures by type of moral dilemma scenario and age group in Experiment 1*

	df	F	η_p^2	*p*
Valence				
Incidental/Instrumental	1	1.69	.01	.50
Self/Other	1	.21	.01	.65
Age Group x Incidental/Instrumental	1	1.69	.19	.19
Age Group x Self/Other	1	.01	.01	.92
Age Group x Instrumental/Incidental x Self/Other	1	1.51	.01	.22
Arousal				
Incidental/Instrumental	1	.02	.01	.89
Self/Other	1	.60	.01	.44
Age Group x Incidental/Instrumental	1	.30	.01	.59
Age Group x Instrumental/Incidental x Self/Other	1	.47	.01	.49

N.B. Analyses controlled for significant demographic differences between Older and Younger groups: University Degree (0 = No, 1 = Yes); Ethnic Group (0 = Non-white, 1 = White); and Politically-Right (0 = No, 1 = Yes).

Table S4: *Zero-order correlations between moral judgments and affective reactions in Experiment 1*

	1	2	3	4
Moral judgment measures				
1. Accepted Actions	--			
2. Moral Acceptability	.55***	--		
Affective measures				
3. Valence	.19**	.28***	--	
4. Arousal	.05	.09	-.53***	--

N.B. * = p < .05, ** = p <.01, *** = p <.001.

Table S5: *Additional ANCOVA analyses of moral judgments by type of moral dilemma and age group in Experiment 2*

	df	F	η_p^2	*p*
Interventions Accepted				
Death/Non-Death	1	.06	.01	.80
Age Group x Death/Non-Death	1	.49	.01	.48
Moral Acceptability				
Age Group	1	.14	.01	.71
Age Group x Death/Non-Death	1	1.17	01	.28

N.B. Analyses controlled for significant demographic differences between Older and Younger groups: University Degree (0 = No, 1 = Yes); Gender (0 = Male, 1 = Female); Religious (0 = No, 1 = Yes); Politically-Right (0 = No, 1 = Yes); Politically-Left (0 = No, 1 = Yes).

Table S6: *Additional ANCOVA analyses of affective measures by type of moral dilemma scenario and age group in Experiment 2*

	df	F	η_p^2	p
Arousal				
Age Group	1	.14	.01	.71
Age Group x Death/Non-Death	1	2.81	.01	.11

N.B. Analyses controlled for significant demographic differences between Older and Younger groups: University Degree (0 = No, 1 = Yes); Gender (0 = Male, 1 = Female); Religious (0 = No, 1 = Yes); Politically-Right (0 = No, 1 = Yes); Politically-Left (0 = No, 1 = Yes).

Table S7: Zero-order correlations between moral judgments, affective measures, and individual difference measures in Experiment 2

	1	2	3	4	5	6	7	8	9	10
Moral judgment measures										
1. Accepted Actions	--									
2. Moral Acceptability	.44***	--								
Affective measures										
3. Valence	.25***	.50***	--							
4. Arousal	.18**	.13*	.01	--						
Individual difference measures										
5. Need for Cognition	-.09	-.01	-.11	.02	--					
6. Ruminative Coping	-.17**	-.29***	-.40***	.07	-.03	--				
7. Numeracy	-.08	-.02	-.14*	-.15*	.21**	.02	--			
8. Rational Decision Style	-.03	-.08	-.17**	.13*	.17**	.14*	.06	--		
9. Intuitive Decision Style	.13*	.08	.07	.15*	-.13*	-.06	-.29***	.07	--	
10. Moral Idealism	-.18**	-.14*	.03	.19**	-.01	.04	-.20**	.19**	.21**	--

N.B. * = p < .05, ** = p <.01, *** = p <.001.

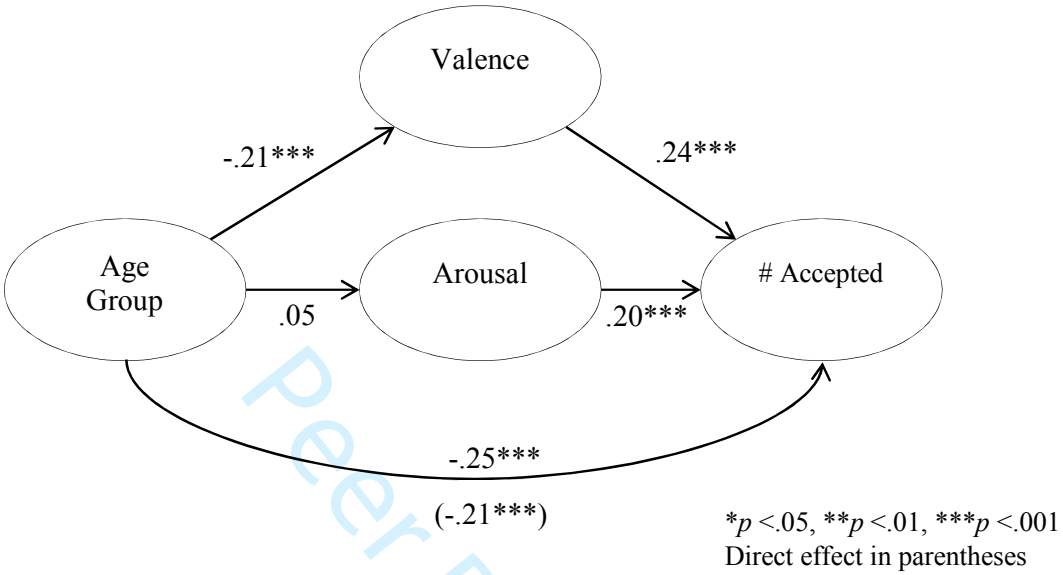

Figure S1. Mediation model (standardized coefficients) for number of accepted actions in Experiment 1.

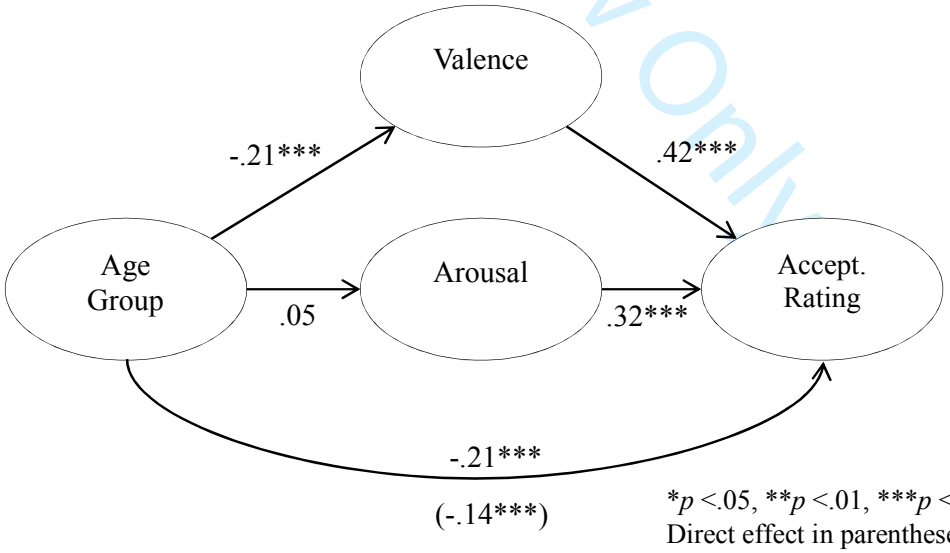

Figure S2. Mediation model (standardized coefficients) for moral acceptability ratings in Experiment 1.

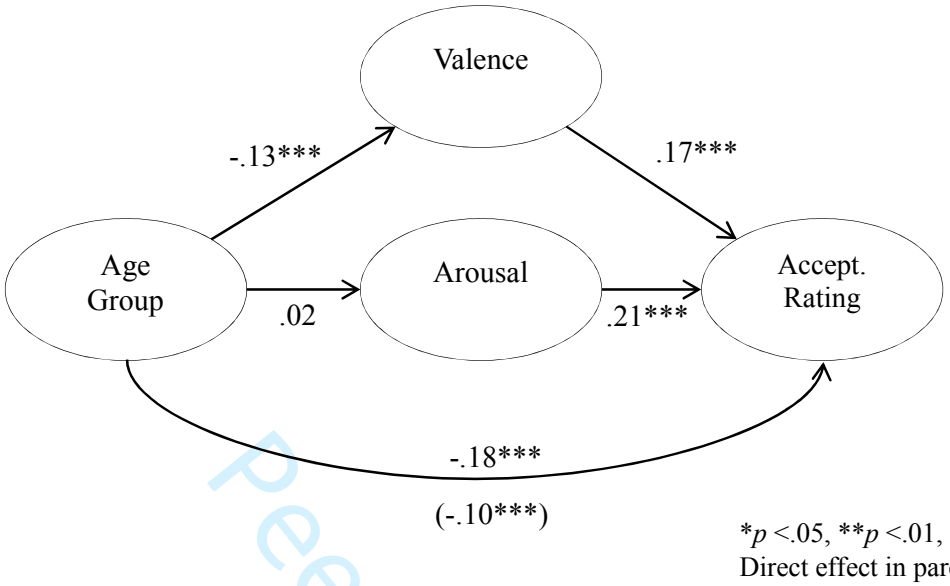

Figure S3. Mediation model (standardized coefficients) for number of accepted actions in Experiment 2.