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Moral cognition: An interdisciplinary investigation of judgment versus action

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Moral cognition: An interdisciplinary investigation of judgment versus action

by

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AUTHOR'S DECLARATION

At no time during the registration for the degree of *Doctor of Philosophy* has the author been registered for any other university award without prior agreement of the Graduate Sub-Committee.

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Date……..……

Kathryn Barbara Francis

Moral cognition: An interdisciplinary investigation of moral judgment versus moral action

In the past, experiments on human morality have predominantly utilised theoretical moral dilemmas to shed light on the nature of moral judgment. However, little attention has been given to determining how these judgments might translate into moral actions. In this thesis, I utilised novel and state-of-the-art Virtual Reality environments and combined approaches from social psychology, experimental philosophy, computer science, robotics, and speculative design. Over the course of six experiments with more than 200 participants, simulated moral actions made in Virtual Reality were found to be dissociated from moral judgments made in conventional paradigms. The results suggest that moral judgment and action may be driven by distinct mechanisms. The association between personality traits and moral judgments versus actions, was also investigated. In two experiments, psychopathic and associated traits predicted moral actions and the power with which these were simulated, but failed to predict moral judgments. With research suggesting a mediating role for empathy in this relationship, two further experiments examined empathic and affective processing in moral judgment versus action. In the first of these, alcohol consumption successfully lowered affective empathy and arousal in virtual dilemmas, but moral judgment and action remained unaffected. In the second, an investigation of professionally trained paramedics and fire service incident commanders, revealed distinct differences in empathic and related personality traits, reduced emotional arousal, and less regret following moral action. Taken together, this research suggests that novel virtual technologies can provide insights into self-referent actions, which sit in contrast to judgments motivated by social norms. Ethically, incorporating Virtual Reality in investigations of morality of harm offers a balanced approach; protecting participant wellbeing while increasing the ecological validity of moral investigations. The roles of personality traits and associated emotional processes in moral judgment and action remain multifaceted and as such, I outline the necessity of considering both the characteristics of the decision-maker and the context in which the decision is undertaken, within an interactionist model of morality.

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CHAPTER 1: GENERAL INTRODUCTION

TRANSITIONING FROM MORAL JUDGMENT TO MORAL ACTION

Questions of morality emerge early on in the history of humanity; consider the moral narrative of Adam and Eve which opens the Bible (Haidt, 2008). These tales of moral transgressions highlight our fascination with moral regulation; "…what we did, could have done, or should have done" (Tague, 2016, p. 118). From a philosophical perspective, explorations of the origins of good and bad have appeared in works from ancient Greek philosophy and across Western philosophy in general (e.g., Fieser, 2001). Morality, as a topic in philosophy, has been predominantly considered in the context of normative ethics rather than through empirical investigation (Doris, 2010). It was the emergence of moral psychology that marked the fusion of both theoretical and experimental approaches in investigating the nature of morality, but more specifically, moral judgment (Doris, 2010; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001). Despite advances in the field, little research has investigated moral actions and their relationship to moral judgments due to ethical constraints. Firstly, I will review models of moral decision-making investigating morality of harm using moral judgments. I will then present recent evidence from personality, clinical, and neuroscience research suggesting dissociation between moral judgment and moral action. Secondly, I will review methodological considerations when assessing moral judgments versus moral actions and how recent advances in Virtual Reality (VR) technologies can be used to investigate harmful moral actions for the first time.

Morality, Reason, and Emotion

Investigations of moral judgment have primarily centred round debates regarding emotion (Hume, 1739/2012) and reason (Kant, 1785/2002) and their

influence on moral decision-making (G. Miller, 2008). If you were to ask a moral psychologist about the history of this extensive debate, they might begin with the work of Kohlberg (1969). Inspired by the cognitive-developmentalist approach pioneered by Piaget (1997) and rooted in Kantian theories of ethics, Kohlberg conceptualized moral development in the framework of cognitive development; the assumption being that moral judgment is accomplished by conscious reasoning (Kohlberg, 1969; Turiel, 1983). This moral reasoning is often referred to as a "cool" process comprising conscious mental evaluations in order to attain a moral judgment (Haidt, 2007).

However, the viewpoint that moral phenomena must be operated by rational deliberation is considered a "…fading paradigm" (Narvaez & Vaydich, 2008, p. 292). In fact, sentimentalist theories of morality first appeared in modern moral philosophy (Cooper, 1699-1714/2001; Hume, 1751/2012) and pioneered the viewpoint that emotions were central to moral judgment with reason remaining peripheral. In the context of later empirical research, "emotions" became of interest in psychology and sociobiology in the 1980s during the so-called "affective revolution" (Greene & Haidt, 2002; Haidt, 2008). In the years prior to this, E.O Wilson had claimed that ethics needed to be "biologicized" (Wilson, 1975/2000, p. 562) arguing that both moral philosophers and developmentalists consult "…emotive centres of their own hypothalamic-limbic system…even when they are being their most severely objective" (Wilson, 1975/2000, p. 563). The new synthesis of moral psychology that subsequently emerged from this emphasis on emotion and evolution, arguably laid the foundations for the intuitivist perspectives of moral decision-making (e.g., Haidt, 2008; Hauser, 2006). In moral psychology and from an empirical perspective, Haidt has pioneered these intuitivist theories, arguing that moral judgment is in fact driven by fast intuitive processes (Haidt, 2001). These processes are often affective in nature with moral evaluations arising in

consciousness with no apparent steps preceding them (Haidt, 2007). Moral reasoning subsequently follows as a "…post hoc construction, generated after a judgment has been reached" (Haidt, 2001, p. 814). Indeed, this viewpoint has been supported in studies examining "moral dumbfounding" or the inability to articulate a rational for strong and intuitive moral convictions (Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Prinz, 2005). It has also been supported in neuroscientific studies evidencing an association between moral decision-making and emotion centres in the brain (e.g., Greene et al., 2001; Koenigs et al., 2007).

Whilst the support for this intuitive framework in moral decision-making is convincing, "…it does not follow from this that emotional intuition is the whole story" (Cushman, Young, & Greene, 2010, p. 48). Pioneers of "universal moral grammar" for example, argue that deliberative information processing is necessary in moral decision-making and often precedes affective responses (Cushman et al., 2010; Hauser, 2006). In recent years and in an attempt to reconcile these perspectives, focus has been placed on dual-process approaches (e.g., Cushman, 2013; Greene et al., 2001). These argue for the role of both intuitive (or affective) and rational (or cognitive) processes in moral judgment (Cushman et al., 2010).

Dual-Process Models of Moral Judgment

Traditionally, provocative moral dilemmas pitting characteristically utilitarian versus deontological ideologies have played a central role in the investigation of moral judgment (e.g., Bartels, Bauman, Cushman, Pizarro, & McGraw, 2015; Cushman et al., 2010). Perhaps the most acknowledged example of these dilemmas is the "Trolley Problem", incorporating two contrasting dilemmas, which have been extensively discussed in the fields of philosophy, neuroscience, and psychology (e.g., Foot, 1978; Greene et al., 2001). In the *switch* dilemma, individuals must decide whether to flick a

switch, redirecting a trolley car to kill one worker on the tracks instead of five. Alternatively, in the *footbridge* dilemma, individuals must decide whether to push a large person in front of the trolley, in order to stop it from killing the five workers on the tracks (see Figure 1.1). This problem has generated interest for the reason that individuals tend to give the typically consequentialist or utilitarian judgment (they judge that maximising the number of lives saved is morally acceptable) in the *switch* case but refuse to do so in a characteristically deontological sense (harm is wrong and the ends don't justify the means) in the *footbridge* case (Thomson, 1976).

Figure 1.1. The Trolley Problem

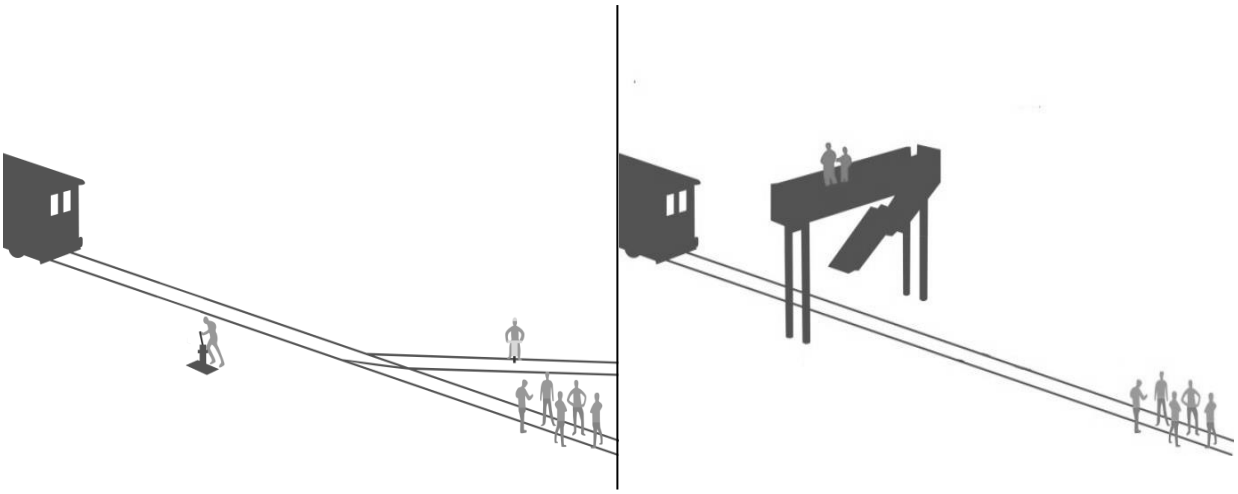


Figure 1.1. The Trolley Problem comprising the *switch* (left) and *footbridge* (right) dilemmas. This diagram shows the five-for-one trade-off in both dilemmas. Diagram created by the author for a conference in 2015.

Several theories have attempted to understand these divergent responses given their structural similarity in entailing the five-for-one trade off (Thomson, 1976). According to dual-process models of moral judgment, contrasting features in these dilemmas drive competing responses from distinct systems.

Perhaps the most recognised dual-process approach is Joshua Greene's dual process model of moral judgment (Greene et al., 2001) distinguishing between "personal" dilemmas like the *footbridge* and "impersonal" dilemmas such as the *switch*. In this model, personal dilemmas are defined as those "involving actions that are (a) likely to cause serious bodily harm, (b) to a particular person, where (c) this harm does not result from deflecting an existing threat onto a different party" (Greene et al., 2001, p. 2107). These dilemmas are thought to trigger an immediate, emotional, and aversive response; an "alarm bell" associated with emotional systems in the brain (Cushman, Young, & Greene, 2010, p. 50) resulting in a deontological or non-utilitarian response (i.e., refusing to endorse harmful actions). In the absence of this negative alarm bell in impersonal dilemmas, the utilitarian option of killing one to save many dominates the response, driven by increased activations in brain areas associated with controlled cognitive processes (Greene et al., 2001). Importantly, the endorsement of a harmful action or a utilitarian response in a personal dilemma, leads to an interference effect as mechanisms in the cognitive system attempt to override the immediate emotional response (Greene et al., 2001).

Greene's dual-process model of moral judgment has received attention and investigation across many research domains (e.g., Crockett, Clark, Hauser, & Robbins, 2010; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene et al., 2001; Koenigs et al., 2007). In support of the notion of interplay between cognitive and emotion-based systems, Greene et al. (2004)

found that making utilitarian judgments in personal dilemmas was associated with increased activation in the dorsolateral prefrontal cortex (DLPFC), a brain area associated with "cognitive control" (Cushman et al., 2010); corroborating the model's argument that making a utilitarian response requires the cognitive system to compete with and override initial emotional responses (Greene et al., 2001).

Due to the correlational nature of these initial studies, the evidence supporting this dual process approach was "…compelling but limited" (Greene et al., 2008, p. 1146). As such and in order to establish a causal relationship, Greene et al. (2008) examined the effects of cognitive load on both utilitarian and deontological judgments in response to personal dilemmas. As predicted and supporting Greene's dual process model, cognitive load slowed utilitarian judgments but had no effect on deontological judgments. Following from this, neurological evidence for Greene's dual process approach has come from research examining patients with deteriorating or impaired emotional processing. For example, individuals with frontotemporal dementia (Mendez, Anderson, & Shapira, 2005) and focal ventromedial prefrontal cortex (VMPFC) damage (Ciaramelli, Muccioli, Ladavas, & di Pellegrino, 2007; Koenigs et al., 2007) have been found to be more utilitarian in personal moral dilemmas, lending support to the model's theory regarding the role of emotion in deontological judgments and cognitive control in utilitarian judgments (Cushman et al., 2010; Greene et al., 2001).

Arguably, Greene's model centres on the antagonism between reason and emotion (Greene et al., 2004). In fact, in terms of dualism, research has suggested that this arbitrary division of cognition and emotion might be somewhat artificial (Greene et al., 2004) and "…overly simple" (Cushman et al., 2010, p. 54). For example, while the initial study by Koenigs et al. (2007) examining patients with damage to the VMPFC supports the notion that emotional blunting may result in utilitarian preferences, or more

broadly "rational decisions", a second study produces conflicting results (Koenigs & Tranel, 2007). This study utilised the ultimatum game in which individuals must decide whether to accept an unfair but financially gainful offer (the supposedly rational choice) or whether to reject the unfair offer (a supposedly emotional choice). Patients with VMPFC damage made more emotional choices. This fails to support the theory that making rational choices may result "…from a general emotional blunting" (Moll & de Oliveira-Souza, 2007, p. 321). In this case, deficits in brain areas previously associated with rational and utilitarian preferences, resulted in more emotionally-driven responses (Koenigs & Tranel, 2007).[1] Furthermore, from a philosophical perspective, it is certainly possible for deliberative reasoning to lead to non-utilitarian judgments (Cushman et al., 2010).

In an attempt to remove this distinction between emotion and reason, Cushman (2013) proposed a second dual-process framework in his action, outcome and value model, relating moral decision-making back to reinforcement learning mechanisms. Rather than distinguishing between reason and emotion, this model distinguishes two processes; one process that assigns a value to an action (e.g., pushing the person off the bridge in the *footbridge* dilemma) and one process that selects actions based on the value assigned to their outcome instead (e.g., causing the person severe harm). Cushman argues that both processes involve emotional and cognitive elements and are not mutually exclusive. According to this model, the *switch* dilemma is processed by a model-based system (that contains an explicit model of the environment including the consequences of actions) which weighs up the potential outcomes in the scenario against one another. The system selects the utilitarian decision having assigned positive

[1] Although Greene developed his dual-process model to explain moral judgment specifically and not social decision-making, arguably both personal moral dilemmas and ultimatum game variants are thought to demonstrate the extent to which affective versus cognitive considerations can influence decision-making (Greene et al., 2001; Koenigs, Kruepke, Zeier, & Newman, 2012; Koenigs & Tranel, 2007).

value to the outcome of saving the most lives (outcome-based value). The *footbridge* dilemma on the other hand, involves a model-free system, which operates without explicit knowledge of the environment and relies on retrospective experience instead. Rather than assigning positive value to outcomes, this system assigns negative value to the action of pushing (action-based value) as this typically leads to negative outcomes. Essentially, the act of pushing is thought to carry with it a history of learned moral violations; in the past, we have learned that pushing often results in harm to another and punishment to ourselves. As such, we are less likely to condone the pushing of a person as it is a typical moral violation. Flicking a switch on the other hand is an atypical moral violation as we typically associate this action with completing everyday tasks such as turning the lights on or off (for a full review of this model see Cushman, 2013).

While Cushman's model addresses limitations of Greene's dual process model, it also has its own limitations (Cushman, 2013). Cushman (2013) notes that the role of learning in moral decision-making may be limited to certain moral norms. For example, our action-based aversion to sibling incest (Haidt, Koller, & Dias, 1993) is thought to have an innate origin (Lieberman, Tooby, & Cosmides, 2003) and is not likely driven by learning (Cushman, 2013). However, adopting these principles from reinforcement learning can improve on the "old division" of emotion and reason, providing a more precise characterisation of dual-process models of moral judgment (Cushman, 2013, p. 288).

Moral Action as Distinct from Moral Judgment

To date, investigations of moral decision-making have been dominated by theories that emphasise the role of reasoning (Garcia & Ostrosky-Solis, 2006; Kohlberg, 1969) and/or emotion in moral judgment (e.g., Cushman, 2013; Greene et al., 2001;

Haidt, 2001; Moll, de Oliveira-Souza, & Eslinger, 2003) but the relationship between moral judgment and moral action remains unclear (S. Thoma, 1994).

Morality and action possibility have been linked in adaptive frameworks examining perceptions of morality and how this subsequently regulates social behaviours (Ellemers, Pagliaro, & Barreto, 2013). The predictive element of morality is thought to play a subsequent role in social perception, aiding the identification of potentially beneficial or harmful group members (Fiske, Cuddy, & Glick, 2007). For example, individual's expressing non-utilitarian values are perceived as more trustworthy and are subsequently preferred as partners in a social context (Everett, Pizarro, & Crockett, 2016); demonstrating this adaptive function. This finding that moral judgments influence behavioural regulation raises an important distinction in the present research; here I aim to examine the relationship between moral judgment and moral action rather than moral judgments and implications for action.

When considering the relationship between judgment and action, we might look to real life examples of not "practicing what you preach" (e.g., Monin & Merritt, 2012); numerous examples of moral inconsistencies can be found for individuals who demonstrate a disparity between how they say they will act and how they actually act (FeldmanHall et al., 2012). In line with everyday examples of hypocrisy, research has questioned whether moral actions are driven by different mechanisms to those used for moral judgments (e.g., Camerer & Mobbs, 2017; Tassy, Deruelle, Mancini, Leistedt, & Wicker, 2013; Tassy, Oullier, Mancini, & Wicker, 2013). Tassy et al. (2012) found that application of rTMS to the DLPFC, altered moral judgments ("Is it morally acceptable?") but not action-choices ("Would you do it?"). This disparity can also be seen in the finding that action-choice questions elicit a greater proportion of utilitarian responses when compared to judgment questions (Tassy, Oullier, et al., 2013). Tassy et

al. (2013) argue that these moral inconsistencies may arise from differences in perspectives; judgments may centre on allocentric evaluations influenced by cultural norms as opposed to actions which involve self-focused perspectives (e.g., Saltzstein, 1994; Tassy, Oullier, et al., 2013). This idea of self-focused versus allocentric perspectives also relates to findings that responses to moral dilemmas phrased in the third person or the first person result in differing degrees of utilitarianism, with third person perspectives eliciting a greater proportion of utilitarian responses (e.g., Nadelhoffer & Feltz, 2008).

Moral Inconsistency in Anti-Social Personalities

"I am not what I am" – "Iago"

(Shakespeare, 2005, p. 7)

Consider Shakespeare's Iago as the classic hypocrite for example; a modest character in public but an immoral character when alone declaring that "I am not what I am" (Shakespeare, 2005, p. 7). Indeed, inconsistency between moral judgment and action is well established in results demonstrating that institutionalised psychopaths have intact understanding of moral codes yet display anti-social behaviours (Cima, Tonnaer, & Hauser, 2010; Kiehl, 2008). These findings also translate to non-institutionalised populations in the finding that healthy individuals with high psychopathic traits and low Honesty-Humility endorse utilitarian responses for action-choice questions ("Would you do it?") but not for judgment questions ("Is it morally acceptable?") (e.g., Djeriouat & Tremoliere, 2014; Tassy, Deruelle, et al., 2013).

Dysfunction in areas of the prefrontal cortex have been observed in these instances of "…sociomoral deterioration" or the dissociation between understanding and moral behaviour (Garcia & Ostrosky-Solis, 2006, p. 352). In early research, H.

Damasio, Grabowski, Frank, Galaburda, and Damasio (1994) found that patients with damage to ventral and medial areas of the frontal lobes, displayed emotional deficits but more specifically, failed to apply "somatic markers" or bodily responses with emotional significance (A. Damasio, 1994). Further, Bechara, Damasio, Damasio, and Anderson (1994) found that these patients demonstrated impaired real-life judgments in the Iowa Gambling Task. Participants were sat in front of four virtual card decks and were asked to repeatedly select cards in order to win as much money as possible. By selecting a card, the participant would receive an amount of money but occasionally, would also lose an amount of money. Hence, some decks were deemed good and others bad based on whether selecting cards from them would result in long-term gains versus losses. When completing the task, healthy participants tended to switch to using good decks, anticipating the long-term consequences of selecting bad decks. On the other hand, impaired patients tended to remain oblivious to the long-term consequences, repeatedly selecting bad decks throughout the task (Bechara et al., 1994; Bechara, Tranel, Damasio, & Damasio, 1996). Importantly, while these patients displayed impairment in real-life decision making, they demonstrated intact intellectual abilities and knowledge of social and moral conventions (e.g., A. Damasio, 1994). Further, in the context of morality specifically, Saver and Damasio (1991) found that a patient with VMPFC damage, demonstrated impairments in social behaviour while displaying intact social knowledge and moral reasoning.

Research has theorised that deficits in empathic skills, may result in these morally inappropriate behaviours (Glenn, Iyer, Graham, Koleva, & Haidt, 2009). More specifically, psychopathic individuals demonstrate impairments in emotional empathy but their cognitive and motor empathy remains intact (e.g., Blair, 2005; Decety & Moriguchi, 2007). This has been supported in neuroscientific studies examining high

trait psychopaths, who exhibit reduced activity in brain regions involved in moral decision-making, including the amygdala, medial frontal cortex, posterior cingulate, and angular gyrus (Glenn, Raine, & Schug, 2009) and across the paralimbic system in general (Kiehl, 2008). Whilst activity in the amygdala is associated with emotion and detecting distress cues in others, activations in these latter regions have been found to be involved in emotional perspective taking and self-referential thinking (Glenn, Raine, & Schug, 2009). In fact, a recent study found that psychopathy was associated with increased activation in the DLPFC, an area associated with cognitive control in moral decision-making, when responding to personal moral dilemmas (Glenn, Raine, Schug, Young, & Hauser, 2009). Crucially, there was no significant association between the proportion of utilitarian endorsements and psychopathy score, supporting the notion that psychopaths tend to produce similar moral judgments (Cima et al., 2010; Kiehl, 2008; Tassy, Deruelle, et al., 2013) despite differences in neural activation in the DLPFC (Glenn, Raine, Schug, et al., 2009) and areas of the paralimbic system including the amygdala (e.g., Glenn, Raine, & Schug, 2009; Kiehl, 2008).

The process of empathising in the context of moral dilemmas, might involve taking the perspective of a potential victim and experiencing a vicarious awareness of their distress which subsequently influences moral decision-making (Patil, 2015). The self-referent nature of action choices means that when individuals are faced with the prospect of carrying out the harmful actions described in personal moral dilemmas, they refuse to endorse the utilitarian outcome because "…they take into account the suffering and pain that such an action would elicit" (Cushman, 2013; Cushman, Gray, Gaffey, & Mendes, 2012; Patil, 2015, p. 351; Tassy, Deruelle, et al., 2013). Following from this**,** it might be that the increased propensity in psychopathy to endorse supposedly "utilitarian" actions is as a result of diminished aversion to performing harmful actions (Patil, 2015).

This has been supported in psychopharmacological studies demonstrating that increasing serotonin functioning, which is often diminished in psychopathy, enhances harm aversion in moral decision-making (Crockett et al., 2010). With judgments, on the other hand, being driven by a supposedly allocentric perspective, individuals scoring high in psychopathy retain an intact knowledge and understanding of moral norms (e.g., Cima et al., 2010) and may be inclined to respond to judgment questions in a way that will make them appear "normal" to others (Tassy, Deruelle, et al., 2013).

Overall, evidence for diminished harm aversion and disparity between moral judgment and moral action in these populations (e.g., Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Tassy, Deruelle, et al., 2013), endorses the view that moral judgments and actions may be driven by at least partially distinct mechanisms (Tassy, Deruelle, et al., 2013; Tassy, Oullier, et al., 2013).

Measuring Moral Judgment and Moral Action

To further the discussion regarding the relationship between moral judgment and moral action, the current measures adopted in the moral domain as a means of assessing morality must be addressed.

At the methodological level, researchers tend to present trolley-like problems to participants in text-based paradigms that require a subsequent moral judgment. Typically, participants are asked whether the utilitarian act described in the dilemma is "appropriate" or "acceptable". In their conception, these hypothetical moral dilemmas were not intended to reveal insights into real-life decisions but instead, in their experimental simplicity, allow moral scientists to explore the "…foundational psychological processes that underlie human moral cognition" (Christensen & Gomila, 2012, p. 1250). The level of experimental control available to scientists in incorporating

these paradigms is paramount; allowing moral conflicts to arise in artificial contexts with anonymous agents (e.g., Christensen & Gomila, 2012; Hauser et al., 2007).

Despite the prevalent use of these paradigms, concerns have been raised about the preciseness with which moral dilemmas have been constructed (Christensen & Gomila, 2012). Differences in several factors including framing, word count, perspective, situational circumstances, and type of question have been shown to influence moral judgments (e.g., Bartels et al., 2015; Christensen & Gomila, 2012). In a well-known framing study for example, participants were found to endorse utilitarian outcomes when the phrasing "save" was used as opposed to "kill" (Petrinovich & ONeill, 1996). I can also refer back to research examining the distinction between judgment questions and action-choice questions, which elicit distinct moral judgments (Tassy, Oullier, et al., 2013).

In addition to disagreement over the formulations of these moral dilemmas, research has also questioned the ability of these paradigms to reflect genuine deontological or utilitarian responses (e.g., Bartels et al., 2015; Kahane, Everett, Earp, Farias, & Savulescu, 2015). According to classical utilitarianism, individuals should maximise welfare for the greatest number of people (Bentham, 1789/2007). When individuals consider the self-sacrifice necessary to follow such a principle, it becomes a "…highly demanding moral view" (Kahane et al., 2015, p. 193). As such, labelling endorsements of harm in personal and impersonal moral dilemmas as being "utilitarian" might implicate impartial concern for the greater good in sacrificial dilemmas, which does not appear to be the case (e.g., Gawronski, 2016; Kahane, 2012; Kahane et al., 2015). The same might be said for deontology which classically denotes a moral ideal formed around rights and duties (Kant, 1785/2002).

Further, there appears to be no way of separating the motives behind moral decisions made in trolley-type problems. For example, in the *footbridge* dilemma, researchers have no clear method for distinguishing the action of pushing the person as (i) a utilitarian moral decision grounded in the belief that killing one to save the majority is most important, or as (ii) an "un-deontological" decision driven by less aversion to harm (Bartels et al., 2015; Conway & Gawronski, 2013; Cushman et al., 2012; Patil, 2015). This has implications for previous research showing that people possessing antisocial personality traits tend to endorse more harmful actions; these would be masked as being utilitarian with alternative motives hidden (e.g., Bartels & Pizarro, 2011; Djeriouat & Tremoliere, 2014; Gao & Tang, 2013).

Greene has attempted to address these criticisms by arguing that responses are "characteristically" utilitarian or deontological (Cushman et al., 2010; Greene, 2008). For example, in Greene's model, a "characteristically deontological" or "non-utilitarian" judgment is also concerned with certain moral rules (Greene, 2008) but more specifically, the rule that it is wrong to harm "…despite the benefits" (Greene, 2008, p. 361) and a "characteristically utilitarian" judgment favours consequentialist outcomes and more specifically, the conclusion that it is better to save more lives (Greene, 2008). Essentially, specific characteristics of these moral ideologies do apply to sacrificial moral dilemmas (e.g., "better to save more" versus "wrong to harm despite benefits") (Cushman et al., 2010; Greene, 2008) even if they do not reflect the overall and demanding moral ideology itself (Kahane et al., 2015). Here, and in line with previous literature, I adopt the labels "utilitarian" and "non-utilitarian" as defined using Greene's "characteristically" non-utilitarian and utilitarian framework.

Recent attempts to validate moral dilemmas have addressed previous inconsistencies in formulation (e.g., Christensen, Flexas, Calabrese, Gut, & Gomila,

2014) and previous attempts to label individuals as either utilitarian or deontological have been challenged with research arguing that people instead, tend to adopt a "…particularist approach to morals that takes the details of each case into account" (Christensen et al., 2014, p. 16). Whilst the methodology is valuable in shedding light on the mechanisms underlying moral judgments (Christensen et al., 2014), there remain gaps in our understanding; again, research has asked how declarations made in response to these text-based paradigms, translate into real-world moral behaviours (Parsons, 2015; Teper, Tullett, Page-Gould, & Inzlicht, 2015).

Attempts to explicate moral behaviour have largely explored non-harmful actions in economical paradigms (Navarrete, McDonald, Mott, & Asher, 2012) and so the investigation of harmful moral actions has made little headway. While text-based moral dilemmas possess an advantage in producing unambiguous outputs, these questionnaire-based paradigms "…only offer a very low degree of immersion" (Skulmowski, Bunge, Kaspar, & Pipa, 2014, p. 2). In fact, FeldmanHall et al. (2012) found that these contextually impoverished scenarios, elicited distinct moral decisions to those made in real counterparts of the same scenario. Critically, by increasing the amount of contextual information available in the hypothetical scenario, the researchers were able to bring hypothetical moral choices in keeping with real moral choices. This line of research would suggest that contextual richness alters moral decisions and raises further questions regarding the reliance on text-based moral dilemmas in moral psychology (FeldmanHall et al., 2012).

Moral Actions in "Virtual Reality"

The evidence supporting a partial dissociation between moral judgments and moral actions (e.g., Cima et al., 2010; Tassy, Oullier, et al., 2013) and the potential for contextual information to bridge the gap allowing assessment of moral actions

(FeldmanHall et al., 2012), highlights the need for a contextually rich testing tool. Fortunately, the emergence of contextually salient VR technologies, have opened opportunities to explore simulated harmful moral actions in environments free from issues concerning de-contextualisation (Huebner, Dwyer, & Hauser, 2009; Navarrete et al., 2012; Patil, Cogoni, Zangrando, Chittaro, & Silani, 2014; Skulmowski et al., 2014). VR systems adopt sensory-tracking, most commonly head-tracking, to immerse participants within life-size simulated environments (see Figure 1.2). In these dynamic environments, researchers can begin to investigate theoretical and normative decisions in the framework of moral action (Navarrete et al., 2012); "would someone … actually resort to this course of action when the full repertoire of contextual features comes into play?" (Patil et al., 2014, p. 95). Crucially, while previous research has examined action-choice questions ("Would you do it?") as distinct from judgment questions ("Is it morally acceptable?"), both of these remain self-reported moral judgments; an action-choice question is only "…what the participants think their action could be if they were to make the decision in real-life" (Tassy, Oullier, et al., 2013, p. 2).

Figure 1.2. Head-Tracking VR Systems

Figure 1.2. Head-tracking VR systems. The Oculus Rift is a headset device that immerses individuals within a life-size simulated virtual world. The picture shows a participant wearing the Oculus Rift 1. Photograph taken and edited by the author; June, 2016.

In this virtual domain of moral psychology, attempts to reproduce moral dilemmas in VR have revealed mixed findings regarding the relationship between moral judgment and action (e.g., Navarrete et al., 2012; Patil et al., 2014). To date, virtual moral simulations have incorporated impersonal moral dilemmas only (Navarrete et al., 2012; Pan & Slater, 2011; Patil et al., 2014; Skulmowski et al., 2014). In an early study, Navarrete et al. (2012) created a virtual version of the *switch* dilemma. In this paradigm, virtual simulated actions were compared to theoretical moral judgments and electrodermal activity was measured to assess arousal. In both the action and judgment conditions, the majority of people endorsed utilitarian outcomes with increased emotional arousal associated with decreased utilitarian judgments. This supports the generalisation of Greene's model to the context of moral action (Greene et al., 2001; Skulmowski et al., 2014).

More recently, Skulmowski et al. (2014) advanced this research and created the *switch* dilemma in VR with the user acting as the driver of the train rather than being a passive onlooker. The authors presented the same dilemma multiple times predicting a behavioural pattern of responses moving from immediate and automatic, to socially desirable. Participants showed response patterns similar to that of previous studies using hypothetical dilemmas (e.g. Greene et al., 2001) with the majority of responses being utilitarian in nature. The authors used eye-tracking as opposed to electrodermal analysis and found that participants tended to look at the virtual character in danger for an extended time. A limitation of this study was that some trials involved responding to one-to-one dilemmas and may not be comparable to the classic moral dilemma frameworks frequently used in this field (Skulmowski et al., 2014).

On the contrary, further virtual studies have found that utilitarian responses were greater for impersonal dilemmas in VR when action was required than for their

judgment counterparts (Pan & Slater, 2011; Patil et al., 2014). In research carried out by Patil et al. (2014), the authors incorporated a desktop VR hardware system and presented four virtual impersonal dilemmas to participants. Electrodermal activity was measured to assess arousal. Unlike the findings from Navarrete et al. (2012), Patil et al. (2014) found that virtual dilemmas increased arousal to a greater extent than text-based dilemmas with greater utilitarian actions endorsed in VR. They argue that Cushman's action-outcome model explained their findings; the saliency of the virtual environment meant that the outcome-based value associated with not acting to save endangered victims had a stronger negative value, than choosing to carry out a harmful action against one individual (Patil et al., 2014).When contextual features are available, the "…influence of harm aversion diminishes as the impact of other motivational forces…become more salient" (FeldmanHall et al., 2012, p. 440). Taken together, these studies support previous findings regarding the disparity between judgment and action (Tassy, Oullier, et al., 2013).

Overall, while some research has demonstrated consistency between judgments in original text-based paradigms and simulated actions in virtual counterparts (Navarrete et al., 2012; Skulmowski et al., 2014), contrasting research has demonstrated a disparity with greater utilitarian endorsements observed in virtual dilemmas (Pan & Slater, 2011; Patil et al., 2014).

Virtual Morality: Ethics and Realism

VR systems offer considerable advantages as, unlike other domains in which actions can be examined both in the laboratory and in the field, the domain of morality presents unique ethical challenges (Navarrete et al., 2012; Slater et al., 2006). While economic paradigms have begun to shed light on non-harmful actions (e.g., Gold, Pulford, & Colman, 2015), studies investigating morality of harm have remained largely

non-behavioural (Navarrete et al., 2012) for the reason that, ethically, harmful behaviours prove difficult to test (e.g., Navarrete et al., 2012; Patil et al., 2014; Rovira, Swapp, Spanlang, & Slater, 2009). Although the incorporation of harm-based moral dilemmas, whether text-based or virtual, is a somewhat limited approach (Cushman et al., 2010) helping us to investigate "…only a fragment of our moral psychology", it is a "…potentially significant one" (Hauser et al., 2007, p. 4). The application of VR to study harm-specific moral actions, for example, has significance for professions exposed to sensitive and emotionally arousing moral decision-making on a regular basis. Emergency service professionals have begun to adopt VR systems for several reasons; not only do they offer full immersion but they are also both cost-effective and safe in contexts where there is little room for error (e.g., Andreatta et al., 2010). This application of VR demonstrates its broader value (e.g., Rovira et al., 2009); investigating real-world moral decision-making beyond that of hypothetical scenarios centred round normative theories (Parsons, 2015).

The level of "realism" available in virtual environments not only relies on visual saliency but also on "sensorimotor contingencies" or the congruence between motor actions and sensory simulation (e.g., Rovira et al., 2009; Skulmowski et al., 2014). Presently, VR systems can only "…offer crude approximations" of sensorimotor contingencies (Rovira et al., 2009, p. 2) and subsequent plausibility. Despite this shortcoming, research has shown that even basic virtual environments can elicit a range of realistic responses (e.g., Rovira et al., 2009; Slater et al., 2006) providing opportunities to bridge the "reality gap" in social domains (Rovira et al., 2009, p. 2). Essentially, if the virtual environment can deliver the subjective experience of "being there" (Carassa, Morganti, & Tirassa, 2005, p. 384), life-like thoughts and emotions can be elicited (Rovira et al., 2009; Skulmowski et al., 2014). Importantly, research has

shown that VR systems can offer successful collaboration between the experimental control available in laboratory settings and components of ecological validity in providing enhanced affective experiences (e.g., Parsons, 2015; Rosenberg, Baughman, & Bailenson, 2013; Rovira et al., 2009; Teper et al., 2015).

In fact, with regards to making virtual environments true-to-life, we face a paradox in research settings; preserving the distinction between reality and VR is essential for ethical reasons (Slater et al., 2006). If the boundary were to breakdown, then the potentially hazardous reasons for not evaluating moral choices in the field in the first place would become of concern in VR paradigms (Rovira et al., 2009). Despite the compromise here between bridging the reality gap and preserving the technological boundary, fundamentally, VR systems can generate experiences and trigger emotions that de-contextualised and impoverished text-based paradigms cannot (Parsons, 2015; Patil et al., 2014; Rovira et al., 2009; Skulmowski et al., 2014).

General Hypotheses

The main aim of this thesis is to determine whether moral actions and moral judgments are distinct and to identify the role of personality traits and associated emotional processes in these moral judgment and moral action frameworks.

In terms of VR paradigms specifically, research has produced mixed findings regarding the association between moral judgments in text-based paradigms and moral actions made in VR paradigms (e.g., Navarrete et al., 2012; Patil et al., 2014). If Greene's dual-process theory of moral judgment also applies to moral actions (e.g., Navarrete et al., 2012; Skulmowski et al., 2014), individuals might make as few utilitarian actions in VR as utilitarian judgments in traditional paradigms (Greene et al., 2001). On the other hand, if Cushman's action-outcome model applies, as described by

Patil et al. (2014), a stronger negative value might be assigned to outcomes in the virtual scenario, leading to a greater number of utilitarian actions (Cushman, 2013). Chapters 2 and 3 of this thesis incorporate virtual moral dilemmas in order to address this.

Beyond VR paradigms and in terms of examining moral inconsistency, previous research has suggested that the distinction between moral judgment and moral action may be driven by anti-social traits such as psychopathy (Cima et al., 2010; Kiehl, 2008; Tassy, Deruelle, et al., 2013) which result in diminished aversion to performing harmful actions (e.g., Patil, 2015). If anti-social personality traits (and associated traits) are predictors of harmful actions, they might predict utilitarian actions in VR but not utilitarian judgments in text-based counterparts. Here, I define moral actions as those simulated in virtual moral dilemmas as opposed to action-choice questions (e.g., "Would you do it?") which I argue remain moral judgments in their theoretical nature. Across the experimental chapters in this thesis, the relationship between anti- and pro-social traits, and moral actions are investigated.

In the following two chapters, four primary experiments will be presented that incorporate novel VR paradigms to study simulated moral actions, comparing them to moral judgments. Across all experimental chapters, I will investigate psychopathy and associated traits and their roles in moral judgment versus moral action. In the final two experimental chapters of this thesis, I will present two experiments that investigate the emotional processes underlying personality trait profiles in order to identify the motivations driving moral judgments versus moral actions. Taken together, the investigations presented in this thesis, will subsequently allow a methodological critique of the incorporation of VR technologies within the domain of moral cognition.

CHAPTER 2: UTILITARIAN MORAL ACTIONS IN VIRTUAL REALITY

Introduction

The present experiments investigated the relationship between simulated moral actions made in a VR dilemma and moral judgments made in a text-based counterpart. Whilst previous studies incorporating VR within moral frameworks have provided the foundations for further virtual studies in the moral domain (Navarrete et al., 2012; Pan & Slater, 2011; Patil et al., 2014; Skulmowski et al., 2014), they have yet to incorporate up-close and personal moral dilemmas in VR. This is significant, as the distinction between the *switch* dilemma and *footbridge* dilemma allows the examination of principles such as action, intention, contact, and personal force (Cushman & Greene, 2012). Importantly, in personal dilemmas, the proportion of utilitarian responses varies significantly due to conflict (Patil et al., 2014). As such, the investigation of personal dilemmas in action frameworks is essential in interpreting the influence of highly arousing scenarios on the moral decision-making framework (Patil et al., 2014; Skulmowski et al., 2014). To my knowledge, these experiments are the first to implement a personal dilemma (the *footbridge* dilemma) in immersive VR.

Specific Hypotheses

Based on my general hypotheses, the experiments presented here, explored the relationship between moral judgments and moral actions to investigate whether they were associated or distinct using a personal moral dilemma. These experiments also assessed the role of personality traits, including trait psychopathy, in predicting moral judgments and/or moral actions.

Additionally, physiological arousal was measured in the form of heart rate response. Given the novelty and visual saliency of VR, heart rate response was assessed

in control (non-moral) tasks and also experimental (moral) tasks to primarily examine whether arousal was triggered by modality or moral context. Additionally, according to existing dual-process models of moral judgment (Greene et al., 2001) and previous virtual paradigms assessing arousal (Navarrete et al., 2012), heart rate change is expected to predict non-utilitarian responses in both judgment and action paradigms.

Experiment 1

Method

Participants

Forty participants comprising 35 females and five males, (M_{age} = 26.00, *SD* = 9.77 years, age range: 18 - 52 years)[2] were recruited from the Plymouth University, School of Psychology, participant pool and participated for course credit. All participants had normal or corrected-to-normal vision. The majority of participants were right-handed (92.5%). This research received ethical approval from the Plymouth University Ethics Committee with written consent obtained from all individuals.

Personality Measures

All participants were asked to complete an electronic questionnaire comprising three self-report questionnaires assessing pro- and anti-social traits associated with psychopathy:

The *Levenson Self-Report Psychopathy Scale (LSRP)* (Levenson, Kiehl, & Fitzpatrick, 1995) is a self-report measure of psychopathy intended for research purposes. It has a two-factor structure assessing both primary (i.e., selfishness) (16

[2] Gender differences in moral decision-making are vastly debated. There is no clear evidence for why gender differences should exist and the evolutionary basis for these is unknown (Christensen et al., 2014). As such, any considerations regarding these are sensitive and require explicit investigations that go beyond the scope of this thesis.

items; α = .81) and secondary psychopathic traits (i.e., impulsivity) (10 items; α = .68) in non-institutionalised populations. The scale contains 26 items total, rated on a 4-point Likert scale (from 1 = *strongly disagree* to 4 = *strongly agree*). The scale includes items such as "*For me, what's right is whatever I can get away with*".

The *Hexaco-IP-PR* (Ashton & Lee, 2009) is a personality inventory designed to assess six dimensions of personality. The inventory assesses the characteristics of Honesty-Humility (Items 10; α = .82), Emotionality (Items 10; α = .85), Extraversion (Items 10; α = .67), Agreeableness (Items 10; α = .82), Conscientiousness (Items 10; α = .80) and Openness to experience (Items 10; α = .84). The inventory contains 60 items with responses given on a 5-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*). The inventory contains items such as "*I wouldn't pretend to like someone just to get that person to do favours for me*".

The *Interpersonal Reactivity Index (IRI)* (Davis, 1983) is an inventory designed to measure dispositional empathy. It contains four subscales to measure Perspective Taking, Empathic Concern, Personal Distress, and Fantasy Seeking. The inventory contains 28 items with responses given on a 5-point Likert scale (from A = *Does not describe me well* to E = *Describes me very well*). The scale contains items such as "*I really get involved with the feelings of characters in a novel*" (αs = .80 - .85).

Moral Judgment and Action Measures

The experiment comprised two conditions to which participants were randomly allocated; a judgment condition (N = 20) and an action condition (N = 20). In the action condition, participants were first given a virtual non-moral task that required them to push a virtual object in space after hearing a tone. This task was included to ensure that increased arousal could be attributed to the moral nature of the experimental scenario as

opposed to the saliency of the virtual modality. The virtual moral task was an audio-visual VR version of the *footbridge* dilemma as described in Foot (1978). In the scenario, the participant viewed the scene in first person view. The landscape in the virtual scenario was kept neutral with hills in the background and a neutral "skybox" or representation of the sky was incorporated. Specifically, participants stood on a footbridge with a large virtual human standing in front of them. Next, a trolley car (modern train railcar) approached from behind and travelled towards five virtual humans standing on the tracks in front of the participant (Figure 2.1). Participants had to decide whether they wanted to push the large person off the bridge to stop the trolley car's progress or to allow the trolley car to continue and kill the five people standing on the tracks. Both the non-moral task and moral task were programmed in JavaScript within the Unity 3D game software environment. Verbal instructions played during the 3D scenario and specific instructions were given prior to the moral task, explaining that this task involved using a joystick but that participants would be given a choice about whether they wanted to interact with the virtual object or not. The VR dilemma began with a 30 second period of ambient noise and no verbal instructions to allow the participants to familiarise themselves with the virtual environment. After 30 seconds, verbal instructions informed participants that a trolley car was approaching ("*Look behind you, a train is coming*."). After a further 25 seconds, a second verbal dialogue then followed ("*Hey I am too far away but if you want to save the people you could push the large person on to the tracks and derail the train. If you're going to push them, do it now, but it is your choice.*"). Participants were then given a maximum of ten seconds to respond to the dilemma by either pushing the person with the joystick or by choosing to do nothing.[3] As the trolley car approached and at a marked time interval, the people on the tracks began to shout for help. If the large person was pushed, they

[3] The response time was selected based on that adopted in previous virtual paradigms (Patil et al., 2014).

would also shout. The virtual environment also included other salient features including the sound of the trolley car approaching. After the trolley car had either collided with the large person's body or with the people on the tracks, participants were left in the virtual environment for a further five seconds to ensure that they had seen and understood the consequences of their actions.

Figure 2.1. Virtual Reconstruction of the Footbridge Dilemma

Figure 2.1. Stereoscopic image showing a scene from the *footbridge* virtual dilemma through the Oculus Rift head-mounted display. The image is taken from the perspective of the participant at the end of the scenario in which the trolley car is about to collide with five virtual avatars standing on the tracks below. Participants are able to rotate in the virtual environment with voice commands included to ensure full understanding of the events being played out.

In the judgment condition, participants were first given a text-based non-moral task that comprised a set of instructions displayed in the format of the pending dilemmas. In the text-based moral task, participants were given a vignette describing the *footbridge* dilemma embedded in a further nine distracter moral dilemmas (see Appendix 2.1). These moral dilemmas were selected from those originally used in Greene et al., (2001; 2008) and were presented electronically in a random order. In the final section of each dilemma, participants were asked a judgment question ("*Is it morally acceptable to [specific to the scenario]*?"). After a response was given, a second action-choice question was displayed asking ("*Would you do it?*"). Participants were given ten seconds to respond to each question, matching the response time given in the virtual moral task. Participants responded by selecting "Yes" (Y - key) or "No" (N - key) and responses were recorded.[4]

Physiological Measures

Heart rate was recorded using a Cateye PL-6000 heart rate monitor in both conditions before and after non-moral and moral tasks. This provided a means of examining arousal (Navarrete et al., 2012; Patil et al., 2014). The ear lobe clip was attached before participants began the electronic questionnaire to ensure that the device was working and to ensure that participants could adjust to the set-up. Given that rate of heart rate change (bpm) is not stable and can be either gradual or abrupt, heart rate readings were taken at onset and offset of the current task. The duration of time between onset and offset heart rate readings was dependent on task type and for the judgment task, determined by self-paced reading speed.

[4] Response times in the action condition were recorded in Unity while those in the judgment condition were recorded in E-prime. Both software have different time recording sensitivities and as such, I could not carry out a reliable comparison between reaction times.

In the action condition, heart rate readings were taken at the onset and offset of the virtual non-moral task. The onset was defined as the moment in which the VR task started. Offset was defined as the moment when the VR task automatically stopped after participants had pushed the object. This task was self-paced. Heart rate readings were also taken at the onset of the virtual moral task (when the virtual moral task started) and at the offset, which was defined as five seconds after the temporal events in the virtual scenario had played out (i.e., the train had collided with the large person or the five people on the tracks). The time between onset heart rate and offset heart rate was 90 seconds. Heart rate sampling was performed to assess whether changes in arousal were a result of the moral nature of the dilemma itself rather than the novelty of being in VR.

In the judgment condition, heart rate measurements were taken at the onset and offset of the text-based non-moral task. The length of the task was self-paced as a result of individual reading speeds. In the text-based moral task, heart rate readings were taken on presentation of the first text section of the *footbridge* dilemma (onset) and after participants had responded to the dilemma (offset). Heart rate change was calculated for the text-based non-moral task and for the text-based moral task (*footbridge*).

Procedure

All participants first completed the personality trait assessments electronically before being randomly allocated to one of the two conditions. In the judgment condition, all scenarios were presented on a computer running E-prime software. In the action condition, participants first completed an electronic pre-questionnaire assessing their gaming experience (hours per week of video game play and number of games played annually) (see Appendix 2.2). Both the virtual non-moral task and virtual moral task were presented via the Oculus Rift head-mounted display which was setup using the Oculus SDK 1 development kit. The Oculus Rift is a head mounted VR system that

provides an immersive, motion tracked, 3-D experience. The device uses a 7-inch screen with a colour depth of 24 bits per pixel generating a VR environment with a wide field of view (110º diagonal) and resolution of 1280 x 800 pixels (640 x 800 per eye). Head orientation tracking is enabled via a head tracker which runs at 250 Hz. During the tasks, the participants also wore a pair of Sennheiser headphones and interacted with the scene using a joystick.

Results

Pre-Questionnaire Responses

For the action condition, endorsing a utilitarian outcome and pushing the person in VR was not associated with prior gaming experience (*ps* >.105).[5]

Moral Responses

Judgments made in response to the text-based *footbridge* moral dilemma were compared with actions made in response to the virtual *footbridge* dilemma. In the judgment condition, when asked if the action described was morally acceptable, 20% of participants endorsed a utilitarian response (i.e., judged that they regarded pushing the person as morally acceptable). In the action condition, 70% of participants endorsed a utilitarian response, significantly more than in the judgment condition, ($\chi^2(1) = 10.10$, $p = .001$). The odds of participants endorsing a utilitarian response were 9.33 times higher in the action condition than in the judgment condition. When asked if they would perform the action (action-choice question) in the judgment condition, 10% of participants endorsed a utilitarian response to the *footbridge* dilemma, compared to the 70% who endorsed the action in the virtual dilemma, ($\chi^2(1) = 15.00$, $p < .001$) (see Figure 2.2).

[5] For notes regarding statistical assumption checks and analysis decisions for all chapters, please see Statistical Note (p. 191).

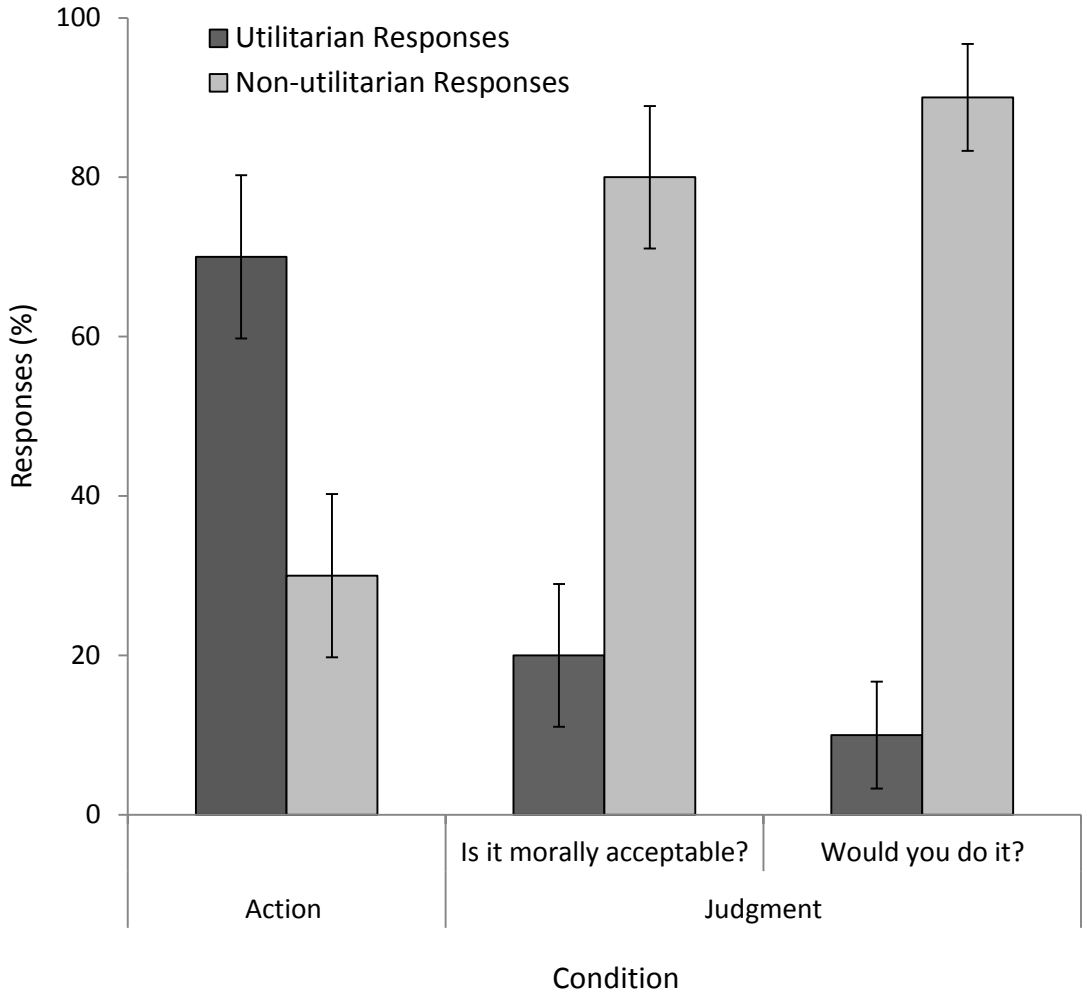


Figure 2.2. Responses (%) in the action condition and judgment condition in response to the *footbridge* dilemma. In the judgment condition, participants were asked whether the action was morally acceptable and whether they would do it. A greater number of utilitarian outcomes were endorsed in the action condition. Error bars represent +- 1 SE_p.

In the judgment condition for the text-based version of the *footbridge* dilemma, no significant difference was found when comparing responses to the judgment question (i.e., moral acceptability) and the action-choice question (i.e., whether they would do it), (p = .625).

Heart Rate Analyses

In both the judgment and action conditions, heart rate change was computed by calculating the difference between heart rate readings (bpm) taken at the onset of the task and readings taken at the offset of the task. Heart rate changes were computed for each participant in the non-moral task and in the moral task of their assigned condition. These were averaged to produce mean heart rate change for non-moral and moral tasks in each condition. In the judgment condition, heart rate decreased during the non-moral task (M = -2.45, SD = 4.19) and in the moral task (M = -0.45, SD = 1.79). In the action condition, heart rate decreased for the non-moral task (M = -3.95, SD = 3.75) but increased for the moral task (M = 5.15, SD = 5.84) (see Figure 2.3).

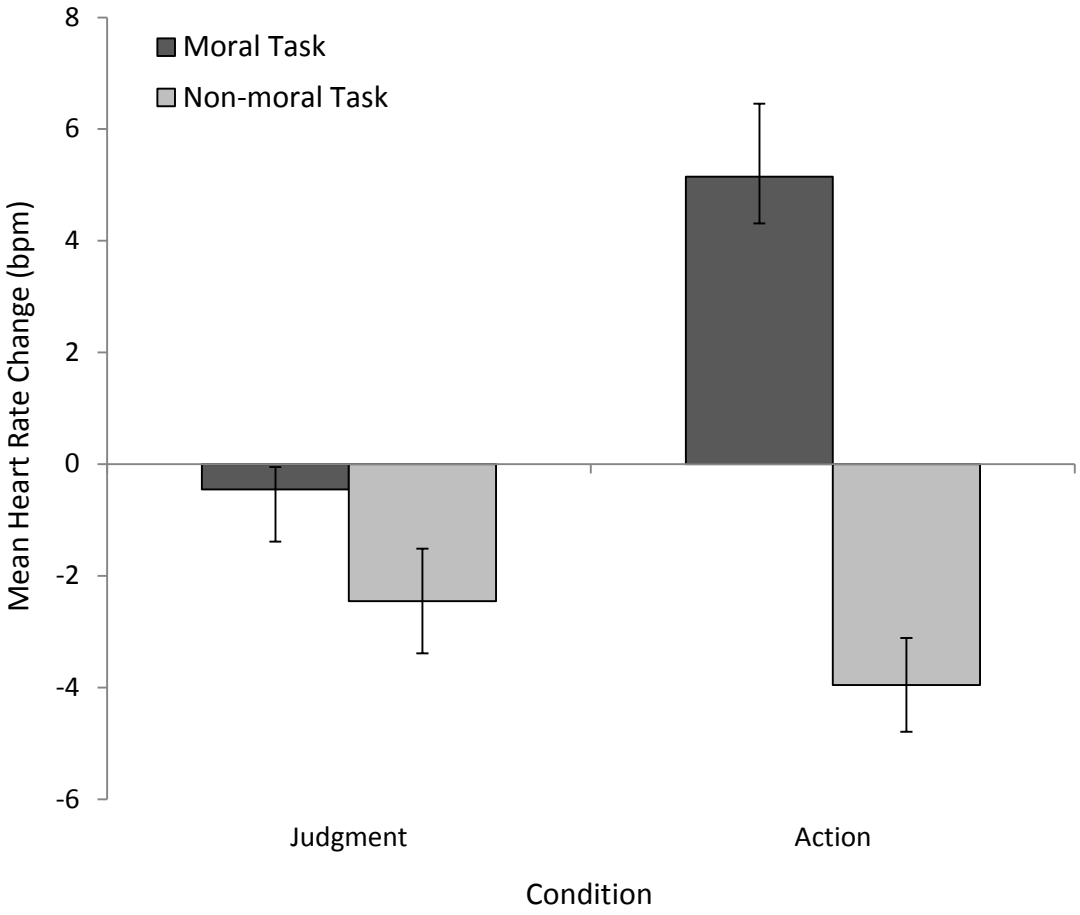


Figure 2.3. Mean heart rate change (bpm) for moral and non-moral tasks in both the judgment and action conditions. Increased heart rate was observed in the virtual moral dilemma. Error bars represent +- 1 SE.

A mixed ANOVA was conducted with task (non-moral task; moral task) as the within-subjects factor and condition (judgment; action) as the between-subjects factor. Analysis revealed a main effect of task, ($F(1, 38) = 41.51$, $p < .001$, $\eta_p^2 = .52$) condition, ($F(1, 38) = 4.28$, $p = .045$, $\eta_p^2 = .10$) and a significant interaction of task x condition, ($F(1, 38) = 16.99$, $p < .001$, $\eta_p^2 = .31$). To further investigate this interaction, simple effects analyses were performed comparing heart rate change in non-moral and moral tasks in both conditions (see Statistical Note (2.1)). This analysis suggested that for the non-moral task, heart rate changes were not significantly different between judgment and action conditions, ($p = .240$). However, for the moral task, analysis suggested that heart rate changes were significantly different between conditions, ($F(1, 38) = 16.80$, $p < .001$, $\eta_p^2 = .31$). Specifically, in the action condition, heart rate changes were significantly greater in the virtual moral task than in the virtual non-moral task, ($F(1, 38) = 55.80$, $p < .001$, $\eta_p^2 = .60$).[6]

I assessed whether heart rate change was associated with an increase in utilitarian responses in logistic regression models incorporating heart rate change and its interaction effect with condition (judgment [judgment question, action-choice question], action). As expected, the regression supported previous chi-square analyses (see Figure 2.2) revealing a positive relationship between condition (referencing action condition) and the odds of endorsing a utilitarian response. This was the case when using the judgment question, ($b = 2.23$, Wald $X^2(1) = 9.06$, $p = .003$) and also the action-choice question, ($b = 3.05$, Wald $X^2(1) = 11.68$, $p = .001$). However, the analysis revealed no significant relationship between heart rate changes and the likelihood of endorsing a utilitarian response in either condition ($ps > .359$).

[6] The ratio of greatest and least variance in heart rate change was >3 and as such, this analysis was repeated and findings replicated using Generalised Estimating Equations, which does not assume homogeneity of variance (see Statistical Note (2.2)).

Personality Trait Analyses

In order to assess any differences in personality trait scores between the judgment and action conditions, a one-way ANOVA was used to compare trait measures. No significant differences between the judgment and action conditions were found (all *ps* > .313), except for Conscientiousness, ($F(1, 38) = 4.25$, $p = .046$, $\eta_p^2 = .10$) which was higher in the action condition. Emotionality, ($F(1, 38) = 3.84$, $p = .058$) and Openness, ($F(1, 38) = 3.63$, $p = .064$) were marginally significantly different between conditions (see Table 2.1).

Table 2.1

Means and Standard Deviations for LSRP, HEXACO-PI-IR and IRI Subscales

		Condition	
		Judgment	Action
Measure	Subscale	M*(SD)*	M*(SD)*
1. LSRP			
	Primary	28.70*(6.62)*	28.70*(5.36)*
	Secondary	21.60*(4.52)*	19.70*(4.03)*
2. HEXACO			
	H	3.58*(0.73)*	3.53*(0.60)*
	Em	3.32*(0.70)*	3.74*(0.67)*
	Ex	3.23*(0.50)*	3.37*(0.51)*
	A	3.11*(0.78)*	3.03*(0.65)*
	C	3.47*(0.70)**	3.86*(0.47)**
	O	3.53*(0.72)*	3.11*(0.67)*
3. IRI			
	PT	19.45*(5.29)*	18.10*(5.10)*
	EC	17.80*(5.86)*	19.15*(5.63)*
	PD	11.35*(5.11)*	12.45*(6.39)*
	FS	20.40*(6.04)*	21.35*(3.95)*

Note. H = Honesty-Humility, Em = Emotionality, Ex = Extraversion, A = Agreeableness, C = Conscientiousness, O = Openness to experience. PT = Perspective Taking, EC = Empathic Concern, PD = Personal Distress, FS = Fantasy Seeking.
*p <.05

First, in order to determine whether psychopathic traits predicted utilitarian responses as in previous studies (e.g., Tassy, Deruelle, et al., 2013), univariate logistic regressions were performed with condition (judgment; action) as the selection variable, primary and secondary psychopathy as the continuous predictors and response as the categorical outcome (non-utilitarian; utilitarian). In the judgment condition, responses to both action-choice and judgment questions were analysed. For the judgment condition, neither dimension of psychopathy was a significant predictor of utilitarian responses to each question (*ps* > .159). In the action condition, primary psychopathy was a marginally significant predictor of utilitarian responses, (b = 0.21, Wald $X^2(1) = 3.54$, p = .060) (see Table 2.2).

Table 2.2

Logistic Regression with Primary Psychopathy as Predictor

			95% CI for Odds Ratio		
		B (*SE*)	Lower	Odds Ratio	Upper
Included					
Constant		-4.98 (*3.09*)			
Psychopathy					
	Primary	0.21* (*0.11*)	0.99	1.23	1.53

Note. R^2 = .18 (Hosmer & Lemeshow), .20 (Cox & Snell), .28 (Nagelkerke). *Model* $X^2(1) = 4.38$, p = .04. (*SE)* = standard error.
*p = .06

Honesty-Humility, a trait negatively correlated with primary psychopathy, ($r(40) = -.73$, $p < .001$), was found to be a significant negative predictor of utilitarian responses in a second univariate logistic regression (including all HEXACO traits) in the action condition, (b = -2.53, Wald $X^2(1) = 3.95$, p = .047) (see Table 3). For the judgment

condition, Honesty-Humility was not a significant negative predictor of utilitarian responses (*ps* > .256).

Table 2.3

Logistic Regression with Honesty-Humility as Predictor

		95% CI for Odds Ratio		
	B (*SE*)	Lower	Odds Ratio	Upper
Included				
Constant	1.19 (*0.67*)			
HEXACO				
H	-2.53* (*1.27*)	0.07	0.08	0.97

Note. H = Honesty-Humility. R^2 = .25 (Hosmer & Lemeshow), .26 (Cox & Snell), .37 (Nagelkerke). *Model* $X^2(1) = 6.01$, $p = .01$. (*SE)* = standard error.
*$p = .05$

In order to control for the shared association between primary psychopathy and Honesty-Humility, principal component analysis (PCA) was used to combine the correlated variables into one single factor (see Statistical Note (2.3)). The new factor represented the shared variance contributed by primary psychopathy and Honesty-Humility and represented traits captured by primary psychopathy that are contrary to those underlying the prosocial trait, Honesty-Humility. As such, this new factor was termed “anti-social tendency”.

Subsequently, univariate logistic regressions were conducted with condition (judgment; action) as the selection variable, personality trait (anti-social tendency) as the continuous predictor and response as the categorical outcome (non-utilitarian; utilitarian). For the judgment condition, anti-social tendency did not significantly predict utilitarian responses to either question (*ps* > .161). In the action condition, anti-social tendency was a significant predictor of utilitarian responses, (b = 1.55, Wald $X^2(1)$

= 4.20, p = .041) (See Table 2.4). The higher the new composite score, the more likely participants were to endorse a utilitarian outcome in the action condition.

Table 2.4

Logistic Regression with Composite Anti-Social Tendency Score as Predictor

			95% CI for Odds Ratio		
		B (*SE*)	Lower	Odds Ratio	Upper
Included					
Constant		1.14 (*0.64*)			
Composite score					
	Anti-social tendency	1.55* (*0.76*)	1.07	4.70	20.64

Note. R^2 = .24 (Hosmer & Lemeshow), .25 (Cox & Snell), .36 (Nagelkerke). *Model* $X^2(1) = 5.87$, p = .02. (*SE)* = standard error.
*p = .04

The four components of empathy were not found to be significant predictors of response type in the judgment condition (*ps* > .271) or the action condition (*ps* > .073).

Summary and Discussion

In Experiment 1, participants endorsed the utilitarian response of pushing the person off the bridge when action was required in VR, but refused to endorse the same response when judgment was required in the text-based counterpart.

Heart rate change was primarily assessed to determine whether arousal was triggered by modality or moral content. In the present experiment, heart rate change was highest in the action condition when participants completed the virtual moral task while there was no difference between groups in arousal in the non-moral tasks. This suggests that the VR modality alone was not responsible for this increased arousal. Subsequent analysis found that heart rate change did not predict moral responses in either condition.

This contradicts previous dual-process models that would argue that personal moral dilemmas elicit aversive emotional reactions and subsequently non-utilitarian responses (Greene et al., 2001). However it is important to note that arousal responses in the present action paradigm were assessed not only across the moment of decision-making as in previous research (Navarrete et al., 2012) but also during the time in which participants witnessed the consequences of their actions (or omissions of action). This may explain why arousal did not predict moral actions in the present experiment.

Additionally, previous gaming experience did not predict utilitarian responses in the action condition; this might suggest that responses in the virtual moral dilemma were not akin to those of a gaming environment.

As a secondary finding, primary psychopathy was found to be a marginal predictor of the endorsement of action responses. Honesty-Humility was found to be a negative predictor of this endorsement in the action condition only. This can be explained given the association between Honesty-Humility and traits such as fairness and sincerity. These traits are contrasted with those associated with the Dark Triad of personality (Psychopathy, Narcissism and Machiavellianism) (Ashton & Lee, 2005) giving it an inverse association with psychopathy (Djeriouat & Tremoliere, 2014). Given the high correlation between primary psychopathy and Honesty-Humility, the underlying shared variance between these was extracted into a composite variable termed anti-social tendency and this was found to positively predict utilitarian endorsements in the action condition. Although I found that empathy was not a significant predictor in either condition, this may have been a result of "…questionable levels of content validity" in the present assessment of both cognitive and emotional empathy (Wai & Tiliopoulos, 2012, p. 795). With cognitive empathy often remaining intact in individuals who display psychopathic traits (e.g., Blair, 2005), it is important to

incorporate empathic assessments that can accurately attribute deficits to either cognitive or affective systems (Wai & Tiliopoulos, 2012). In order to address this, previous research has assessed cognitive and affective empathy by monitoring individual responses to emotional stimuli as opposed to relying on self-report measures (Wai & Tiliopoulos, 2012). Future research seeking to understand the role of empathy and harm aversion in virtual moral actions should consider adopting a similar paradigm (see Chapter 4 of this thesis).

In the present methodology, it could be argued that the incorporation of a joystick device in the virtual moral dilemma, compared to key-based responses in the text-based dilemmas, resulted in game-related affordance effects; the joystick itself may have primed pushing responses. In order to inspect this further, I carried out a short follow-up experiment in which participants refused or endorsed the actions described in text-based personal moral dilemmas using either a keyboard ("Y"; "N") or a joystick (pushing forward; pulling back) (see Appendix 2. 3). There were no differences in the proportion of utilitarian responses endorsed in these dilemmas based on the response device, suggesting that the greater endorsement of utilitarian actions observed in Experiment 1 was not likely due to affordance effects.

However, the nature of the sample in Experiment 1 may constrain the generalizability of these results. The present sample was narrowed in its representation, comprising undergraduate psychology students (35 females, 5 males, M_{age} = 26.00 years old, *SD* = 9.77 years). Thus in Experiment 2, I replicated the existing methodology but with a qualitatively different sample.

Experiment 2

In Experiment 2, I examined the same research hypotheses as in Experiment 1, leaving all methodological procedures identical. The personality variables included in this study were limited to dimensions of psychopathy (αs = .43- .72) and Honesty-Humility (10 items; α = .76), as these were found to be associated with moral responses in Experiment 1.

Method

Participants

Sixty two participants comprising 41 females and 21 males (M_{age} = 31.10 years old, *SD* = 15.54 years, age range: 18 - 71 years) were recruited from the public in Plymouth, Devon (UK) and the surrounding area using online advertisements. Participants were paid for their participation in the experiment. All participants had normal or corrected-to-normal vision. The majority of participants were right-handed (81.7%). Two participants were excluded from the experiment as they failed to complete the task due to lack of understanding. As such, 60 participants comprising 41 females and 19 males (M_{age} = 30.05, *SD* = 14.55 years, age range: 18 - 68 years) comprised the final sample. As in Experiment 1, participants were randomly allocated to a judgment condition (*N* = 30) or an action condition (*N* = 30). This research received ethical approval from the Plymouth University Ethics Committee.

Results

Pre-Questionnaire Responses

For the action condition, endorsing a utilitarian outcome and pushing the person in VR was not associated with prior gaming experience (*ps* > .307).

Moral Responses

First, responses from the *footbridge* moral dilemma in the judgment condition were compared with those from the virtual action condition. In the judgment condition, when asked if the action was morally acceptable, 10% of participants endorsed a utilitarian response (i.e., judged that they regarded pushing the person as morally acceptable). In the virtual action condition, 63.3% of participants endorsed a utilitarian response, significantly more than in the judgment condition, ($\chi^2(1) = 18.37$, $p < .001$). The odds of participants endorsing a utilitarian response were 15.55 times higher in the action condition than in the judgment condition. When asked if they would perform the action (action-choice question) in the judgment condition, the same responses were observed with 10% of participants endorsing a utilitarian response to the *footbridge* dilemma, compared to the 63.3% who endorsed the action in the virtual dilemma, ($\chi^2(1) = 18.37$, $p < .001$) (see Figure 2.4).

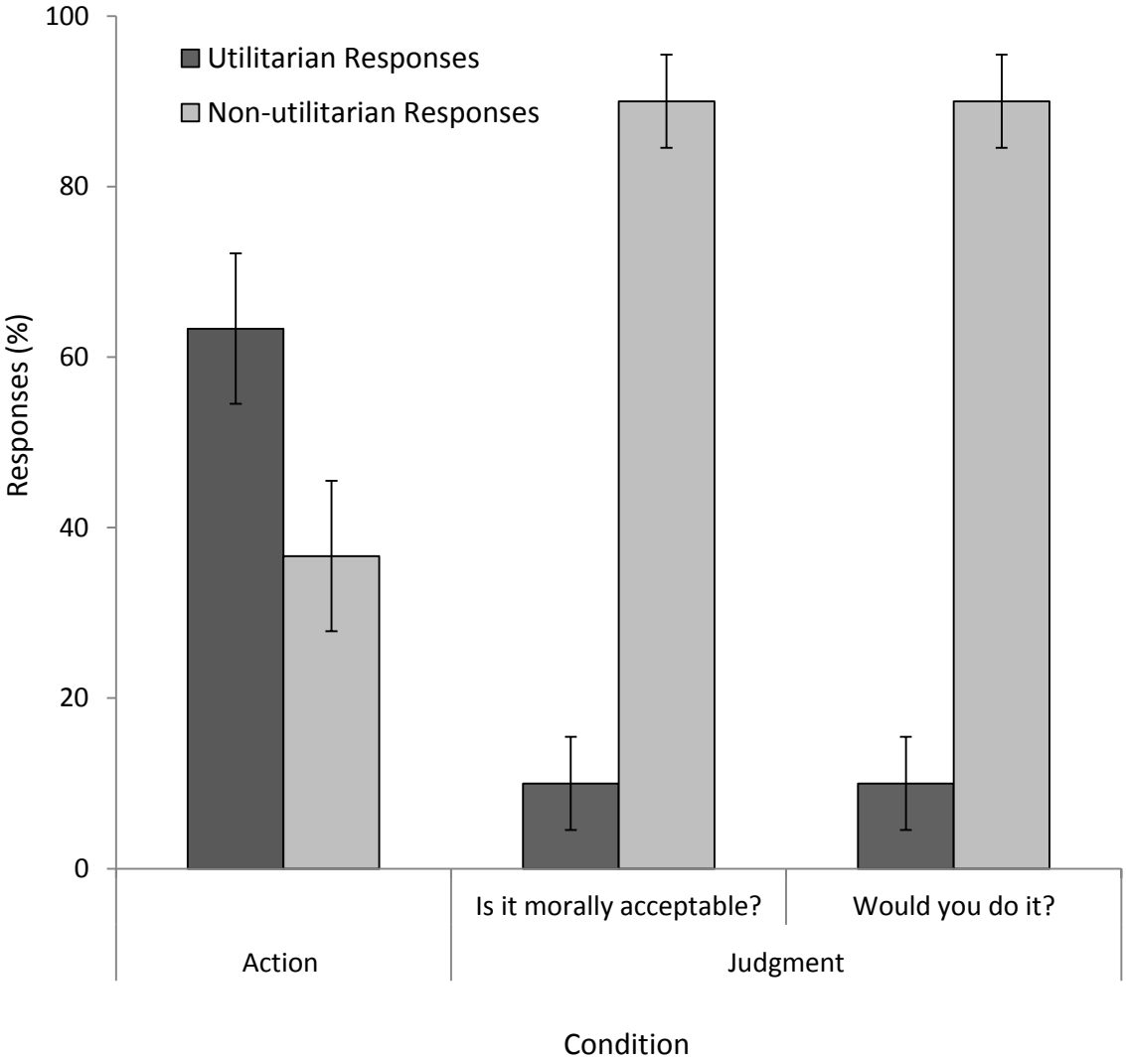


Figure 2.4. Responses (%) in the action condition and judgment condition in response to the *footbridge* dilemma in Experiment 2. In the judgment condition, participants were asked whether the action was morally acceptable and whether they would do it. A greater number of utilitarian outcomes were endorsed in the action condition. Error bars represent +- 1 SE_p.

In the judgment condition for the text-based version of the *footbridge* dilemma, no significant difference was found when comparing responses to the judgment question (i.e., moral acceptability) and the action-choice question (i.e., whether they would do it), (p = 1.00).

Heart Rate Analyses

In the judgment condition, heart rate decreased during the text-based non-moral task (M = -1.37, SD = 1.92) and increased in the text-based moral task (M = 1.47, SD = 3.27). In the action condition, heart rate decreased for the virtual non-moral task (M = -2.30, SD = 2.83) and also increased for the virtual moral task (M = 5.63, SD = 6.25) (see Figure 2.5).

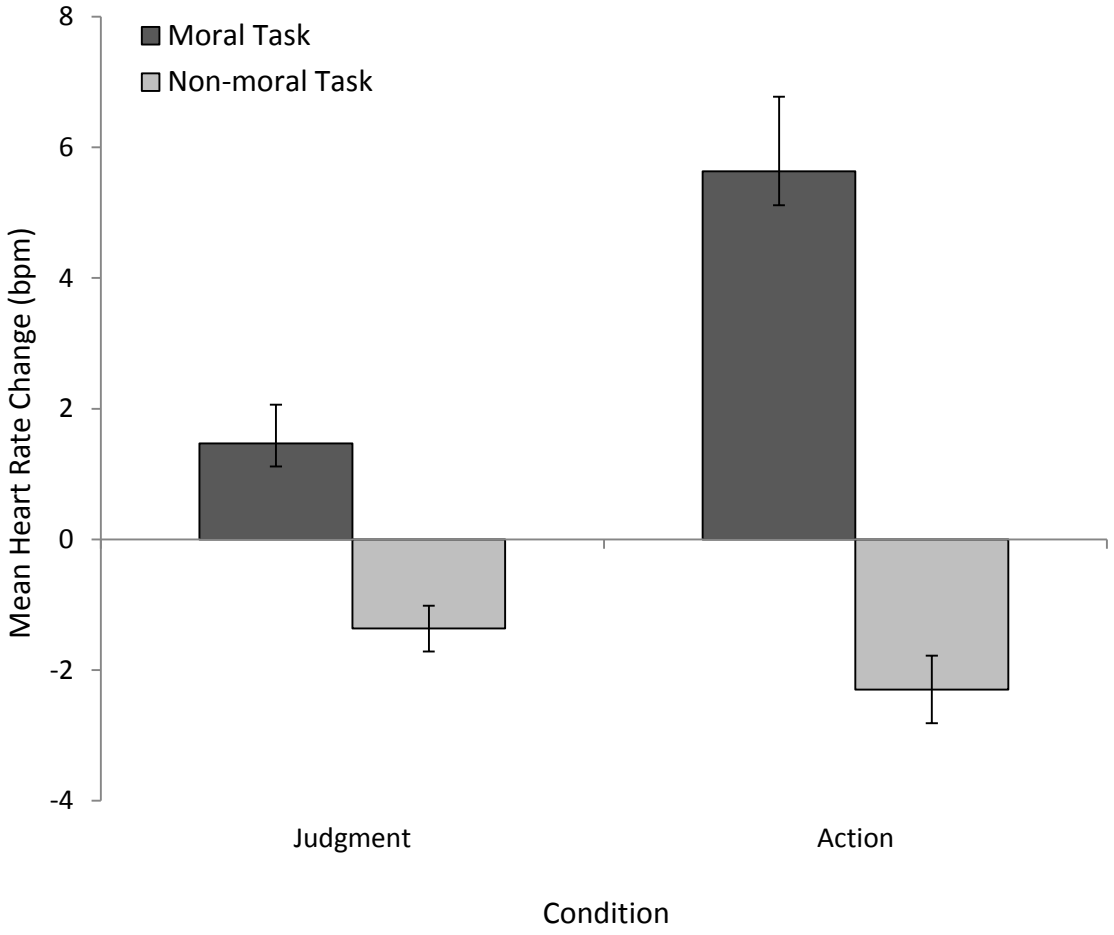


Figure 2.5. Mean heart rate change (bpm) for non-moral and moral tasks in both the judgment and action conditions. Heart rate change was significantly higher in the virtual moral dilemma. Error bars represent +- 1 SE.

A mixed ANOVA with task (non-moral task; moral task) as within-subjects factor and condition (judgment, action) as the between-subjects factor was performed. Analysis revealed a main effect of task, ($F(1, 58) = 57.50$, $p < .001$, $\eta_p^2 = .50$) condition, ($F(1, 58) = 5.03$, $p = .029$, $\eta_p^2 = .08$) and a significant interaction of task x condition, ($F(1, 58) = 12.90$, $p = .001$, $\eta_p^2 = .18$). To further investigate this interaction, simple effects analyses were performed, comparing heart rate change in non-moral and moral tasks in both conditions. Analysis suggested that heart rate changes were significantly greater in the moral tasks than in the non-moral tasks in both the action condition, ($F(1, 58) = 62.43$, $p < .001$, $\eta_p^2 = .52$) and the judgment condition, ($F(1, 58) = 7.96$, $p = .007$, $\eta_p^2 = .12$). However, for the moral task, heart rate changes were significantly higher in the action condition compared to the judgment condition, ($F(1, 58) = 10.47$, $p = .002$, $\eta_p^2 = .15$). For the non-moral task, heart rate changes were not significantly different between the judgment and action conditions, ($p = .140$).[7]

As in Experiment 1, I assessed whether heart rate change was associated with an increase in utilitarian responses in logistic regression models. As expected, the regression supported previous chi-square analyses (see Figure 2.4) revealing a positive relationship between condition (referencing action condition) and the odds of endorsing a utilitarian response. This was the case when referencing the judgment condition using the judgment question, ($b = 2.74$, Wald $X^2(1) = 14.65$, $p < .001$) and also the action-choice question, ($b = 2.74$, Wald $X^2(1) = 14.65$, $p = .008$). However, the analysis revealed no significant relationship between heart rate changes and the likelihood of endorsing a utilitarian response in either condition ($ps > .088$).

[7] Again, the ratio of greatest and least variance in heart rate change was >3 and as such, this analysis was repeated and findings replicated using Generalised Estimating Equations, which does not assume homogeneity of variance (see Statistical Note (2.4)).

Personality Trait Analyses

In order to assess any differences in personality trait scores between the judgment and action conditions, a one-way ANOVA was used to compare trait measures. A significant difference was found in both primary psychopathy, ($F(1, 58) = 22.09$, $p < .001$, $\eta_p^2 = .28$) and secondary psychopathy, ($F(1, 58) = 7.55$, $p = .008$, $\eta_p^2 = .12$) between the action and judgment conditions; higher primary psychopathy and secondary psychopathy scores were observed in the action condition. No differences were found between Honesty-Humility scores ($p = .529$) (see Table 2.5).

Table 2.5

Means and Standard Deviations for LSRP and Honesty-Humility

		Condition	
		Judgment	Action
Measure	Subscale	M*(SD)*	M*(SD)*
1. LSRP			
	Primary	30.60*(6.54)***	37.07*(3.75)***
	Secondary	19.67*(3.52)**	21.97*(2.94)**
2. HEXACO			
	H	3.40*(0.60)*	3.50*(0.62)*

Note. H = Honesty-Humility.
*p <.05 ** p <.001

As in Experiment 1, univariate logistic regressions were conducted with condition (judgment; action) as the selection variable, psychopathy subscales as the continuous predictors and response as the categorical outcome (non-utilitarian; utilitarian). In the judgment condition, responses to both action-choice and judgment questions were analysed. Psychopathy subscales were not significant predictors of

utilitarian responses in either the judgment condition for both questions (*ps* > .802) or in the action condition (*ps* > .207).

Additionally, Honesty-Humility was not a significant negative predictor of utilitarian responses in either the judgment condition for both questions (*ps* > .601) or in the action condition ($p = .787$).[8]

Summary and Discussion

Experiment 2 supported the finding that participants endorse the utilitarian response of pushing when action is required in VR. However, they refuse to endorse the same response when judgment is required in a text-based version of the *footbridge* dilemma. As in Experiment 1, heart rate significantly increased for the virtual moral task in the action condition whereas no differences were found between conditions in arousal in non-moral tasks. As before, this indicates that the VR modality alone was not responsible for increased levels of arousal. Subsequent analysis found that arousal did not predict moral responses. As in Experiment 1, this may have been due to the heart rate sampling period which incorporated the time in which participants witnessed the consequences of their actions. Again, previous gaming experience did not predict utilitarian responses in the action condition. Contrary to Experiment 1, primary psychopathy and Honesty-Humility did not predict moral actions in VR.

General Discussion

Overall, participants behaved differently in judgment-based formulations and action-based virtual formulations of the same moral dilemma. In both Experiments 1 and 2, participants who responded to a virtual personal dilemma, endorsed a greater

[8] In this instance, PCA was not performed given that neither primary psychopathy nor Honesty-Humility predicted utilitarian actions.

proportion of utilitarian responses than those who responded to the same text-based dilemma.

Given previous theories arguing that personal moral dilemmas elicit immediate and aversive emotional responses (Greene et al., 2001), it was theorised that a virtual personal dilemma might elicit the same or fewer utilitarian endorsements as in the judgment counterpart. However, this cannot explain the results of the present experiments as individuals endorsed greater utilitarian actions in VR. At this early stage, these results appear to fall in line with the theory of Cushman (2013) regarding outcome and action-based value representations. Given the contextual saliency of the virtual *footbridge* dilemma, outcome-based value representations for not pushing the person and allowing the people on the tracks to be killed, might have had a greater negative value (Cushman, 2013). This may have been greater than the action-based negative value representation for pushing the person to their death. Indeed, in Patil et al. (2014), the authors propose a similar theory in which there may have been greater outcome-based value representations for not acting and allowing individuals to be harmed, leading to a greater number of utilitarian responses. As adapted from Patil et al. (2014), I suggest that the saliency in the present experiments may have been generated by the personal nature of the dilemma and the ability to see potential victims on the tracks. In the text-based dilemmas, the absence of salient features and reliance on imagination might have led to the assignment of negative value to the action of harming, as opposed to the outcome of not acting (Cushman, 2013). More broadly, this interpretation of the present findings also falls in line with the work of FeldmanHall et al. (2012) exploring contextually rich versus contextually impoverished paradigms (as outlined in Chapter 1). The introduction of contextual features diminishes the impact of aversion to harm as other motivational forces "…become more salient" (FeldmanHall et al., 2012, p. 440).

In this instance and in line with action-outcome accounts (Cushman, 2013; Patil et al., 2014), the visual saliency in VR may have generated new motivational forces, promoting the need for action to prevent an aversive outcome, over the aversion to carrying out the harmful action.

Emotional Arousal

Heart rate change was monitored in order to determine whether increases in emotional arousal would be triggered by modality or moral content. In Experiment 2, both the moral text-based dilemma and virtual moral task were more arousing than their non-moral counterparts with the virtual moral task eliciting the greatest increase in arousal overall. In Experiment 1, the virtual moral task was more arousing than the non-moral counterpart and also the moral text-based dilemma. This suggests that the modality of VR alone was not responsible for changes in heart rate but rather the moral nature of the virtual task.

Given previous theories regarding the association between non-utilitarian responses and emotional arousal in personal moral dilemmas (Greene et al., 2001), it was hypothesised that an increase in heart rate might predict non-utilitarian responses. Previous virtual studies have measured emotional arousal and have yielded mixed findings; whilst Navarrete et al. (2012) found that autonomic arousal was negatively related to utilitarian actions in VR, Patil et al. (2014) found that arousal was highest in virtual moral dilemmas and this corresponded with a greater proportion of utilitarian responses. In the present research, I also found an overall increase in emotional arousal in the action conditions for the virtual moral dilemma. However, in both Experiment 1 and Experiment 2, I did not find that increased heart rate predicted either non-utilitarian judgments or actions, contradicting the role of emotional arousal as defined in Greene's dual-process model.

However, it is important to note here that heart rate change in the action condition also incorporated the moment in which participants witnessed the consequences of their actions and, as such, recorded arousal beyond the decision-making process itself. The main purpose of arousal assessment in the present research was to examine whether changes in arousal were as a result of modality or moral content. Whilst the finding that arousal was greatest in the virtual moral task suggests that modality alone is not responsible for this increase, it is important to acknowledge an additional explanation; witnessing consequences in the action condition may have led to greater emotional arousal compared to imagining consequences in the judgment condition. As a result of this, and given that this research is the first to implement a personal moral dilemma in VR, implications of these physiological results for Greene's dual process model remain unclear.

Personality Traits

In Experiment 1, psychopathic traits marginally predicted and Honesty-Humility negatively predicted utilitarian endorsements in the action condition in VR but not in the text-based judgment condition. Given that a low Honesty-Humility level is often associated with traits such as fairness and sincerity; the opposite of which are associated with the Dark Triad of personality (Psychopathy, Narcissism and Machiavellianism) (Ashton & Lee, 2005), the correlation between primary psychopathy and Honesty-Humility was strong. A latent variable was extracted from these associated traits (anti-social tendency) and this was also found to positively predict utilitarian endorsements in the action condition in VR. These results might support previous research finding that psychopaths have distinct moral judgments and actions (Cima et al., 2010; Kiehl, 2008). More generally, it might give support to the viewpoint that moral judgment and moral action remain dissociated. However, these conclusions are given tentatively as

Experiment 2 failed to support these findings. Further examination of the role of pro- and anti-social traits in these action frameworks is required prior to further interpretation.

Alternative Interpretations

Whilst Cushman's action, outcome and value model seems to offer a convincing interpretation of these experiments' findings, there are alternative explanations that need addressing.

Firstly, the potential interpretation that the increase in virtual utilitarian actions could be a result of artificial gaming behaviours, as opposed to moral-based decision making, is not supported in the present research. Decisions made in the virtual moral dilemma were not influenced by previous gaming experience; as such, video game desensitization cannot explain these findings. Additionally, there was no evidence of game-related affordance effects when incorporating a joystick device in a short-follow up experiment; as such, I argue that the increased utilitarian response pattern found in VR was not likely induced by this.

In terms of further differences between the modalities of the virtual moral dilemma and its text-based counterpart, whilst I attempted to match the temporal nature of the paradigms, it might be argued that salient auditory cues in the virtual dilemma resulted in the present outcome. Specifically, in the virtual dilemma, the victims on the track began to yell at a fixed time interval during the dilemma whilst the person on the bridge did not yell until pushed; potentially leading to the victims calling attention to themselves, whilst the person remained mute until after the participant had responded. In an attempt to investigate this, I compared those individuals who gave a utilitarian response prior to hearing the victims yell, to those who acted after hearing the victims

yell. In Experiment 1, of the 70% of individuals that endorsed a utilitarian response, 7.1% executed the action after the victims had begun to yell. In Experiment 2, of the 63.3% utilitarian responses, 16.6% elicited this response after hearing the victims yell. This indicates that in both experiments, the majority of participants in VR chose to push before the victims had called attention to themselves. As such, the response patterns found in the virtual moral dilemma were not likely triggered by these salient auditory cues.

Differences in auditory cues, with regards to instructions, must also be considered. In the judgment condition, the text-based vignette explicitly draws equal attention to the acts of killing and saving; "the stranger will die if you do this, but the five workmen will be saved" (Greene et al., 2008). In the action condition however, the verbal instructions explicitly refer to saving; "…if you want to save the people, you could push the large person…". As such, it could be argued that the lack of conflict created in the virtual scenario biased participant's attention to the act of saving (e.g., Broeders, van den Bos, Müller, & Ham, 2011). Despite this, I would argue that the visual saliency of the virtual scenario makes the act of killing the person explicit; there is no reliance on imagination in the virtual scenario and the consequences of your action (or omission of action) can be processed visually. In order to address this point, I later asked a sample of 15 participants who took part in Experiment 1, "Did you know that the person would die if you pushed them?" to which all responded "Yes". This supports the view that participants had explicit knowledge that their actions would result in the person dying in VR. Despite this, it must still be acknowledged that the incorporation of auditory instructions may have actively encouraged or coerced individuals into endorsing the utilitarian outcome. As such, future research should ask participants

whether they felt coerced when responding in the virtual dilemma (see Chapter 4 of this thesis).

Finally, it might be that an alternative explanation for these findings rests in an embodied-cognition perspective of moral decision-making. Situated-embodied perspectives argue that physical experiences or bodily states can map onto cognitive states and actions (e.g., Barsalou, 2008; Meier, Schnall, Schwarz, & Bargh, 2012). In this case, perceiving the physical or concrete context and consequences of moral actions in VR, may have reactivated learned or memorised experiences. This may have resulted in individuals experiencing greater involvement in the action compared to when facing a more abstract text-based dilemma. This theory is arguably an extension of Patil et al.'s action-outcome account (2014) and FeldmanHall et al.'s contextual account (2012) of the present findings. In this case, embodied states are triggered by the contextual saliency available in VR. This embodied perspective should be investigated within future virtual paradigms perhaps through the incorporation of realistic haptic feedback. This would allow exploration of the physical components of VR and subsequent effects on simulated moral actions (see Chapter 3 of this thesis).

Methodological Considerations

Although this research addressed the problem of excluding personal dilemmas in VR research (Patil et al., 2014), I acknowledge the limitation of including a single virtual reconstruction of the *footbridge* dilemma in the present research; as such, the generalizability of our results is limited in the broader moral decision-making literature. However, given that previous virtual paradigms have considered only impersonal moral dilemmas, this research has offered initial insights into the immediate emotional responses prompted by a novel simulation of a personal moral dilemma. Future research might consider constructing multiple personal moral dilemmas in VR in order to

investigate further personal factors such as personal force in this action framework (see Chapter 3 of this thesis).

Further, given that I discuss moral inconsistency in light of the disparity between moral actions and moral judgments, one criticism of the present experiments is that I did not compare participant's actions with their own judgments (Patil et al., 2014). With research in moral decision-making suggesting that both between and within-subjects designs should be utilised (Bartels et al., 2015), future research should consider incorporating the present paradigm in a within-groups design to allow examination of the relationship between judgments and actions for the same individual (see Chapter 4 of this thesis).

Additionally, given increases in the use of virtual simulation training paradigms across emergency and healthcare services as a means of assessing emotionally conflicting decision-making processes, future research should consider expanding the present virtual paradigms to include life-like scenarios or to examine virtual moral actions in these specialised populations (see Chapter 5 of this thesis), extending the generalization of findings concerning moral actions.

CHAPTER 3: UTILITARIAN MORAL ACTIONS AND HAPTIC FEEDBACK

Introduction

In experiments reported in the previous chapter of this thesis, moral judgments made in text-based moral dilemmas were found to be distinct from moral actions simulated in VR (see Chapter 2). More specifically, virtual moral actions in a personal moral dilemma (*footbridge* dilemma) elicited greater utilitarian endorsements than moral judgments made in a text-based counterpart. I argued that one explanation for this finding can be adapted from Cushman's action-outcome model (Cushman, 2013) and theories regarding contextual richness (FeldmanHall et al., 2012; Patil et al., 2014); visual saliency in virtual dilemmas may prompt the assignment of negative value to the outcome of not acting and seeing the majority of people die. This then outweighs the action-based negative value representation for sacrificing one person and motivates individuals to endorse the utilitarian action in VR. However, I have also argued that situated-embodied perspectives may be able to explain the disparity between moral action and moral judgment in this case, as experiencing the concrete consequences of actions in contextually salient VR may have made people feel more involved in the action.

In the present chapter, I investigated this further by incorporating haptic feedback within VR paradigms, examining its subsequent influence on moral action. Whilst the virtual *footbridge* dilemma incorporated into Chapter 2 of this thesis is "up close and personal" (Greene et al., 2001, p. 2106), sensorimotor qualities and aspects of embodiment are still absent (Skulmowski et al., 2014). In Experiment 3, I utilised a VR robotic system (vBOT) to simulate performing a realistic physical action in response to moral dilemmas involving personal force (Howard, Ingram, & Wolpert, 2009). The vBOT system can simulate the physical resistance force that would be experienced if

touching or pushing a physical object. For example, it can generate the sensation of moving through water or touching a spherical object. Thus, it is able to generate realistic haptic feedback. To my knowledge, this is the first experiment to use a vBOT system within a moral dilemma framework and thereby adds a novel sensorimotor aspect to existing moral paradigms. Further, in Experiment 4, I combined a realistic and life-like interactive sculpture that simulated the sensation of pushing a real person with the VR *footbridge* dilemma (introduced in Chapter 2) to explore the combined effects of visual and physical saliency on moral actions.

Moral Principles: Introducing Personal Force

"There is more reason in your body than in your best wisdom"

(Nietzsche & Parkes, 1883/2005, p. 30)

As outlined in Chapter 1, research in the field of moral psychology has largely focused on examining what drives distinct responses to personal dilemmas (such as the *footbridge*) and impersonal dilemmas (such as the *switch*) (e.g., Greene et al., 2001). One way in which to examine moral judgments is to consider the moral principles that influence moral judgments (Cushman, Young, & Hauser, 2006). For example, the intention principle posits that the crucial difference in the *Trolley Problem* is that the person in the *footbridge* case is used as a means of saving the five, whereas the death of the single worker in the *switch* case is simply a side-effect of the trolley's diversion away from the five (Cushman, Young, & Greene, 2010). The conceptual factor of inevitability also plays a role in the footbridge-switch distinction (e.g., Christensen et al., 2014); harmful actions that lead to inevitable consequences are often judged as more morally acceptable (Christensen & Gomila, 2012).

In contrast to these principles, the contact principle has received little attention (Cushman et al., 2006). It states that using physical contact to harm someone is worse than doing so without physical contact; hence pushing the person in the *footbridge* case is judged more harshly than flicking a switch. However, a mistake commonly made is to assume that personal moral dilemmas such as the *footbridge*, require physical contact but this is not the case given the definition provided by Greene (Greene et al., 2001). For this reason, Greene et al., (2009) established a new factor known as "personal force" exacted when "the force that directly impacts the other [person] is generated by the agent's muscles" (Greene et al., 2009, p. 365). This factor is distinguished from physical contact in that the personal force can be exacted through other objects; in a modified version of the *footbridge* dilemma, for example, a pole can be used to transfer personal force onto the stranger on the bridge, with no physical contact being required (Greene et al., 2009).

In an investigation of this new moral principle, Greene et al., (2009) found that if personal force was required, utilitarian moral judgments were significantly lower. This supports the "simulated motor plan" hypothesis suggesting that when faced with a personal dilemma, we imagine carrying out the harmful action ourselves (Cushman & Greene, 2012). In the *footbridge* dilemma, we might imagine ourselves pushing the person, shaping our hands and preparing our bodies in such a way as to direct our personal force onto them. In doing so, we are faced with an immediate emotional aversion to this act (e.g., Greene et al., 2001) and so we judge it as unacceptable (Cushman & Greene, 2012). This theory relates back to Greene's dual process model (see Chapter 1 for full description); responding in a utilitarian manner to personal dilemmas requires suppression of an affective response (Greene et al., 2001). Further, in Cushman's action, outcome and value model (see Chapter 1 for full description),

personal force and physical contact are related back to reinforcement learning mechanisms (Cushman, 2013). For humans, simply the act of pushing carries with it a history of learned moral violations. In the past, individuals have learned that pushing someone results in harm to another and punishment to themselves. As such, individuals are less likely to condone pushing as it is a typical moral violation (Cushman, 2013).

Personal Force and Moral Action

Despite the embodied nature of the theories regarding personal force, research has largely explored this principle in the context of moral judgment (e.g., Greene et al., 2009) with little research examining how these theories might relay into moral actions (Patil et al., 2014).

In one experiment, Cushman et al. (2012) did utilise an active behavioural paradigm in order to investigate simulated harmful actions. In their study, the authors had participants simulate harmful actions such as hitting a plastic baby doll or hitting a PVC leg with a hammer and found that individuals experience a strong aversion to performing these actions. They argued that findings from previous moral judgment paradigms showing fewer utilitarian judgments when personal force is present (e.g., Greene et al., 2009), can subsequently translate into active behaviours (Cushman et al., 2012). However, one criticism of this behavioural paradigm, is that harmful actions did not result in specific outcomes such as saving more lives (Cushman et al., 2012). As such, this paradigm may not be comparable to the classic one-for-many dilemmas frequently adopted in the moral domain (e.g., Greene et al., 2001).

Addressing Limitations

In terms of addressing the limitations outlined in the previous chapter, multiple personal moral dilemmas are incorporated within the present VR paradigm as opposed

to a single scenario. Further, in order to shed light on the relationship between moral actions and anti- and pro-social traits given the mixed findings in the previous chapter, I include trait assessments in Experiment 3.

Specific Hypotheses

Based on our general hypotheses, the following experiments examined the relationship between moral judgment and moral actions but more specifically and based on the outcomes of Chapter 2, the influence of sensorimotor aspects of personal force (and subsequent haptic feedback) on simulated moral actions. Given theories regarding our tendency to imagine ourselves carrying out harmful actions (Cushman & Greene, 2012) and Cushman's theories regarding negative value assignment for harmful actions (Cushman, 2013), the incorporation of haptic feedback within personal force dilemmas, could lead to increased aversion for harmful acts and subsequently, the same or fewer utilitarian actions as compared to judgments.

However, in the previous chapter of this thesis, virtual moral dilemmas prompted a greater proportion of utilitarian actions. As I outlined, this may result from increased contextual saliency and differences in action-outcome value assignment in virtual dilemmas (Cushman, 2013; FeldmanHall et al., 2012; Patil et al., 2014). Additionally, I have also argued, from an embodied perspective, that experiencing the concrete consequences of actions may have resulted in individuals feeling more deeply involved in actions in VR. If theories centred on contextually saliency in VR extend to physical saliency and the situated-embodied theory stands, greater utilitarian actions may be endorsed when action is required (FeldmanHall et al., 2012; Patil et al., 2014). In order to address this hypothesis, in Experiment 3 of this thesis, the visual aspects of VR were removed in order to isolate the influence of haptic feedback on moral actions. In Experiment 4, both visual aspects and physical features of VR were combined.

Further, in Experiment 3, the incorporation of the vBOT system not only enabled the generation of haptic feedback but also allowed the measurement of new moral measures including the speed of movement, the force exerted, and subsequently, the overall power exerted when simulating moral actions. The novel measure of power provided by this paradigm, may offer additional information about moral actions.

Experiment 3

Method

Participants

Forty participants comprising 34 females and six males **(**M_{age} = 20.23, *SD* = 2.97 years, age range: 18 - 31 years) were recruited from the Plymouth University, School of Psychology, participant pool and participated for course credit. All participants had normal or corrected-to-normal vision and were right-handed. This research received ethical approval from the Plymouth University Ethics Committee.

Measures

Participants were asked to fill out an electronic questionnaire comprising the LSRP (αs = .66 - .90) and HEXACO-IP-R (αs = .74 - .87) and the pre-questionnaire assessing prior gaming experience (see Chapter 2). In the present experiment, measures of arousal could not be obtained as a result of the excessive movement (repeatedly simulating actions) in the action condition.

Moral Judgment and Action Measures

The experiment comprised two conditions to which participants were randomly allocated; a judgment condition (*N* = 20) and an action condition (*N* = 20). In both conditions, participants were presented with vignettes describing the *footbridge*

dilemma and 14 further personal force dilemmas. These moral dilemmas were selected from those originally used in Greene et al. (2001) and also included five personal force dilemmas adapted from this database (see Appendix 3.1). Of the dilemmas originally used in Greene et al. (2001), personal dilemmas were modified to ensure that each involved personal force. For example, consider the "euthanasia" dilemma:

You are a leader of a small group of soldiers. You are on your way back from a completed mission deep in enemy territory when one of your men has stepped in a trap that has been set by the enemy and is badly injured. The trap is connected to a radio device that by now has alerted the enemy to your presence. They will soon be on their way.

If the enemy finds your injured man they will torture him and kill him. He begs you not to leave him behind, but if you try to take him with you your entire group will be captured. The only way to prevent this injured soldier from being tortured is to shoot him yourself.

This dilemma, while categorised as personal, does not involve personal force according to its original definition (Greene et al., 2009). As such, in the present experiment it was adapted as follows:

If the enemy finds your injured man they will torture him and kill him. He begs you not to leave him behind, but if you try to take him with you your entire group will be captured. The only way to prevent this injured soldier from being tortured is to kill him yourself by stabbing him.

Replacing a gun with a knife ensures that "the force that directly impacts the other [person] is generated by the agent's muscles" (Greene et al., 2009, p. 365).

In the judgment condition, dilemmas were presented to participants via a computer display. After each dilemma, participants were asked a judgment question ("*Is it morally acceptable to [specific to the scenario]*?") followed by an action-choice question ("*Would you do it?*"). Responses were given by selecting "Yes" (Y-key) or "No" (N-key).

In the action condition, participants were first presented with three non-moral dilemmas (see Appendix 3.1) selected from an existing database (Greene et al., 2001) to provide a baseline measure of force. The personal force moral dilemmas were then presented. All dilemmas were completed using the VR robotic system (vBOT) (see Figure 3.1). The participant held the handle of the vBOT and moved it to respond to each dilemma. In this system the handle position of the manipulandum is measured using optical encoders sampled at 1000 Hz and it uses motors operating under torque control to allow the application of end-point forces. A force transducer (Nano 25; ATI) is mounted under the handle to measure the applied forces. The vBOT arm simulated the physical resistance force that would be experienced by pushing an object or person, thereby generating haptic feedback to the participant.

Participants were able to read the vignettes in the semi-silvered mirror. After the end of each dilemma had been reached, upon a final button click the participant was asked ("*Are you going to [specific to scenario]?"*) followed by the phrase (*"If so, move the arm forward to [specific to scenario]. If not, then pull away [specific to scenario]"*). A final button press was then used to cue the response action and this generated the message ("*Act now"*). Responses were then given by pushing forward with the vBOT arm to endorse a utilitarian action or by pulling away with the arm to reject an action (non-utilitarian endorsement).

Figure 3.1. The vBOT System.

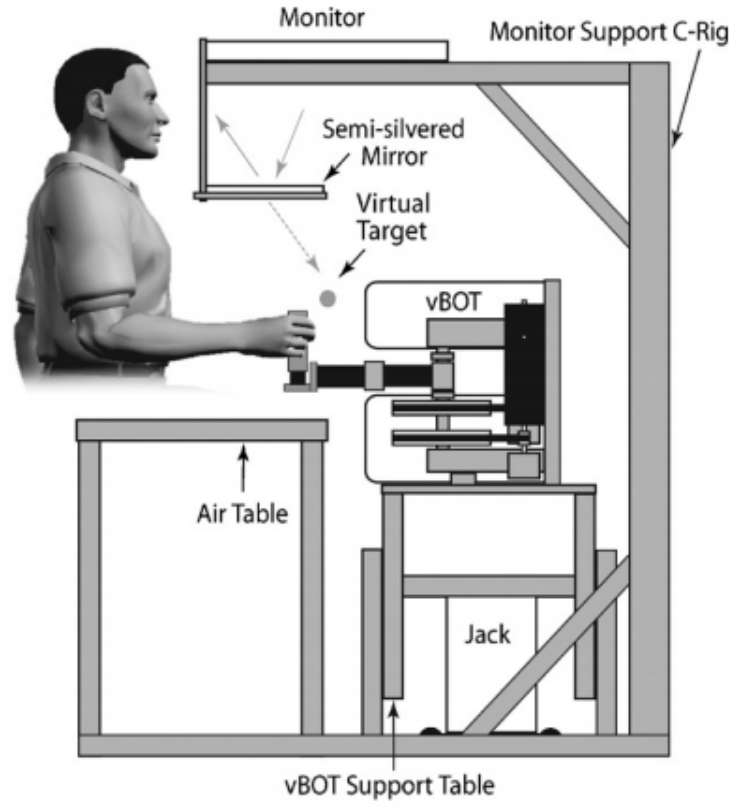


Figure 3.1. The diagram shows the side-view of the set-up with a participant holding the handle of the vBOT arm whilst viewing the monitor via a semi-silvered mirror. Text-based vignettes of dilemmas were displayed on the monitor for participants to read.

Action Variables

In the action condition, the vBOT system provided additional measures including force and speed.

Force. Baseline force measurements were calculated for each participant in order to control for varying strengths among participants. The vBOT arm allowed participants to push forward when endorsing an action (utilitarian) or to pull away when refusing to endorse an action (non-utilitarian). Baseline measurements were first created by averaging the force of endorsements of actions in non-moral dilemmas (baseline force for endorsements) and by averaging the force of refusals to endorse actions in non-moral dilemmas (baseline force for refusals). The normalised force (for utilitarian or non-utilitarian actions) applied by each participant in each dilemma was then calculated as a proportion of their baseline force.

Speed. Speed was defined as the maximum speed (cm/s) that a participant moved the vBOT arm across the movement trajectory. Using the same procedure for force measurements, normalised maximum speed was conditionally calculated (for utilitarian actions or non-utilitarian actions). Baseline measurements were conditionally created by averaging the speed of endorsements and refusals of actions in non-moral dilemmas. The utilitarian or non-utilitarian normalised speed was then calculated as a proportion of baseline speed.

Power. The relative force and speed with which individuals simulated harmful actions (utilitarian actions) were strongly correlated, ($r(18) = .51$, $p = .021$).[9] Given that the product of speed and force equates to a measure of power, a normalised force and speed score were used to create a relative measure of power for each participant. This

[9] There was no correlation between relative force and speed with which individuals simulated non-utilitarian actions ($p = .335$).

measure of power represented the power exerted by an individual when giving a utilitarian response and simulating a harmful action with the vBOT arm.

Procedure

In both conditions, participants first completed the electronic questionnaire comprising the trait assessments. All personal force dilemmas were presented in a randomised order. In the judgment condition, dilemmas were presented on a computer running E-Prime software and each dilemma was presented in three blocks of text that could be read at a speed determined by the participant. Having read each dilemma, participants were given eight seconds to respond.[10]

In the action condition, participants initially completed the electronic pre-questionnaire assessing their gaming experience (see Chapter 2). When responding to both non-moral dilemmas and personal force dilemmas, vignettes were presented using the vBOT system. At the start of each trial the vBOT handle first pulled the participants hand to the starting position, which was at a central location (in the mid-sagittal plane 30 cm below the eyes and 30 cm in front of the chest). Participants were prevented from viewing their hand directly, and the VR system was used to overlay images of the hand cursor (0.5 cm radius red disk). As in the judgment condition, dilemmas were presented in blocks of text that could be read at a speed determined by the participant. Participants used a button press with their left hand to scroll forward through these blocks of text. Matched to the judgment condition, after reading each dilemma in full, participants were given eight seconds to respond. A utilitarian endorsement was achieved when the handle was pushed forward into a soft object (which required the application of force)

[10] This time frame was selected as it was long enough to allow responses that were not time-pressured but short enough to prevent a long elaborate decision-making process that would be unrealistic in an action framework. It was also within a similar time frame window adopted in previous VR moral action paradigms (Patil et al., 2014) and the VR *footbridge* task previously adopted in this thesis (see Chapter 2).

by more than 2cm. The simulated soft object was located immediately forward of the start position and implemented using the combined effect of a weak spring ($k = -4Ncm^{-1}$) and a resistive viscous field ($k = -0.5Ncm-^{2}$). A refused (non-utilitarian) response was achieved when the handle was pulled backwards more than 1.25cm from the start position. No resistance was experienced when pulling back.

In the judgment condition, the proportion of utilitarian endorsements for judgment and action-choice questions was recorded. In the action condition, the proportion of utilitarian actions, force, and speed were all recorded for further analyses.[11]

Results

Pre-Questionnaire Responses

For the action condition, endorsing a utilitarian action using the vBOT system was not associated with previous gaming experience (*ps* > .096).

Moral Responses

Analyses compared responses to personal force moral dilemmas in the action condition (using the vBOT system) versus the judgment condition. In the action condition, there was a greater proportion of utilitarian responses in personal force dilemmas ($M = 0.54$, $SD = 0.17$) when compared to the judgment condition in response to both the judgment question ($M = 0.33$, $SD = 0.26$) and the action-choice question ($M = 0.41$, $SD = 0.24$) (see Figure 3.2).

[11] Response times in the action condition were recorded by the vBOT system while those in the judgment condition were recorded in E-prime. As in the previous chapter, both programmes had different time recording sensitivities and as such, a reliable comparison between reaction times could not be performed.

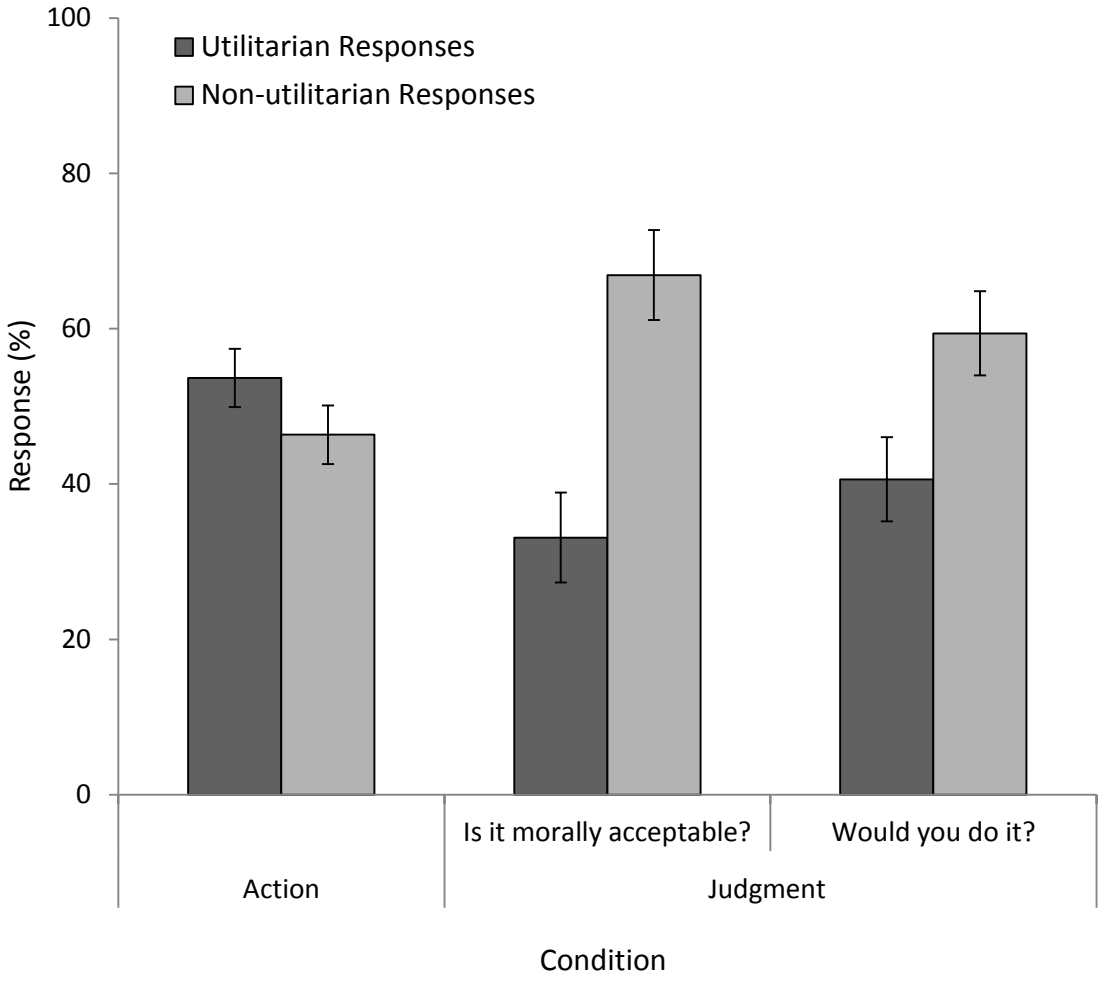


Figure 3.2. Responses (%) (utilitarian or non-utilitarian) in the action condition and judgment condition in response to personal force dilemmas. In the judgment condition, participants were asked both a judgment question and action-choice question. A greater number of utilitarian endorsements were observed in the action condition when the vBOT system was used to respond. Error bars represent +- 1 SE.

One-way ANOVAs with condition (judgment; action) as the between-subjects factor were performed. Separate one-way ANOVAs were utilised with responses to the judgment question and action-choice question (from the judgment condition) as dependent variables.

Is it morally acceptable*?* The assumption of homogeneity of variance was violated and as such, the Brown-Forsythe *F*-ratio is reported. Analysis revealed a main effect of condition, ($F(1, 32.64) = 8.89$, $p = .005$, $\eta_p^2 = .20$) with a greater proportion of utilitarian endorsements observed in the action condition compared to the judgment condition.

Would you do it*?* Analysis revealed a marginally significant main effect of condition, ($F(1, 38) = 3.92$, $p = .055$, $\eta_p^2 = .10$) with a greater proportion of utilitarian responses observed in the action condition compared to the judgment condition.[12]

Personality Trait Analyses

In order to assess any differences between personality traits across both the judgment and action conditions, a one-way ANOVA was used to compare trait measures. No significant differences between the judgment and action conditions were found (all *ps* > .071), except for Honesty-Humility, ($F(1, 38) = 6.31$, $p = .016$, $\eta_p^2 = .14$) which was higher in the judgment condition ($M = 3.63$, $SD = 0.47$) than the action condition ($M = 3.17$, $SD = 0.67$).

Traits and moral responses. In order to determine whether traits predicted utilitarian responses in the action or the judgment framework, univariate linear

[12] As in Chapter 2, in the judgment condition specifically, no significant difference was found when comparing responses to the judgment question (i.e., moral acceptability) and the action-choice question (i.e., whether they would do it), ($p = .378$).

regressions were conducted with personality traits as predictors and proportion of utilitarian responses as the outcome variable.[13] In both conditions, no personality traits predicted utilitarian responses (*ps* > .208).

Traits and action variables. In order to determine whether personality traits were related to the measure of power unique to the action condition, bivariate correlations were performed between traits and the power exerted for utilitarian actions.[14] Correlations revealed a significant positive correlation between the power exerted when simulating a utilitarian action and primary psychopathy, ($r(18) = .51$, $p = .022$) and a significant negative correlation between utilitarian power and Honesty-Humility, ($r(18) = -.55$, $p = .013$). In order to determine whether these traits predicted the proportion of force endorsed by each participant, two univariate regressions were conducted. When the LSRP dimensions were entered as continuous predictors and power exerted as the outcome variable, primary psychopathy (LSRP dimension) was found to explain 26% of the variance in the model, ($R^2 = .260$, $F(1,18) = 6.33$, $p = .022$) predicting the power exerted when simulating a utilitarian response using the vBOT system ($\beta = .51$, $p = .022$) (see Figure 3.3). Honesty-Humility, was a significant negative predictor of power exerted ($\beta = -.55$, $p = .013$) when entered in an additional univariate regression with all HEXACO traits, explaining 30% of the variance in the model, ($R^2 = .298$, $F(1,18) = 7.65$, $p = .013$) (see Figure 3.4).[15]

[13] As in Chapter 2, separate linear regressions were performed for psychopathy dimensions and HEXACO dimensions.

[14] Given that power was not calculated for non-utilitarian actions. Bivariate correlations were performed between traits and force and speed variables for non-utilitarian actions. Analysis revealed no relationship between the speed or force for non-utilitarian actions (refusals to endorse harm) and any personality traits (*ps* > .070).

[15] In terms of the relationship between power exerted and moral responses, bivariate correlations revealed that the proportion of utilitarian responses was not correlated with the power exerted when simulating a utilitarian action ($p = .230$).

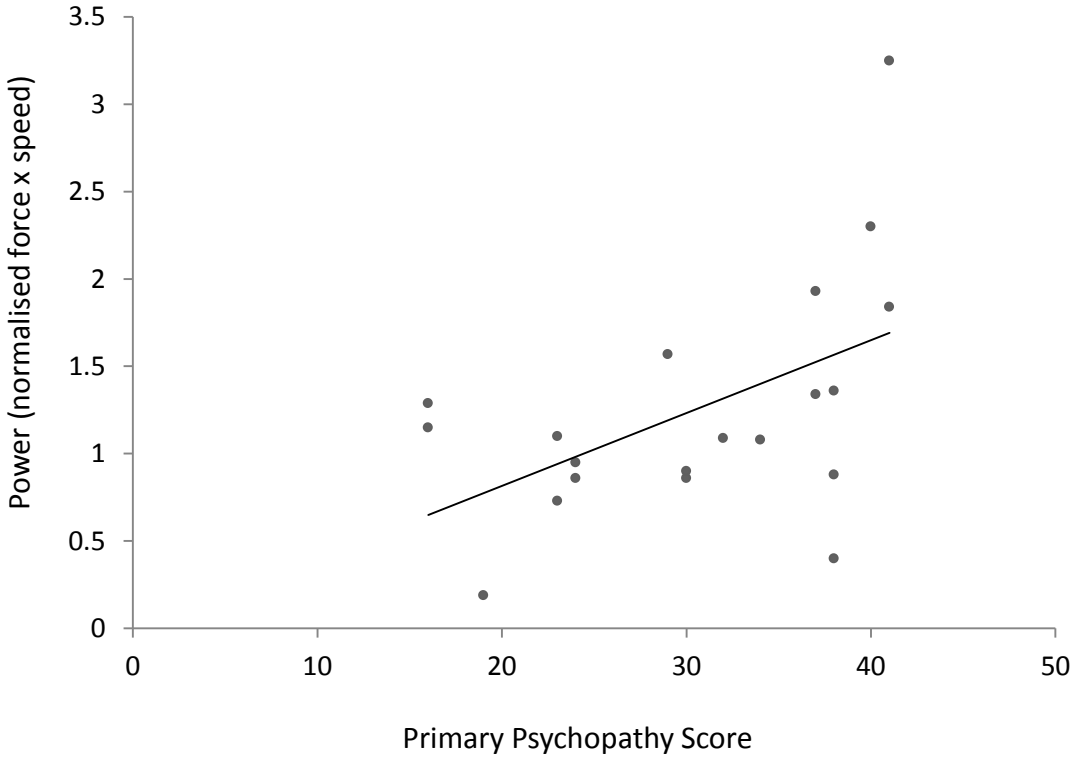


Figure 3.3. Primary psychopathy scores plotted against power exerted when simulating utilitarian actions with the vBOT. The power exerted when simulating a utilitarian action, was positively correlated with primary psychopathy score.[16]

[16] *Note.* The high reading at 3.25 power and low reading at 0.40 power were investigated following visual inspection. Power had a significant positive skewness of 1.35 ($p < .05$) and as such data were log-transformed (base 10) prior to outlier analysis. Following transformation, three outliers were identified using Tukey's interquartile range (IQR) method, including the points at 3.25 and 0.40 power. Prior to outlier removal, primary psychopathy was a significant predictor of transformed power, ($R^2 = .201$, $F(1,18) = 4.53$, $p = .047$) and the model fit improved following outlier removal, ($R^2 = .234$, $F(1,15) = 4.59$, $p = .049$) suggesting that the relationship between psychopathy and power was robust when controlling for potential confounds.

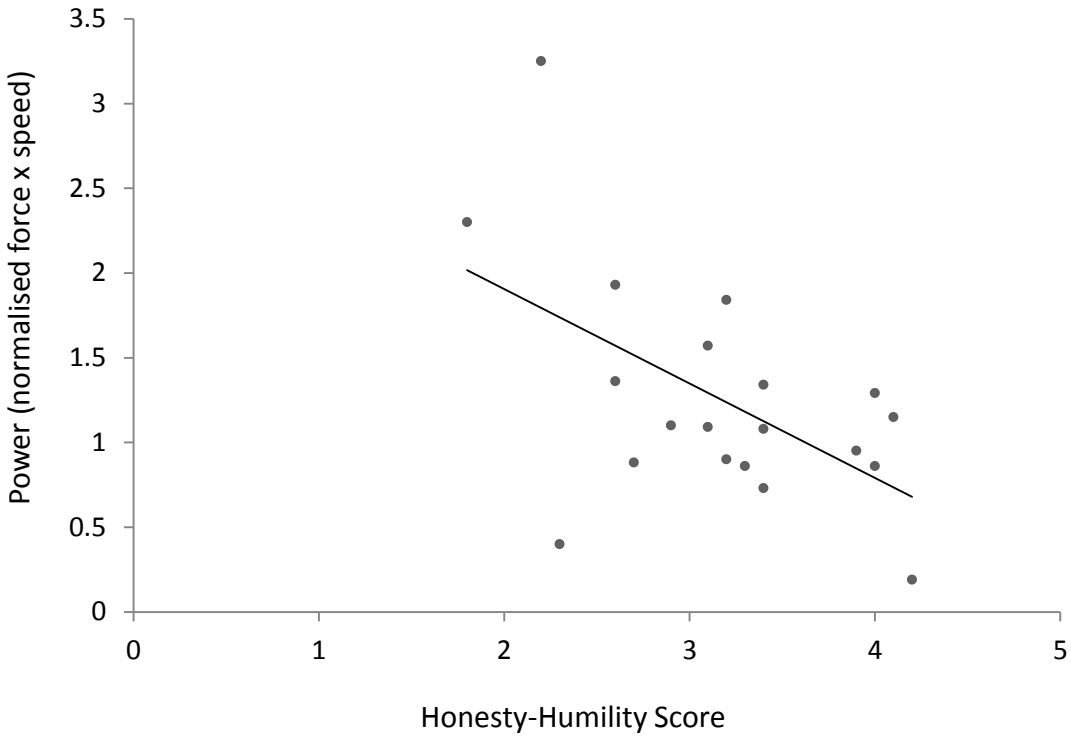


Figure 3.4. Honesty-Humility scores plotted against power exerted when simulating utilitarian actions with the vBOT. The power exerted when simulating a utilitarian action, was negatively correlated with Honesty-Humility score.[17]

[17] *Note.* The robustness of this relationship was examined in light of the high reading at 3.25 power and low reading at 0.40 power. Prior to outlier removal, Honesty-Humility was a significant predictor of transformed power, (R^2 = .210, $F(1,18) = 4.78$, p = .042) and the model fit improved following removal of three outliers, (R^2 = .280 , $F(1,15) = 5.92$, p = .028) suggesting that the relationship between Honesty-Humility and power was robust when controlling for potential confounds.

In order to control for the shared association between primary psychopathy and Honesty-Humility, principal component analysis (PCA) was used to combine primary psychopathy and Honesty-Humility ($r(38) = -.70$, $p < .001$) into one single factor using identical procedures to those adopted in Chapter 2. All criteria were met for PCA (see Statistical Note (3.1)) and "anti-social tendency" scores were extracted as before. In a further linear regression, with this new variable entered as a continuous predictor and power exerted as the outcome variable, anti-social tendency was found to explain 31% of the variance in the model, ($R^2 = .309$, $F(1,18) = 8.07$, $p = .011$) predicting the power exerted when simulating harmful actions (endorsing a utilitarian response) using the vBOT system ($\beta = .56$, $p = .011$).[18]

Summary and Discussion

Experiment 3 found that participants endorsed utilitarian responses when simulated action was required using the vBOT, but were less inclined to endorse the same responses when judgment was required in the same dilemmas. Previous gaming experience did not predict utilitarian endorsements when simulated action was required, suggesting that responses in the action condition were not comparable to detached responses that might be made in a gaming context. These findings replicate those of Chapter 2.

Additionally, whilst personality traits did not predict moral responses in either condition (as in Experiment 2 of Chapter 2 in this thesis), primary psychopathy was a significant predictor of the power exerted when simulating a utilitarian response in the action condition. Honesty-Humility was found to be a negative predictor of this power in the action condition only. Again, this contrasting relationship can be explained given

[18] The composite score (anti-social tendency) was not a significant predictor of utilitarian endorsements in the judgment condition to either question ($ps > .604$) or to utilitarian endorsements in the action condition simulated with the vBOT ($p = .096$).

that the Honesty-Humility facets, sincerity and fairness, negatively map on to primary psychopathic traits (e.g., Djeriouat & Tremoliere, 2014). Again, the composite factor extracted from these traits (anti-social tendency) also significantly predicted the power exerted when simulating a utilitarian action. Given that the power exerted when carrying out a utilitarian action, relates to anti- and pro-social traits, the measure of power collected here should correspond to individual differences. Hence, this measure of power should not correspond to the imagined force an individual thinks they may need to carry out a utilitarian action. In order to investigate this, in a follow-up study (see Appendix 3.2), I presented participants with personal force dilemmas and asked them to rate the physical force that they thought would be required to carry out the harmful action described in each of these moral dilemmas. There was no relationship between the physical force that participants imagined would be required to carry out an action and the power exerted in the present experiment. As such, the measure of force collected in Experiment 3 likely corresponds to individual differences rather than the imagined force thought necessary to carry out a particular action.

One limitation of the present experiment is the difference in framing of the text-based dilemmas between conditions. In the judgment condition, dilemmas were framed using the judgment question and action-choice questions. In the action condition however, the same dilemmas were framed using the phrase *"Are you going to [specific to scenario]* followed by *"Act now"*. Given that a significantly greater proportion of utilitarian endorsements in the action condition were observed, it could be argued that this was due to framing effects rather than the haptic feedback generated by the vBOT system. In order to explore this explanation further, I carried out a short follow-up study (see Appendix 3.3) presenting participants with personal force dilemmas. Having read a dilemma, participants were either presented with a judgment question, an action-choice

question, or the phrasing adopted in the present experiment (*Are you going to [specific to scenario]?"* followed by *"Act now"*). There were no significant differences between the proportion of utilitarian responses given, based on phrasing. This suggests that it was the influence of haptic feedback as opposed to framing effects that influenced moral actions in personal force dilemmas.

Further, whilst I included a VR device (vBOT system) in order to allow simulations of moral actions, I acknowledge the limitation of relying on text-based formulations of personal force dilemmas. In Chapter 2, I investigated the influence of visual contextual saliency on moral actions but in the present experiment, the impact of haptic feedback on moral responses was separated from the influence of visual immersion. Previous research examining simulated murder has predominantly incorporated life-like stimuli such as PVC arms (Cushman et al., 2012), while the present experiment incorporated text and an abstract response device (vBOT arm) which may "…lack salient properties reliably associated with victim distress" (Cushman et al., 2012, p. 5). Consequently, these may have failed to trigger the same affective responses, resulting in greater utilitarian endorsements (e.g., Greene et al., 2001). As such, future research might consider adopting an interdisciplinary approach to combine state-of-the-art VR technologies and life-like response devices to examine multisensory immersion on moral actions (Briazu, Francis, & Haines, 2015). Experiment 4 in this chapter aimed to do just that, incorporating haptic feedback and physical presence within a visually salient virtual moral dilemma.

Experiment 4

In order to examine the combined effects of visual immersion in state-of-the-art VR technologies and haptic feedback on simulated moral actions, Experiment 4 combined the visually immersive virtual *footbridge* dilemma (described in Chapter 2)

and an interactive sculpture mechanism designed to generate haptic feedback and the sensation of pushing the person off the bridge. This experiment is presented as a preliminary investigation of the incorporation of this novel sculpture within a virtual moral framework.

Method

Participants

Twenty-five participants comprising 13 females and 12 males (M_{age} = 33.80, *SD* = 13.51 years, age range: 19 - 64 years) were recruited from the public in Plymouth and the surrounding area of Devon and took part on a voluntary basis at a public engagement event at Plymouth University. Data were collected in a separate room divided from the main foyer of the event with the primary investigator and a research collaborator present. This research received ethical approval from the Plymouth University Ethics Committee.

Moral Action Measure

The virtual version of the *footbridge* dilemma (incorporated in Chapter 2) was also incorporated into the present experiment. All elements of the virtual dilemma were kept the same including the audio descriptions. In the original paradigm, a joystick device was used to respond in the dilemma but this was replaced in the present experiment. As part of a multidisciplinary project, the interactive sculpture was designed in the shape of a large person's back (see Figure 3.5). This response device had several key features designed to generate haptic feedback and create an immersive experience for participants:

(i) The body of the sculpture itself was created using expandable foam and finished with platinum grade silicon. When fabric was placed over this textured surface, the feeling of

the sculpture mirrored that of a real person. Heated wiring was also built in beneath the silicon coating to warm the sculpture, generating a life-like touch (see Figure 3.5).

(ii) Sections of rubber were added to the front of the sculpture ensuring that enough resistance would be generated if someone attempted to push the sculpture forward. These rubber sections would hit the surrounding frame of the sculpture if it was only pushed tentatively. If pushed hard enough, and with a more realistic force, the rubber sections would move past the frame causing the sculpture to fall.

(iii) Upon falling, the sculpture would trigger the joystick mechanism, resulting in the person in the virtual dilemma falling off the bridge. This established synchronisation between the physical sensation of pushing and seeing the person fall in VR.

Figure 3.5. The Interactive Sculpture Mechanism

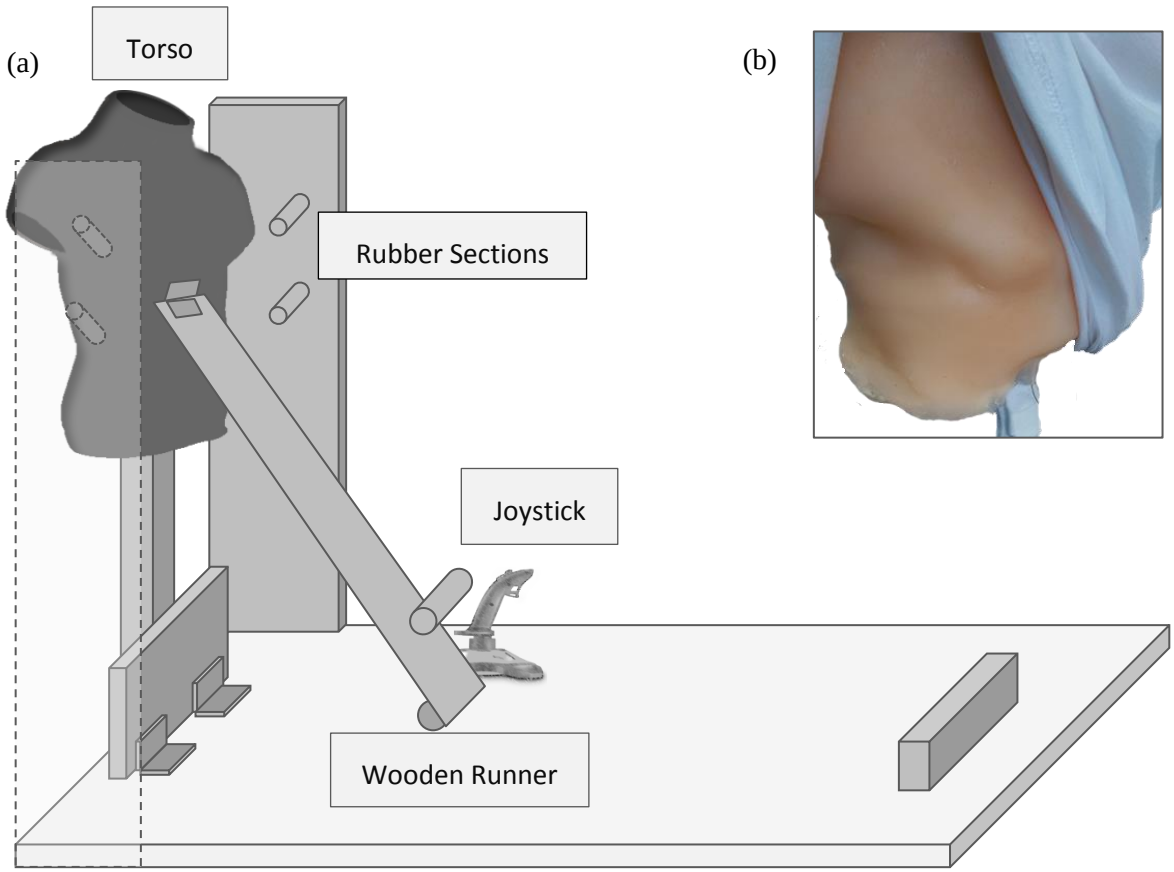


Figure 3.5. (a) The diagram shows the side-view of the interactive sculpture. The participant stood behind the back of the torso wearing the Oculus Rift. If they chose to endorse a utilitarian action, they would then apply pressure to the back of the torso with their own hand. Rubber sections on the outside of the sculpture would generate resistance when pushed and would spring forward to release the body of the sculpture if pushed hard enough. A wooden runner would then capture the weight of the body as it fell, pushing the joystick forward, subsequently triggering the virtual action of pushing in the VR headset. *(b)* Photograph displaying the silicon beneath the fabric covering the back of the torso. Heated wiring sits beneath this silicon layer generating a corporeal temperature.

Procedure

Participants were given the pre-questionnaire incorporated within Chapter 2 assessing previous gaming experience. Participants then entered a quiet room and were asked to place the Oculus Rift headset on and a pair of Sennheiser headphones. Subsequently, participants were guided forward into a separate room which held the interactive sculpture. This set-up was designed to ensure that participants did not see the sculpture in real-life. Based on the participant's height, they were placed at the correct distance from the sculpture in order to synchronise the sculpture location in real-life with the man's location in VR. Once the virtual dilemma had loaded, participants were verbally informed of the following; "You can interact with the person standing in front of you, by reaching out with your right arm". Upon hearing this information, participants would extend their right arm and make contact with the interactive sculpture familiarizing them with its location. No further information was given following this and participants continued to listen to the audio descriptions as the scenario played out in VR (as described in Chapter 2).

Results

Responses made using this novel setup (haptic-VR action condition) were compared to responses made in Experiment 2 (Chapter 2) in the original virtual moral dilemma (VR action condition) and text-based moral dilemma (judgment condition). Experiment 2 was deemed an adequate comparable sample having also been sampled from the public in Plymouth and the surrounding area with similar gender and age ratios.

Pre-Questionnaire Responses

Endorsing a utilitarian action using the interactive sculpture was not associated with previous gaming experience (*ps* > .163).

Moral Responses

Responses from the haptic-VR action condition (N = 25) from the present experiment were compared to responses from the VR action condition (N = 30) and judgment condition (N = 30) in Experiment 2 (Chapter 2). In the judgment condition, when asked if the action was morally acceptable, 10% of participants endorsed a utilitarian response (i.e. judged that they regarded pushing the person as morally acceptable). In the VR action condition, 63.3% of participants endorsed a utilitarian response (i.e. pushed the person off the bridge using the joystick). In the haptic-VR action condition in the present experiment, 56% of participants endorsed a utilitarian response (i.e. pushed the person off the bridge using the interactive sculpture). A chi-square analysis revealed a significant difference between these three conditions, ($\chi^2(2) = 20.18$, $p < .001$) .

Chi-square follow-up tests with Bonferroni corrections ($p < .016$) were performed to determine which conditions were significantly different. As reported in Experiment 2 (Chapter 2), utilitarian endorsements were significantly higher in the VR action condition compared to the judgment condition, ($\chi^2(1) = 18.37$, $p < .001$). Utilitarian endorsements were also significantly higher in the new haptic-VR action condition when compared to the judgment condition, ($\chi^2(1) = 13.51$, $p < .001$). The odds of participants endorsing a utilitarian response were 11.55 times higher in the VR-haptic condition than in the judgment condition. There was no significant difference between moral actions in the VR action condition from Experiment 2 (Chapter 2) and moral actions in the new haptic-VR action condition ($p = .580$). When asked if they would perform the action (action-choice question) in the judgment condition, the same responses were observed with 10% of participants endorsing a utilitarian response in the text-based *footbridge* dilemma, compared to the 63.3% who endorsed the action in the

VR action condition, ($\chi^2(1) = 18.37$, $p < .001$) and the 56% of participants who endorsed the action in the new haptic-VR action condition, ($\chi^2(1) = 13.51$, $p < .001$) (see Figure 3.6).

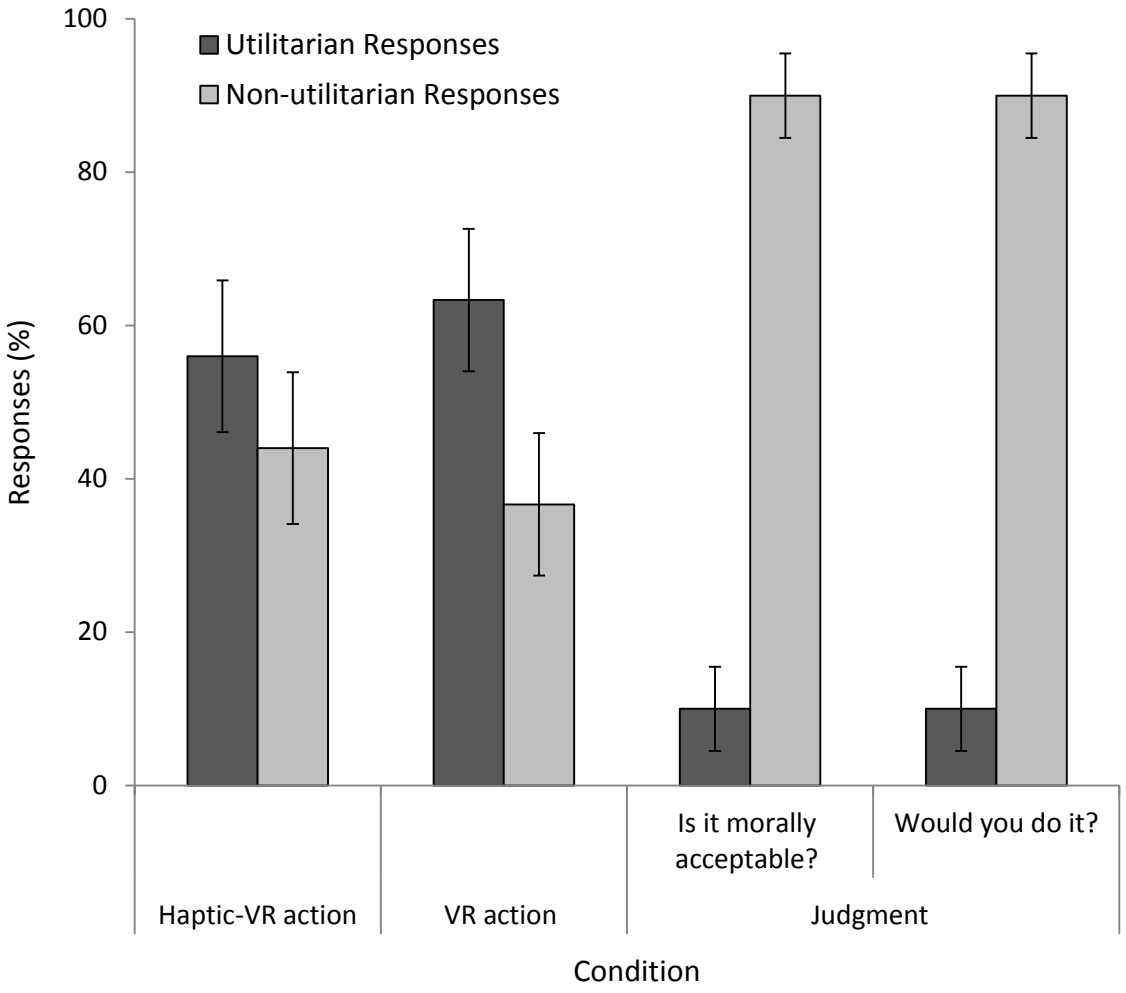


Figure 3.6. Responses (%) in the haptic-VR action condition from the present experiment and VR action and judgment responses from Experiment 2 (Chapter 2). In the judgment condition, participants were asked whether the action was morally acceptable and whether they would do it. A greater number of utilitarian actions were simulated in both the haptic-VR action and VR action conditions. Error bars represent +- 1 SE_p.

Summary and Discussion

The results presented in this experiment suggest that combining the visual aspects of VR with multisensory and life-like haptic feedback, continues to promote greater utilitarian endorsements in an emotionally arousing personal dilemma when simulated action is required. As such, the greater utilitarian actions observed in Experiment 3 were not likely due to the abstract nature of the text-based dilemmas combined with the contrived, or less realistic, robotic response device; responses remain the same when controlling for visual saliency and life-like stimuli.

General Discussion

Overall and in line with findings from Chapter 2, in the present experiments participants respond differently in text-based moral dilemmas requiring judgment compared to VR dilemmas that require simulated actions. In Experiment 3, participants who simulated actions and received haptic feedback using the vBOT system, endorsed greater utilitarian responses compared to those who responded to judgment and action-choice questions for the same moral dilemmas. In Experiment 4**,** when including visual saliency and providing a more life-like response device, participants continued to endorse greater utilitarian responses when simulated action was required compared to those who responded to judgment and action-choice questions in a text-based counterpart.

Given the findings of Greene et al. (2009), it was predicted that simulations of personal force in actions might lead to a decrease in utilitarian endorsements as these responses would require suppression of an affective response (Greene et al., 2001). This directly maps onto theories regarding the simulated motor plan hypothesis as individuals imagine themselves carrying out a harmful action and are faced with an

immediate emotional aversion to the harmful act (Cushman & Greene, 2012). This evidence combined, fails to explain the present findings. In this case, the physical simulation of a moral action resulted in an increase in utilitarian endorsements.

The results of the present chapter appear to fall in line with an alternative hypothesis. In previous research in this thesis (see Chapter 2), I argued that greater contextual information in the form of visual saliency, may have resulted in greater negative emphasis being placed on witnessing victims die than on performing a harmful action itself (Patil et al., 2014). From an embodied perspective, I have also extended these theories arguing that perceiving the concrete consequences of actions in contextually salient VR, may have made people feel more involved in the action when compared to facing an abstract text-based dilemma. This subsequently results in greater utilitarian endorsements when action is required in VR. While the application of these theories in previous research (Patil et al., 2014) and in this thesis (see Chapter 2) have rested on the assumption that individuals can "see" new motivational forces in virtual moral dilemmas, the present findings suggest that these theories may extend beyond visual features of VR to the physical features of VR. In Experiment 3 specifically, incorporating haptic feedback resulted in greater utilitarian actions, despite the absence of visual features. This suggests that increasing contextual saliency (FeldmanHall et al., 2012), whether visual or physical, may result in greater value assignment to outcomes, whether driven by reinforcement learning mechanisms (Cushman, 2013; Patil et al., 2014) or embodied states. This explanation is somewhat tentative given the novelty of these virtual paradigms. As such, and when technological advancements allow it, future virtual research should consider investigating the incorporation of varying degrees of physical contextual information, exploring subsequent effects on simulated moral actions.

Previous research examining simulated harmful actions has incorporated realistic or life-like stimuli such as PVC limbs (Cushman et al., 2012). Arguably, a criticism of the incorporation of the vBOT system in Experiment 3 is that participants were still responding to a text-based moral dilemma with an abstract response device, making it less aversive and incomparable to previous studies investigating personal force. However, in Experiment 4, utilising a life-like body as an interactive device and replacing text-based descriptions with a visual simulation, resulted in the utilitarian preference remaining when action was required. In the original simulating murder paradigm, Cushman et al. (2012) investigated simulated harmful actions in the absence of a moral outcome, while the present research utilised moral consequences. While Cushman et al. (2012) found an aversion to performing harmful actions, the present research found greater endorsement of harmful actions, suggesting that the inclusion of the one-for-many trade-off has a considerable influence on decision-making, despite harmful actions being involved.

Power

Whilst anti-social and pro-social personality traits did not predict endorsements of utilitarian responses in either the judgment condition or the action condition, primary psychopathy was found to predict the power exerted when simulating utilitarian responses in the action condition. Honesty-Humility, a pro-social trait negatively associated with the Dark Triad, negatively predicted this power. Further, a composite factor (anti-social tendency) extracted from these highly associated traits, predicted the power exerted when simulating a utilitarian action. In previous research in this thesis, findings regarding the relationship between these traits and moral actions have been mixed (see Chapter 2). Perhaps the novel measure of power introduced in Experiment 3, may provide a more sensitive measure of the influence of these trait profiles in moral

action frameworks, beyond that of moral responses. These results contribute to the line of research examining disparity between moral judgment versus action in individuals possessing anti-social traits (e.g., Tassy, Deruelle, et al., 2013).

Alternative Interpretations

Whilst these perspectives might offer a convincing interpretation of this chapter's findings, there are alternative explanations that need addressing.

Firstly, the theory that the increase in utilitarian endorsements observed here could be a result of gaming-related behaviours is not supported in the current research. As in Chapter 2, simulated moral actions were not predicted by previous game-related experiences in either Experiment 3 or 4. Additionally, research in this thesis assessed gaming affordance effects and found that the incorporation of joystick devices did not influence moral responses (see Appendix 2.3) and therefore it is unlikely that the vBOT arm itself in Experiment 3 or the interactive sculpture in Experiment 4, influenced subsequent moral actions.

Secondly, it is also important to note that differences existed between the judgment and action conditions in Experiment 3, in terms of the framing of the judgment-based or action-based instructions. Specifically, in the action condition, when responding to dilemmas using the vBOT system, participants were presented with the phrase *"Are you going to [specific to scenario]?"* prior to responding, whereas participants in the judgment condition were presented with the judgment and action-choice questions. It could therefore be argued that the greater utilitarian endorsement in the action condition was a result of coercion generated by framing effects. However, results from a follow-up study failed to support the presence of framing effects. Therefore, it is unlikely that the increased utilitarian endorsements in the action

condition in Experiment 3 were generated by coercive framing effects. Further, findings in Experiment 4 demonstrated that preference for utilitarian action remained when haptic feedback was given via an interactive sculpture and any possible text-based framing effects were removed altogether.

Methodological Considerations

Given that moral actions simulated using the interactive sculpture and VR paradigm in Experiment 4 were collected during a public engagement event, I was unable to assess personality traits. As such, future research should investigate moral actions simulated using these multidisciplinary approaches in lab-based settings in which personality traits can also be assessed. Further, given that Experiment 4 was a preliminary investigation of this multisensory paradigm, I was unable to incorporate a measure of power with which participants interacted with the sculpture as was possible in Experiment 3 with the vBOT system. However, with further development, pressure sensors could be incorporated within the interactive sculpture indicating where and with how much pressure, participants interacted with the sculpture when choosing to carry out a harmful action.

Despite the present shortcomings, the novel approaches to the investigation of moral actions presented in this chapter, could offer insights beyond that of moral responses. For example, with regards to the study of morality of harm specifically, researchers can now begin to investigate not only whether a moral action was endorsed but how hard that action was simulated.

CHAPTER 4: EMOTIONAL PROCESSES IN MORAL ACTION AND JUDGMENT

Introduction

In Chapters 2 and 3 of this thesis, I have presented research demonstrating that simulated moral actions in VR paradigms contradict theoretical moral judgments. Utilitarian endorsements are significantly greater when action is required in personal virtual dilemmas (see Chapter 2; Chapter 3) with arousal being highest in virtual dilemmas (see Chapter 2). These results are in contrast to Greene's dual-process model, which argues that personal moral dilemmas trigger immediate emotional responses, subsequently resulting in a greater proportion of non-utilitarian responses (Greene et al., 2001). One explanation for these findings can arise after adapting existing theories to account for contextual differences in VR (FeldmanHall et al., 2012; Patil et al., 2014); both visual features (see Chapter 2) and physical features (see Chapter 3) in VR may have formed new motivational forces for action; through altering reinforcement learning mechanisms (Cushman, 2013) and/or embodied states.

In this thesis, I have also presented evidence that pro- and anti-social traits (associated with psychopathy and subsequent diminished empathy and harm aversion), predict actions (see Chapter 2) and predict the power with which actions are simulated in VR (see Chapter 3). However, they are not associated with theoretical moral judgments (see Chapter 2 and 3). This supports previous theories regarding the differences in processing involved in action and judgment; with actions eliciting self-referent processing and judgments prompting evaluations from an allocentric perspective (e.g., Tassy, Deruelle, et al., 2013). However, these findings have been inconsistent (see Experiment 2 Chapter 2) and require further investigation.

As such, and to further the investigation of the role of emotional processes underlying psychopathic and associated traits in moral judgment versus moral action, in this experiment, I adopted behavioural assessments of empathy and harm aversion and introduced a psychopharmacological manipulation of social functioning.

Deliberation and Empathy

As outlined previously in this thesis, there is a strong body of research indicating that deliberative reasoning results in greater utilitarian moral judgments originating from Greene's dual-process model of moral judgment (Greene et al., 2001) (see Chapter 1). However, the proposed link between utilitarian response and increased reasoning has been challenged (e.g., Kahane et al., 2015) with research suggesting that increased utilitarian preference may derive from a decreased aversion to harming others as a result of deficits in social processing (Patil, 2015). For example, research suggests that the increased apparent "utilitarianism" found in psychopathic populations results from deficits in affective empathy (Bartels & Pizarro, 2011; Djeriouat & Tremoliere, 2014; Gao & Tang, 2013). As mentioned previously, support for this association can also be found in pharmacological studies; Citalopram (a drug that enhances serotonin and subsequent pro-social behaviour) actually enhanced non-utilitarian moral responses (Crockett et al., 2010), while increased levels of testosterone (Carney et al., 2010) and increased levels of anger (e.g., Choe & Min, 2011) have been associated with increased utilitarian responses.

Alcohol and Moral Judgments

One way in which research has sought to investigate the relationship between social and cognitive functioning in moral decision-making, is to study populations in which affective empathy and higher-order cognitive abilities are impaired. For example,

previous research has examined individuals with deficits in emotional processing either as a result of brain lesions (e.g., Ciaramelli et al., 2007), neurological disorders (e.g., Mendez et al., 2005) or alcohol and drug dependence (Martina Carmona-Perera, Clark, Young, Perez-Garcia, & Verdejo-Garcia, 2014; M. Carmona-Perera, Reyes Del Paso, Perez-Garcia, & Verdejo-Garcia, 2013; Khemiri, Guterstam, Franck, & Jayaram-Lindstrom, 2012).

To date, there have been few investigations of the acute effects of alcohol on moral judgments made in response to hypothetical moral dilemmas. A recent investigation, carried out by Duke and Begue (2015), examined the acute effects of blood alcohol concentration (BAC) levels on moral decision-making in participants recruited at bars in France. Across two studies, they found that BAC levels were positively correlated with utilitarian preferences in response to the footbridge dilemma. This effect was not mediated by self-reported feelings of behavioural disinhibition or self-reported positive mood.

The finding that acute alcohol consumption promotes utilitarian moral judgments in response to personal moral dilemmas supports previous research examining moral decision-making in alcohol-dependent individuals (Martina Carmona-Perera et al., 2014; Khemiri et al., 2012). These studies have found that prolonged effects of alcohol dependence result in greater utilitarian moral judgments as a result of affective processing deficits. Crucially, these findings are in contention with Greene's dual process model which would argue that alcohol intoxication triggers emotional reactivity and impaired higher order functioning, which in turn prompts increased non-utilitarian moral judgments (Greene et al., 2001). Duke and Begue (2015) argue that their finding instead, implicates a strong role for impaired social cognition in predicting utilitarian preferences. Alcohol intoxication results in a "…decreased capacity for

empathy" or more specifically, decreased aversion to harming others which subsequently promotes the utilitarian option (Duke & Begue, 2015, p. 125). The psychopharmacological effects of alcohol consumption are not reviewed in length here as alcohol has several mechanisms of action on the central nervous system (Carlson, 2010); alcohol produces a complex effect that is mediated by distinct receptor systems that are not evenly amplified with ethanol dosage (Stoleman, 2010). For example, alcohol facilitates GABA transmission, inhibits glutamatergic transmission, and increases serotonin transmission, among other effects (Stoleman, 2010). Each of these prompts and mediates various anxiolytic, sedative, stimulant, and reinforcing effects (Carlson, 2010). From a broader perspective, the theory that alcohol intoxication produces utilitarian responses as a result of impaired empathic processing, is consistent with the connection between utilitarianism and certain deficits in social functioning as a result of brain damage (e.g., Koenigs et al., 2007) and psychopathic traits (e.g., Patil, 2015).

While Duke and Begue (2015) theorise the relevance of alcohol-induced deficits in empathic processing and utilitarian moral decision-making, very few studies have investigated empathic processing in alcohol-dependent individuals specifically (P. Thoma, Friedmann, & Suchan, 2013). Of the few studies examining empathic processing in alcohol-dependent individuals, some argue that impairments in premorbid trait empathy compromise social functioning, leading to more social problems, which could then predispose individuals to use alcohol as a coping strategy (P. Thoma et al., 2013). However, the specific effects of acute alcohol intake on affective empathic processing have yet to be investigated and this is particularly important following suggestions that it is this, which mediates the relationship between alcohol consumption and utilitarian moral decision-making (Duke & Begue, 2015).

Further, whilst the research by Duke and Begue (2015) may have shed further light on the role of social deficits on utilitarian moral judgments, research has yet to investigate similar manipulations within the domain of moral action. This is significant given the findings presented in this thesis, demonstrating the disparity between moral judgments and moral actions. Further, with previous research in moral psychology revealing an association between moral action and personality traits associated with empathy decline and harm aversion (e.g., Tassy, Deruelle, et al., 2013), exploring the effects of a diminished capacity to process social cues seems highly relevant in the domain of moral action.

Addressing Limitations

The quasi-experimental setup adopted in the research carried out by Duke and Begue (2015), raises questions regarding the influence of social atmosphere, potential social awareness, and uncontrolled alcohol dosages on moral decision-making. The present experiment addressed these limitations through a laboratory-controlled adapted replication, examining the effects of low and moderate dosages of alcohol consumption on both moral judgments and moral actions.

The present experiment was also adapted in response to methodological considerations previously raised in this thesis. Firstly, regarding concerns that individuals were coerced into endorsing a utilitarian action (pushing the person off the footbridge) (see Chapter 2), in the present experiment, I asked participants whether they did indeed feel coerced into carrying out actions in VR. Secondly and regarding the limitations of incorporating a between-subjects design (as in Chapter 2; Chapter 3), a within-subjects design was incorporated into the present experiment, allowing comparison between moral actions and moral judgments made by the same individual. Additionally, whilst this thesis has identified relationships between moral actions and

certain personality traits, these findings require further investigation. As such, in the present experiment, I incorporated behavioural assessments of empathy and harm aversion as well as physiological assessments of these traits in an attempt to shed light on the relationship between these traits and moral decision-making, beyond that of questionnaire assessments.

Specific Hypotheses

Behavioural Empathy

In previous research, self-reported valence towards facial displays of emotion has been used as a measure of affective empathy (Wai & Tiliopoulos, 2012). Self-reported valence towards happy faces was negatively predicted by psychopathy, with valence towards sad faces showing the inverse effect (Ali, Amorim, & Chamorro-Premuzic, 2009; Wai & Tiliopoulos, 2012). If behavioural assessments of affective empathy provide a valid measure of empathic traits, performance in them is expected to correlate with existing trait assessments of primary psychopathy and associated traits, as in previous research (Wai & Tiliopoulos, 2012).

As an additional measure, previous research has adopted empathy for pain tasks as a means of assessing affective responses to the pain of others (Decety & Jackson, 2004; Jackson, Meltzoff, & Decety, 2005). If these provide a valid assessment of empathy for pain, reduced empathy for harm might be observed in individuals scoring higher in psychopathy and associated traits based on previous research (Bartels & Pizarro, 2011; Patil, 2015).

The second purpose of incorporating these behavioural empathy tasks was to provide a baseline with which to compare performances in post-intervention empathy tasks following alcohol consumption. If acute alcohol intake does affect social

processing, by reducing the capacity for empathy and decreasing harm aversion, then alcohol consumption is expected to reduce performance in these behavioural empathy tasks. Self-reported valence towards happy and sad faces and self-reported empathy towards painful images may be reduced as a result of impaired social processing and emotional blunting (Duke & Begue, 2015). For facial displays of emotion specifically, self-reported valences following alcohol consumption may mirror the inappropriate responses given by individuals scoring high in psychopathy (Wai & Tiliopoulos, 2012).[19]

Physiological measures in these behavioural empathy tasks should support behavioural findings. If pupil diameter changes reflect affective processing (Bradley, Miccoli, Escrig, & Lang, 2008; Partala & Surakka, 2003), then reduced pupil diameter variation towards painful images and facial displays of emotion in post-intervention tests following alcohol consumption are expected.

Moral Responses

If existing research examining acute effects of alcohol (Duke & Begue, 2015) and alcohol dependence (Martina Carmona-Perera et al., 2014) on moral judgments in personal moral dilemmas is supported, increased utilitarian preferences may be observed. If this relationship is mediated by deficits in social processing and reduced aversion to harm, performance in behavioural empathy tasks should mediate this relationship.

[19] There has been evidence supporting gender differences in subjective ratings of facial displays of emotion (e.g., Lang, Greenwald, Bradley, & Hamm, 1993; Montagne, Kessels, Frigerio, de Haan, & Perrett, 2005) and neural mechanisms underlying the processing of the pain of others (e.g., Han, Fan, & Mao, 2008). However, these findings have been mixed with research arguing that subjective reports are often "contaminated by…a bias to confirm the sex-role stereotypes" (Han et al., 2008, p. 86). For results regarding facial tasks and pain tasks, I report (in footnotes) follow-up analyses examining potential gender effects given the ambiguity of findings in previous research.

If, on the other hand, existing dual-process models of moral judgment can be supported, then alcohol consumption might lead to increased preference for non-utilitarian moral judgments as a result of increased emotional reactivity and decreased cognitive functioning (Greene et al., 2001).

Predictions regarding moral actions are less certain. Given previous research demonstrating the link between utilitarian moral actions and traits associated with empathy decline and less aversion to harm (e.g., Patil, 2015), alcohol intoxication might result in greater utilitarian actions if empathic processing is diminished in behavioural empathy tasks. However, the latter hypothesis supporting Greene's dual process model may also stand if existing models apply to the domain of moral action (Navarrete et al., 2012).

Experiment 5

Method

Participants

Fifty participants comprising 33 females and 17 males (M_{age} = 21.60, *SD* = 4.65 years, age range: 18 - 42 years) were recruited from the Plymouth University, School of Psychology, participant pool and participated for course credit. All participants had normal or corrected-to-normal vision. The majority of participants were right-handed (84.1%). Two participants were excluded from the experiment; one having failed to see clearly in the non-moral virtual task as a result of vision problems and one having failed to complete the non-moral virtual task due to lack of understanding. As such, 48 participants comprising 31 females and 17 males (M_{age} = 21.44, *SD* = 4.63 years, age range: 18 - 42 years) formed the final sample. This research received ethical approval from the Plymouth University Ethics Committee.

Personality Measures

Participants were asked to fill out the electronic questionnaire incorporated in Chapter 2, comprising the LSRP (αs = .72 - .84), the HEXACO-IP-R (αs = .66 - .79)[20], and the IRI (αs = .72 - .84). In the present study, an additional measure of moral identity was also included as individuals with psychopathic traits often demonstrate a reduced sense of moral identity (Glenn, Koleva, Iyer, Graham, & Ditto, 2010).

The *Self-Importance of Moral Identity Scale* (Aquino & Reed, 2002) provides a measure of moral identity. It contains two subscales that assess symbolization (i.e., public dimension of moral identity) (5 items; α = .69) and internalization (i.e., private dimension of moral identity) (5 items; α = .87). The inventory contains 10 items with responses given on a 5-point Likert scale (from A = *Does not describe me well* to E = *Describes me very well*). The scale contains items such as "*It would make me feel good to be a person who has these characteristics*". In the present experiment, personality traits were assessed in order to investigate their relationship with behavioural empathy measures, subsequently allowing validation of these behavioural approaches (Wai & Tiliopoulos, 2012).

Behavioural Empathy Measures

In the present experiment, additional behavioural measures of affective and cognitive empathy were included. These were completed pre- and post-intervention:

Facial task. The s*elf-assessment manikin (SAM)* (Bradley & Lang, 1994) assesses an individual's response to emotional stimuli rather than relying on self-report

[20] The HEXACO scale was minimised to the Honesty-Humility and Agreeableness facets given their overlapping association (Ashton & Lee, 2005) and relevance to reciprocal altruism (Ashton, Lee, & de Vries, 2014). Agreeableness was also significant to the present investigation given its inverse association with anger and aggression (Ashton & Lee, 2007); states also associated with alcohol consumption (Giancola, 2004).

questionnaires, in an attempt to assess affective empathy. Adopting a procedure similar to that of previous research (Wai & Tiliopoulos, 2012) images depicting specific facial expressions (happy, sad, and neutral) were presented to participants. These images were sampled from the Montreal Set of Facial Displays of Emotion (MSFDE) (Beaupré, Cheung, & Hess, 2000) and comprised eight images per emotion, gender-balanced and comprising only Caucasian faces. All images were presented in the same size and in greyscale. Following presentation, participants were asked to indicate how they felt towards the face on the SAM valence scale (1 (negative) – 9 (positive)) (see Appendix 4.1). In the pre-intervention task, four images of each emotion were presented to participants with the remaining 50% of images presented during the post-intervention task to prevent carryover effects.

Pain task. The e*mpathy for pain* paradigm included in the present experiment has been adopted in previous research as a means of assessing affective responses when perceiving the pain of others (Jackson et al., 2005) and has been argued to be a way in which to address the processes involved in empathy (Decety & Jackson, 2004). Adopting procedures from previous research (e.g., Jackson et al., 2005), images of hands and feet in painful and neutral conditions were presented to individuals. Following this, participants were asked to indicate on a Visual Analogue Scale (VAS) (0 (no pain) - 10 (worse pain ever)) the intensity of pain they thought the person in the image would feel in that situation (see Appendix 4.2). Our image group, sampled from an existing set (Jackson et al., 2005), comprised 18 painful images of familiar events and 18 neutral counterparts of the same events taken at "…angles that promoted first-person perspective" (Jackson et al., 2005, p. 772). The types of pain included in these images were mechanical, thermal, and pressure-related with individuals in the images varying in both gender and age. All images were displayed in the same size. In the pre-

intervention task, nine of the neutral and nine of the painful images were presented to participants with the remaining images presented during the post-intervention task to prevent carryover effects.

The presentation of facial displays of emotion and pain image blocks were counterbalanced across participants in both the pre-intervention and post-intervention completion of the tasks. No image was displayed more than once throughout the whole experiment.

Moral Decision-Making Measures

In all conditions, participants completed a moral action and a moral judgment task. For the moral action task, participants completed the same non-moral virtual task and moral virtual task as described in Chapter 2.

For the judgment task, participants were given the text-based non-moral task from Chapter 2. Given that participants completed both the moral action and moral judgment tasks, I could not present the footbridge dilemma in both tasks as a result of carryover effects (e.g., Bartels et al., 2015). As such, in the text-based moral task, participants were given a vignette describing a validated comparable dilemma (see Appendix 4.3 for validation studies) as opposed to the *footbridge* dilemma. This was embedded in nine additional distractor dilemmas (Greene et al., 2001). In total, five of these dilemmas were classified as personal and four as impersonal and were selected from those originally used in Greene et al. (2001) and from those incorporated in Chapter 2 and Chapter 3 of this thesis.

All dilemmas were presented electronically in a random order. As in Chapter 2, after each dilemma, participants were asked a judgment question ("*Is it morally acceptable to [specific to the scenario]*?"). After a response was given, a second action-

choice question was displayed asking ("*Would you do it?*"). Participants responded by selecting "Yes" (Y- key) or "No" (N - key).

Physiological Measures

Alcohol. In order to assess and monitor the effects of alcohol in the low and high alcohol conditions, estimated blood alcohol levels (% BAC) were taken at specific intervals during the experiment from each participant's breath air, using a portable breathalyser device (AlcoSense Pro Breathalyser and Alcohol Tester) utilised by UK police forces. The breathalyser measures the concentration of alcohol vapour in a single breath.

Behavioural empathy tasks. Whilst participants viewed both facial expressions and pain images, additional data in the form of pupillary diameters were collected as a physiological measure of affective responses (Partala & Surakka, 2003). Pupillary size was collected by monitoring each participant's left eye during stimulus presentation (The Eye Tribe). The sampling rate of the system was 30Hz with the Eye Tribe running on a PC computer.

Moral decision-making tasks. Heart rate was recorded using the equipment and procedure described in Chapter 2 of this thesis. As in Chapter 2, heart rate sampling was completed with the primary aims of assessing whether arousal was modality or moral specific and in this experiment specifically, whether blood alcohol level affected physiological arousal in response to moral scenarios.

Procedure

Prior to arriving at the experiment, participants were reminded to refrain from drinking alcoholic beverages within 12 hours of the experiment beginning.

Pre-intervention. All conditions first completed the personality trait assessments and pre-questionnaire electronically (see Chapter 2) along with a subjective mood visual analogue scale (100mm long) assessing disinhibition and positive affect (Duke & Begue, 2015) (see Appendix 4.4). Participants then completed the behavioural empathy task. Participants were seated 50cm away from a PC and were asked to keep their heads as still as possible. Lighting conditions within the lab were kept constant across participants using blackout adjustable blinds. Participants first completed an eye-tracking calibration that involved looking at various fixation points across the computer screen. Following this, a resting slide appeared on-screen and participants were instructed to look at the fixation cross at the centre of the screen. Sixty seconds from the onset of the resting slide, the first stimulus appeared. Following an existing procedure (Partala & Surakka, 2003), each image stimulus was presented for six seconds. After image offset, the relevant scale was presented for eight seconds to be completed by participants (SAM valence scale for facial displays of emotion or VAS for pain images). Participants used the computer mouse with their right hand to select a rating along the given scale. Following scale offset, a blank slide with a fixation cross would be displayed for a randomised interval of 10-15s before the next image stimulus was delivered to prevent anticipation of stimuli (see Figure 4.1)**.** Following completion of the pre-intervention behavioural empathy task, participants were given an additional questionnaire to complete which assessed their alcohol consumption (units per week) and their current weight (kg) (see Appendix 4.5).[21] Participants were then randomly allocated to one of the three conditions (placebo; low alcohol; high alcohol) and an estimate baseline BAC was taken (participants were asked to blow into a sterile tube attached to the portable breathalysing device).

[21] This questionnaire also assessed exclusion criteria for the present experiment including alcohol naivety, alcohol dependence (including that of family members) and current medication use. These criteria had been outlined to participants prior to signing up to the experiment but were also included during the experiment as a precautionary measure.

Figure 4.1. Diagram of Behavioural Empathy Task Procedure

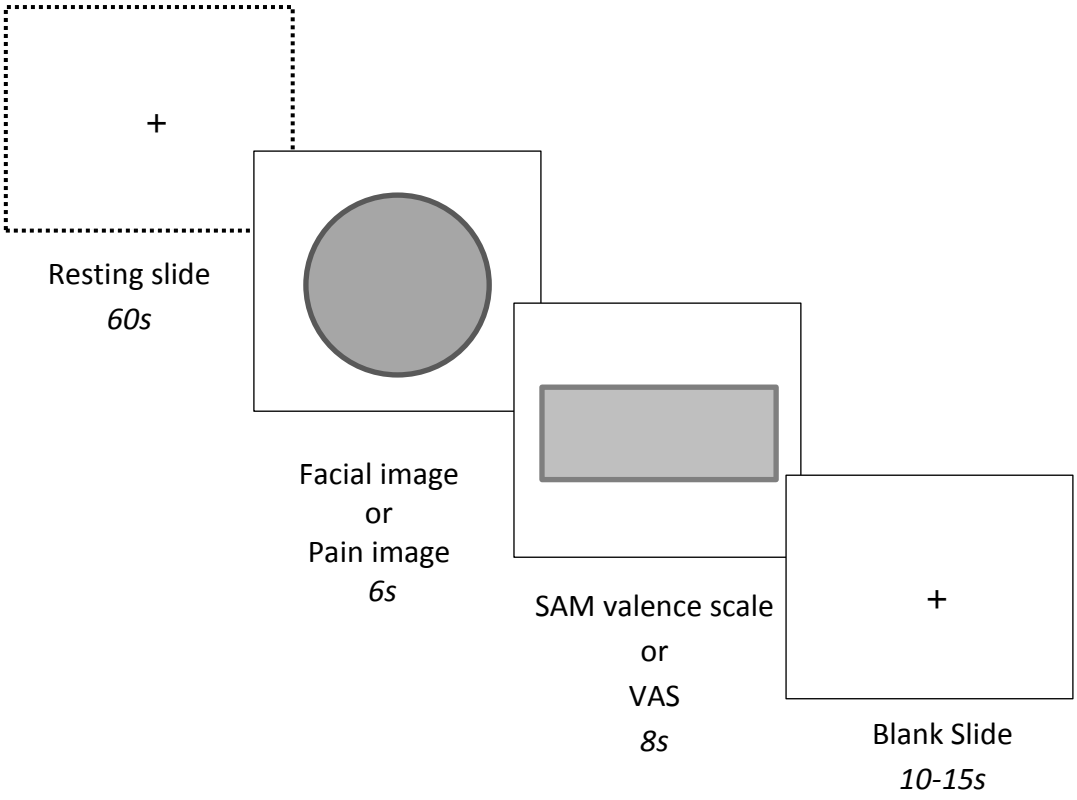


Figure 4.1. Diagram of experimental procedure in behavioural empathy tasks for facial and pain tasks. The same procedure was adopted in both the pre-intervention and post-intervention behavioural empathy tasks.

Intervention. In an attempt to reach target BAC levels predefined in existing research and subsequently shown to affect moral decision-making (0.04%) (Duke & Begue, 2015), the low alcohol condition received a dose of 0.40g/kg vodka (37.5% alcohol by volume) and the high alcohol condition received 0.80g/kg vodka (37.5% alcohol by volume). All alcoholic drinks were mixed with two-parts lemonade and were flavoured with fresh lime juice. Participants in the placebo condition were given lemonade flavoured with lime and alcohol was sprayed around the edge of the glass in order to provide an alcohol odour, ensuring that condition assignment was unknown. Given the influence of alcohol expectancy on social behaviours (e.g., Assefi & Garry, 2003), additional alcohol cues such as floating a small amount of alcohol on top of each placebo glass (e.g., Roberts, Fillmore, & Milich, 2012), were not adopted here. The aim of this manipulation was to ensure that condition assignment was unknown and not to deceive placebo participants into accepting that they had consumed alcohol. In all conditions, participants were given ten minutes to consume the beverage. In order to control for awareness of condition assignment, an awareness check was performed (see Appendix 4.6) asking participants whether they knew which condition they had been assignment to and if so, how they knew. A waiting period of 20 minutes followed in order for alcohol to be absorbed into the blood and to reach a predefined optimal level.[22] Following this, a second BAC reading was taken (estimated peak BAC).

Post-intervention. All participants completed a second subjective mood assessment of disinhibition and positive affect, followed by the moral action and judgment tasks. The order of the moral tasks was counterbalanced. Having completed the virtual moral task, participants completed the post-questionnaire (see Chapter 2). Further, as an addition to this post-questionnaire, participants were also asked "Did you

[22] Peak BAC was estimated using previous research (Mitchell, Teigen, & Ramchandani, 2014) and initial pilot testing; participants (N = 7, M_{age} = 27.72, 3 females, 4 males) who consumed alcohol at low and high dosage reached peak BAC between approximately 20 – 40 minutes.

feel coerced into carrying out these actions in Virtual Reality?" and could response with "Yes" or "No" addressing previous concerns regarding utilitarian actions and coercion (Chapter 2). Participants then completed the post-intervention behavioural empathy task using a procedure identical to that of the pre-intervention behavioural empathy task. Following completion of this task, a final estimate BAC reading was taken. Participants were invited to leave the experiment after their BAC level had returned to a predetermined limit (< 0.01%).

Results

Order Effects

Across groups, no order effects were found based on task presentation when referencing the judgment question (p = .437) or action-choice question (p = .775).

Pre-Questionnaire Responses

Additionally, as in previous chapters (see Chapter 2; Chapter 3), endorsing a utilitarian outcome in the moral action task (pushing the person in VR) was not associated with prior gaming experience (ps > .381).

Control Variables and Checks

BAC level. In order to determine if the low and high alcohol interventions had increased BAC levels, a comparison between peak BAC levels (20 minutes after alcohol consumption) was first completed. Average peak BAC levels (%) were highest in the high alcohol condition (M = 0.03%, SD = 0.01, $Range$ = 0.01% - 0.05%), moderately high in the low alcohol condition (M = 0.01%, SD = 0.01, $Range$ = 0% - 0.03%), and as expected, were absent in the placebo condition. A one-way ANOVA was performed with condition entered as the between-subjects variable (placebo; low alcohol; high

alcohol) and peak BAC level entered as the dependent variable. Analysis found a significant difference in peak BAC levels between conditions, ($F(2, 45) = 51.97$, $p < .001$, $\eta_p^2 = .70$) with follow-up tests revealing significant differences between the placebo and low alcohol conditions, ($p = .005$), the placebo and high alcohol conditions, ($p < .001$), and the low and high alcohol conditions, ($p < .001$).[23]

Awareness check. Awareness checks revealed that 87.5% of participants in the placebo condition were unaware of condition assignment and did not know whether they had consumed alcohol or not. In the low alcohol condition, 68.75% of participants reported that they did not know whether they had consumed alcohol or not and this decreased to 31.25% in the high alcohol condition. However, reported awareness of condition assignment was not associated with either moral actions ($p = .383$) or moral judgments (when referencing either the action-choice and judgment question) ($ps > .450$) when controlling for condition. As such, awareness checks were not included in further analyses.

Drinking habits. Having measured drinking habits (total units of alcohol consumed weekly), preliminary analyses were performed to identify possible confounding effects of alcohol tolerance on condition assignment and BAC level. A one-way ANOVA with condition (placebo; low alcohol; high alcohol) as the between-subjects variable and drinking habits as the dependent variable, found no significant differences between the total units of alcohol consumed weekly between conditions ($p = .328$). Further, self-reported total units of alcohol consumed weekly did not correlate

[23] Previous research has reported mixed findings regarding gender differences in ethanol metabolic rates and subsequent blood alcohol levels (e.g., Frezza et al., 1990; Thomasson, 1995). In order to control for potential differences in BAC levels, the same analysis was performed with gender as an additional between-subjects factor. Analysis revealed no main effect of gender on BAC level ($p = .151$) and no interaction between gender x condition ($p = .331$). Supporting previous analysis, a significant main effect of condition was found, ($F(2, 42) = 42.14$, $p < .001$, $\eta_p^2 = .67$).

with peak BAC level (p = .975). As such, drinking habits were not included in further analyses.

Subjective mood. With previous research suggesting that the relationship between alcohol and moral decision-making may be mediated by feelings of disinhibition or positive affect (Duke & Begue, 2015), subjective mood ratings (disinhibition; positive affect) were compared before and after the alcohol intervention. A two-way mixed model ANOVA with disinhibition as the dependent variable, condition (placebo; low alcohol; high alcohol) as the between-subjects factor and time completed (pre-intervention; post-intervention) as the within-subjects variable, revealed no effect of condition (p = .740) or time completed (p = .938) or subsequent interaction effects (p = .096) on subjective reports of disinhibition. Therefore, disinhibition was not included in further analysis. A second ANOVA with positive affect entered in the model as the dependent variable, revealed a main effect of time on subjective reports of happiness, ($F(1, 45) = 9.18$, p = .004, η_p^2 = .70) with subjective reports of happiness significantly lower after the intervention. However, there were no main effects of condition (p = .804) and no interaction effects (p = .850). Point-biserial correlations revealed no relationship between subjective ratings of positive affect following the intervention and moral actions (p = .673) or moral judgments (when referencing either the judgment or action-choice question) (ps > .175). As such, positive affect was not included in further analysis.

Moral Responses and Alcohol

In order to compare moral judgments and moral actions, simulated moral actions in the virtual version of the footbridge dilemma were compared to the moral judgments made in response to the text-based counterpart. In all groups, the proportion

of utilitarian responses was higher when simulated action was required in VR compared to when judgment was required in the text-based counterpart (see Table 4.1).

Table 4.1

Percentage of Utilitarian Responses in Moral Judgment and Action Tasks

Condition	Moral judgment task		Moral action task
	Judgment question	Action-choice question	
Placebo	25%	25%	75%
Low Alcohol	18.75%	6.25%	68.75%
High Alcohol	6.25%	6.25%	68.75%

Given that responses to the moral judgment task and moral action task were binary, Generalised Estimating Equations (GEE) were performed using a binary logistic model with task (judgment task; action task) as within-subjects factor and condition (placebo; low alcohol; high alcohol) as between-subjects factor (see Figure 4.2) (see Statistical Note (4.1)). Two analyses were carried out, the first using the judgment question in the judgment task and the second using the action-choice question in the judgment task.[24]

Judgment question. When selecting the judgment question, analysis revealed a main effect of task, (Wald $X^2[1] = 27.18$, $p < .001$), with a greater proportion of utilitarian responses overall in action tasks compared to judgment tasks. There was no main effect of condition ($p = .470$) and no interaction ($p = .566$).

[24] This analysis was designed to compare moral actions in VR and moral judgments in text-based vignettes, hence the judgment and action-choice questions were referenced in separate analyses (as both derived from the same text-based moral dilemma). In order to determine if there were differences in responses to questions, an additional GEE analysis incorporating both the judgment and action-choice questions, revealed a main effect of task (Wald $X^2[1] = 36.28$, $p < .001$), with a greater proportion of utilitarian responses overall in the action task as compared to both questions in the judgment task (*ps* < .001) but no difference between moral responses to the judgment question and action-choice question ($p = 1.00$).

Action-choice question. When selecting the action-choice question, analysis revealed a main effect of task, (Wald $X^2[1] = 24.90$, $p < .001$), with a greater proportion of utilitarian responses overall in action tasks compared to judgment tasks. There was no main effect of condition ($p = .286$) and no interaction ($p = .480$).

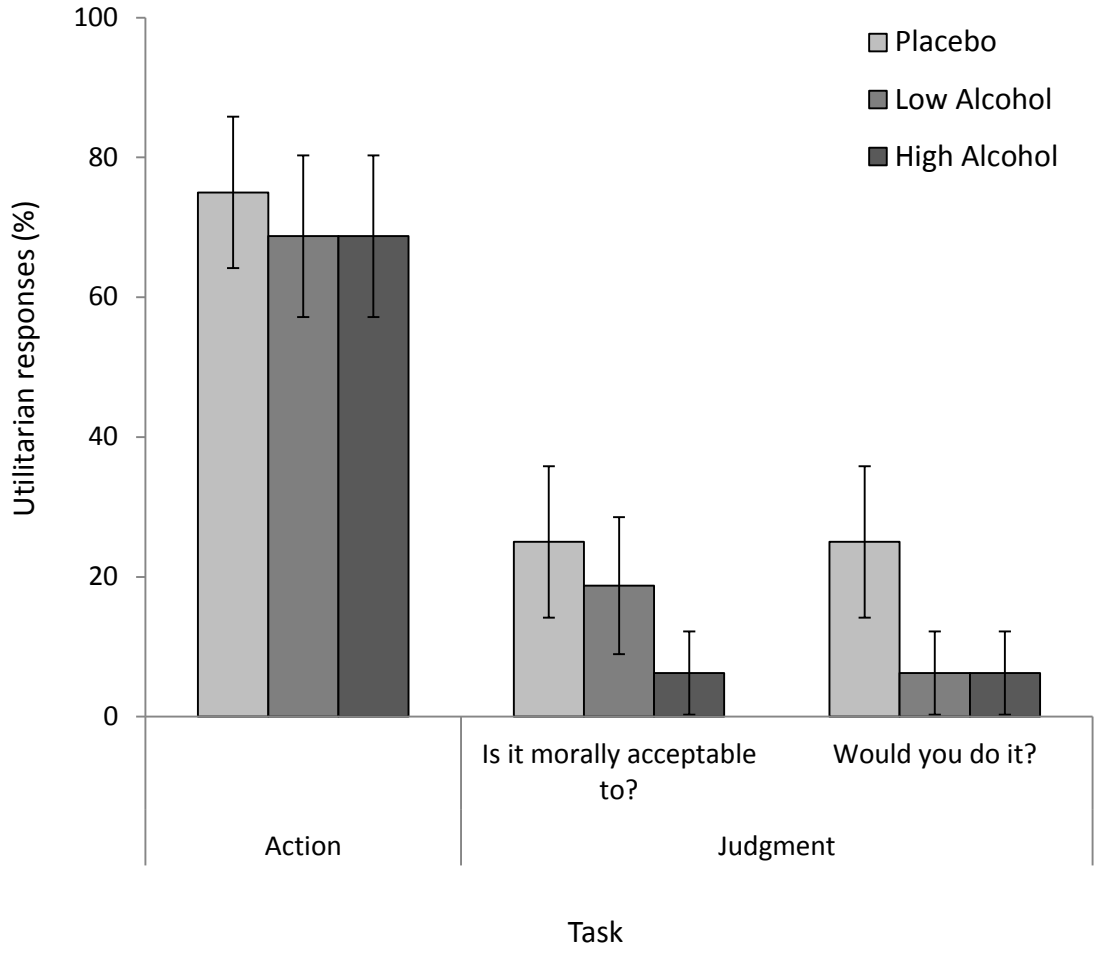


Figure 4.2. Utilitarian responses (%) in the moral action task (VR footbridge) and the moral judgment task (footbridge counterpart) in the placebo, low alcohol and high alcohol conditions. In the judgment task, participants were asked whether the action was morally acceptable and whether they would do it. A greater number of utilitarian outcomes were endorsed in the moral action task.[25] Error bars represent +- 1 SE_p.

[25] Although GEE analyses revealed no significant response differences between conditions, the differences between conditions in their responses to the judgment task appeared to be large (e.g., 6.25% versus 25% utilitarian responses). As such, I carried out additional separate chi-square tests comparing responses to the judgment question and the action-choice question between conditions. These supported GEE analyses showing no significant differences between conditions in their moral judgments made in response to either the judgment question (p = .492) or action question (p = .333).

Following statistical analyses adopted in previous research (Duke & Begue, 2015), analyses were also carried out using BAC level as a predictor of moral responses (non-utilitarian; utilitarian) in both the moral action task and moral judgment task. Peak BAC level was not a significant predictor of moral responses in the virtual moral action task (p = .575) or the moral judgment task when referencing both the judgment and action-choice question (ps > .109).

Heart Rate and Alcohol

In all groups, changes in heart rate were calculated as in Chapters 2 and 4 by subtracting heart rate readings (bpm) taken at the end of the moral (and non-moral) tasks to those taken at the start of the moral (and non-moral task) tasks. Mean heart rate change was highest for the moral action task (VR *footbridge* dilemma) across conditions. Heart rate change decreased for the moral judgment task (text counterpart dilemma) and both the action and judgment non-moral tasks (see Table 4.2).

Table 4.2

Mean Heart Rate Change across Judgment and Action Tasks

	Judgment task		Action task	
	Non-moral	Moral	Non-moral	Moral
Condition	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Placebo	-0.63 (0.81)	0.06 (1.18)	-0.25 (2.02)	2.81 (3.35)
Low Alcohol	-0.75 (0.93)	-0.13 (1.59)	-0.50 (2.37)	2.13 (3.34)
High Alcohol	-0.88 (0.72)	-0.06 (1.39)	-0.06 (1.06)	0.94 (3.59)

A mixed ANOVA with task (judgment task; action task) and type (non-moral task; moral task) as within-subjects factors and condition (placebo; low alcohol; high alcohol) as the between-subjects factor was conducted. Analysis revealed a main effect of task, (F(1, 45) = 23.12, p < .001, η_p^2 = .34), a main effect of type, (F(1, 45) = 20.70, p

< .001, η_p^2 = .32) and a significant interaction of type x task, (F(1, 45) = 5.92, p = .019, η_p^2 = .12) (see Figure 4.3). There was no main effect of condition (p = .436) and no further interactions (ps > .320).

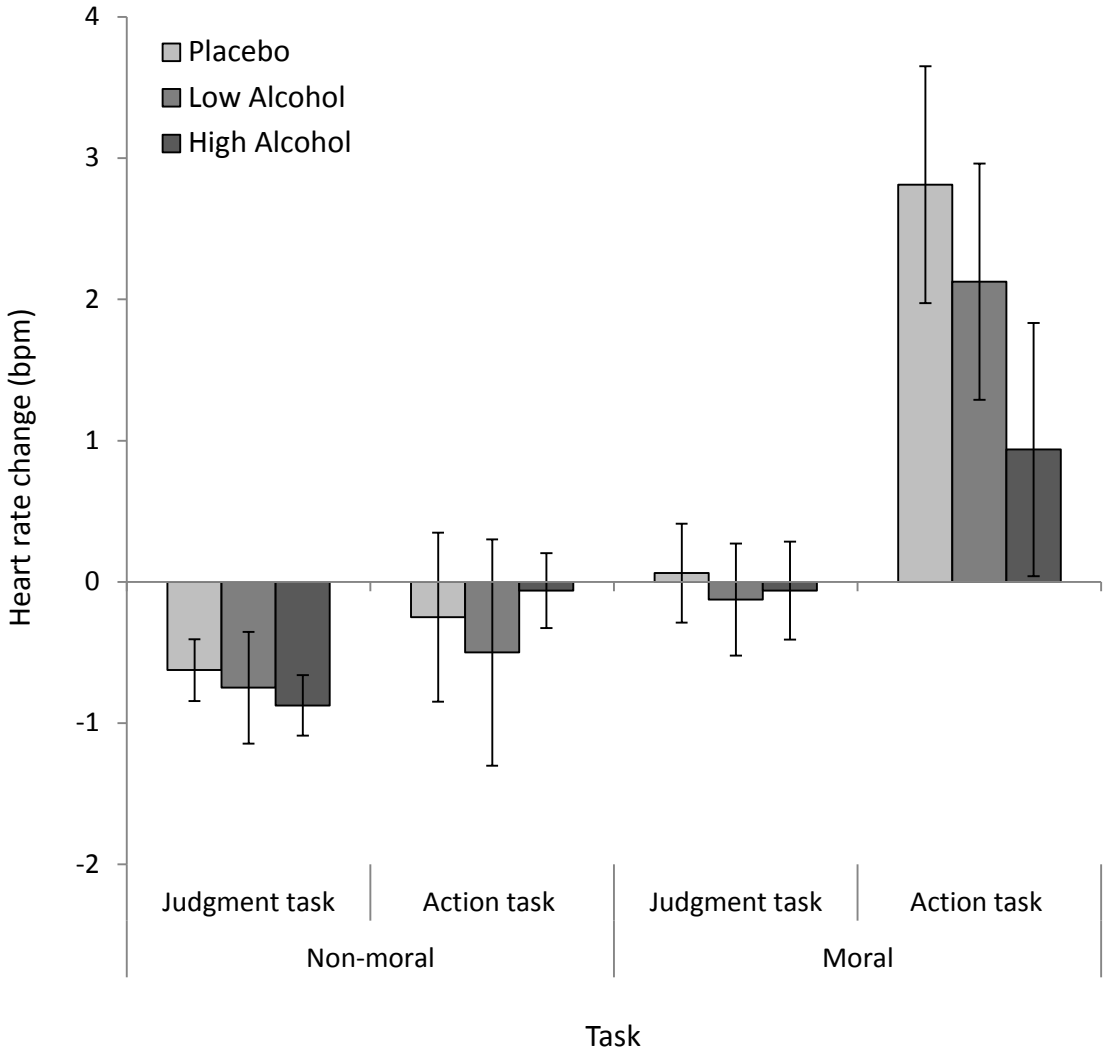


Figure 4.3. Mean heart rate change (bpm) for non-moral and moral task type in judgment and action tasks by condition. Increased heart rate changes were observed in the virtual moral action task across conditions**.** Error bars represent +- 1 SE.

To further investigate the interaction of type x task, simple effects analyses were performed comparing heart rate changes in non-moral and moral tasks within both judgment and action tasks. A significant difference was found between non-moral and moral tasks in the judgment task across groups, ($F(1, 45) = 8.11$, $p = .007$, $\eta_p^2 = .15$) and in the action task across groups, ($F(1, 45) = 14.53$, $p < .001$, $\eta_p^2 = .24$) with greater heart rate changes observed in moral tasks. There was a significant difference in heart rate change between the judgment and action task but for the moral tasks only, ($F(1, 45) = 17.21$, $p < .001$, $\eta_p^2 = .28$) with greater heart rate changes observed overall in the virtual moral action task. Heart rate change for the non-moral tasks was not significantly different between action and judgment tasks ($p = .129$).[26]

In further analyses accounting for variation in alcohol absorption, bivariate correlations were carried out to determine whether heart rate change in tasks was associated with peak BAC levels. BAC levels were not correlated with heart rate change in the moral judgment task ($p = .789$) or the judgment and action non-moral tasks ($ps > .536$). Peak BAC level had a moderate negative correlation with heart rate change in the moral action task, ($r(46) = -.37$, $p = .009$) (see Figure 4.4) and when entered into a univariate linear regression, was found to explain 13.8% of the variance in the model, ($R^2 = .138$, $F(1,46) = 7.36$, $p = .009$) when predicting this heart rate change ($\beta = -.37$, $p = .009$).[27]

[26] The ratio of greatest and least variance in heart rate change was >3 and as such, this analysis was repeated and findings replicated using Generalised Estimating Equations, which does not assume homogeneity of variance (see Statistical Note (4.2)).

[27] In Chapter 2, I also assessed whether arousal was a significant predictor of non-utilitarian moral responses based on existing dual-process models (Greene et al., 2001). However, given that heart rate change in the virtual moral task also included the time in which individuals witnessed the consequences of their moral actions, this analysis cannot shed light on existing dual-process models and the prediction of moral responses from arousal. As such, this analysis is no longer performed.

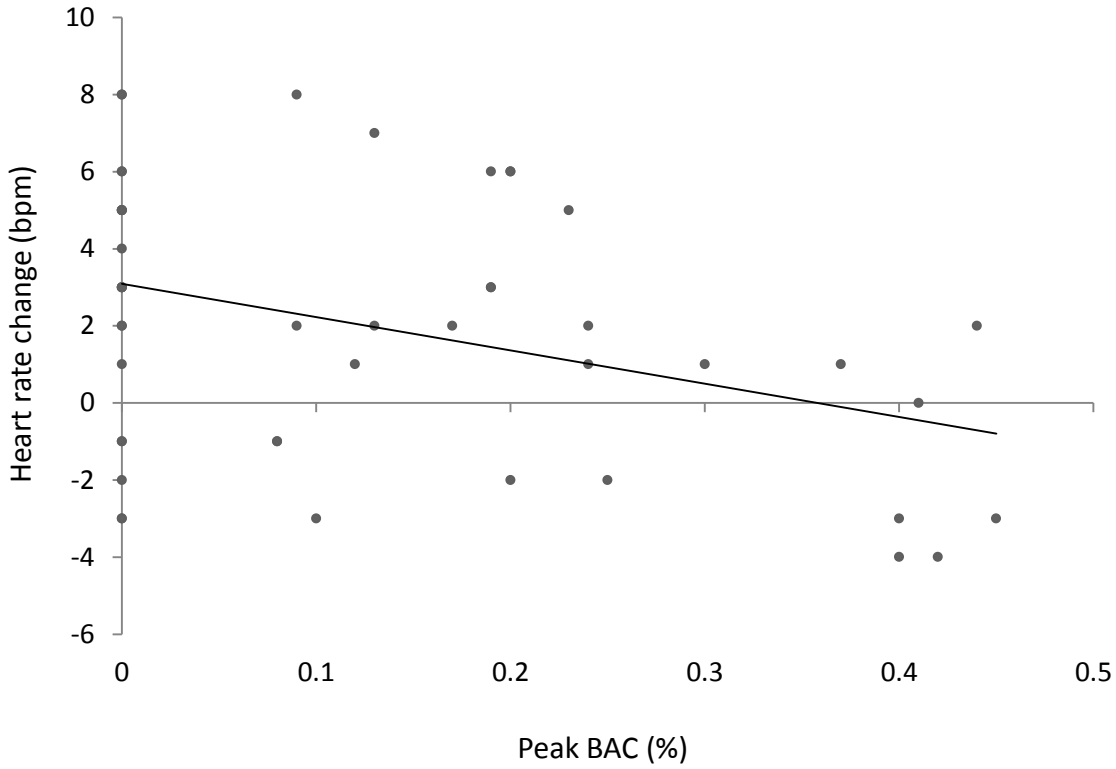


Figure 4.4. Heart rate change (bpm) in the virtual moral action task plotted against peak BAC levels (%). Peak BAC was a negative predictor of heart rate change in the virtual moral task. Linear regression trendline: $R^2 = .14$.

Alcohol and Behavioural Empathy Assessments

Facial task. The SAM was used to assess self-reported valence to facial emotions and subsequent affective empathy (Wai & Tiliopoulos, 2012). Valence scores were calculated by averaging the self-reported valence scores (1(negative) – 9(positive)) across each emotion set of facial expressions (neutral; happy; sad) for the pre-intervention and post-intervention tests (see Table 4.3).

Table 4.3

Valence Scores across Conditions

	Pre-intervention			Post-intervention		
	Neutral	Happy	Sad	Neutral	Happy	Sad
Condition	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Placebo	4.72 (0.34)	6.80 (1.01)	3.45 (0.83)	4.81 (0.38)	6.72 (1.12)	3.42 (1.02)
Low Alcohol	4.56 (0.69)	6.49 (0.91)	3.63 (0.89)	4.75 (0.42)	6.67 (0.85)	3.72 (1.05)
High Alcohol	4.70 (0.60)	7.02 (1.08)	3.10 (1.09)	4.83 (0.71)	6.39 (1.10)	3.77 (1.39)

Valence and traits. In order to determine if this behavioural assessment of affective empathy was related to self-report measures of empathy, psychopathy, and associated traits, bivariate correlations were performed between traits and self-reported valence to facial emotions collected in the pre-intervention test.[28] Moderate correlations showed that individuals scoring higher in primary psychopathy felt more positively when looking at sad facial expressions and more negatively when looking at happy facial expressions. Honesty-Humility, on the other hand, correlated negatively with

[28] SAM valence scores in the pre-intervention facial task and VAS scores collected during the pre-intervention pain task were compared to traits prior to the alcohol intervention. This was done to validate the behavioural empathy tasks included here as in previous research (Wai & Tiliopoulos, 2012). The post-intervention behavioural empathy tests were not included in this analysis given the potential mediating effects of alcohol consumption on on-line performances in these tasks.

valence towards sad facial expressions and positively with valence towards happy facial expressions. Additionally, individuals scoring higher in Internalization, felt more positively towards happy facial expressions and individuals with higher Empathic Concern scores, reported feeling more negative towards sad facial expressions (see Table 4.4).

Table 4.4

Correlation between Valence Scores for Facial Emotions in the SAM Facial Test and Trait Measures

		Facial test (SAM)[a]		
		Valence		
Trait measure	Subscale	Neutral (*r*)	Happy (*r*)	Sad (*r*)
1. LPS				
	Primary	.13	-.34*	.39**
	Secondary	-.09	-.01	.04
2. HEXACO				
	H	-.13	.35*	-.47**
	A	.26	.11	-.08
3. IRI				
	PT	.08	.05	-.19
	EC	-.14	.15	-.30*
	PD	-.05	-.14	.06
	FS	.08	.13	.02
4. Moral Identity				
	Symbolization	-.12	.26	-.18
	Internalization	-.18	.29*	-.27

Note. *r* = correlation coefficient; H = Honesty-Humility; A = Agreeableness; PT = Perspective Taking; EC = Empathic Concern; PD = Personal Distress; FS = Fantasy Seeking.
[a]Valence scores from the SAM facial pre-intervention test only.
*p <.05. **p <.01. ***p <.001

Valence and alcohol. In order to examine the effects of the alcohol intervention, a three-way mixed ANOVA was performed to determine the effects of condition (placebo; low alcohol; high alcohol), emotion (neutral; happy; sad), and test (pre-intervention; post-intervention) on self-reported valence to faces. Analysis revealed a main effect of emotion, ($F(2,90) = 141.04$, $p < .001$, $\eta_p^2 = .76$), a significant two-way interaction of test x emotion, ($F(2,90) = 5.95$, $p = .004$, $\eta_p^2 = .12$), and a statistically significant three-way interaction between condition x test x emotion, ($F(4,90) = 6.03$, $p < .001$, $\eta_p^2 = .21$). There was no main effect test ($p = .195$) or condition ($p = .990$) and no further interactions ($ps > .463$).

In order to examine the higher-order interaction further, simple effects tests follow. Statistical significance of simple two-way interactions and follow-up simple main effects were accepted at a Bonferroni-adjusted level ($p = .017$). Analysis revealed a statistically significant two-way interaction of test x emotion in the high alcohol condition, ($F(2, 30) = 21.21$, $p < .001$, $\eta_p^2 = .59$) (see Figure 4.5 *(iii)*) but not in the placebo ($p = .665$) (see Figure 4.5 *(i)*) or low alcohol conditions ($p = .933$) (see Figure 4.5 *(ii)*). In order to investigate this interaction further, the effect of test (pre-intervention; post-intervention) was examined for each emotion (neutral; happy; sad) using simple effects tests. There was a statistically significant simple main effect of test for the high alcohol condition in reported valence to happy faces and sad faces but not in valence towards neutral faces ($p = .309$). For participants in the high alcohol condition, valence towards happy faces was significantly lower (more negative) in the post-test after alcohol consumption, ($t(15) = 5.18$, $p < .001$, $d = 1.29$) and valence

towards sad faces was significantly higher (more positive) in the post-test after alcohol consumption, ($t(15) = -3.46$, $p = .003$, $d = -0.87$). [29]

[29] To control for potential interaction effects of gender differences in subjective ratings of facial displays of emotion, this analysis was repeated with gender entered as a dummy-coded covariate (male; female). Analysis revealed that existing effects and interactions remained significant when controlling for gender.

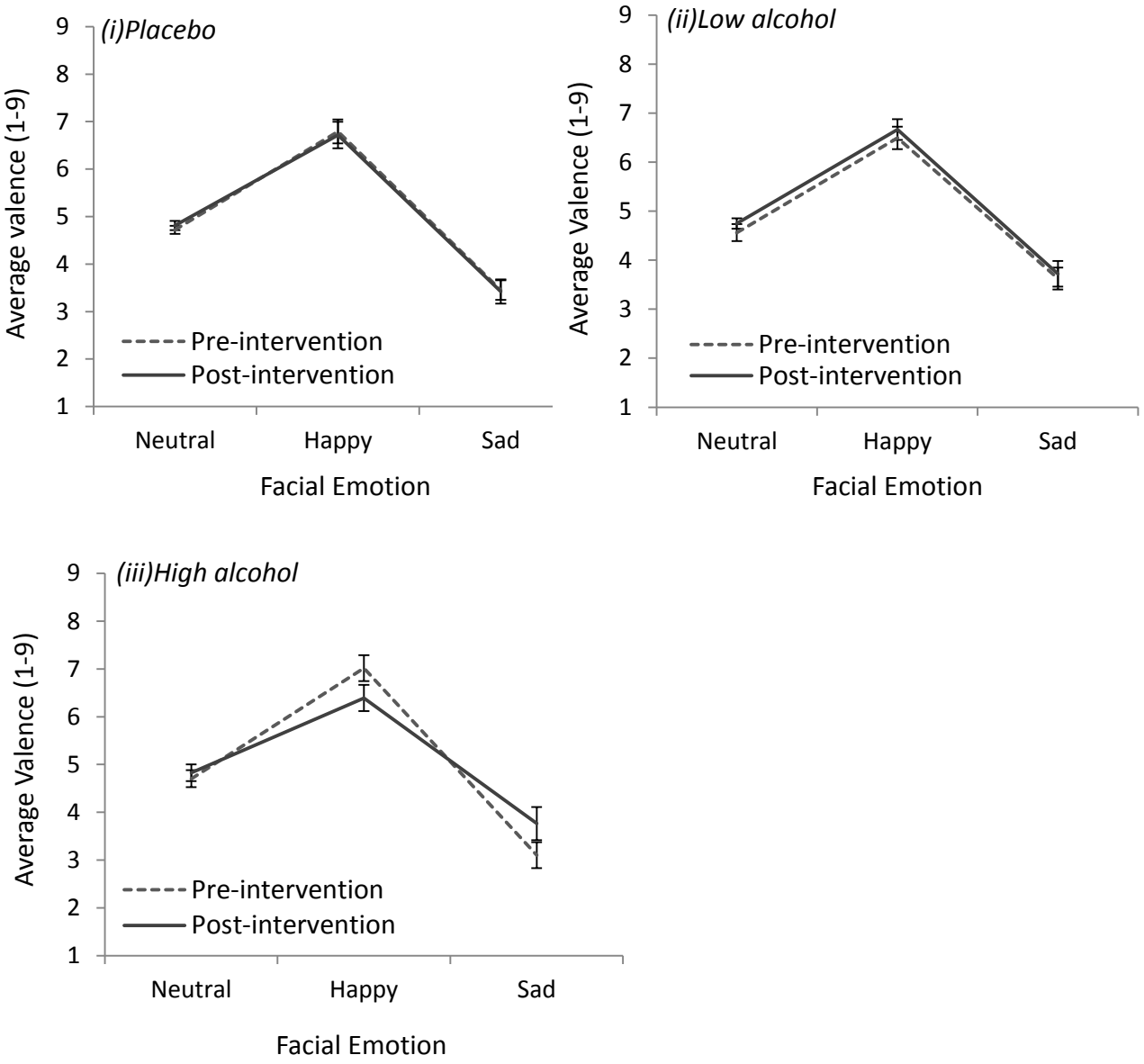


Figure 4.5. Simple interaction effects showing average self-reported valence to facial expressions in (*i*) placebo condition, *(ii)* low alcohol condition, and *(iii)* high alcohol condition. A significant interaction effect was found for the high alcohol condition and for happy and sad facial expressions only. Error bars represent +- 1 SE.

Valence and moral responses. Following the finding that valence towards sad and happy faces was affected by alcohol consumption, a secondary analysis was performed to determine whether this change affected moral decision-making. Changes in valence were defined as the difference in valence scores for happy and sad faces between the pre- and post-intervention tests. These changes in self-reported valence towards happy and sad faces between the pre- and post-intervention tests, were not associated with moral actions (*ps* > .651) or moral judgments (*ps* > .372).[30]

Pain task. The pain task was used to assess affective empathy for pain (Jackson et al., 2005). Empathy for pain scores were calculated by averaging the responses given on the VAS (0 (no pain) – 10 (worse pain ever)) for neutral and painful images for the pre-intervention and post-intervention tests (see Table 4.5).

Table 4.5

Empathy for Pain Scores across Conditions

	Pre-Intervention		Post-Intervention	
	Neutral	Painful	Neutral	Painful
Condition	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Placebo	0.75 (0.64)	6.89 (1.17)	0.26 (0.42)	7.16 (1.35)
Low Alcohol	1.03 (1.16)	7.01 (1.08)	0.61 (0.90)	7.19 (1.40)
High Alcohol	1.00 (0.91)	6.89 (1.65)	0.62 (0.86)	6.76 (1.89)

Empathy for pain and traits. In order to examine the relationship between self-reported empathy for pain and personality traits, bivariate correlations were performed between traits and pain scores for neutral and painful images in the pre-intervention test (see Table 4.6). Moderate correlations revealed that individuals scoring higher in primary psychopathy had lower empathy for pain scores when looking at painful images.

[30] Given the test x emotion x condition interaction, partial correlations controlling for BAC levels were also performed revealing no relationship between changes in self-reported valence towards happy and sad faces and moral responses (*ps* > .132).

Empathic Concern, on the other hand, correlated positively with empathy for pain scores on the VAS in response to painful images. Individuals scoring higher in Honesty-Humility reported greater empathy for pain scores when looking at neutral images.

Table 4.6

Correlations between VAS Scores in the Pain Test and Trait Measures

		Empathy for pain[b]	
		VAS score	
Trait measure	Subscale	Neutral	Painful
1. LPS			
	Primary	-.24	-.35*
	Secondary	-.06	.11
2. HEXACO			
	H	-.32*	.21
	A	.12	-.08
3. IRI			
	PT	.05	-.00
	EC	.09	.31*
	PD	-.08	.15
	FS	-.21	-.03
4. Moral Identity			
	Symbolization	.18	.04
	Internalization	.11	.27

Note. H = Honesty-Humility; A = Agreeableness; PT = Perspective Taking; EC = Empathic Concern; PD = Personal Distress; FS = Fantasy Seeking.
[a]VAS scores from the empathy for pain pre-intervention test only.
*p <.05. **p <.01. ***p <.001

Empathy for pain and alcohol. In order to examine the effect of the alcohol intervention, a three-way mixed ANOVA was performed to determine the effects of condition (placebo; low alcohol; high alcohol), image type (neutral; painful), and test

(pre-intervention; post-intervention) on VAS scores assessing empathy for pain. Analysis revealed a marginally significant main effect of test, ($F(1, 45) = 3.84$, $p = .056$, $\eta_p^2 = .08$), a main effect of image type, ($F(1, 45) = 1221.51$, $p < .001$, $\eta_p^2 = .96$), and a significant two-way interaction of test x image type, ($F(1, 45) = 9.23$, $p = .004$, $\eta_p^2 = .17$). There was no main effect of condition ($p = .835$) and no further interactions ($ps > .500$).

To further investigate the interaction between test x image type, simple effects analyses were performed comparing empathy for pain scores for neutral and painful images within both the pre-intervention and post-intervention tests. A significant difference was found between pain scores for neutral and painful images in both the pre-test ($F(1, 45) = 948.00$, $p < .001$, $\eta_p^2 = .95$) and post-test ($F(1, 45) = 943.13$, $p < .001$, $\eta_p^2 = .95$) with painful images eliciting higher VAS scores overall. In the post-test, empathy for pain scores in response to neutral images, were significantly lower compared to the pre-test, ($F(1, 45) = 16.91$, $p < .001$, $\eta_p^2 = .27$) (see Figure 4.6).[31]

[31] To control for potential interaction effects of gender differences in subjective ratings of the pain of others, this analysis was repeated with gender entered as a dummy-coded covariate (male; female). Analysis revealed that the existing main effect of image type remained. The marginally significant main effect of test and significant interaction of test x image type were no longer significant following the inclusion of gender ($ps > .412$). Follow-up analyses revealed a marginally significant interaction of test x image type x gender ($p = .064$) with females giving lower VAS scores for neutral images in the post-test compared to the pre-test ($p < .001$). However, there were significant violations of homogeneity of variances, likely driven by the difference in the ratio of females ($N = 32$) to males ($N = 17$). As such, these analyses must be treated with caution.

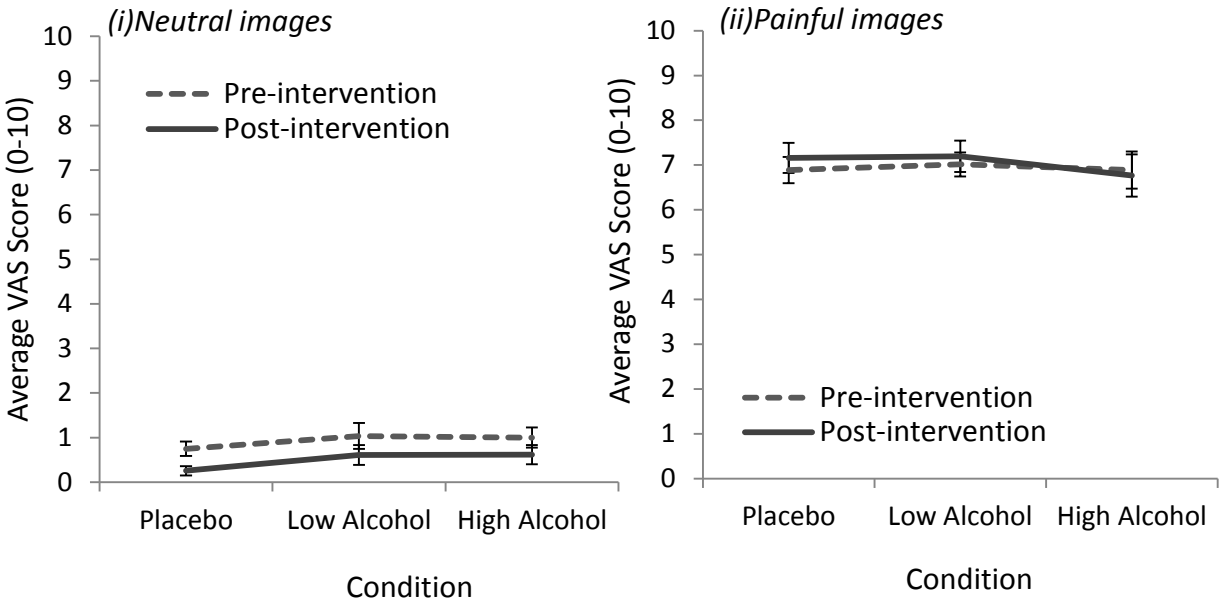


Figure 4.6. Line graphs showing average empathy for pain scores on the VAS in response to *(i)* neutral images and *(ii)* painful images. A significant interaction effect revealed higher VAS scores for painful images across pre- and post-intervention tests and significantly lower VAS scores for neutral images in the post-test. Error bars represent +- 1 SE.

Empathy for pain and moral responses. Changes in empathy for pain scores between the pre- and post-interventions for neutral and painful images were not associated with either moral actions (*ps* > .114) or moral judgments (*ps* > .344).

Alcohol and Affective Processing

Whilst completing the facial tasks and pain tasks, pupil diameters were measured as a means of assessing affective processing (Partala & Surakka, 2003). For statistical analyses, blinks were removed using a procedure adapted from previous research (Skulmowski et al., 2014) by discarding the eye tracking data 120ms before and after a pixel diameter of 0 pixels. Artefacts were also removed and identified as large changes in pupil diameter (Partala & Surakka, 2003). In this case, these changes were defined as any reading more than two standard deviations from average pupil diameter and each flagged detection was visually inspected prior to removal (to ensure that these parameters identified physically impossible increases in diameter) (Jainta & Baccino, 2010). In order to create a visual timeline of pupillary diameter, discarded blinks (and artefacts) were interpolated linearly (extrapolated) accounting for pre- and post-blink or saccade artefacts[32] (for a similar procedure see: Bradley et al., 2008; Jainta & Baccino, 2010; Skulmowski et al., 2014; Van Rijn, Dalenberg, Borst, & Sprenger, 2012).[33]

All pupil diameter data were analysed using a baseline correction (subject zeroing) by subtracting the initial pupillary reading (at trial onset) from proceeding pupillary readings within a trial (for a similar procedure see: Azevedo et al., 2013). The

[32] A custom-built software was developed to carry out this procedure but all raw and corrected trials were also visually inspected.

[33] Over all participants, 178 individual stimulus trials (7.15%) were excluded from subsequent analysis as a result of tracking loss, extensive blinks, or excessive corrections (if the number of extrapolated points between stimulus onset and 9000ms following offset exceeded 3000ms).

data were then analysed by examining the baseline-corrected data over the 6-s stimulus interval (of each image).

Whilst existing research often converts the arbitrary pixel values provided by eye-tracking software into mm (using manufacturer's instructions) (e.g., Skulmowski et al., 2014), a conversion tool is currently unavailable for The Eye Tribe. As such, I report the average pupil diameter change from baseline (% delta).

Facial tasks. Pupillary diameter changes were averaged across facial emotion in the pre- and post-intervention facial tasks (see Table 4.7).

	Pre-intervention			Post-intervention		
	Neutral	Happy	Sad	Neutral	Happy	Sad
Condition	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Placebo	6.25 (2.93)	6.65 (2.93)	4.96 (3.29)	5.04 (3.40)	4.41 (2.73)	4.25 (2.12)
Low Alcohol	5.61 (3.35)	5.15 (3.17)	5.61 (2.83)	4.27 (2.93)	4.10 (2.39)	2.76 (2.93)
High Alcohol	6.24 (4.08)	6.09 (4.00)	6.11 (3.50)	4.94 (2.67)	5.14 (3.31)	5.24 (3.11)

Table 4.7

Pupillary Diameter (% delta) across Conditions in Pre- and Post-Intervention Facial Tasks

Note. Average pupil diameter values = % delta

Pupil diameter and traits. In order to determine if changes in pupil diameter in response to facial expressions of emotions were related to self-report measures of dispositional traits, bivariate correlations were performed between traits and pupillary changes recorded in the pre-intervention facial tasks. There were no significant associations between primary psychopathy and pupil diameter changes across facial emotions (*ps* > .083) or any remaining traits and diameter changes (*ps* > .080).

Pupil diameter and alcohol. In order to examine the effects of the alcohol intervention, a three-way mixed ANOVA was performed to determine the effects of condition (placebo; low alcohol; high alcohol), emotion (neutral; happy; sad), and test (pre-intervention; post- intervention) on pupil diameter change in response to faces. Analysis revealed a main effect of test, ($F(1,45) = 16.66$, $p < .001$, $\eta_p^2 = .27$) but no further main effects (*ps* > .187) or interactions (*ps* > .412). Across facial emotions and conditions, pupil diameter changes were significantly lower in the post-intervention test (see Figure 4.7).[34]

Pupil diameter and moral responses. Changes in pupil diameter were calculated as the difference between pupil diameter readings (% delta) in the pre- and post-intervention facial tasks for neutral, happy, and sad faces. Changes in pupil diameter between the pre- and post-intervention tests for all faces were not correlated with either moral actions (*ps* > .103) or moral judgments (*ps* > .386).

[34] Supporting previous research (Partala & Surakka, 2003), including gender as a dummy-coded covariate (male; female) in this analysis, did not affect the results.

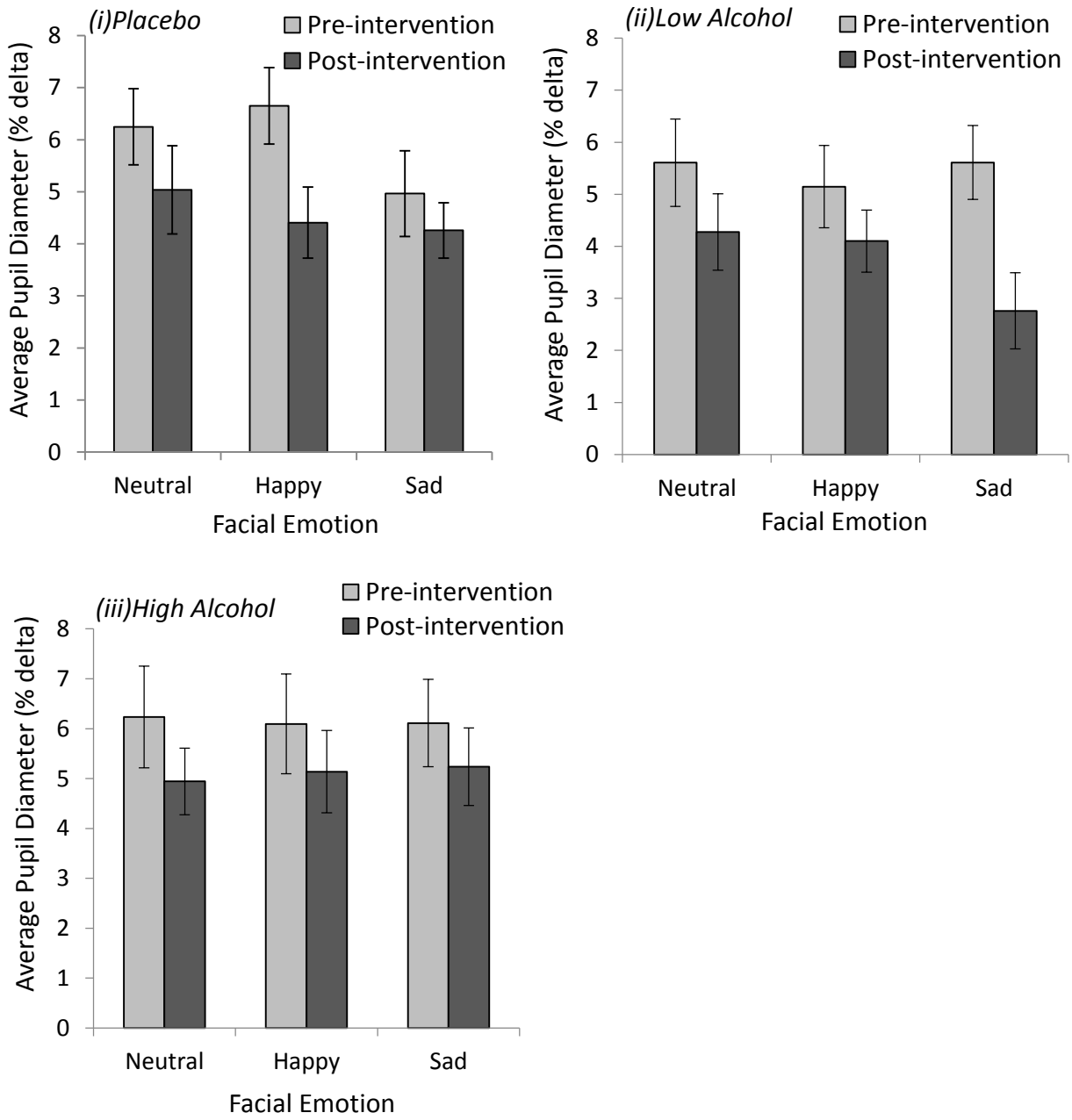


Figure 4.7. Mean pupil diameter change (%) in facial tasks for each facial emotion in pre- and post-intervention tests by condition. Lower pupil diameter changes were observed in the post-intervention facial tasks across conditions**.** Error bars represent +- 1 SE.

Pain task. Pupillary diameter changes were averaged across image type in the pre- and post-intervention pain tasks (see Table 4.8).

Table 4.8

Pupillary Diameter (% delta) across Conditions in Pre- and Post-Intervention Pain Tasks

	Pre-Intervention		Post-Intervention	
	Neutral	Painful	Neutral	Painful
Condition	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Placebo	4.81 (2.56)	4.13 (3.16)	3.00 (1.93)	3.07 (1.73)
Low Alcohol	2.50 (2.41)	4.31 (2.19)	1.68 (2.68)	1.94 (3.21)
High Alcohol	4.74 (2.77)	4.89 (3.31)	2.97 (3.11)	2.83 (3.01)

Note. Average pupil diameter values = % delta

Pupil diameter and traits. In order to determine if changes in pupil diameter in response to empathy for pain tasks were related to self-report measures of dispositional traits, bivariate correlations were performed between traits and pupillary changes recorded in the pre-intervention pain task. There were no significant associations between pupil diameter changes in response to neutral images and any traits (*ps* > .070). Agreeableness had a small positive correlation with change in pupil diameter when viewing painful images, ($r(46) = .29$, $p = .046$) but no further traits were associated (*ps* > .080).

Pupil diameter and alcohol. In order to examine the effects of the alcohol intervention, a three-way mixed ANOVA was performed to determine the effects of condition (placebo; low alcohol; high alcohol), image type (neutral; painful), and test (pre-intervention; post- intervention) on pupil diameter change in response to empathy for pain tasks. Analysis revealed a main effect of test, ($F(1,45) = 26.13$, $p < .001$, η_p^2

= .37) but no main effect of condition (p = .147), image type (p = .376) or any further interactions (ps > .128). Across neutral and painful images for all conditions, pupil diameter changes were significantly lower in the post-intervention test (see Figure 4.8).[35]

Pupil diameter and moral responses. Changes in pupil diameter were calculated as the difference between pupil diameters (% delta) in the pre- and post-intervention pain tasks for neutral and painful images. These changes in pupil diameter between the pre- and post-intervention tests were not correlated with either moral actions (ps > .192) or moral judgments (ps > .106).

[35] When including gender as a dummy-coded covariate (male; female) in this analysis, the main effect of test remained significant.

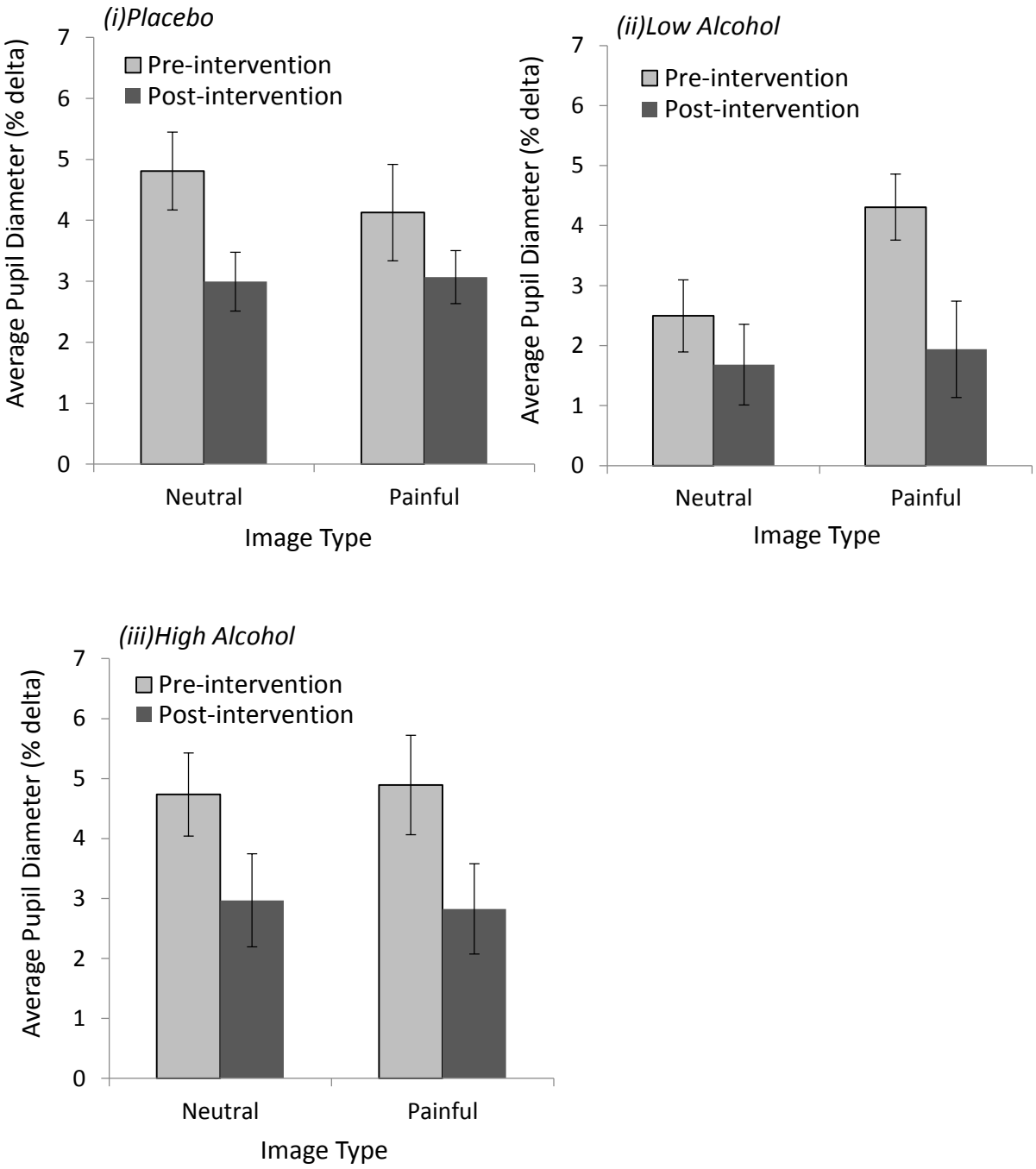


Figure 4.8. Mean pupil diameter change (%) in pain tasks for painful and neutral images in pre- and post-intervention tests by condition. Lower pupil diameter changes were observed in the post-intervention pain task across conditions**.** Error bars represent +- 1 SE.

Coercion

The majority of the participants in the placebo condition (56.25%), low alcohol condition (75%), and high alcohol condition (75%) reported that they did not feel coerced in VR. In order to see if coercion predicted action responses in the virtual footbridge dilemma, univariate logistic regressions were conducted with condition (placebo; low alcohol; high alcohol) as the selection variable, coerced (yes; no) as the categorical predictor and VR action response as the categorical outcome (non-utilitarian action; utilitarian action). Coercion did not predict VR action responses in the placebo condition (p = .395), in the low alcohol condition (p = .999) or in the high alcohol condition (p = .999).

General Discussion

Overall, greater utilitarian endorsements were observed when simulated action was required in VR compared to when moral judgments were required in the text-based counterpart. Whilst alcohol consumption altered self-reported performances in behavioural empathy tasks and heart-rate responses in VR, alcohol intake did not affect moral actions or moral judgments. This raises questions regarding the replicability of previous findings investigating acute alcohol effects on moral decision-making and the theorised relationship between empathic processing and moral decision-making.

Moral Actions versus Judgments

Participants in the present experiment demonstrated moral inconsistency; greater utilitarian actions were observed in the virtual *footbridge* dilemma, with fewer utilitarian judgments observed in the text-based counterpart, regardless of condition assignment. These results corroborate existing virtual research that demonstrates disparity between saying and doing (Pan & Slater, 2011; Patil et al., 2014).

With regards to the alcohol intervention, I had hypothesised alternative outcomes based on divergent streams of research seeking to understand the roles of deliberation versus social processing in moral decision-making (e.g., Duke & Begue, 2015; Greene et al., 2001; Patil, 2015). Based on a deliberation-focused hypothesis, with alcohol increasing emotional reactivity and decreasing cognitive functioning, non-utilitarian preferences would be predicted (Greene et al., 2001). Alternatively, previous research has argued that alcohol intake results in deficits in social processing but more specifically, reduced aversion to harm, subsequently resulting in an increase in utilitarian moral judgments (Duke & Begue, 2015).

In terms of moral actions, I outlined similar divergent hypotheses. If dual-process theories of moral judgment (Greene et al., 2001) transfer to the domain of moral action (Navarrete et al., 2012), the deliberation hypothesis might also transfer to moral actions, resulting in fewer utilitarian endorsements. However, given evidence that moral action and judgment are partially distinct (e.g., Tassy, Oullier, et al., 2013) and that moral inconsistency is often present in populations with social deficits (e.g., Cima et al., 2010; Patil, 2015), there could be a preference for greater utilitarian actions after alcohol consumption following the social processing hypothesis. However, in the present experiment, neither moral judgments nor moral actions were affected by alcohol consumption, contradicting previous research supporting the social processing hypothesis (Duke & Begue, 2015) as well as research supporting the deliberation-based hypothesis (Greene et al., 2001).

Alcohol and Arousal

In terms of arousal responses in virtual moral dilemmas, heart rate changes in the VR *footbridge* dilemma were assessed (as in Chapter 2). Supporting the previous findings presented in this thesis, heart rate changes were highest for VR moral tasks

across conditions (see Chapter 2). When taking BAC levels into account, increased BAC levels were associated with reduced arousal responses in the VR moral task only. This supports the theory that VR paradigms can prompt realistic physiological responses (Parsons, 2015) and the theory that alcohol may trigger affective processing deficits in emotionally aversive situations (Duke & Begue, 2015).

Facial Displays of Emotion and Empathy

Behavioural empathy tasks prior to the alcohol intervention were validated against existing personality trait assessments. Replicating previous research (Ali et al., 2009; Wai & Tiliopoulos, 2012), primary psychopathy was negatively associated with self-reported valence towards positive faces and positively related to self-reported valence towards negative faces. Wai and Tiliopoulos (2012) argue that the presentation of facial displays of emotion using the SAM (Bradley & Lang, 1994), may provide a more accurate measure of affective empathy than trait questionnaires. They argue that picturing another's emotions generates an emotional contagion. Subsequently, the way in which an individual then feels (negatively or positively) about this display of emotion, is an empathic measure derived from the appropriateness of that reaction (Wai & Tiliopoulos, 2012). The finding that individuals scoring high in primary psychopathy demonstrate "…inappropriate responding" to sad and happy faces (Wai & Tiliopoulos, 2012, p. 797), reflects a deficit in this empathic contagion. The present experiment also extends these findings, having observed the opposite trend in individuals scoring high in traits negatively correlated with the Dark Triad, including Honesty-Humility, Empathic Concern, and Internalization. In these cases, emotional responses to facial displays of emotion were appropriately aligned, with happy faces motivating self-reported positive valence and sad faces motivating negative valence.

Given that alcohol is thought to diminish aversion for harm and hinder social processing (e.g., Martina Carmona-Perera et al., 2014; Duke & Begue, 2015), I hypothesised that alcohol consumption would impair performance in the SAM as a result of these social impairments. This was supported in the present experiment; individuals receiving the high dosage of alcohol reported feeling more positively towards sad faces and more negatively towards happy faces in the post-intervention facial SAM task. These inappropriate responses reflect those of individuals scoring high in primary psychopathy (Wai & Tiliopoulos, 2012) and support the theory that alcohol impairs components of affective empathic processing (Duke & Begue, 2015).

However, in terms of moral responses, differences in the pre- and post-intervention facial behavioural empathy task, did not relate to either moral actions or moral judgments when controlling for alcohol consumption. Despite supporting the association between alcohol and impairment of affective empathic processing (Duke & Begue, 2015), this impairment did not result in utilitarian decision-making, as the social processing hypothesis would suggest.

Empathy for Pain and Harm Aversion

Given evidence that harm aversion plays a mediating role in personality traits associated with making supposedly utilitarian endorsements (Patil, 2015), evidence for the role of these traits in moral inconsistency (Cima et al., 2010), and the theory that alcohol reduces harm aversion (Duke & Begue, 2015), I also included an additional measure of empathy for pain specifically. Previous research has argued that these paradigms provide a means of assessing affective responses to the pain of others (Jackson et al., 2005).

I had hypothesised that primary psychopathy would negatively correlate with empathy for pain scores. This was supported in the present findings; individuals scoring higher in trait primary psychopathy demonstrated less intensity when rating the pain of others. Extending from this, the inversely related trait, Empathic Concern, was positively correlated with empathy for pain. This seems intuitive given that individuals scoring higher in Empathic Concern demonstrate a high level of care and consideration for the welfare of others (Davis, 1983). Surprisingly, Honesty-Humility was a positive predictor of empathy for pain scores in neutral images. There are a few explanations for this association. Firstly, follow-up analysis revealed that empathy for pain scores between neutral and painful images were positively correlated in the pre-intervention task, ($r(46) = .37$, $p = .009$) and post-intervention task, ($r(46) = .33$, $p = .022$) suggesting that similar mechanisms drive ratings of pain or anticipated pain in neutral images. Secondly, higher Honesty-Humility has been associated with lower health and safety related risk-taking (Weller & Tikir, 2011) which, in this instance, may have intensified the anticipation of harmful outcomes pictured in neutral images.

Following alcohol consumption and based on the assumption that alcohol intake reduces aversion to harm (Duke & Begue, 2015), I had predicted reduced empathy towards individuals in painful circumstances. However, alcohol dosage did not affect empathy for pain scores in the present experiment. Surprisingly, empathy for pain scores for neutral images, were significantly lower following the intervention across all conditions regardless of alcohol intake. It is likely that this finding reflects a familiarity effect as individuals became aware of the distinction between painful and neutral images in the present investigation.[36]

[36] Additional analysis controlling for gender differences suggested that this effect existed for females only. However, given the ratio of females ($N = 31$) to males ($N = 17$) and violations of homogeneity (unbalanced data), further research is required prior to interpreting true gender differences.

The finding that empathy for harm was not affected by alcohol consumption has important implications for existing research exploring the effects of similar alcohol dosages on moral decision-making (Duke & Begue, 2015). If empathy for pain is not influenced by acute alcohol effects, then the influence of alcohol on moral decision-making in previous research may be driven by alternative factors.

Alternative Interpretations: Alcohol, Empathy, and Utilitarianism

The relationship between acute alcohol effects and utilitarian moral decision-making found in previous research (Duke & Begue, 2015) may, instead, derive from social awareness or social influence. Duke and Begue (2015) collected moral judgments made in response to the *footbridge* dilemma in bars. These social settings may have influenced moral judgments in a number of ways. Firstly, the disinhibited atmosphere may have made the perception of hypothetical trolley problems less serious, with previous research suggesting that these scenarios can be perceived as humorous (e.g., Bauman, McGraw, Bartels, & Warren, 2014). Alternatively, social pressures may have resulted in individuals acting in a way that they felt was publicly acceptable under social expectation (Gold et al., 2015; Skulmowski et al., 2014). As such, future research examining the acute effects of alcohol intake on moral decision-making might consider including control measures such as social desirability and self-awareness scales.

Further, it is important to raise an alternative interpretation based on the implications of these findings to the proposed association between affective empathy and utilitarian moral decision-making. This thesis has identified evidence of a relationship between anti-social traits, and simulated moral actions (see Chapter 2) and the power of these simulated actions (see Chapter 3). I expanded this investigation using behavioural assessments of affective empathy given evidence that the relationship between psychopathy and utilitarian decision-making derives from empathic deficits

(e.g., Glenn, Iyer, et al., 2009) and subsequent diminished aversion to performing harmful actions (e.g., Patil, 2015). There are two points to discuss following this line of investigation. Firstly, in the present experiment, affective empathic processing of faces was successfully manipulated following alcohol consumption, but this did not affect moral decision-making. This may suggest that is not the un-empathic facets of traits such as psychopathy that drive utilitarian moral decision-making but perhaps other facets. For example, psychopaths have been found to demonstrate low anxiety and fearlessness (e.g., J. D. Miller, Gaughan, & Pryor, 2008) which might instead explain their diminished aversion to harm and tendency to respond in a utilitarian manner. Indeed, Koenigs et al. (2012) found that low-anxious psychopaths (with inhibitory deficits) endorsed a greater proportion of utilitarian moral judgments in personal moral dilemmas when compared to high-anxious psychopaths, suggesting a role for facets other than empathy in this discussion. Secondly, in the present experiment, alcohol consumption did not impair empathy for pain and as such, the association between aversion to harm specifically and utilitarian decision-making cannot be evaluated. Future research should investigate individuals who are frequently exposed to aversive events, who likely demonstrate resilience in the face of these (see Chapter 5 for such an investigation).

Alternative Interpretations: Moral Inconsistency

Addressing limitations previously raised regarding the incorporation of a between-subjects design (see Chapter 2), this is the first experiment to incorporate the present VR moral paradigm in a within-groups design. While this allowed a direct comparison between moral judgments and moral actions made by the same individual (Patil et al., 2014), it might be argued that the comparison of moral judgments and moral actions is limited given that each paradigm incorporated a different hypothetical

moral dilemma. I chose not to include the footbridge dilemma in both the virtual and text-based tasks to remove any potential carry-over effects (Bartels et al., 2015). Importantly, in validation studies, I did not find a significant difference between responses to the footbridge dilemma and the modified dilemma, suggesting that it could be utilised as a reliable comparable dilemma. Further, no order effects were found based on the presentation of moral judgment and action tasks suggesting that utilising different dilemmas did prevent potential carry-over effects.

As an alternative interpretation of the present findings and highlighted as a potential limitation earlier in this thesis (see Chapter 2), it might be argued that greater utilitarian endorsements in VR are elicited as a result of coercion induced by auditory instructions. In order to address this, in the present experiment, I asked participants whether they felt coerced into carrying out simulated actions in VR. Across the groups, the majority of participants reported that they had not felt coerced and reports of coercion did not predict virtual moral actions. As such, it is unlikely that the greater utilitarian actions observed across VR experiments, were as a result of coercion. Further and supporting previous research (see Chapter 2; Chapter 3), self-reported gaming experiences did not predict moral actions in VR, reinforcing the argument that the responses simulated in these tasks are not akin to that of a gaming environment.

Methodological Considerations

It is also important to highlight limitations of the present methodology. Firstly, no measure of cognitive functioning or executive functioning was included in the present experiment, a criticism mirroring that of previous research (Duke & Begue, 2015). This is significant given the mediating effect of executive functioning in the relationship between alcohol and aggression (e.g., Giancola, 2000, 2004; Godlaski & Giancola, 2009) and alcohol-related aggression and empathy (Giancola, 2003). As such,

it was difficult to determine the extent to which the present dosages of alcohol affected executive functioning and the subsequent effects of this on moral decision-making. Future research, should consider exploring the acute effects of alcohol in both social processing and executive function-based tasks.

Secondly, the order of tasks following the intervention, had moral judgment and moral actions preceding the post-intervention empathy tasks. This decision was made to ensure that moral judgment and moral action tasks were completed during the window of peak BAC level. However, it might be that completing moral decision-making tasks first, subsequently influenced performance in empathy tasks. Consequently, future research should consider counterbalancing the order of these tasks to control for possible carry-over effects.

Furthermore, during behavioural assessments of empathy, changes in pupillary size were measured having been shown to reflect affective processing in previous research (Partala & Surakka, 2003)**.** However, in the present experiment, changes in pupil diameter were not significantly different between conditions or image types. A follow-up analysis revealed that all pupil responses in the pre-intervention empathy tasks correlated and all pupil responses in post-intervention empathy tasks correlated, suggesting that in the present experiment, changes in pupil diameter reflected general processing as opposed to affective processing specifically. This supports previous research demonstrating that changes in pupil size can reflect low-level arousal responses triggered by multiple concepts including, but not limited to, cognitive effort (e.g., Jainta & Baccino, 2010; Van Rijn et al., 2012), emotional contagion (Harrison, Singer, Rotshtein, Dolan, & Critchley, 2006), decision uncertainty (Urai, Braun, & Donner, 2017) and interest value more broadly (Hess & Polt, 1960), as well as affective processing (e.g, Bradley et al., 2008; Partala & Surakka, 2003). As a result, future

research might consider adopting measures of arousal response specific to affective processing.

Following from these methodological considerations, it is also important to consider the roles of dispositional traits and behavioural states in the current discussion. Dispositional traits are thought to reflect core personality profiles (e.g., Haslam, Bastian, & Bissett, 2004), with moral traits playing an important role in shaping our personal identity (Strohminger & Nichols, 2014). Arguably and following from this, it is unlikely that the small to moderate dosages of alcohol in the present experiment, would alter core moral principles shaped by social and moral norms, despite influencing behavioural and state-dependent measures of empathic and social processing (Duke & Begue, 2015). Further investigations should advance beyond the manipulation of state-dependent empathic processing and investigate moral decision-making in populations in which there are likely to be distinct dispositional trait profiles (see Chapter 5 for such an investigation).

CHAPTER 5: PROFESSIONAL TRAINING IN MORAL ACTION VERSUS JUDGMENT

Introduction

Thus far, this thesis has uncovered two primary findings. Firstly, moral actions made in emotionally arousing virtual dilemmas are significantly different to theoretical moral judgments. Secondly, certain pro- and anti-social personality traits predict moral actions (see Chapter 2) and the power with which those moral actions are endorsed (see Chapter 3).

Research has argued that the relationship between these traits and moral actions may derive from emotional processes such as reduced empathic processing and less aversion to harm (Patil, 2015). In the previous chapter of this thesis, empathic processing and harm aversion were manipulated using a psychopharmacological paradigm. Reducing behavioural empathic processing with alcohol did not affect moral judgments or moral actions. However, I highlighted the importance of extending this investigation beyond on-line (state) effects, given the significance of dispositional traits in shaping personal and moral identities (Strohminger & Nichols, 2014) and I also highlighted the importance of investigating populations who are likely to demonstrate less aversion to performing specifically harmful actions. As such, in the final chapter of this thesis, I examine moral decision-making in individuals who are frequently exposed to emotionally aversive events. This provided the opportunity to further investigate the roles of empathy and harm aversion in moral judgments and moral actions made by specialised populations.

Moral Decision-Making and Occupation

The research presented in this thesis, and previous studies investigating moral action and moral judgment, have employed diverse populations in order to shed light on moral decision-making (e.g., Cushman et al., 2010; Greene, 2015; Greene et al., 2004; Shenhav & Greene, 2014). Recently however, research has begun to question the significance of occupation on moral decision-making; more specifically, occupations that are directly connected to moral decision-making including those in healthcare settings and the military (e.g., Colangeli et al., 2015; Grinberg, Hristova, & Kadreva, 2016; Ransohoff, 2011; Ransohoff, Wikler, & Greene).

This line of investigation is significant to this thesis for several reasons. Firstly, specialised training in medical and emergency services involves frequent and direct exposure to emotionally salient and aversive situations (Grinberg et al., 2016). Secondly, recent research has argued that "helping professions" adopt a "rescue personality" (Wagner, Martin, & McFee, 2009) which is often associated with emotional resilience and coping strategies. For example, emergency service and healthcare professionals have been found to have reduced aspects of empathy (e.g., Neumann et al., 2011; Williams et al., 2012) and down-regulation of responses to the pain of others (Decety, Yang, & Cheng, 2010). Lastly, with VR offering immersive approaches to investigating realistic moral actions, emergency and healthcare services have begun to utilise virtual simulations in their training programmes (e.g., Colangeli et al., 2015). If moral judgments and moral actions in VR are at least partially distinct (e.g., Tassy, Oullier, et al., 2013), then this is significant for occupations involved in regular moral decision-making who begin to utilise VR in their training and assessment. As such, in the following chapter, I now focus on investigating moral judgment and moral action in these specialised populations.

Morality and the Helping Professions

Grinberg et al. (2016) first investigated moral judgments made by midwives and firefighters revealing a strong effect of occupation on moral decision-making; less utilitarian judgments were made by helping professions overall with fewest given by midwives. The authors initially note that in these professions, decision-making can impact human life and that subsequently, training might lessen emotional arousal resulting in more utilitarian judgments. However, they later argue that their reverse finding suggests that "…these professions share high moral values… respect more strongly individual rights" (Grinberg et al., 2016, p. 709).

The idea that fewer utilitarian judgments can be observed in "helping professions" has been further supported in research examining moral judgments made by medical doctors and public health professionals (Ransohoff, 2011; Ransohoff et al.). Medical doctors are professionally obliged to protect the rights of their patients while public health professionals are more likely to be concerned with the bigger picture of public health (Greene, 2014). These moral ideals were supported in the finding that public health professionals gave more utilitarian judgments than both medical doctors and controls, suggesting that they give"…priority to the greater good" (Greene, 2014, p. 130).

In line with this research and from a military perspective, Colangeli et al. (2015) found that pilots endorsed fewer utilitarian solutions when compared to non-pilots when asked to judge the moral acceptability of the proposed utilitarian solution. When asked whether they would do the proposed utilitarian action described, no difference was found between pilots and non-pilots. The authors argue that fewer ratings of moral acceptability may result from their previous experiences; leading to increased awareness and sensitivity when faced with emotionally aversive dilemmas (Colangeli et al., 2015).

Despite the recent focus on investigating the significance of occupation on moral judgment and separate lines of investigation examining the discrepancy between judgment and action, research has yet to investigate the impact of specialised training on simulated moral actions and moral inconsistency. This is particularly relevant given the increased incorporation of VR technologies in healthcare and military training (Colangeli et al., 2015) and the need to assess real actions "…in strong time pressure conditions" (Colangeli et al., 2015, p. 76).

In order to address this, in the present chapter, I investigated both moral judgments and moral actions made by non-specialised controls and helping professions that were both experienced and in training. In the following section, I present specific hypotheses for the present experiment with research outlining characteristics of trained professionals that may alter moral judgment and moral action and evaluations following moral action.

Specific Hypotheses

Specialised Training and Moral Decision-Making

If helping professions are frequently exposed to aversive situations, moral judgments might be more utilitarian in nature when compared to normal populations as a result of successful emotion management (e.g., Grinberg et al., 2016) and less aversion to performing harmful actions (e.g., Patil, 2015). Alternatively, based on previous research, and if exposure to single-life saving incidences is prevalent, these individuals could prioritise individual rights resulting in non-utilitarian moral judgments (e.g., Greene, 2014; Grinberg et al., 2016). However, if the hypothetical nature of these trolley-type problems is extensive, it might be that decisions made in response to them, bear little resemblance to the real-life decisions made by professionals (Grinberg et al.,

2016) resulting in no difference in moral responses between untrained and trained populations.

In terms of moral actions specifically, predictions are less certain. Moral actions could fall in line with the former hypotheses given the findings of previous research (e.g., Grinberg et al., 2016; Ransohoff, 2011; Ransohoff et al.). However, the footbridge dilemma, whether text-based or virtual, remains hypothetical in nature and so moral actions might also fall in line with the latter prediction (Grinberg et al., 2016).

Specialised Training and Moral Inconsistency

Arguably, the professional code of conduct under which helping professions operate "…is potent to implicitly bias moral judgment outside the professional context" (Grinberg et al., 2016, p. 704); personal moral orientations may alter through training and experience to fall in line with professional codes of conduct. For example, strong moral convictions in healthcare professionals become less prominent in experienced individuals perhaps reflecting this process (Grinberg et al., 2016). Thus, in terms of moral inconsistency, specialised training may alter these perspectives with both moral judgments and moral actions deriving from the same underlying moral principles or codes of conduct prescribed by the profession. This would subsequently result in less moral inconsistency in trained professionals.

Alternatively, if moral judgment and action are driven by distinct mechanisms and training does not alter perspectives, moral inconsistency may remain universal and unaffected by training.

Specialised Training and Resilience

"Non, je ne regrette rien"

(Dumont, 1956)

Evidence that helping professions demonstrate resilience comes from a multidisciplinary body of research. For example, in extensive interviews with firefighters, Alexander (2016, p. 162) noted that "…they instinctively understood the danger of upward counterfactual thinking" or imagining alternative circumstances that may have been better than reality (e.g., Roese, 1997). Firefighters also produced fewer expressions of regret, taking strength from "…professional pride, sense of duty" (Alexander, 2016, p. 212). This association between occupations involving moral decision-making and resilience, has also been found in research with physicians; traits associated with resilience support functioning in professions that are both "…demanding and stressful" (Eley et al., 2013, p. 7). If trained professionals do demonstrate this resilience, then post-hoc evaluations of simulated moral actions may differ from normal populations in that they reflect this resilience rather than show any regret.

Exposure, Empathy, and Arousal

Investigations seeking to understand the origins of resilience in helping professions have highlighted the role of empathy arguing that lower empathy may "…serve as an adaptive function" providing resilience in emotionally aversive emergencies (Williams et al., 2012, p. 9). In fact, empathy decline has been observed in medical students and medical residents (Neumann et al., 2011). Importantly, this does not implicate all aspects of empathy as, arguably, specialist training allows professionals to empathise with a patient's circumstances "…without becoming

emotionally entangled" (Williams et al., 2012, p. 9). For example, research has also shown that aspects of empathy can increase or remain stable throughout healthcare training across professions (e.g., Williams et al., 2014). If certain components of empathy are lower in trained professionals, aspects of empathy decline might be observed with years of experience working in the profession. Furthermore, if these aspects of empathy are lower in trained professionals, then empathy scores and associated traits are likely to be significantly lower in helping professions when compared to non-specialised individuals. On the other hand, if additional aspects of empathy are in fact higher in trained professionals, the opposite outcome might be observed.

Given that "empathy" encompasses a variety of components and is frequently used to refer to "…a heterogeneous collection of related phenomena" (Decety & Cowell, 2015, p. 2), here I investigate aspects of empathy using the Perspective Taking, Empathic Concern, and Personal Distress facets of the Interpersonal Reactivity Index (Davis, 1983). Although seen as a distinct conceptualisation to empathy (e.g., Batson, 2009; Decety & Moriguchi, 2007), Personal Distress is included as a measure of "…self-oriented, egoistic" reactions (Decety & Moriguchi, 2007, p. 17) with previous research indicating that prevalence of Personal Distress over empathy, results in fewer helping behaviours (Carrera et al., 2013).

With trained professionals demonstrating emotional resilience (e.g., Neumann et al., 2011; Williams et al., 2012) and an ability to down-regulate responses to the pain of others (Decety et al., 2010), repeated exposure to emotionally aversive events is also likely to affect arousal during moral decision-making. In previous VR paradigms, research has found increased arousal in virtual moral dilemmas as compared to text-based counterparts (Patil et al., 2014) indicating the value of virtual paradigms in

triggering realistic physiological responses to aversive situations. Trained professionals, having had repeated exposure to aversive incidents, may prove emotionally resilient in virtual simulations showing little or no arousal increase and this should be related to years of experience in the profession.

Experiment 6

Method

Participants

Sixty participants were recruited in total from three populations. Participants were sampled in order to gain a non-specialised group (control), a specialised group in training (paramedic practitioners) and an experienced specialised group (incident commanders from the fire service) [37]:

-Twenty control participants comprising 17 females and three males, (M_{age} = 19.40, *SD* = 1.67 years, age range: 18 - 25 years) were recruited from the Plymouth University, School of Psychology participant pool and completed the study for course credit.

-Twenty paramedic practitioners comprising 12 females and eight males (M_{age} = 24.05, *SD* = 7.67 years, age range: 18 - 50 years) were recruited from Plymouth University, School of Health Professions and completed the study on a voluntary basis. Paramedic practitioners were currently completing the first year of a BSc Paramedic Practitioner course and were predominantly in training at the university.

[37] Although previous research examining moral judgments made by helping professionals has identified gender differences in these specialist populations (Grinberg et al., 2016), this is not examined in the present experiment for the reason that significant gender imbalances existed in the present samples and as mentioned previously, for the reason that there appears to be "…no sound scientific evidence that supports why there should be gender differences in moral judgment" (Christensen et al., 2014, p. 14).

-Twenty incident commanders comprising two females and 18 males (M_{age} = 39.85, *SD* = 9.37 years, age range: 22 - 61 years) were recruited from the Devon and Somerset Fire and Rescue Service and completed the study on a voluntary basis at the Fire Training Centre at Exeter Airport. Incident commanders were based at different stations across the counties of Cornwall, Devon, and Somerset. Although having various roles within the fire service rank structure, all were trained in incident command.

Measures

Participants were asked to fill out the electronic questionnaire incorporated in Chapter 4, comprising the LSRP (αs = .55 - .78), components of the HEXACO-IP-R (αs = .66 - .79)[38], and the Perspective Taking, Empathic Concern, and Personal Distress components of the IRI (αs = .72 - .87)[39] and the Self-Importance of Moral Identity Scale (αs = .64 - .80). In the present experiment, these personality traits were assessed in order to determine whether trait differences existed between specialist groups and control populations.

Moral Decision-Making Measures

Following the within-groups procedure adopted in the previous chapter (see Chapter 4), all participants completed both the moral action and the moral judgment tasks. For the moral action task, participants completed the same non-moral virtual task and moral virtual task as described in Chapter 2 (see Figure 5.1).

[38] Four of the six HEXACO dimensions were included in the present experiment. Honesty-Humility was included given its associations with primary psychopathy (Djeriouat & Tremoliere, 2014). Three further dimensions were included as their facets have relevance to medical and healthcare professions; Agreeableness (gentleness and patience), Conscientiousness (diligence and organisation), and Emotionality (fearfulness and sentimentality).

[39] The Fantasy Seeking subscale was not included in the present experiment given evidence suggesting that it does not represent modern conceptualisations of empathy (Baldner & McGinley, 2014; Batson, 2009).

For the judgment task, participants were given the text-based non-moral task from Chapter 2. In the text-based moral task, participants were then given a vignette describing the comparable dilemma (adopted in Chapter 4), embedded in five additional distractor dilemmas (Greene et al., 2001). These dilemmas were classified as personal and impersonal and were selected from those used in Greene et al. (2001) and in previous chapters of this thesis (see Chapter 4).

All dilemmas were presented electronically in a random order. As in previous chapters, after each dilemma, participants were asked a judgment question ("*Is it morally acceptable to [specific to the scenario]*?"). After a response was given, a second action-choice question was displayed asking ("*Would you do it?*"). Participants responded by selecting "Yes" (Y - key) or "No" (N - key).

Figure 5.1. Experimental Setup with Incident Commander

Figure 5.1. Incident commander wearing the Oculus Rift in the setup adopted at the Fire Training Centre at Exeter Airport. Photograph taken by the author: June, 2016.

Physiological Measures

Heart rate was recorded using the equipment and procedure described in Chapter 2. As in Chapter 2 and Chapter 4, heart rate sampling was completed with the primary aims of assessing whether arousal was modality or moral specific and in this experiment specifically, to determine whether trained professionals demonstrated emotional resilience to arousing moral scenarios.

Procedure

The procedure adopted in the present experiment was identical to that of Chapter 4 with the completion of the action and judgment tasks counterbalanced. Further, as an addition to the pre-questionnaire, all individuals were asked to record their direct experience working with any sector of the emergency services (in years). In the post-questionnaire following the virtual moral task, individuals were also asked "Did you take the right action?" and could respond with "Yes" or "No". This additional post-question was included to allow assessment of post-hoc expressions of regret and resilience.

Results

Order Effects

Across groups, no order effects were found based on task presentation when referencing the judgment question (*ps* > .490) or action-choice question (*ps* > .598).

Pre-Questionnaire Responses

For the moral action task, endorsing a utilitarian outcome (pushing the person in VR) was not associated with prior gaming experience (*ps* > .165) or VR experience (*ps* > .262) across groups.

Coercion

As in Chapter 4, coercion did not predict VR action responses in the control group (p = .187), in the paramedic group (p = .999) or in the fire service group (p = .691).

Moral Responses

In order to compare moral judgments and moral actions, simulated moral actions in the virtual version of the footbridge dilemma were compared to the moral judgments made in response to the text-based counterpart. In all groups, the proportion of utilitarian responses was higher when simulated action was required in VR compared to when judgment was required in the text-based counterpart (see Table 5.1).

Table 5.1

Percentage of Utilitarian Responses in Moral Judgment and Action Tasks

Group	Moral judgment task		Moral action task
	Judgment question	Action-choice question	
Control	10%	5%	60%
Paramedic	30%	30%	70%
Fire service	25%	25%	60%

Generalised Estimating Equations (GEE) were conducted using a binary logistic model with task (judgment task; action task) as within-subjects factor and group (control; paramedics; fire service) as between-subjects factor (see Figure 5.2). As in

Chapter 4, two analyses were carried out, the first using the judgment question in the judgment task and the second using the action-choice question in the judgment task.[40]

Judgment question. When selecting the judgment question, analysis revealed a main effect of task, (Wald $X^2[1] = 30.50$, $p < .001$), with a greater proportion of utilitarian responses overall in action tasks compared to judgment tasks. There was no main effect of group ($p = .373$) and no interaction ($p = .473$).

Action-choice question. When selecting the action-choice question, analysis revealed a main effect of task, (Wald $X^2[1] = 24.91$, $p < .001$), with a greater proportion of utilitarian responses overall in action tasks compared to judgment tasks. There was no main effect of group ($p = .217$) and no interaction ($p = .288$).

[40] This analysis was designed to compare moral actions in VR and moral judgments in text-based vignettes, hence the judgment and action-choice questions were referenced in separate analyses (as both derived from the same text-based moral dilemma). In order to determine if there were differences in responses to questions, an additional GEE analysis incorporating both the judgment and action-choice questions, revealed a main effect of task (Wald $X^2[1] = 33.36$, $p < .001$), with a greater proportion of utilitarian responses overall in the action task as compared to both questions in the judgment task (*ps* < .001) but no difference between moral responses to the judgment question and action-choice question ($p = 1.000$).

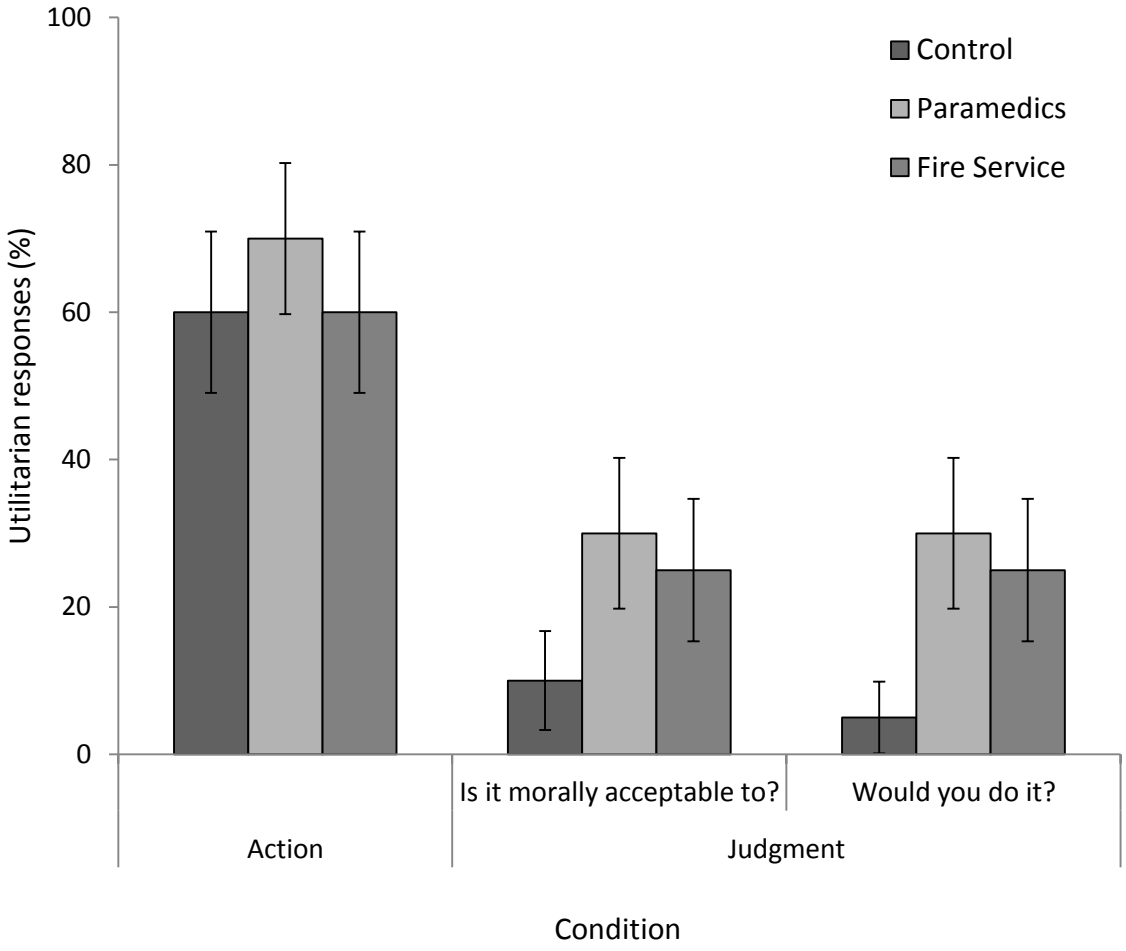


Figure 5.2. Utilitarian responses (%) in the moral action task (VR footbridge) and the moral judgment task (footbridge counterpart) in the control, paramedic, and fire service groups. In the judgment task, participants were asked whether the action was morally acceptable and whether they would do it. A greater number of utilitarian outcomes were endorsed in the moral action task.[41] Errors bars represent +- 1 SE_p.

[41] Although GEE analyses revealed no significant response differences between groups, the differences between groups in their responses to the judgment task still appeared large (e.g., 5% versus 30% utilitarian responses). As such, I carried out additional separate chi-square tests comparing responses to the judgment question and the action-choice question between groups. These supported GEE analyses showing no significant differences between groups in their moral judgments made in response to either the judgment question (p = .381) or action question (p = .121).

Heart Rate Analyses

In all groups, changes in heart rate were calculated as in Chapter 2 resulting in a heart rate change for non-moral tasks (judgment non-moral task; action VR non-moral task) and moral tasks (text counterpart dilemma; VR *footbridge* dilemma). Mean heart rate change increased in the moral action task for the control group and paramedic practitioners but decreased for incident command officers in the fire service (see Table 5.2).

Table 5.2

Mean Heart Rate Change across Judgment and Action Tasks

	Judgment task		Action task	
	Non-moral	Moral	Non-moral	Moral
Group	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Control	-0.45 (1.15)	0.80 (2.50)	-0.95 (2.21)	3.10 (3.21)
Paramedics	-0.50 (0.67)	-0.05 (1.43)	-0.25 (1.74)	1.75 (3.52)
Fire service	-0.05 (1.15)	-0.10 (1.68)	0.05 (1.54)	-0.20 (3.40)

A mixed ANOVA with task (judgment task; action task) and type (non-moral task; moral task) as within-subjects factors and group (control; paramedics; fire service) as the between-subjects factor was conducted. Analysis revealed a main effect of task, ($F(1, 57) = 5.30$, $p = .025$, $\eta_p^2 = .09$), a main effect of type, ($F(1, 57) = 14.99$, $p < .001$, $\eta_p^2 = .21$), a significant interaction of type x task, ($F(2, 57) = 7.17$, $p = .010$, $\eta_p^2 = .11$), and a significant interaction of type x group, ($F(2, 57) = 6.35$, $p = .003$, $\eta_p^2 = .18$) (see Figure 5.3). There was no main effect of group ($p = .136$).[42]

[42] The three-way interaction of type x task x condition approached marginal significance, ($F(2. 57) = 2.83$, $p = .067$, $\eta_p^2 = .09$). In this instance statistically significant two-way interactions were followed up.

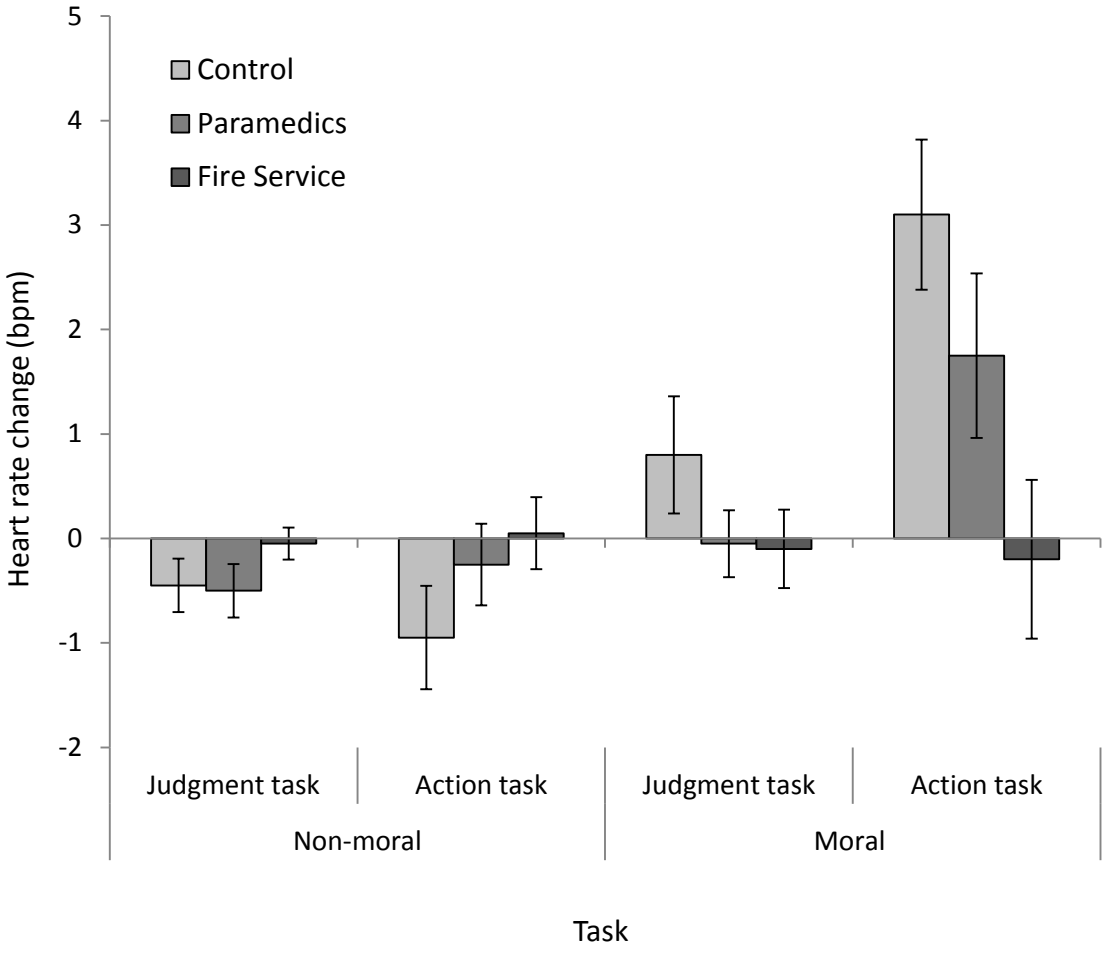


Figure 5.3. Mean heart rate change (bpm) for non-moral and moral task type in judgment and action tasks by group. Increased heart rate changes were observed in moral tasks for the control group and paramedics only. Error bars represent +- 1 SE.

To further investigate the interaction of type x task, simple effects analyses were performed comparing heart rate changes in non-moral and moral tasks within both judgment and action tasks. In the judgment task, heart rate change was marginally significantly higher in the moral task compared to the non-moral task across groups, ($F(1, 57) = 3.92$, $p = .052$, $\eta_p^2 = .06$). In the action task, heart rate change was significantly higher in the moral task compared to the non-moral task, ($F(1, 57) = 14.26$, $p < .001$, $\eta_p^2 = .20$). For the moral tasks only, there was a significant difference in heart rate change between the judgment and action task across groups, ($F(1, 57) = 7.86$, $p = .007$, $\eta_p^2 = .12$) with heart rate change highest in the virtual moral action task.

To further investigate the interaction of type x group, simple effects analyses were performed comparing heart rate change in non-moral and moral tasks across groups. This analysis suggested that for the non-moral tasks, heart rate changes were not significantly different between the three groups, ($p = .159$). However for the moral tasks, analysis suggested that heart rate changes were different between groups, ($F(2, 57) = 5.28$, $p = .008$, $\eta_p^2 = .16$). Specifically, in the control group, heart rate changes were significantly greater in the moral tasks than in the non-moral tasks, ($F(1, 57) = 22.75$, $p = < .001$, $\eta_p^2 = .29$) and this was also the case for the paramedic practitioners, ($F(1, 57) = 4.86$, $p = .032$, $\eta_p^2 = .08$). Analysis suggested that there was no significant difference in heart rate changes between non-moral and moral tasks for the incident command officers in the fire service group, ($p = .788$).[43]

[43] The ratio of greatest and least variance in heart rate change was >3 and as such, this analysis was repeated and using Generalised Estimating Equations, which does not assume homogeneity of variance (see Statistical Note (5.1)). All findings were replicated in GEE although post hoc comparisons indicated that there was no difference in heart rate changes between non-moral and moral tasks for both incident commanders *and* paramedic practitioners.

Personality Traits

In order to assess any differences in personality trait scores between groups, a one-way ANOVA was used to compare traits. Several significant differences between personality traits were found between groups and follow-up comparisons with Bonferroni corrections were performed to determine between which groups these differences were present (see Table 5.3).

Table 5.3

Personality Trait Differences

		Group		
		Control	Paramedics	Fire service
Measure	Subscale	M (*SD*)	M (*SD*)	M (*SD*)
1. LPS				
	Primary	30.60 (*7.43*)	29.20 (*5.55*)	29.20 (*5.15*)
	Secondary	20.85 (*3.28*)	21.45 (*3.00*)	18.60 (*3.80*)
2. HEXACO				
	H	3.31 (*0.53*)	3.73 (*0.60*)	3.73 (*0.39*)
	Em	3.32 (*0.83*)	3.23 (*0.63*)	2.64 (*0.61*)
	A	3.23 (*0.71*)	3.14 (*0.69*)	3.16 (*0.56*)
	C	3.65 (*0.47*)	3.56 (*0.48*)	3.78*0.49*)
3. IRI				
	PT	17.90 (*3.84*)	17.20 (*4.96*)	16.75 (*4.64*)
	EC	19.30 (*4.74*)	19.30 (*3.25*)	17.70 (*4.29*)
	PD	11.15 (*3.73*)	8.35 (*4.37*)	5.45*3.07*)
4. Moral Identity				
	Symbolization	2.92 (*0.62*)	3.04 (*0.85*)	3.13 (*0.53*)
	Internalization	4.36 (*0.44*)	4.37 (*0.51*)	4.25 (*0.43*)

Note. H = Honesty-Humility, Em = Emotionality, Ex = Extraversion, A = Agreeableness, C = Conscientiousness, O = Openness to experience. PT = Perspective Taking, EC = Empathic Concern, PD = Personal Distress.
-·-·- p =.05 ------- p <.05 —— p <.001

No significant differences between the control group, the fire service and the paramedics were found for Moral Identity in either Symbolization or Internalization (*ps* > .621), the HEXACO subscales Agreeableness and Conscientiousness (*ps* > .368), primary psychopathy (p = .707), or the IRI subscales Perspective Taking and Empathic Concern (*p*s > .376).

Years of Experience

Heart rate. Given that trained professionals are frequently exposed to emotionally aversive situations, bivariate correlations were carried out to determine whether heart rate change in the virtual moral task and heart rate change in the text-based moral task were associated with years of direct experience working with any sector of the emergency services (see Figure 5.4). Years of experience was not correlated with heart rate change in the text-based moral judgment task (p = .566) or heart rate change in either the judgment or action non-moral tasks (ps > .227). Years of experience had a small negative correlation with heart rate change in the virtual moral task, (r(58) = -.28, p = .033) and when entered into a univariate linear regression, was found to explain 7.6% of the variance in the model, (R^2 = .076, F(1,58) = 4.76, p = .033) when predicting heart rate change (β = -.28, p = .033).

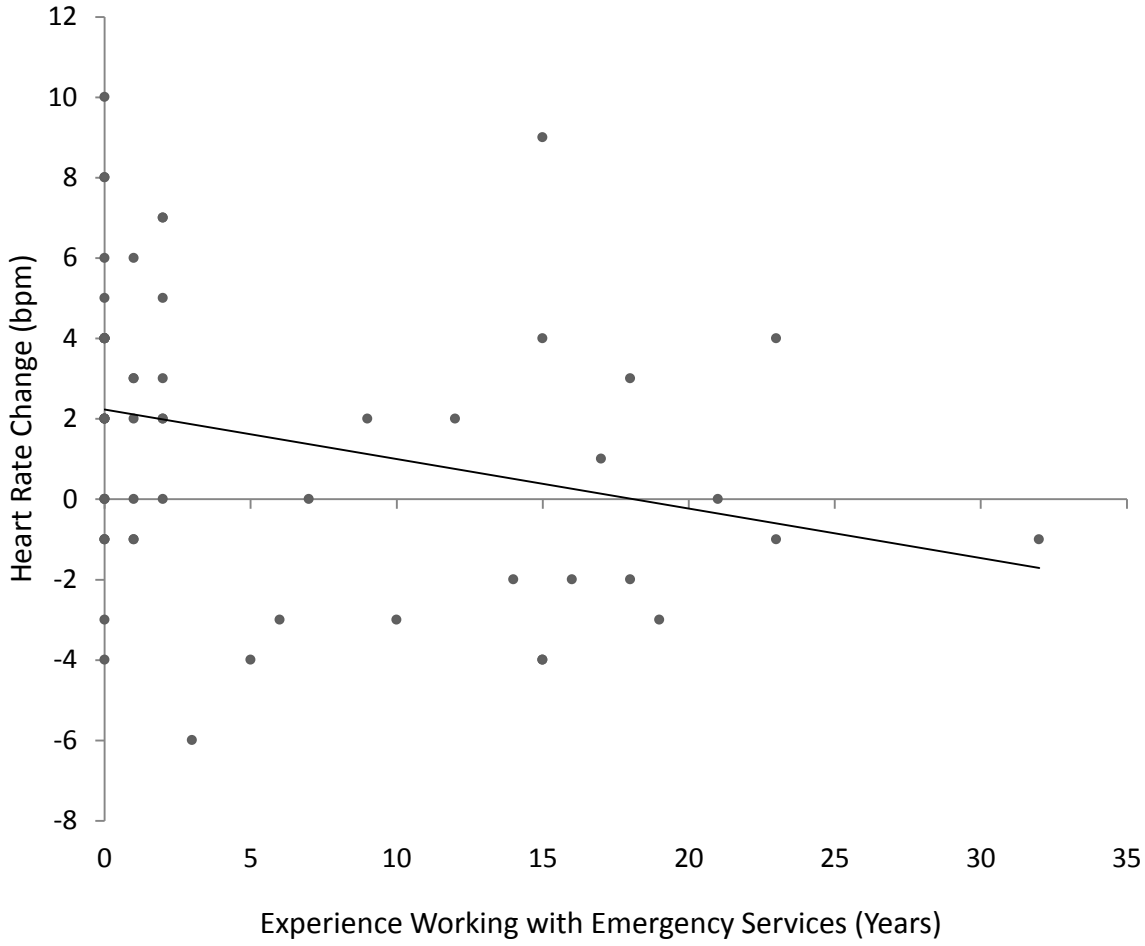


Figure 5.4. Heart rate change (bpm) in the virtual moral action task plotted against direct experience working with any sector of the emergency services (years). Years of experience negatively predicted heart rate change in the virtual moral task. Linear regression trendline: $R^2 = .08$.

Personality traits. Given that previous research has found empathy decline in trained professionals (Neumann et al., 2011) arguably as an adaptive function (Williams et al., 2012), personality traits were also correlated with years of direct experience working with any sector of the emergency services. Years of experience were negatively correlated with secondary psychopathy ($r(58) = -.44$, $p < .001$), Emotionality ($r(58) = -.32$, $p = .011$) and Personal Distress ($r(58) = -.40$, $p = .001$) (see Figure 5.5). A multivariate regression with these traits entered as dependent variables and years of experience entered as the predictor variable, found that experience negatively predicted these traits, ($\Lambda_{pillai} = .320$, $F(3,56) = 8.77$, $p < .001$) (see Table 5.4).[44]

[44] Given theories regarding the relationship between empathy (and related traits) and emotional resilience in experienced professionals working in the emergency sector, I also performed mediation analyses. These revealed that heart rate change in the virtual moral task did not mediate the relationship between years of experience and the above traits (*ps* > .085).

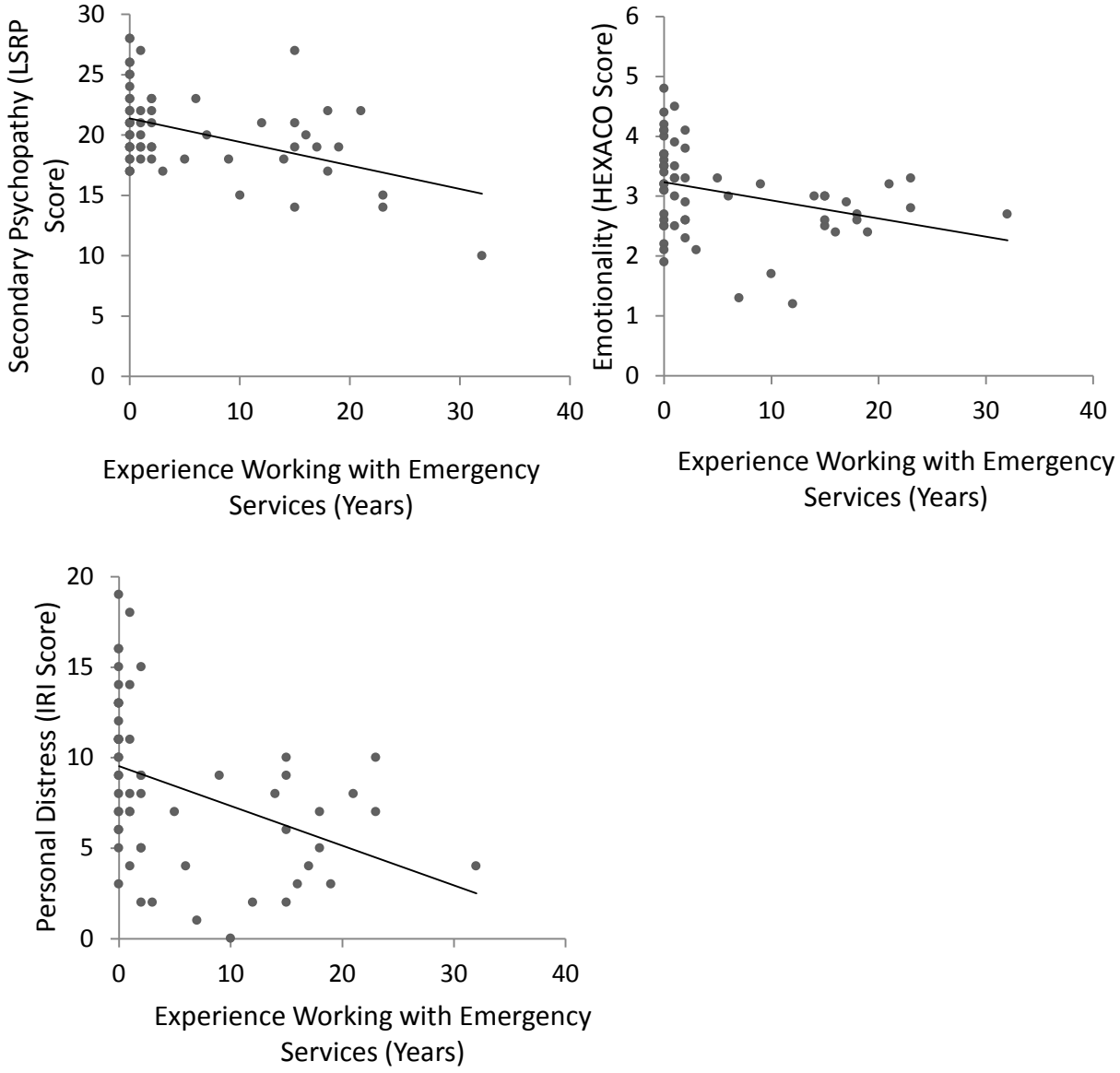


Figure 5.5. Personality traits including *(i)* secondary psychopathy *(ii)* Emotionality *(iii)* Personal Distress plotted against direct experience working with any sector of the emergency services (years). Linear regression trendlines for *(i)* $R^2 = .20$ *(ii)* $R^2 = .11$ *(iii)* $R^2 = .16$. LSRP = Levenson Self-Report Psychopathy Scale; IRI = Interpersonal Reactivity Index.

Table 5.4

Univariate Outputs of Multivariate Regression with Years of Experience as Predictor of Traits

Dependent Variable	Included	B (*SE*)	β	R^2
Secondary psychopathy				
	Constant	21.39 (*0.51*)		
	Experience	-0.20 (*0.05*)	-.44**	.20
Emotionality				
	Constant	3.23 (*0.11*)		
	Experience	-0.03(*0.01*)	-.32*	.11
PD				
	Constant	9.54 (*0.64*)		
	Experience	-0.22(*0.07*)	-.40*	.16

Note: Experience = years of direct experience working with any sector of the emergency services. PD = Personal Distress.
*p <.05. **p <.001
(*SE)* = standard error

Post-Action Judgments

In order to assess post-hoc evaluations of simulated moral actions in VR (or omission of simulated moral actions), responses to the question "Did you take the right action?" were compared across groups. This was done with the intention of examining resilience versus regret in post-hoc evaluations of moral actions. A three-way chi-square test was performed to examine the relation between group (control; paramedics; fire service) and post response (right action: yes; no) based on response type in VR (non-utilitarian; utilitarian). Fisher's Exact Tests (FET) are reported for instances in which cells have expected counts less than five. There was a significant association between group and whether or not participants reported that they had taken the right action. This

was only the case when a utilitarian action had been endorsed in VR, ($\chi^2(2) = 14.79$, $p < .001$; FET).

In order to interpret this finding, follow-up tests using two-way chi-square tests were performed with Bonferroni corrections. Of the participants in the control group who pushed in VR, only 33.33% stated that they had taken the right action. Of the paramedic practitioners who pushed in VR, 100% stated that this was the right action, significantly more than in the control group, ($p < .001$; FET). Similarly, of the incident commanders who pushed in VR, 83.33% stated that this was the right action, again, significantly more than in the control group, ($\chi^2(1) = 6.17$, $p = .013$) (see Figure 5.6). There was no significant difference in post responses between paramedics and incident commanders ($p = .203$; FET).

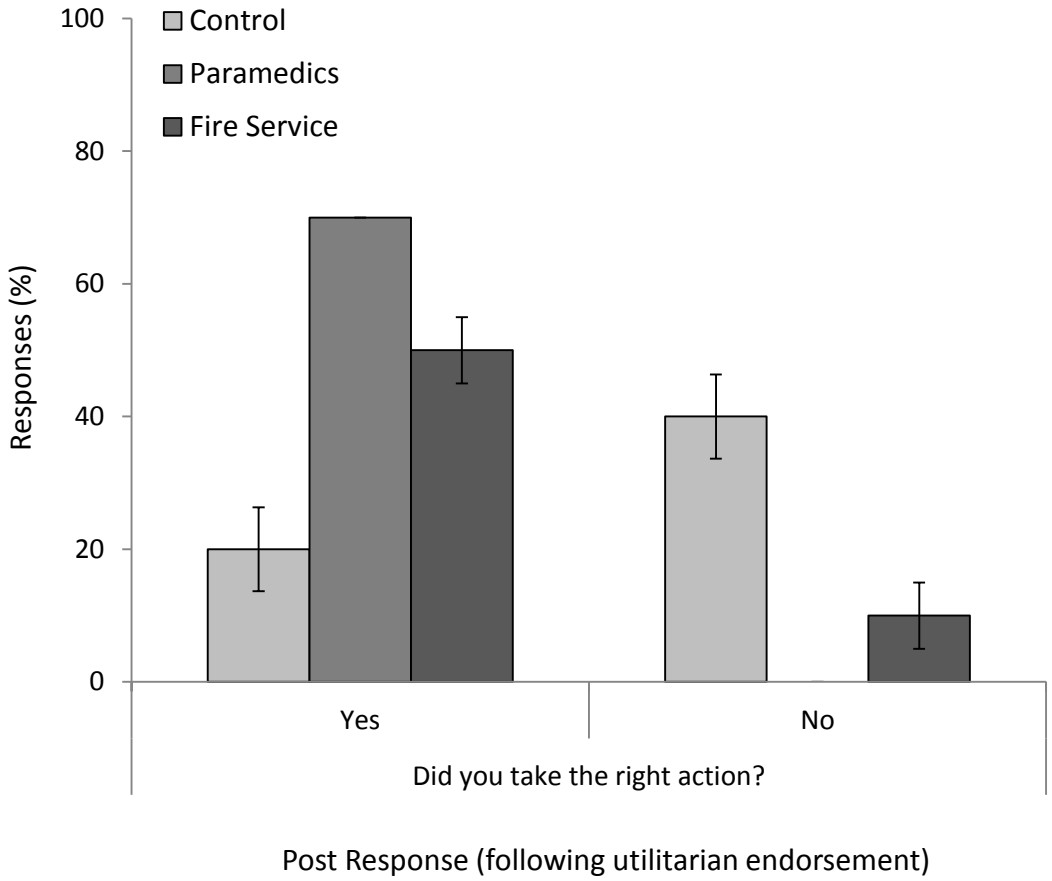


Figure 5.6. Post responses (%) to the question "Did you take the right action?" following the endorsement of a utilitarian action (pushing the man) in VR by group. A greater number of "Yes" responses were given in both the paramedic and fire service groups. Error bars represent +- 1 $SE_{p.}$[45]

[45] Note: Error bars for standard error of proportion are not visible for paramedic responses as all paramedic practitioners who responded in VR with a utilitarian action later said they had taken the right action (with no variance in responses, $SE_p = 0$).

General Discussion

Overall, greater utilitarian endorsements were observed when simulated action was required in VR and this was the case across untrained individuals, individuals in-training, and trained individuals. While moral judgments and moral actions were not significantly different between unspecialised and specialised individuals, there were differences between these populations with regards to resilience; in terms of arousal in virtual simulations and in post-hoc judgments of actions.

Moral Actions versus Judgments

In terms of moral judgment and moral action, participants endorsed the utilitarian response (pushing the person off the bridge) when action was required in VR significantly more than when judgment was required in the traditional text-based counterpart of the footbridge dilemma across all groups, regardless of specialised training. Our results support previous virtual research (Pan & Slater, 2011; Patil et al., 2014) and the previous research presented in this thesis (Chapter 2; Chapter 3; Chapter 4) with VR moral dilemmas offering insights into the role of immediate moral actions as opposed to judgments made in text-based moral dilemmas. For the helping professions specifically, I had hypothesised that they may demonstrate reduced moral inconsistency as a result of professional codes of conduct influencing and driving both moral judgments and moral actions. However, the present findings suggest that moral inconsistency remains unaffected by professional training, again supporting the theory that moral judgment and action are driven by distinct mechanisms (e.g., Tassy, Oullier, et al., 2013).

Further, with trained professionals often exposed to aversive situations and less aversion to harm previously linked to utilitarian moral decision-making (e.g., Patil,

2015), I theorised that this might lead to greater utilitarian endorsements while previous research argued that exposure to single-life incidences would lead to fewer utilitarian endorsements (e.g., Grinberg et al., 2016). However, in the present experiment, both virtual moral actions and moral judgments were not significantly different between groups, contradicting previous research (Grinberg et al., 2016) which has subsequently argued that trolley-type dilemmas can have significance "…in the real world and not just in the lab" (Greene, 2014, p. 130). Our findings here do not directly support this claim and might suggest that the hypothetical nature of these trolley-type problems limit their application to real-life decision-making.

However, I propose an alternative interpretation of the present finding. Hypothetical moral dilemmas were designed, in their experimental simplicity, to allow moral conflicts to play out in artificial contexts with anonymous agents; making them impervious to individual experience (Christensen & Gomila, 2012; Hauser et al., 2007). The finding that specialised training does not alter moral decisions in trolley-type problems, whether text-based or virtual, supports the experimental control available in these hypothetical scenarios. They remain unaffected by personal experiences, as was originally intended in their formulation, allowing moral psychologists to understand the "…foundational psychological processes that underlie human moral cognition" (Christensen & Gomila, 2012, p. 1250).

Specialised Training and Personality Traits

With specialised professionals often employing a "rescue personality" (Wagner et al., 2009) associated with emotional resilience, I predicted that there would be differences in empathy and associated traits between untrained individuals and helping professions. This was supported, with several personality trait differences found between untrained controls, paramedic practitioners, and incident commanders in the

fire service. I outlined contrasting hypotheses predicting either an associated decline or increase in these traits with years of experience working in the profession. The former hypothesis was supported with negative associations found between several personality traits and years of experience working with the emergency services. Secondary psychopathy, a trait associated with impulsivity and quick-temperedness was negatively predicted by years of experience. In terms of HEXACO traits, Emotionality, a trait associated with fearfulness and empathic sensitivity (Ashton & Lee, 2005), was negatively predicted by years of experience. Further and in line with this, Personal Distress, a trait "…negatively related to measures of social functioning" (Davis, 1983, p. 116) and associated with feeling anxiety when observing the negative experiences of others, also declined with years of experience working in the emergency services.

The finding that length of time working in helping professions results in a significant decline in traits associated with fearfulness and personal distress, might reflect the emotional resilience that is formed in response to repeated exposure to aversive, dangerous, and emotionally volatile situations (e.g., Eley et al., 2013; Grinberg et al., 2016) and suggests that helping professionals gain "…increasing confidence in facing emergencies" (Bellini & Shea, 2005, p. 167). Whether the present findings support reports of empathy decline in healthcare professionals (e.g., Neumann et al., 2011), is less clear. While lowered Personal Distress and Emotionality scores were observed, both Empathic Concern and Perspective Taking scores in both paramedic practitioners and experienced incident command officers were stable. Given that the latter components fall within conceptualisations of "empathy" and are arguably "…two behaviours particularly important for medicine" (Bellini & Shea, 2005, p. 167), our findings suggest that caring for another's welfare and putting oneself into the mind of another, are not affected through healthcare and emergency training.

Importantly, with healthcare research disputing the adaptive function of lowered empathic responses versus "...the need to incorporate, promote and instil empathy" (Williams et al., 2012, p. 10), we are reminded that in this complex issue "…empathic shades of gray are needed" as trained professionals learn to "…moderate the degree to which they harden their hearts" (Newton, 2013, p. 9). Future research should begin to distinguish empathic components when investigating the supposed "empathy decline" in healthcare and military settings given the findings presented here.

While years of experience working in the emergency services resulted in lower trait scores associated with fearlessness and personal distress, both moral judgments and moral actions made by these specialised populations remained the same as untrained individuals. Again, these findings have significance for theories regarding the roles of empathy and harm aversion in moral decision-making. Exposure to aversive events and differences in trait profiles associated with emotionality, did not influence either moral judgments or moral actions. As in Chapter 4, this might suggest that facets, other than empathy and harm aversion, underlie the relationship between psychopathic traits and moral actions (e.g., Cima et al., 2010; Patil, 2015) evidenced in previous experiments in this thesis (see Chapter 2; Chapter 3).

Exposure and Arousal

Heart rate change was assessed to determine whether arousal was triggered by modality (VR versus text) or moral content and also as a means of examining emotional resilience in trained professionals. With both incident commanders and paramedics frequently working in critical emergency situations in which they have to make "…quick and potentially life-saving decisions…with limited medical back-up" (Williams et al., 2012, p. 9), I theorised that arousal might be lower in these populations and influenced by experience. In the present experiment, greater heart rate change was

observed for moral tasks compared to non-moral tasks for both action and judgment tasks suggesting that the VR modality alone was not responsible for increased arousal, supporting previous findings in this thesis (Chapter 2). However, this increased arousal in moral, as compared to non-moral tasks, was only found for the untrained control group and paramedic practitioners in-training, and not in the trained incident commanders from the fire service, suggesting that trained professionals may demonstrate emotional resilience to arousing situations.

Further, years of experience in the emergency services did negatively predict a proportion of variation in heart rate change in the virtual moral task. Whilst this provides some support for a resilience hypothesis, this association was small. Importantly, this relationship was not found for heart rate change in the text-based judgment task, providing further evidence that utilising VR paradigms in the moral domain can offer valuable insights into realistic emotional responses (Parsons, 2015; Rovira et al., 2009).

Specialised Training and Regret

Previous research has suggested that helping professions also demonstrate resilience in decision-making, exhibiting reduced expressions of regret (Alexander, 2016) and resistance to imagining alternatives that may have been better than reality (e.g., Roese, 1997). I theorised that this resilience might surface in post-hoc judgments about virtual moral actions with trained professionals expressing less regret than untrained populations. In support of this, it was found that when utilitarian actions were endorsed in VR, untrained individuals in the control group, expressed feelings of regret reporting that they had taken the wrong action. Conversely, the majority of paramedic practitioners and incident commanders who had endorsed the utilitarian action in VR reported that they had taken the right action. This suggests that specialised training in

the helping professions provides post-hoc resilience following moral action. Future research might consider extending this investigation of resilience following moral action in trained professionals by incorporating counterfactual thinking and moral emotion measures.

Alternative Interpretations

As in previous experiments, gaming experience did not predict utilitarian responses in the virtual moral task for any group, supporting previous arguments that responses in VR tasks are not akin to those of a gaming environment (see Chapter 2; Chapter 3; Chapter 4). Further and supporting previous experiments (see Chapter 4), coercion did not predict the endorsement of virtual moral actions.

Methodological Considerations

It might be argued that the incorporation of a single hypothetical dilemma in the present experiment limits the reliability with which I can assert that helping professions produced the same moral actions and moral judgments as untrained controls. In previous studies that found a significant difference in healthcare professional's moral judgments (e.g., Grinberg et al., 2016; Ransohoff, 2011), multiple moral dilemmas were incorporated. In the present experiment, additional text-based moral dilemmas were incorporated within the judgment task but as distracter dilemmas. However, in order to address the above consideration, I later analysed moral judgments across all text-based moral dilemmas comparing them between groups (see Appendix 5.1). Overall, greater utilitarian responses were observed for personal over impersonal dilemmas across all groups but no significant differences between groups in their judgments and no interactions between condition, dilemma type, or question were found. I was unable to carry out a similar analysis for moral actions given the incorporation of a single virtual

moral simulation. However, this follow-up analysis does suggest that moral judgments remained the same across untrained individuals, specialists in-training, and trained specialists, even when incorporating multiple moral dilemmas.

In addition, in the present experiment, while differences between paramedic practitioners and incident command officers were investigated, I did also assess years of experience in the helping professions broadly without distinguishing years of experience as a paramedic or years of experience in the fire service. This approach to studying helping professions in previous research has been criticised; "…assuming homogeneity among professions may be unwise" (Wagner et al., 2009, p. 7). For example, in the present experiment, the relationship between years of experience working in the helping professions and changes in arousal in the virtual moral action task were small. Arguably, decreased arousal responses may result from working in the fire service specifically and may not reflect the effect of working in helping professions more broadly. As such, future research should explore emergency service groups independently prior to identifying disparities and similarities between them (Wagner et al., 2009). For example, future research examining the effect of years of experience working in the emergency services on emotional resilience, might consider recruiting both experienced professionals and professionals-in-training from the same helping profession.

Additionally, existing research examining moral decision-making in specialist occupations has largely adopted the theory that exposure and experience may produce either utilitarian or deontological ideals (e.g., Grinberg et al., 2016; Ransohoff, 2011; Ransohoff et al.). However, following completion of the present investigation, I asked both paramedic practitioners and incident commanders whether they applied utilitarian principles in their profession and found a diverse range of responses (see Appendix 5.2).

For example, while one incident commander said that "sometimes a sacrifice needs to be made in order for the greater good" another said "I am totally against this idea. Go fast, go alone, but to go far, go together". One paramedic practitioner said "I believe it is a good ideology. Harm may be needed to help people" while another commented that "only do an action if it is morally right to do so; as in not harming people". In fact, many comments made by both groups argued that the moral ideal they would apply would depend on the situation. For example, a paramedic practitioner remarked that "it is difficult. Every case is different as nothing is ever black and white". As such, it appears that these helping professions do not necessarily adopt one moral principle over another as previous research would suggest (e.g., Ransohoff, 2011). The diversity in opinions expressed by professionals and focus on incident-specific applications of moral ideals, supports the theory that individuals do not assume one moral label but instead adopt a "…particularist approach to morals that takes the details of each case into account" (Christensen et al., 2014, p. 16). Future research should consider this particularist approach when investigating moral decision-making in specialist occupations.

CHAPTER 6: GENERAL DISCUSSION

Introduction

The trolley problem has long offered moral philosophers and psychologists a way of comparing utilitarian and deontological philosophies "…in one neat little puzzle" (Greene, 2014, p. 116). Traditional vignettes describing these trolley problems, whilst being ideal in their experimental simplicity, often lack peripheral contextual features (FeldmanHall et al., 2012; Patil et al., 2014). With increasing considerations of how moral judgments might translate into moral actions (e.g., Navarrete et al., 2012; Tassy, Oullier, et al., 2013), research has begun to incorporate these contextual features into existing paradigms in an attempt to bring judgments "…in line with moral behaviour in real situations" (FeldmanHall et al., 2012, p. 434). In this interdisciplinary thesis, I investigated the relationship between moral judgments made in response to traditional vignettes and moral actions simulated in contextually salient VR paradigms. I also investigated personality traits associated with simulated moral actions versus moral judgments and the emotional processes underlying these. I will end this thesis with a discussion summarising the findings from this investigation, outlining the limitations of the approaches adopted, and suggesting directions for future research.

Moral Judgment versus Moral Action

Whilst previous virtual research utilised virtual reconstructions of impersonal moral dilemmas (Navarrete et al., 2012; Pan & Slater, 2011; Patil et al., 2014; Skulmowski et al., 2014), emphasis was placed on the necessity of investigating virtual reconstructions of personal moral dilemmas, given their ability to generate conflict, prompting greater variation in moral responses (Patil et al., 2014). The experiments

presented in this thesis are the first to incorporate virtual moral dilemmas that involve up-close and emotionally aversive actions.

It was found that moral actions and moral judgments were distinct in the general population (see Chapter 2; Chapter 3) and in populations trained in emergency response (see Chapter 5), supporting previous research also showing dissociation (Pan & Slater, 2011; Patil et al., 2014). This distinction adds to the body of research suggesting that moral action and moral judgment may be driven by at least partially distinct mechanisms (Tassy, Deruelle, et al., 2013; Tassy et al., 2012; Tassy, Oullier, et al., 2013).

Consistent across this investigation was the finding that utilitarian endorsements were greatest when simulated action was required in virtual moral dilemmas. This was found when utilising visually immersive VR (see Chapter 2), physically salient VR dilemmas with haptic feedback (see Chapter 3, Experiment 3), and VR combining both visual immersion and haptic feedback (see Chapter 3, Experiment 4). Moral judgments made in response to judgment and action-choice questions in text-based personal dilemmas, were predominantly non-utilitarian (see Chapter 2; Chapter 3; Chapter 4; Chapter 5). These findings have significance for existing dual-process models of moral judgment. With moral judgments made in response to text-based personal dilemmas being primarily non-utilitarian, these findings support existing dual-process models; the emotionally evocative nature of these dilemmas prompts immediate aversive reactions, resulting in refusals to endorse harm (Cushman, 2013; Greene et al., 2001). Conversely, the finding that utilitarian actions are predominantly simulated in VR contradicts existing dual-process models.

Prior to further discussion, it is important to note that these models were originally developed for moral judgment, and given the disparity between judgment and

action, may not extend adequately to action frameworks. As such, in the present investigation, I have adopted an alternative theory (Patil et al., 2014) that takes existing dual-process models and adapts them to action frameworks, when accounting for VR modalities. In the present investigation, increased contextual saliency, by way of visual or physical features, may have resulted in greater value being assigned to outcomes in VR environments (Cushman, 2013; Patil et al., 2014). The combined influence of feeling and seeing in VR, may give weight to moral decision-making with greater emphasis being placed on protecting victims from harm compared to performing harmful actions (Patil et al., 2014).

I present this modified theory of action-outcome value assignment tentatively. In the present investigation, I did not directly investigate this adapted model and as such, the conclusions that I make here remain theoretical. In order to experimentally investigate this model of moral action, future research might consider incorporating eye-tracking techniques to measure gaze durations for victims and non-victims. There are two important considerations for this research. Firstly, although longer gaze durations arguably indicate which person(s) are likely to be harmed (Skulmowski et al., 2014), findings in this area have been mixed with individuals also tending to avoid looking at victims (Kastner, 2010). Secondly, eye-tracking hardware would need to be incorporated within VR head-mounted devices. Presently, development kits of these technologies are either in the later stages of development pre-release (such as FOVE [apparatus and software]) or are in preliminary stages of distribution (such as Tobii Tech VR [apparatus and software]).

Further, in the present investigation, the role of embodied theories in this model of moral action, were not explicitly examined. Given the view that "…people think, feel, and act inside their bodies." (Meier et al., 2012, p. 707), this investigation is particularly

relevant for further research investigating simulated moral actions. Future research is needed in this area "… to enrich the ethical literature" (Dinh & Lord, 2013, p. 381).

Personality Traits

With previous research suggesting that high psychopathic and associated traits predict moral actions but not moral judgments (e.g., Djeriouat & Tremoliere, 2014; Tassy, Deruelle, et al., 2013), the experiments presented in this thesis sought to investigate the relationship between these personality traits and moral actions made in novel paradigms, in addition to moral judgments.

It was found that primary psychopathy marginally predicted and Honesty-Humility negatively predicted utilitarian moral actions in VR dilemmas (see Chapter 2) and also the power with which individuals simulated moral actions (see Chapter 3). A composite trait score derived from these associated traits, labelled in the present investigation as "anti-social tendency", predicted utilitarian actions (see Chapter 2) and the power of these actions (see Chapter 3). These findings contribute to a body of research suggesting that moral actions are driven by self-focused evaluations (Tassy, Oullier, et al., 2013) and unlike judgments, reflect self-interested motivations as individuals consider the self-relevant consequences of their actions (Tassy, Deruelle, et al., 2013). These traits did not predict moral judgments (see Chapter 2; Chapter 3), again supporting the notion that allocentric perspectives motivate moral judgments (Tassy, Oullier, et al., 2013) with individual responses being driven by moral norms (Tassy, Deruelle, et al., 2013). This finding also has important implications for existing methodologies distinguishing between judgment and action-choice questions (e.g., Tassy, Deruelle, et al., 2013; Tassy, Oullier, et al., 2013); the present investigations support the view that both are self-reported judgments in nature, with neither being predicted by psychopathic or associated traits.

It is important to consider the replicability and power of these findings regarding personality traits. Firstly, primary psychopathy and associated traits did not consistently predict moral actions across experiments (see Chapter 2, Experiment 2). Secondly, with regards to investigating how these individual differences contribute to moral decision-making, the present investigations were limited in terms of their sample sizes. In order to thoroughly investigate the relationship between personality trait profiles and simulated moral actions in VR, future research should adopt approaches from differential psychology in order to examine individual differences in larger sample sizes. Future investigations in this area are critical; the overall findings presented here do suggest that a group of associated traits predict moral actions or features of moral actions but do not appear to predict moral judgments (e.g., Cima et al., 2010; Tassy, Deruelle, et al., 2013).

Emotional Processes

Given that the relationship between psychopathic traits and utilitarian endorsements, is thought to be mediated by diminished affective empathy (e.g., Glenn, Iyer, et al., 2009) and aversion to harm (e.g., Patil, 2015), I examined these components specifically via an experimental manipulation (see Chapter 4) and by examining specialist populations with repeated exposure to aversive events (see Chapter 5). Investigating these emotional processes revealed a complex picture. Consuming alcohol at higher dosages did reduce affective empathic processing (see Chapter 4) but this did not alter moral decision-making; moral actions continued to be dominated by utilitarian responses and moral judgments primarily comprised non-utilitarian responses. In order to extend this investigation of empathic processing beyond state measures, I also investigated moral decision-making in helping professions in which personality traits and subsequent harm aversion were likely to be marked by extensive exposure to

demanding events (see Chapter 5). Repeated exposure to emergency incidences and distinct traits profiles in these individuals did not alter moral actions or moral judgments.

Importantly, and in terms of peripheral features of moral actions, I did observe differences in the emotional arousal and post-responses of helping professionals when compared to control populations. Emergency service professionals showed reduced arousal in virtual moral simulations and demonstrated less regret following a utilitarian endorsement, supporting previous suggestions that these professionals develop a form of emotional resilience (e.g., Alexander, 2016). As outlined previously and within a resilience framework, future research might consider investigating the role of counterfactual thinking and regret more explicitly to shed light on the development of resilience in these professions as they learn to "…walk a fine empathic line" (Newton, 2013, p. 9).

Beyond Empathy and Affective Processing

The outcomes of the present investigation might suggest that facets, beyond or in addition to deficits in empathic processing, mediate the relationship between psychopathic traits and utilitarian endorsements found in chapters of this thesis (see Chapter 2; Chapter 3). As outlined previously (see Chapter 4; Chapter 5), empathy represents only one component of trait psychopathy. Across both two-factor models of psychopathy (e.g., Levenson et al., 1995) and triarchic conceptualisations of psychopathy (e.g., Patrick, Fowles, & Krueger, 2009), there are multiple underlying factors ranging from callousness, to disinhibition, to boldness, among many others. Given the multifaceted nature of psychopathy, I now outline an alternative explanation for the association between psychopathy and utilitarian endorsements, beyond that of deficits in empathic processing.

As outlined previously, low anxiety has been found to play a role in the association between psychopathy and utilitarian endorsements (e.g., Koenigs et al., 2012) with low anxious psychopaths endorsing greater utilitarian responses in emotionally aversive moral dilemmas. This relationship has also been evidenced in psychopharmacological investigations in which anti-anxiety drugs (Lorazepam) have reduced harm aversion and subsequently resulted in greater utilitarian endorsements (Perkins et al., 2013). Research has argued that the low anxious facets of primary psychopathy reflect emotional and inhibitory deficits (Koenigs et al., 2012), that compromise conditionability of moral norms (Blair, 1995) and subsequently reduce aversion to harm. For example, when facing a punishment following a transgression, we feel anxious, and this subsequently conditions us to avoid future transgressions. A diminished anxiety response is thought to compromise this conditioned response (e.g., Blair, 1995). Again, evidence in this area has been mixed (e.g., Schmitt & Newman, 1999; Visser, Ashton, & Pozzebon, 2012) with research also highlighting the moderating role of aggression, rather than trait anxiety, in this relationship (Choe & Min, 2011; Gao & Tang, 2013). In the present investigation, I did not include measures of anxiety or aggression and so this theory remains speculative. However, with research suggesting a critical role for these facets in the action aversion deficits in psychopathy, future research should consider incorporating these assessments in both moral judgment and moral action paradigms.

Moral and Non-Moral Motivations

In this thesis, I have discussed concerns regarding the identification of the motivations underlying utilitarian acts; are these driven by morally principled motives or self-interested motives and even desires to harm others (Bartels et al., 2015; Conway & Gawronski, 2013; Cushman & Greene, 2012; Patil, 2015)? Despite the finding that

anti-social traits predicted supposedly "utilitarian" actions (see Chapter 2) and the power of these actions (see Chapter 3), the discussion regarding moral motivations remains a multifaceted one.

Given the association between psychopathic traits and utilitarian actions, research has argued that endorsing a "utilitarian" action requires empathic suppression (e.g., Patil, 2015; Uhlmann, Zhu, & Tannenbaum, 2013) and has subsequently labelled the utilitarian response as the "harmful" action. However, given the findings presented here regarding empathy, and the discussion above, I would argue that this assumption might be more complex. For example, it is important to consider instances in which there are care-oriented motivations for utilitarian actions (Uhlmann et al., 2013); these might be found in circumstances where aggregate outcomes for the greatest number of people are placed at the centre of action motivation. Many individuals working in helping professions expressed this idea clearly when asked whether utilitarianism played a role in their duties. Conversely, it is also possible for non-utilitarian actions to be driven by self-interested motivations (Uhlmann et al., 2013). Following from this, it is also important to highlight a limitation of existing investigations of moral decision-making, in their assertion that utilitarian and non-utilitarian (or deontological) motivations operate inversely (Patil, 2015). However, process dissociation approaches have revealed that moral ideologies guide moral judgments independently (Conway & Gawronski, 2013). Whether this process dissociation translates to moral actions, requires further investigation. One way in which future research might investigate a multiple-motives hypothesis in a moral action framework, would be to recreate low-conflict personal moral dilemmas in VR. These dilemmas describe instances in which harm to one person serves another person's self-interest rather than morally-focused outcomes (Cushman et al., 2010). Incorporating these dilemmas would offer the

opportunity to distinguish moral intentions from non-moral intentions and the role of traits in motivating self-interested or morally-driven actions.

Overall, this preliminary line of investigation has demonstrated that the relationship between traits, subsequent emotional processes, and moral decision-making is far from straight-forward. Extending from a particularist approach to moral decision-making (Christensen et al., 2014), it seems that identifying the processes underlying both moral judgment and moral action requires an "interactionist framework" that considers the profile of the decision maker and the context in which the decision is being made (Bartels et al., 2015). After all, "…most human behaviour is the joint product of the person and the situation" (Bartels et al., 2015, p. 6).

Methodological Critique

The experiments presented in this interdisciplinary thesis have incorporated novel and state-of-the-art technologies. With previous research outlining the advantages of applying VR in experimental settings as a contextually rich testing tool, I now review this methodological approach in light of the outcomes of the present investigation.

Previous research has argued that even basic virtual environments can prompt an array of realistic behavioural and physiological responses (Rovira et al., 2009; Slater et al., 2006). Arguably, the life-like responses that VR can elicit make it an ecologically valid alternative to conventional methods that are frequently utilised in social experiments (Parsons, 2015; Rovira et al., 2009). In the present investigation, the visually immersive VR reconstruction of the *footbridge* dilemma did prompt a range of physiological responses that were otherwise absent in the text-based conventional paradigms. In the VR dilemma, heart rate increases were observed across experiments and these responses reflected a number of personal characteristics; reduced

physiological responses were observed for individuals under the influence of alcohol and for trained professionals with extensive experience working in the emergency services. As such, VR appears to be a compelling method with which researchers can examine immediate emotional responses (Parsons, 2015; Rovira et al., 2009) by "…reducing the opportunity for mental simulation" (FeldmanHall et al., 2012, p. 434).

In terms of ethical considerations, attempts to investigate moral actions within this framework present unique challenges (Slater et al., 2006) and as such, previous investigations have been predominantly non-behavioural (Navarrete et al., 2012). A significant advantage of utilising VR paradigms in investigations of morality of harm is that they offer a safe context with which to examine harmful moral actions (Parsons, 2015; Slater et al., 2006). In this thesis, the use of VR has shed light on moral actions made in response to virtual reconstructions of moral dilemmas while protecting the wellbeing of participants. The ethical advantages of utilising VR have made it a valuable tool in applied settings; both the fire service commanders and paramedic practitioners, who took part in this investigation, were currently adopting virtual training methods given their safe and cost-effective benefits. Further, alongside the ethical and methodological advantages of utilising VR, the outcomes of this thesis raise further considerations for healthcare and emergency professions seeking to utilise VR in their training programmes. With evidence of dissociation between moral judgment and moral action, new virtual training procedures adopted by the emergency services should take into account moral inconsistency; conventional assessments of strategic decision-making on paper are likely to produce distinct outcomes to virtual training assessments that require simulated actions under pressure.

It is important to acknowledge a fundamental constraint of the virtual paradigms used in the present experiments. Whilst VR might offer greater insight into realistic

behavioural and physiological responses (Parsons, 2015), the dilemmas incorporated into these experiments remain hypothetical in nature, whether virtual or not. Research seeking to expand this investigation should consider virtually reconstructing common moral dilemmas given that it is "…arguably rare in the real world to be faced with the kinds of utilitarian decisions encapsulated in these classic dilemmas" (FeldmanHall et al., 2012, p. 435) and that these are often perceived as improbable (e.g., Gold, Pulford, & Colman, 2014; Kahane et al., 2015). However, it is important to note that this thesis did not aim to predict real-life moral behaviours from these experiments but rather to investigate the disparity between action and judgment in controlled investigations of morality of harm. In this instance, these virtual hypothetical moral dilemmas were incorporated in order to allow a comparison with conventional paradigms.

Despite these shortcomings, a significant strength of this thesis is in its interdisciplinarity, having combined methods and collaborated with researchers from experimental philosophy, social psychology, computer science, robotics, speculative design, healthcare professions, and emergency services. This has generated a novel framework with which to investigate moral decision-making. Importantly, with the phrase "virtual reality" typically associated with video games (Pan et al., 2016) this interdisciplinary investigation has highlighted the value of VR beyond these artificial contexts. Using VR could enhance the "realism" of existing experimental settings (e.g., Parsons, 2015) and beyond this, could both innovate and transform existing training and assessments in medicine, healthcare, and emergency response settings (e.g., Colangeli et al., 2015; Pan et al., 2016). Future research should utilise and maintain the unique interdisciplinary links established during the present investigation.

Concluding Remarks

Researchers have long attempted to interpret responses to moral dilemmas using paradigms that are often "impoverished and unrealistic…limit(ing) participant's engagement" (Patil et al., 2014, p. 95). Although virtual moral research is in its infancy, by promoting "…judicious use" of these contextually-salient virtual paradigms within moral psychology, researchers can begin to validate their potential in assessing moral behaviour (Parsons, 2015, p. 7). Crucially, the finding that moral judgments in conventional paradigms diverge from moral actions in virtual reality paradigms (Patil et al., 2014) raises two points. Firstly, that moral judgment and moral action appear to be distinct and, secondly, that utilising immersive VR paradigms can allow the assessment of moral cognition in "…action-relevant environments where the stakes are immediate, emotionally charged and tangible" (FeldmanHall et al., 2012, p. 435). Critically, when considering the strengths and weaknesses of both conventional and virtual methodologies, it is important to remember that, in either stream, the incorporation and validation of both methods must continue to better our assessment of both moral judgments and actions. After all "…by examining only one blade of a pair of scissors, one will not understand how scissors cut" (Bunge & Skulmowski, 2014, p. 176). Only through adopting these multifaceted and interdisciplinary approaches to the study of morality, can research begin to paint a complete picture of moral decision-making.

STATISTICAL NOTE

Assumption Checks

Normality

Assumptions of normality were tested using Shapiro-Wilk test and visual inspections of Histograms and P-P plots. Violations of these assumptions are stated prior to analysis. However, violations are not reported and parametric procedures remain in analyses when sample sizes are greater than or equal to 30, given that the sampling distribution tends to be normal "…regardless of the shape of the data" (Ghasemi & Zahediasl, 2012, p. 486).

Outliers

Outliers were not removed unless otherwise stated. Outliers were only removed in instances in which the anomaly was due to measurement error (i.e., in Chapter 4 during pupillary diameter analysis) and procedures for removal are described in specific chapters. In instances in which outliers were not likely due to measurement error, but were suspected following visual inspections of scatter plots, a footnote is included reporting analysis with outliers removed for comparison.

Homogeneity of Variances

Homogeneity of variance checks were performed for all ANOVAs using Levene's tests. If Levene's test were significant ($p < .05$), follow-up analyses were performed to determine if the ratio of largest and smallest variance was greater than three (Dean & Voss, 1999, pp. 112-113). If this ratio was less than three, analysis continued. For error ratios higher than three, alternative analyses are reported in footnotes.

Sphericity

Extending from the assumption of homogeneity of variance and for within-groups and mixed model ANOVAs, Mauchly's test was used to determine if the variation in the differences between experimental conditions was sufficiently similar. If sphericity was violated ($p < .05$), Greenhouse-Geisser corrections are reported in specific chapters.

Hypothesis Testing

Significance

P-values < .05 are reported as statistically significant. Values between .05 and .064 are reported as marginally significant. Given the arbitrary nature of p-value parameters, effect sizes are also reported as standardised measures of the strength of any observed effect (Field, 2009).

Effect Sizes

Effect sizes are reported for all parametric statistics. Partial eta-squared is reported for all ANOVAs and Cohen's d is reported for t-tests. Pearson's correlation coefficient, r, determines effect size for correlational and regression analyses. In instances in which chi-square tests were performed, effect sizes are reported as odds ratios. Effect size categories (small, medium, large) were determined using the following parameters (Field, 2009):

- Cohen's d – small (.20), medium (.50), and large (.80)
- Partial eta-squared – small (.01), medium (.06), and large (.14)
- Correlation coefficient r – small (.10), medium (.30), and large (.50)

Analyses

Regression

When performing regression analyses to determine whether certain personality traits predicted moral judgment or moral action, both hierarchal and stepwise regression procedures were performed for each analysis. Hierarchal entry was used to enter trait facets based on previous theories (e.g., primary psychopathy was entered first and secondary psychopathy entered second given evidence that the first facet predicts utilitarian responses (e.g., Tassy, Deruelle, et al., 2013)). Stepwise entry was also used as a means of confirming statistical significance of individual predictors given the novelty of the research (Field, 2009). Across analyses reported in this thesis, both entry methods produced the same predictors. Separate regressions were performed for

- LSRP traits
- HEXACO traits
- IRI traits
- Self-Importance of Moral Identity traits

Separate analyses were performed to account for multicollinearity violations and inverse-related coefficients for predictors (i.e. primary psychopathy and Honesty-Humility).

Predictor variables were not centred or standardised unless predictors had no meaningful “0” value or if multiple predictors from different scales were entered into the same model.

Specific Statistical Notes

The following notes refer to specific analyses within the main body of the thesis and are referenced in-text. They are listed here numerically and under chapter headings.

Chapter 2

(2.1) MANOVA SPSS syntax is a suggested tool for performing simple effects analyses in both mixed and repeated-measures designs (Field, 2009). All simple effects analyses are performed using this syntax unless otherwise stated.

(2.2) Homogeneity of variance assumptions were violated. As such, a Generalized Estimating Equation (GEE) was used as an alternative to mixed model analyses. I conducted the GEE using a linear model with task (non-moral task; moral task) as within-subjects factor and condition (judgment; action) as between-subjects factor. A linear correlational structure was assumed and specified for the within-subjects variable using Identify as the link function. Analysis revealed a main effect of task, (Wald $X^2[1] = 44.19$, $p < .001$), condition, (Wald $X^2[1] = 4.31$, $p = .038$) and a significant interaction of task x condition, (Wald $X^2[1] = 17.26$, $p < .001$). Post hoc comparisons using Bonferroni indicated that for the non-moral task, heart rate changes were not significantly different between judgment and action conditions ($p = 1.00$). However, for the moral task, analysis suggested that heart rate changes were significantly different between conditions, ($p < .001$). In the action condition, heart rate changes were significantly greater in the moral task than in the non-moral task ($p < .001$) but this was not the case in the judgment condition ($p = .115$).

(2.3) The PCA was conducted on standardised scores for primary psychopathy and Honesty-Humility with orthogonal rotation (Varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = .50), and all KMO values for individual scores were above the acceptable limit (.50) (Field, 2009). Bartlett's test of sphericity ($X^2(1) = 30.06$, $p < .001$) indicated that correlations between variables were large enough for PCA. One

component had eigenvalues exceeding Kaiser's criterion and explained 87.13% of the variance and was subsequently extracted. With only two variables, the scree plot was not interpreted.

(2.4) I conducted the GEE using a linear model with task (non-moral task; moral task) as within-subjects factor and condition (judgment; action) as the between-subjects factor. Analysis revealed a main effect of task, (Wald $X^2[1] = 59.48$, $p < .001$), condition, (Wald $X^2[1] = 5.20$, $p = .023$) and a significant interaction of task x condition, (Wald $X^2[1] = 13.35$, $p < .001$). Post hoc comparisons using Bonferroni indicated that for the non-moral task, heart rate changes were not significantly different between judgment and action conditions ($p = .771$). However, for the moral task, analysis suggested that heart rate changes were significantly different between conditions, ($p = .006$). In both the action and judgment conditions, heart rate changes were significantly greater in the moral tasks than in the non-moral tasks ($ps < .001$).

Chapter 3

(3.1) The PCA was conducted on standardised scores for primary psychopathy and Honesty-Humility with orthogonal rotation (Varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = .50), and all KMO values for individual scores were above the acceptable limit (.50) (Field, 2009). Bartlett's test of sphericity ($X^2(1) = 24.90$, $p < .001$) indicated that correlations between variables were large enough for PCA. One component had eigenvalues exceeding Kaiser's criterion and explained 84.83% of the variance and was subsequently extracted. With only two variables, the scree plot was not interpreted.

Chapter 4

(4.1) GEE also extends mixed model ANOVA by including additional non-linear models (in this case, binary logistic).

(4.2) Analysis was replicated with GEE using a linear model with task (judgment; action) and type (non-moral task; moral task) as within-subjects factors and condition (placebo; low alcohol; high alcohol) as the between-subjects factor. Analysis revealed a main effect of task, (Wald $X^2[1]$

= 24.66, $p < .001$), type, (Wald $X^2[1] = 22.08$, $p < .001$), and a significant interaction of task x type, (Wald $X^2[1] = 6.31$, $p = .012$). Post hoc comparisons using Bonferroni indicated that there was a significant difference between non-moral and moral tasks in the judgment task across groups, ($p = .020$) and in the action task across groups, ($p < .001$) with greater heart rate changes observed in moral tasks. There was a significant difference in heart rate change between the judgment and action task but for the moral tasks only, ($p < .001$) with greater heart rate changes observed overall in the virtual moral action task. Heart rate change for the non-moral tasks was not significantly different between action and judgment tasks ($p = .660$)

Chapter 5

(5.1) Analysis was replicated with GEE using a linear model with task (judgment; action) and type (non-moral task; moral task) as within-subjects factors and group (control; paramedics; fire service) as the between-subjects factor. Analysis revealed a main effect of task, (Wald $X^2[1] = 5.58$, $p = .018$), type, (Wald $X^2[1] = 15.78$, $p < .001$), and a significant interaction of task x type, (Wald $X^2[1] = 7.54$, $p = .006$) and group x type, (Wald $X^2[2] = 11.96$, $p = .006$). Post hoc comparisons using Bonferroni indicated that there was a significant difference between non-moral and moral tasks in the action task across groups, ($p = .001$) with greater heart rate changes observed in moral tasks. There was a significant difference in heart rate change between the judgment and action task but for the moral tasks only, ($p = .024$) with greater heart rate changes observed overall in the virtual moral action task. Heart rate change for the non-moral tasks was not significantly different between action and judgment tasks ($p = 1.00$). Further post hoc comparisons indicated that, in the control group, heart rate changes were significantly greater in the moral tasks than in the non-moral tasks, ($p = .001$) Analysis suggested that there was no significant difference in heart rate changes between non-moral and moral tasks for the paramedics ($p = .082$) or incident commanders in the fire service group, ($p = 1.00$).

Appendix 2.1

Chapter 2: Moral Dilemmas

Personal Dilemmas

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

Your baby begins to cry loudly. You press your hand over his mouth to block the sound. If you stop pressing, his crying will summon the attention of the soldiers who will kill you, your child, and the others hiding out in the cellar. To save yourself and the others you must smother your child to death.

Footbridge. A runaway trolley is heading down the tracks toward five workmen who will be killed if the trolley proceeds on its present course. You are on a footbridge over the tracks, in between the approaching trolley and the five workmen. Next to you on this footbridge is a stranger who happens to be very large.

The only way to save the lives of the five workmen is to push this stranger off the bridge and onto the tracks below where their large body will stop the trolley. The stranger will die if you do this, but the five workmen will be saved.

Modified Bomb. You are negotiating with a powerful and determined terrorist who is about to set off a bomb in a crowded area. Your one advantage is that you have his teenage son in your custody.

There is only one thing that you can do to stop him from detonating his bomb, which will kill thousands of people if detonated. To stop him, you must contact him over satellite hook-up that he has established and, in front of the camera, break one of his son's arms and then threaten to break the other if he does not give himself up.

Vitamins. You are the leader of a mountaineering expedition that is stranded in the wilderness. Your expedition includes a family of six that has a genetically caused vitamin deficiency. A few people's kidneys contain large amounts of this vitamin.

There is one such person in your party. The only way to save the lives of the six members of this family is to remove one of this man's kidneys so that the necessary vitamins may be extracted from it. The man will not die if you do this, but his health will be compromised. The man is opposed to this plan, but you have the power to do as you see fit.

Vaccine Test. A viral epidemic has spread across the globe killing millions of people. You have developed two substances in your home laboratory. You know that one of them is a vaccine, but you don't know which one. You also know that the other one is deadly

Once you figure out which substance is the vaccine you can use it to save millions of lives. You have with you two people who are under your care, and the only way to identify the vaccine is to inject each of these people with one of the two substances. One person will live, the other will die, and you will be able to start saving lives with your vaccine.

Impersonal Dilemmas

Guarded speedboat. While on vacation on a remote island, you are fishing from a seaside dock. You observe a group of tourists board a small boat and set sail for a nearby island. Soon after their departure you hear over the radio that there is a violent storm brewing, a storm that is sure to intercept them.

The only way that you can ensure their safety is to warn them by borrowing a nearby speedboat. The speedboat belongs to a miserly tycoon who has hired a fiercely loyal guard to make sure that no one uses his boat without permission. To get to the speedboat you will have to lie to the guard.

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

If you do nothing the trolley will proceed to the left, causing the deaths of the five workmen. The only way to avoid the deaths of these workmen is to hit a switch on your dashboard that will cause the trolley to proceed to the right, causing the death of the single workman.

Illegal Lunch. You are a lawyer working on a big case. The judge presiding over the trial happens to be someone you knew from law school. The two of you were rather friendly back then, but now, decades later, it seems that your old friend barely remembers you.

You're quite sure that if you were to talk to him over lunch, you could jog his memory and he would begin to see you as an old buddy, which would be very good for your work on this case. It's illegal for judges and lawyers working on the same case to meet socially.

Taxes. You are the owner of a small business trying to make ends meet. It occurs to you that you could lower your taxes by pretending that some of your personal expenses are business expenses.

For example, you could pretend that the stereo in your bedroom is being used in the lounge at the office, or that your dinners out with your wife are dinners with clients.

Donation. You are at home one day when the mail arrives. You receive a letter from a reputable international aid organization. The letter asks you to make a donation of two hundred dollars to their organization.

The letter explains that a two hundred-dollar donation will allow this organization to provide needed medical attention to some poor people in another part of the world.

Appendix 2.2

Chapter 2: Pre-Questionnaire

PRE-EXPERIMENT (DEMOGRAPHICS) QUESTIONAIRE

Do you suffer from any panic or anxiety attacks? YES/NO

And finally, since the experiment will take place in Virtual Reality 'The computer animated virtual environment, we have some questions about your previous experience with this

Please state your level of computer literacy on a scale of (1…7) ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 (novice) (expert)	
Please rate your level of experience with computer programming: ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 (novice) (expert)	
How many times did you play video games (at home, work, school, or arcades) in the last year?	○ Never ○ 1 – 5 ○ 6 – 10 ○ 11 – 15 ○ 16 – 20 ○ 21 – 25 ○ > 25
How many *hours per week* do you spend playing video games?	○ 0 ○ < 1 ○ 1 - 3 ○ 3 - 5 ○ 5 - 7 ○ 7 - 9 ○ > 9

Appendix 2.3

Supplementary Study Chapter 2: Affordance Effects

Method

Participants

Forty participants comprising 29 females and 11 males (M_{age} = 22.20, *SD* = 6.79, age range: 18 - 45 years) were recruited from Plymouth University, School of Psychology, participant pool and participated for course credit. This research received ethical approval from the Plymouth University Ethics Committee.

Moral Judgment Measures

The experiment comprised two conditions to which participants were randomly allocated; a joystick-response condition (*N* = 20) and a key-response condition (*N* = 20). In both conditions, participants were presented with ten personal text-based moral dilemmas taken from an existing database including the *footbridge* dilemma (Greene et al., 2008; Greene et al., 2001). In the final section of each dilemma, participants were asked ("*Is it morally acceptable to [specific to the scenario]*?") followed by an action-choice question ("*Would you do it?*"). Participants were given ten seconds to respond to each question. In the key-response condition, participants responded using the key-responses described in the judgment condition of the previous experiment; by selecting "Yes" (Y) or "No" (N). In the joystick-response condition, participants responded using a joystick; pushing forward to elicit a "Yes" response and clicking a side button to elicit a "No" response. This setup allowed a direct assessment of the potential affordance effects triggered by the inclusion of a joystick device.

Procedure

In both conditions, moral dilemmas were presented in a random order on a computer running E-prime software and participants responded using either the keyboard or joystick based on condition assignment.

Results

Moral Responses

The proportion of utilitarian responses was calculated for each participant across question type. A mixed ANOVA with question type (judgment, action-choice) as within-subjects factor and condition (key-response, joystick-response) as the between-subjects factor revealed no significant differences between condition (p = .923), question (p = .472) and no interaction effect (p = .295).

Summary and Discussion

This follow-up experiment found no significant effect of using a joystick on moral decision-making. As such, I found no reason to alter the joystick response option from the present virtual moral dilemma; the increase in utilitarian responses was not likely induced by game-related affordance effects.

Appendix 3.1

Chapter 3: Moral Dilemmas

Personal Force Moral Dilemmas

Bomb. You are negotiating with a powerful and determined terrorist who is about to set off a bomb in a crowded area. Your one advantage is that you have his teenage son in your custody.

There is only one thing that you can do to stop him from detonating his bomb, which will kill thousands of people if detonated. To stop him, you must contact him over satellite hook-up that he has established and, in front of the camera, punch his son in the face, breaking his nose and then threaten to do worse if he does not give himself up.

Crocodiles. You are on a safari cruise that seems to be attracting the attention of several crocodiles, which begin to attack the boat. The force of the crocodiles and their attempts to board the boat, are causing it to sink. The boat is now sitting low in the water – a few inches lower and the crocodiles will be able to reach everyone on board.

The crocodiles become more aggressive. If nothing is done the boat will sink and the crocodiles will attack everyone on board, killing them. However, if you push one person overboard, the crocodiles will attack them leaving the boat to stay afloat. The remaining passengers will be saved.

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

Your baby begins to cry loudly. You press your hand over his mouth to block the sound. If you stop pressing, his crying will summon the attention of the soldiers who will kill you, your child, and the others hiding out in the cellar. To save yourself and the others you must smother your child to death.

Euthanasia. You are a leader of a small group of soldiers. You are on your way back from a completed mission deep in enemy territory when one of your men has stepped in a trap that has been set by the enemy and is badly injured. The trap is connected to a radio device that by now has alerted the enemy to your presence. They will soon be on their way.

If the enemy finds your injured man they will torture him and kill him. He begs you not to leave him behind, but if you try to take him with you your entire group will be captured. The only way to prevent this injured soldier from being tortured is to kill him yourself by stabbing him yourself.

Fire. You are in a house with several people. A fire has started and you and the other people are trapped in a back room. You have called the emergency services but you know that it will take several minutes for you to be rescued. The fire is spreading quickly through the house and towards the room you have taken refuge in.

The fire is spreading dangerously quickly now and it is going to reach the room before you and the people can be rescued. The only way to save the people is to push one person into the fire, slowing its progress and leaving time for the emergency services to get to the house.

Footbridge. A runaway trolley is heading down the tracks toward five workmen who will be killed if the trolley proceeds on its present course. You are on a footbridge over the tracks, in between the approaching trolley and the five workmen. Next to you on this footbridge is a stranger who happens to be very large.

The only way to save the lives of the five workmen is to push this stranger off the bridge and onto the tracks below where their large body will stop the trolley. The stranger will die if you do this, but the five workmen will be saved.

Lawrence of Arabia. You are the leader of a small army that consists of warriors from two tribes, the hill tribe and the river tribe. You belong to neither tribe. During the night a hill tribesman got into an argument with a river tribesman and murdered him. The river tribe will attack the hill tribe unless the murderer is put to death, but the hill tribe refuses to kill one of its own warriors.

The only way for you to avoid a war between the two tribes that will cost hundreds of lives is to publicly execute the murderer by cutting off his head with your sword.

Lifeboat. You are on a cruise ship when there is a fire on board, and the ship has to be abandoned. The lifeboats are carrying many more people than they were designed to carry. The lifeboat you're in is sitting dangerously low in the water – a few inches lower and it will sink.

The seas start to get rough, and the boat begins to fill with water. If nothing is done it will sink before the rescue boats arrive and everyone on board will die. However, there is an injured person who will not survive in any case. If you push that person overboard the boat will stay afloat and the remaining passengers will be saved.

Mercy. You are the law enforcer of a small tribe. A prisoner has escaped from a nearby tribe's camp and he has fled into your community. After arresting him and interviewing him, you establish that his imprisonment was unjust. You know that the prisoner's escape has led to unrest in the other tribe and a mob is on its way.

If the mob finds the prisoner, they will torture him and kill him. He begs you not to hand him over to them, but if you try to protect him your entire tribe will be attacked by the approaching mob. The only way to prevent this prisoner from being tortured and to protect your tribe is to kill him yourself with your knife.

Mining. You are part of a mining expedition. A cave-in has left you and the other miners trapped. You have established radio contact with the surface but you know that it will take several hours for you to be rescued. The cave-in has limited your oxygen supply and has injured one of the miners who is quickly losing blood. The injured crew member is going to die from wounds no matter what happens.

The remaining oxygen is not sufficient for the all of the miners to make it to the surface. The only way to save the miners is to kill the injured miner so that there will be just enough oxygen for the rest of the miners to survive until you are rescued. There is a large rock beside you.

Sacrifice. You, your husband, and your four children are crossing a mountain range on your return journey to your homeland. You have inadvertently set up camp on a local clan's sacred burial ground.

The leader of the clan says that according to the local laws, you and your family must be put to death. However, he will let yourself, your husband, and your three other children live if you yourself will kill your oldest son by pushing him off a nearby cliff face.

Safari. You are part of a group of ecologists who live in a remote stretch of jungle. The entire group, which includes eight children, has been taken hostage by a group of paramilitary terrorists. One of the terrorists takes a liking to you. He informs you that his leader intends to kill you and the rest of the hostages the following morning.

He is willing to help you and the children escape, but as an act of good faith he wants you to kill one of your fellow hostages whom he does not like with a knife he has given you. If you refuse his offer all of the hostages including the children and yourself will die. If you accept his offer then the others will die in the morning but you and the eight children will escape.

Submarine. You are the captain of a military submarine travelling underneath a large iceberg. An on-board explosion has caused you to lose most of your oxygen supply and has injured one of your crew who is quickly losing blood. The injured crew member is going to die from wounds no matter what happens.

The remaining oxygen is not sufficient for the entire crew to make it to the surface. The only way to save the crew members is to push the injured crew member out of an emergency hatch, killing him, but ensuring that there will be just enough oxygen for the rest of the crew to survive.

Vaccine Test. A viral epidemic has spread across the globe killing millions of people. You have developed two substances in your home laboratory. You know that one of them is a vaccine, but you don't know which one. You also know that the other one is deadly

Once you figure out which substance is the vaccine you can use it to save millions of lives. You have with you two people who are under your care, and the only way to identify the vaccine is to inject each of these people with one of the two substances. One person will live, the other will die, and you will be able to start saving lives with your vaccine.

Yelling Person. You and a group of people are running away from a criminal gang. They are intent on killing all of you. You and some of the people have managed to out-run them and have sought refuge in an overgrown area of a park. At the entrance to the park, you hear the voices of the criminals who have come to find you.

One of the people hiding with you seems to be very nervous and they begin to yell loudly in panic. You grab them and press your hand over their mouth and face to block the sound. If you stop pressing, their yelling will summon the attention of the gang who will kill you and everyone hiding with you. To save yourself and the others you must smother the panicking person to death.

Non-Moral Dilemmas

Maze. You are walking through a maze. You are approaching two diverging paths, each blocked by a round-shaped boulder.

By choosing the left path you will have to push a larger boulder to continue through the maze but you will get to the centre faster. By choosing the path on the right, you will get to push a lighter boulder but you will have further to travel until you can reach the centre of the maze.

Are you going to push the heavier boulder to the left in order to get to the centre of the maze faster?

If so, move the arm forward and push the heavier boulder. If not, then pull away from the boulder.

Taking the rubbish out. You intend to accomplish two things this afternoon: pushing the wheelie bin full of rubbish to the front of the garden ready for collection and watching some tv.

The weather is nice at the moment, but the forecast says that in a couple of hours it will start to rain. You very much dislike taking the bin out in the rain, but you don't care what the weather is like when you watch TV.

Are you going to push the wheelie bin to the front of the garden now before it begins to rain?

If so, move the arm forward and push the wheelie bin. If not, then pull away from the boulder.

Food prep. You are preparing pasta with fresh vegetables, and you are deciding on the order in which you will do the various things you need to do. You are in a big hurry.

At the moment you have a slight urge to cut vegetables. If you first start the water boiling and then cut the vegetables you will be done in twenty minutes. If you cut the vegetables and then start the water boiling you will be done in forty minutes.

Are you going to cut the vegetables first and then start the water boiling in order to satisfy your slight urge to cut vegetables?

If so, move the arm forward to start cutting the vegetables. If not, then pull away from them.

Appendix 3.2

Supplementary Study Chapter 3: Imagined Force

Method

Participants

Forty participants comprising 34 females and six males **(**M_{age} = 19.90, *SD* = 2.49 years, age range: 18 – 29 years) were recruited from the Plymouth University, School of Psychology, participant pool and participated for course credit. Participants completed the study online. This research received ethical approval from the Plymouth University Ethics Committee.

Procedure

Participants were presented with the 15 personal force dilemmas incorporated into Experiment 3 and were given the following written instructions: *"In each dilemma, the action you must take is already determined. We are interested in how much physical force you think would be required (in real life) to carry out each of the harmful actions described".* All dilemmas were phrased as if the participant had to carry out the harmful action described. Ratings were given on a 10-point Likert scale (from 1 = *no force* to 10 = *maximum force*).

Results

Responses

The mean required force was computed for each of the 15 personal force dilemmas and compared to the power endorsed for the same dilemmas in Experiment 3. A bivariate correlation revealed that there was no significant correlation between the imagined required force and the power used to endorse a utilitarian action (p = .375).

Appendix 3.3

Supplementary Study Chapter 3: Framing Effects

Method

Participants

Ninety-one participants comprising 81 females and 12 males **(**M_{age} = 20.66, *SD* = 5.42 years, age range: 18 – 50 years) were recruited from the Plymouth University, School of Psychology, participant pool and participated for course credit. Participants completed the study online. This research received ethical approval from the Plymouth University Ethics Committee.

Procedure

Participants were randomly assigned to one of three conditions in which personal force dilemmas were followed by; "*Is it morally acceptable to [specific to scenario]?"* (*N* = 28) or "*Would you do it?"* (*N* = 32) or *"Are you going to [specific to scenario]? Act now."* (*N* = 31). Participants were presented with a sample of eight of the 15 personal force dilemmas incorporated into Experiment 3.

Results

Moral Responses

The proportion of utilitarian responses for personal force dilemmas was higher for participants who were asked *"Are you going to [specific to scenario]? Act now."* (*M* = 0.40, *SD* = 0.24) than for those asked *"Would you do it?"* (*M* = 0.34, *SD* = 0.28) and those asked *"Is it morally acceptable to [specific to scenario]?"* (*M* = 0.33, *SD* = 0.31) (see Figure 1).

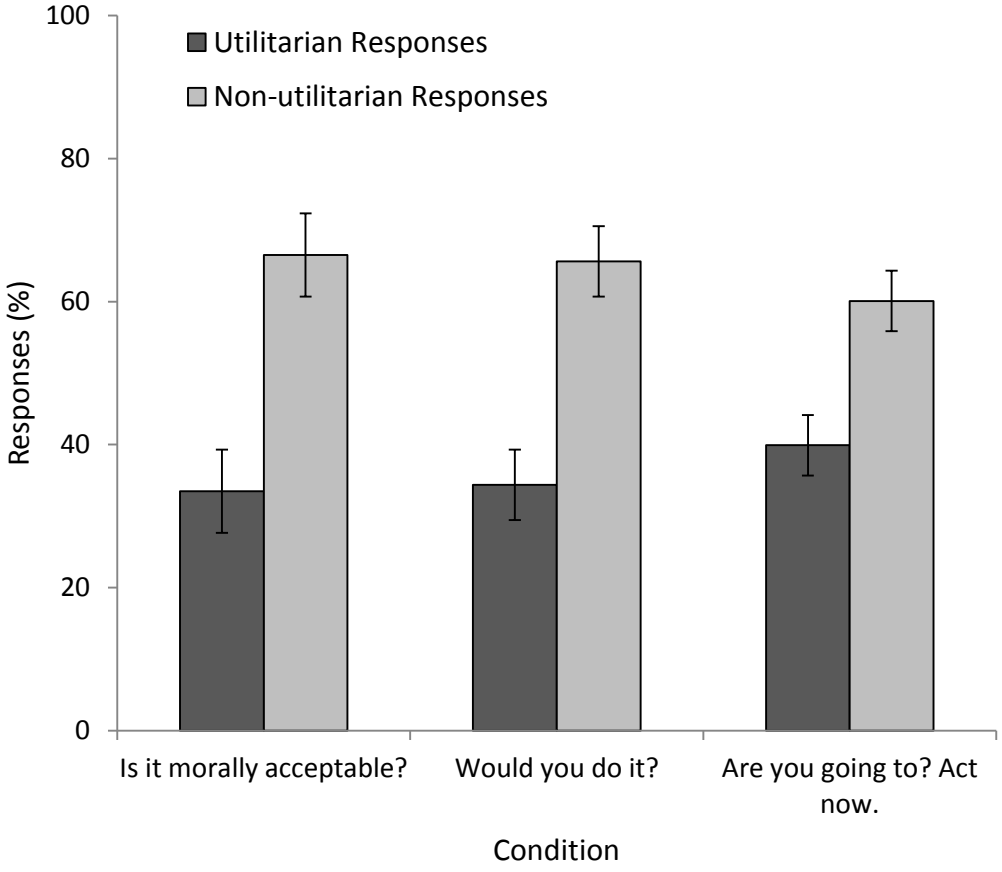
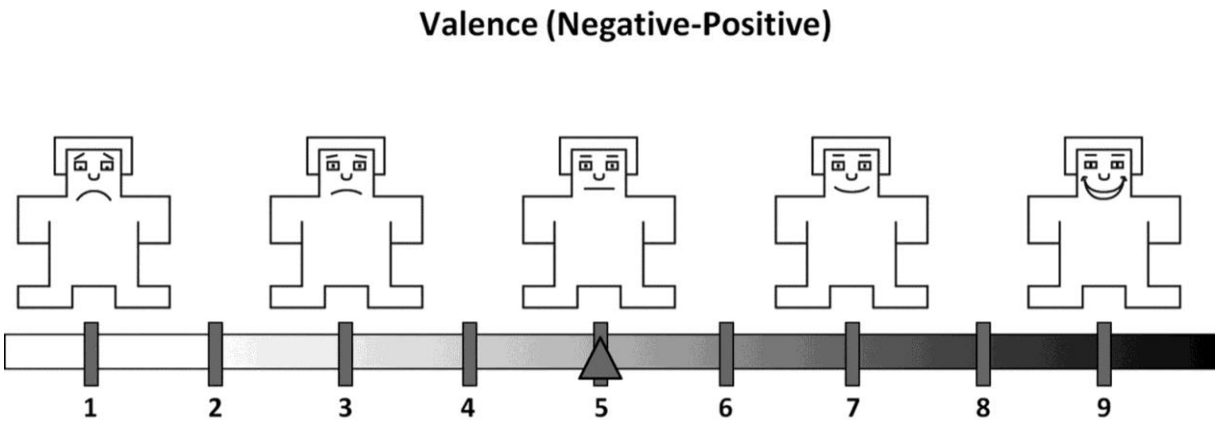


Figure 1. Responses (%) in the three framing conditions in response to eight of the original 15 personal force dilemmas used in Experiment 3. Error bars represent +- 1 SE.

Although sample sizes in each condition were unequal, Levene's test indicated equal variances (F = 1.90, p = .156). A univariate ANOVA comparing the proportion of utilitarian responses in each of the framing conditions, revealed a main effect of condition, (F(2,88) = 0.49, p = .615).

Appendix 4.1

Chapter 4: SAM Valence Scale



Appendix 4.2

Chapter 4: Visual Analogue Scale for Pain Tasks

Appendix 4.3

Supplementary Study Chapter 4: Validation Studies

In order to ensure that responses to our modified dilemma were similar to those given in response to the footbridge dilemma, I carried out two validation studies with qualitatively different populations.

Method

Participants

In validation study one, participants were recruited online (N = 109) on a website dedicated to contributing to psychological research (www.reddit.com/r/samplesize) and took part on a voluntary basis. Of the original participants to sign up to the study, the completion rate was 67% (N = 73, M_{age} = 27.89, SD = 8.40 years, 36 females, 37 males). In the second validation study, one hundred participants comprising 88 females and 12 males, (M_{age} = 21.03, SD = 4.82 years) were recruited from the Plymouth University, School of Psychology, participant pool and completed the study for course credit. This research received ethical approval from the Plymouth University Ethics Committee.

New Moral Dilemma

In the present experiment, I incorporated the following modified dilemma matched to the footbridge dilemma across the moral principles of benefit-recipient, inevitability, moral magnitude, physical contact and personal force:

You are on a safari river cruise with several other tourists. Five of the tourists have decided to go for a swim on the other side of the river. However, they seem to be attracting the attention of several crocodiles, which have started to swim towards them. You are standing on the boat, in between the approaching crocodiles and the five tourists swimming in the water. Next to you on the boat is another tourist.

The only way to save the lives of the five swimmers is to push this tourist off the boat and into the water below where their body will distract and stop the crocodiles. This tourist will die if you do this, but the five other swimming tourists will be saved.

Procedure

In the first validation study, participants were given both the footbridge dilemma and our modified dilemma embedded in a further ten distractor dilemmas borrowed from existing research (e.g., Greene et al., 2008; Greene et al., 2001). After each dilemma was presented to participants on screen, both a judgment question; (Is it morally acceptable to [specific to scenario]?) and action-choice question (Would you do it?) followed. Moral dilemmas were presented in a random order and participants responded to each question by selecting a binary option of "Yes" or "No". In the second validation study, the procedure was kept the same but participants were given both the footbridge dilemma and our modified dilemma embedded in a further eight distractor dilemmas. In this case, all dilemmas were personal dilemmas borrowed from existing research (e.g., Greene et al., 2008; Greene et al., 2001).

Results

The moral judgments given in response to the footbridge dilemma and the modified dilemma were compared for each question using non-parametric related samples tests. For the judgment question, no significant difference was found between responses to the footbridge dilemma and our modified dilemma in validation study one (p= .289) or validation study two (p = .549). This was also the case for the action-choice question in both validation studies one (p = .109) and two (p = .125).

Summary and Discussion

Both validation studies found no significant difference between responses to the original footbridge dilemma and the modified counterpart dilemma. As such, having validated this dilemma in two qualitatively different populations, I incorporated it within Experiment 4 as a comparable dilemma (moral judgment task) for the virtually constructed version of the footbridge scenario (moral action task).

Appendix 4.4

Chapter 4: Visual Analogue Scale for Mood

AT THIS MOMENT I FEEL:

HAPPY

_____

Not at all extremely

DISINHIBITED/UNRESERVED

_____

Not at all extremely

Appendix 4.5

Chapter 4: Pre-Questionnaire for Alcohol

PRE-EXPERIMENT QUESTIONNAIRE

(To be completed by the participant)

Date of Birth: dd/mm/yy

Gender: Male/Female/Transgender/Other/Not sure

Current weight (stone/lb/kg) (**PLEASE be accurate here as it will affect the dosage of alcohol or placebo that you are given**):

Do you suffer from any panic or anxiety attacks? YES/NO

If 'YES', please record the details below.

Are you currently taking any prescribed medications? YES/NO

If 'YES', please record the details below. If this information is sensitive and you do not wish to share the details here, please inform the investigator.

Do you have a personal or family history of alcoholism? YES/NO

Do you have any individual with significant health or psychological problems? YES/NO

Are you pregnant or expecting to become pregnant? YES/NO

Have you had any aversive allergic reactions triggered by alcohol consumption? YES/NO

Are you an alcohol-naïve individual (i.e. have never consumed alcohol before)? YES/NO

Have you consumed alcohol within the last 12 hours? YES/NO

If 'YES', please record an estimate of when the alcohol was consumed and roughly how much.

In a typical week, how often do you have a drink containing alcohol?

Never	1 day	2 days	3 days	4 days	5 days	6 days	Everyday

How many units of alcohol do you have on a typical day when you are drinking?

1-2	3-4	5-6	7-8	9+

What is a Unit? : The number of units depends on the difference strength and size of each drink, so it can vary a lot. Here are some examples:

- Pint of beer, 4%= 2.3 units
- 500ml can of lager, 6% = 3 units
- 250ml glass of wine, 11% = 2.8 units
- 330ml can of cider, 5% = 1.7 units
- Single (25ml) measure of spirits (e.g., vodka or gin) = 1 unit

Appendix 4.6

Chapter 4: Awareness Check

Having consumed the drink prepared by the experimenter, do you know which condition you have been assigned to?

YES/NO

If ‘YES’, please explain which condition you have been assigned to and how you know this:

Appendix 5.1

Supplementary Analysis Chapter 5: Moral Judgments

In order to examine moral judgments across multiple dilemmas between untrained individuals and trained professionals, an additional analysis was carried out incorporating the comparable moral dilemma and additional distractor dilemmas utilised in the present experiment's judgment task.

Results

I conducted a mixed ANOVA with dilemma type (impersonal; personal) and question (judgment question; action-choice question) as within-subjects factors and group (control, fire service, paramedics) as the between-subjects factor. Analysis revealed a main effect of dilemma type, ($F(1, 57) = 7.88$, $p = .007$, $\eta_p^2 = .12$) and a marginally significant main effect of question, ($F(1,57) = 3.60$, $p = .063$, $\eta_p^2 = .06$). There was no main effect of group ($p = .554$) and no significant interactions ($ps > .151$). Follow-up tests with Bonferroni corrections revealed that the proportion of utilitarian responses was higher for impersonal dilemmas than for personal dilemmas ($p = .007$). Additional follow-up tests revealed that the proportion of utilitarian responses was marginally significantly higher for the action-choice question than for the judgment question ($p = .063$).

Summary and Discussion

Overall, when incorporating multiple moral dilemmas into analyses, moral judgments did not significantly differ between non-specialised controls, professionals in-training, and trained professionals.

Appendix 5.2

Chapter 5: Comments from Paramedics and Incident Commanders

These comments were voluntarily given following experiment completion in response to the following question: "*What is your opinion on utilitarianism and it is something that you apply in your practise?*"

Paramedic Practitioners

- "I am not sure I have this. I would rather not kill anyone"
- "It is difficult. Every case is different as nothing is ever black or white"
- "I can see the benefits of utilitarianism. However, situations never occur where there is a clear moral answer"
- "I don't think I could cause harm to another person even if it's for the greater good"
- "I would as a practicing paramedic, maintain an open mind and hopefully make the correct judgement call should the situation arise"
- "I agree with utilitarianism but I don't like the pressure of making those decisions because who am I to make them?"
- "I believe in utilitarianism as it is important to make the most amount of people happy. Those 4 people on the train track could have had family etc. and therefore there are more people getting hurt"
- "Only do an action if it is morally right to do so; as in not harming other people"
- "It is relevant in certain situations, but not all"
- "No I don't agree with utilitarianism, we are all equal and should be treated as so"
- "I believe that in some situations you are forced to make the choice no matter what the outcome and as such would have to save the majority over the few"
- "I believe it is a good ideology. Harm may be needed to help people"
- "In principle I think being utilitarian is ok in the right environment, for example for health reasons and saving lives legitimately. However, I do believe that this principle could be neglected in conducting events that may be beneficial to people who may be greedy or wanting to conduct utilitarianism in a malicious way. Some individual's idea of doing good may be interpreted differently from someone else"

- “If someone has not consented or is not knowledgeable of your action for the greater good, this is not moral. It is not our place to judge this idea on others”
- “It is a "necessary evil" in some cases. It is a principle that will be applied as a paramedic for example during mass casualty incidents where the number of patients may outstrip the equipment/resources available to you”

Incident Commanders

- “Utilitarianism is applied to an extent however there is acceptance that you may not be able to save everyone and that sometimes it is the nature of the beast that people have put themselves in that situation. Adequate risk will be taken to assist”
- “No. Utilitarianism is not acceptable, as I would find a different way to solve the issue”
- “Following this ideology can be misleading and easy to miss-judge”
- “You should do the best for the majority”
- “I am totally against this idea. Go fast, go alone, but to go far, go together”
- [Regarding actions in VR] “I feel it was a professional judgement. It is best to lose one life to save others. I would have liked to save everyone”
- “Many dynamic circumstances would dictate whether you apply this ideology”
- “It would depend on the situation”
- “Utilitarianism has been used in the past although each situation is different”
- “It relates to hard choices which may have to be made but which may sit uncomfortably inside us”
- “I agree with utilitarian principles; unfortunately sometimes a sacrifice needs to be made in order for the greater good. This is only applied after a risk versus benefit analysis is made and all other options are looked at”

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