A MODIFIED TROLLEY PROBLEM PROCEDURE FOR STUDYING DILEMMIC DECISIONS

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Abstract

by

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The Trolley Problem (Foot, 1967) is a flexible moral dilemma often used within decision-making research as it enables researchers to investigate a variety of questions related to dilemmic decision-making. The current research introduces a modern variation on the Trolley Problem involving three different remotely piloted aircraft (RPA) simulation scenarios. Our objective was to investigate emotional engagement within dilemmic decision-making by increasing the emotional and social “value” of the one across three “missions.” Heart rate and decision time served as correlates for measuring emotional engagement. Results indicated that participants were less likely to sacrifice the one as its value increased. Further, emotional engagement varied across the three scenarios, evidenced heart-rate change and longer reaction times. These findings are discussed through a dual-process lens, emphasizing the interaction of reason and emotion in dilemmic decision-making. Implications of this research could be the first steps to a deeper understanding of RPA pilot decision-making.
Dedicated to my mother and grandmother,

who showed me that no obstacle is too large.
CONTENTS

Figures.............................................................................................................................................. vi

Acknowledgments.................................................................................................................................. ix

Chapter 1: Introduction ...................................................................................................................... 1
1.1 The Trolley Problem .................................................................................................................. 1
1.2 Views and Variations of the Trolley Problem ............................................................................ 2
   1.2.1 Moral/Philosophical Views of the Trolley Problem .......................................................... 2
   1.2.2 Selected Variations on the Trolley Problem ..................................................................... 4
   1.2.3 Personal versus Impersonal Decision ............................................................................. 6
   1.2.4 Common Findings with the Trolley and Related Problems ........................................... 7
1.3 Understanding Trolley and Footbridge Problem Decisions in a Broader Context .................. 10
   1.3.1 Intuitive versus Reflective Thinking .............................................................................. 10
   1.3.2 The Interplay between Emotion and Reason ................................................................. 11
   1.3.3 Common Threads across Dual-Process Views ................................................................. 14
   1.3.4 Implications for Decision-making in Personal and Impersonal Dilemmas ................... 15
1.4 A New Dilemma Context for the Present Study ....................................................................... 21
   1.4.1 The Need to Increase Engagement and Actionability .................................................... 21
   1.4.2 The Need to Devise a More Contemporary/Believable Dilemma Scenario ................... 24
   1.4.3 Dilemmas in an RPA Context ......................................................................................... 25
   1.4.4 Making it More Personal ............................................................................................... 27
   1.4.5 Comparing Populations ................................................................................................ 28
1.5 Expected Outcomes of the Present Research .......................................................................... 29
   1.5.1 Dilemmic Decisions in Peers Mission ............................................................................. 29
   1.5.2 Decisions in Commander and Family Member Missions ............................................. 30
   1.5.3 Emotionality ................................................................................................................. 31
   1.5.4 Decision Times ............................................................................................................. 33
   1.5.5 Decision Reasons and Justifications ............................................................................. 34

Chapter 2: ND Methods .................................................................................................................... 38
2.1 Experimental Design ................................................................................................................ 38
2.2 Participants .............................................................................................................................. 38
2.3 Simulation .................................................................................................................................. 39
   2.3.1 Trolley Problem RPA Scenarios .................................................................................. 39
FIGURES

Figure 2.1. This infographic depicts the structure of the Hypothetical Reasoning Measure. For each Hypothetical decision (yellow) there were examples of each of the three argument types (pink). These Decisions were rating on four scales (green) which were grouped into Cognitive and Emotional Reason Component scores (bracketed). .................................................................49

Figure 2.2. This infographic depicts the structure of the Moral Values Measure. For each Value (blue) there were four dimensional scores (pink) on which they were rated. ..............................................................................................................51

Figure 2.3. Screen capture from exploration phase of the Trolley Problem simulation. The map was the same for all three conditions (Military, Firefighter, Surveillance). ..54

Figure 2.4. Screen capture from Practice Phase of Simulation for either the Military or Firefighter mission. The Surveillance mission was altered in script to say, “Decide whether or not to REDIRECT the camera. If you redirect, one object will be photographed. If you do not redirect, five objects will be photographed.” ..........55

Figure 2.5. Screen capture of decision prompt for the Family Member Mission of the Military Scenario. ..........................................................56

Figure 3.1. Proportion of Redirect Decisions made within the first simulation missions, the Peers Mission. The Peers Mission most closely resembled the classic Trolley Problem. The Military and Firefighter scenarios were dilemmic as they involved the death of one or five actors in the simulation; the Surveillance was a control as it did not involve death. .................................................................69

Figure 3.2. Proportion of Redirect Decisions across all three Scenarios within each Mission. The value of the one increased across three missions which added emotional weight to the decision being made; unique from the traditional Problem..............................................................72

Figure 3.3. Displays Mean heart-rate change across all three Scenarios within each Mission. Change is measured in beats per minute and error bars indicate standard error of the mean. Negative changes represent heart-rate decelerations. ............76
Figure 3.4. Displays Mean decision time for redirect decisions across all three Scenarios separately within each Mission. Decision Time is measured in second starting after the prompt to decide until the decision is made. Error bars indicate standard error of the mean. .................................................................81

Figure 3.5. Summed scores across the four items within each reason type for hypothetical redirection reasons endorsed by majority redirectors (left panel) and for hypothetical non-redirection endorsed by majority non-redirectors (right panel) in each Scenario group (M, F, S). ......................................................................................84

Figure 3.6. Proportion of Philosophical Justifications across all three Scenarios within each Mission which were collected after the experiment’s completion. Justifications were based on the participants’ choices made during the simulation. ........................................................................................................89

Figure 3.7. Compares proportion of Philosophical Justifications for overall Redirectors and Non-Redirectors based on Mission Decision. Justifications were based on the participants’ choices made during the simulation. ................................................................91

Figure 3.8. Pre-post difference in Aggression State score across all three Scenarios within each Mission. Aggression state was which measure both before and after the simulation was completed. ........................................................................94

Figure 5.1. Proportion of Redirect Decisions made within the first simulation missions for Experiment 1 (Left panel) and Experiment 2 (Right panel), the Peers Mission. The Peers Mission most closely resembled the classic Trolley Problem. The Military and Firefighter scenarios were dilemmic as they involved the death of one or five actors in the simulation; the Surveillance was a control as it did not involve death. ......................................................................................................................107

Figure 5.2. Proportion of Redirect Decisions across all three Scenarios within each Mission for Experiment 1 (Left panel) and Experiment 2 (Right panel). The value of the one increased across three missions which added emotional weight to the decision being made; unique from the traditional Problem. .................109

Figure 5.3. Displays Mean heart-rate change score across all three Scenarios within each Mission for Experiment 1 (Left panel) and Experiment 2 (Right panel). Deceleration is measured in beats per minute and error bars indicate standard error of the mean. ......................................................................................112

Figure 5.4. Displays Mean decision time for redirect decisions across all three Scenarios within each Mission for Experiment 1 (Left panel) and Experiment 2 (Right panel). Decision Time is measured in msec. starting after the prompt to decide until the decision is made. Error bars indicate standard errors of the mean. .......115

Figure 5.5. Summed scores across the four items within each reason type for hypothetical redirection reasons endorsed by majority redirectors (left panel) and for
hypothetical non-redirection endorsed by majority non-redirectors (right panel) in each Scenario group (M, F, S) for both Experiment 1 (top panels) and Experiment 2 (bottom panels). .................................................................119

Figure 5.6. Proportion of Philosophical Justifications across all three Scenarios within each Mission which were collected after the experiment’s completion. Justifications were based on the participant’s choices made during the simulation for Experiment 1 (left panel) and Experiment 2 (right panel). .........................124

Figure 5.7. Compares proportion of Philosophical Justifications for overall Redirectors and Non-Redirectors based on Mission Decision. Justifications were based on the participant’s choices made during the simulation for Experiment 1 (left panel) and Experiment 2 (right panel). .................................................................126

Figure 5.8. Pre-post difference in Aggression State score across all three Scenarios within each Mission for Experiment 1 (left panel) and Experiment 2 (right panel). Aggression state was which measure both before and after the simulation was completed.................................................................129
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CHAPTER 1:
INTRODUCTION

1.1 The Trolley Problem

As a cornerstone for the current research, we have used a well-studied ethical thought experiment – the Trolley Problem – in which someone is asked to make a tragic choice between saving one life and sacrificing five, or saving five and sacrificing one (Foot, 1967; Thomson, 1985). The original problem was described by Foot in the following way:

“Suppose that a judge or magistrate is faced with rioters demanding that a culprit be found for a certain crime and threatening otherwise to take their own bloody revenge on a particular section of the community. The real culprit being unknown, the judge sees himself as able to prevent the bloodshed only by framing some innocent person and having him executed. Beside this example is placed another in which a pilot whose airplane is about to crash is deciding whether to steer from a more to a less inhabited area. To make the parallel as close as possible it may rather be supposed that he is the driver of a runaway tram which he can only steer from one narrow track on to another; five men are working on one track and one man on the other; anyone on the track he enters is bound to be killed. In the case of the riots the mob have five hostages, so that in both examples the exchange is supposed to be one man's life for the lives of five” (Foot, 1967, p. 3, italics added).

The Trolley problem is most commonly viewed as a *moral dilemma* because it requires a difficult choice between two courses of action, both of which may be viewed as violations of accepted moral principles regarding the taking of life. Thus, the dilemma
lies in the choice between doing nothing and letting five people die or redirecting the tram (i.e., Trolley) to the other track where only one person will die. This Trolley Problem has been the subject of much discussion and debate in moral philosophy and considerable investigation in moral psychology (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Manfrinati, Lotto, Sarlo, Palomba, & Rumiati, 2013; Waldmann & Dieterich, 2007).

In using this moral dilemma, we hope to follow in the footsteps of the many moral philosophy and psychology researchers that have come before. However, we aim to do so in a unique way that creates a more immersive and engaging Trolley Problem paradigm through the use of a more modern scenarios embedded in a computer-based simulation. Furthermore, we want to explore the effects of several variations on the Trolley Problem created by changing the characters within it and the circumstances surrounding it. Our interest is to determine how these changes affect decision making patterns and emotional reactions to the Problem.

1.2 Views and Variations of the Trolley Problem

1.2.1 Moral/Philosophical Views of the Trolley Problem

The moral implications of Trolley Problem are informed by the doctrine of double effect, which has its origins in the early Roman Catholic Church, particularly in the works of Thomas Aquinas (Foot, 1967; Hauser et al., 2007; Waldmann & Dieterich, 2007). This doctrine is commonly interpreted as suggesting it is morally permissible for individuals to inflict fatal harm if it is done for the good of many (i.e., the five), despite the additional, unintended consequence of death for others (i.e., the one). In effect, this
doctrine allows for the infliction of harm on others in order to increase the welfare of the majority. Thus, a decision to save the five and sacrifice the one in the Trolley Problem could be viewed as consistent with the doctrine of double effect.

Such a decision is guided by a type of cost/benefit analysis in which the most positive (or least negative) outcome is selected for the greater good (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati et al., 2013; Waldmann & Dieterich, 2007). In choosing to save the five, the decision-maker emphasizes the “utility” of an action when evaluating its morality (Mill, 1863; Smart, 1961). In the Trolley Problem, this Utilitarian choice is to redirect the trolley, letting the one die in order to allow five to live. Thus, the “redirect decision” in the Trolley Problem may be viewed as the “utilitarian choice.”

In contrast to utilitarian moral reasoning, deontological reasoning focuses on whether or not an action accords with moral “norms” or rules of conduct (Kant, 1785; Nagel, 1986). Deontological systems evaluate the morality of actions based on their relationship to moral rules and based on their intrinsic moral character (Cao et al., 2017; Conway & Gawronski, 2013). According to common interpretations of deontology, because killing violates social moral norms, duties, or rules, it is morally impermissible for someone confronted with the Trolley Problem to elect the redirection choice; the only permissible action is to do nothing (the “deontological choice”).

A third moral philosophical position, called the “Just-War Doctrine” is also relevant here. The Just-War Doctrine is a code of conduct which guides military action during war and other conflicts. One particular tenant of this doctrine, jus in bello, pertains to conduct within war and emphasizes the importance of limiting the number of
casualties on the battlefield, especially civilian casualties. Similar to utilitarianism, *jus in bello* might guide a Trolley Problem decision-maker, despite the non-war scenario, to favor the redirect choice since it limits casualties and loss of life; in particular, the limitation of civilian casualties (Lazar & Valentini, 2016; Orend, 2000). To the best of our knowledge, the Trolley Problem has not been studied in the context of the Just-War Doctrine. Future investigations in this context might be both useful and informative since war contexts often involve tragic decisions.

1.2.2 Selected Variations on the Trolley Problem

The Trolley Problem is well-known to researchers as being a flexible paradigm to study dilemmic decisions. This flexibility has been used to create variants on the original problem for the purpose of altering the choices and/or their consequences. A commonly used variation is the so-called “Footbridge Problem,” sometimes called the “Large (Fat) Man Problem.” In the Footbridge Problem, the decision-maker must choose whether or not to push a large man off a bridge onto the track below in time to stop a train, which otherwise would continue on the track unabated, resulting in the death of five individuals further down the track. In this case, the dilemma is whether or not to sacrifice the large man in order to save the five. This variation alters the situation as the choice to save five requires a direct action to push another person to their death to halt the train, rather than simply redirecting the train to an alternate path as in the Trolley Problem. Variations on the Trolley Problem often involve changing the nature of the one in relation to the five, for example, by changing the age of the one (e.g., a young child vs. an elderly person) or the relatedness of the decision-maker to the one (e.g., a stranger vs. a family member;
Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010). As noted below, each of these types of alterations can affect the choices made by decision-makers.

With the advent of autonomous vehicles (AV) on the rise, there has been another recent variation from researchers out of MIT (Bonnefon, Shariff, & Rahwan, 2016; Noothigattu et al., 2017; Shariff, Bonnefon, & Rahwan, 2017) who created an online survey called the Moral Machine which looked at moral decision making in an AV context. Like RPAs, autonomous cars present multiple moral and philosophical questions for engineers, end-users, and the public at large. First and foremost, what ethical framework do we want these vehicles to follow? According to an early study by Bonnefon et al. (2016), a majority of participants surveyed would prefer and would buy an AV which used a Utilitarian framework. However, further study indicated that this might not be the case, as participants also gave contradictory responses saying they would rather have the vehicle prioritize the lives of the passengers, regardless of the greater good.

These contradictions spurred the creation of the Moral Machine which invited participants to consider a myriad of Trolley-Problem-like decision-making tasks involving an AV (Noothigattu et al., 2017). Through the Moral Machine, participants were confronted with 13 moral dilemmas involving an AV with break failure; participants were asked to choose between two groups to save from the careening vehicle. Several features were manipulated within the paradigm: “relation to the [AV] (passengers or pedestrians), legality (no legality, explicitly legal crossing, or explicitly illegal crossing), and counts of 20 character-types, including ones like man, woman, pregnant woman, male athlete, female doctor, dog, etc.” (Noothigattu et al., 2017, pp 6-7).
Interesting findings emerged when participants had to make a choice between passengers and pedestrians. Across these scenarios, participants thought it morally acceptable for the AV to sacrifice the passengers when pedestrians were the greater number, even when they included a co-worker, family member, or their own child (Bonnefon, et al., 2016). However, these approval ratings were significantly lower when participants were asked in a context where they were actually going to buy the car. This outcome could speak to the difference between moral intention and action. Oftentimes, research shows that, while participants are apt to use popular moral frameworks (such as utilitarianism), this does not always reflect what action is likely to be taken in real life (Francis, et al., 2016; we will return to this point below in section 1.4.1).

1.2.3 Personal versus Impersonal Decision

A common view of the original Trolley Problem, as a dilemmic decision, is that it involves choice-related actions that are “impersonal” rather than “personal” in nature (Greene, 2001). The idea of personal versus impersonal choice-related actions is encapsulated in the heuristic of “ME HURT YOU” (Chelini et al., 2009; Choe & Min, 2011; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Valdesolo & DeSteno, 2006) that identifies three necessary components for a choice-related action to be considered personal. First, the action must be one in which the decision-maker (ME) is the agent whose own action inflicts a consequence, rather than having the consequence be determined by preexisting conditions. Second, for decision to be personal, the consequence of the decision-maker’s action must involve the occurrence of physical harm (HURT) to someone. Finally, in a personal decision, the person(s) harmed must be a specific person(s) (YOU) who will
obviously and visibly be injured or killed as a result of the decision-maker’s actions (Chelini et al., 2009; Choe & Min, 2011; Greene et al., 2004). In contrast, “impersonal” decision-related actions fail to fulfill one or more of the ME-HURT-YOU criteria. That is, impersonal decisions either don’t involve harm (HURT) to other persons (YOU), or the harm that results is not the direct result of the decision-maker’s (ME) actions.

Based on these three criteria, either action (redirect or non-redirect) elected by a Trolley Problem decision-maker can be characterized as “impersonal” because preexisting conditions, rather than the decision-maker (ME) have determined that HURT will be inflicted on others regardless of the choice made. In the Footbridge Problem, however, HURT will come to the large man only and directly as a result of the decision-makers (ME) pushing action, a type of harm that is not pre-ordained by the circumstances.

1.2.4 Common Findings with the Trolley and Related Problems

Much of the research on the Trolley Problem has involved paper and pencil tests wherein dilemmic scenarios are written down or displayed to the decision-maker in a textual format. Typically, these investigations show that, for the original Trolley Problem, most people make the redirect, utilitarian, choice to save the five over the one (Chelini et al., 2009; Foot, 1967; Hauser et al., 2007; Waldmann & Dieterich, 2007). For example, Hauser et al. (2007) confronted participants with four types of Trolley-type Problems. With the classic Trolley Problem, 85% of participants made the redirect, utilitarian choice to throw the switch to save the five, sacrificing the one. However, when confronted with the Footbridge Problem, only 12% made the utilitarian equivalent of the “redirect” choice in this scenario to save the five by pushing the large man off the bridge.
That is, 88% of decision-makers exposed to the Footbridge Problem opted for the Trolley Problem equivalent of the non-redirect, deontological choice (i.e., do nothing and let the five die; Hauser et al., 2007, p 9).

Chelini et al. (2009) reported similar outcomes when comparing the original Trolley Problem with the Footbridge Problem using paper and pencil tests. In their study 89 participants went through the Trolley Problem, 64 chose to redirect (72%) the trolley and 24 choosing not to redirect (27%; one participant did not respond). Conversely, in the Footbridge Problem, 25 chose to push the large man thereby saving the five (28%), while 64 chose not to push the large man allowing the five to die (72%), a complete flip of the numbers between the two problem scenarios (Chelini et al., 2009, p 179). These results draw a distinct picture of the differences in decisions and outcomes of personal versus impersonal dilemmic scenarios. The more impersonal a dilemma is (Trolley Problem) the more likely a person is to follow utilitarian guidelines; the more personal a dilemma is (Footbridge Problem) the more likely a person is to go against utilitarian guidelines, following a deontological path.

As noted, the original paper and pencil version of the Trolley Problem lends itself to many variations as the language used to describe it, the number of people potentially saved, and the nature of the one potentially sacrificed, can all be manipulated easily. For instance, Cao et al. (2017) manipulated the presentation narrative (positive, negative, neutral) and the number of people saved (5 or 15). Findings indicated that presenting the Trolley Problem using more positive language, focusing the language on saving the larger group, influenced participants to make more redirect choices, while a more negative presentation, focusing on killing the smaller group, produced more non-redirect
outcomes. Furthermore, the number of redirect choices was elevated when the number of saved workers went from 5 to 15 (Cao et al., 2017).

Another common variation on the Trolley Problem involves changing the personal characteristics of the potential victim (the one) to be sacrificed by a redirect decision. For example, Bleske-Rechek et al. (2010) varied the age and genetic relatedness of the one, among other variables, in a series of studies. Multiple scenarios were created where the one had different percentages of genetic relatedness to the participant (0%, 12.5%, 25%, and 50%). Between the two extremes, there was a significant difference in redirect decisions. In this study, more than 77% of decision-makers chose to redirect (sacrifice the one) when the one had no genetic relatedness, but only 34.3% elected to redirect when the one was 50% related (Bleske-Rechek et al., 2010, p 121). Similar findings were reported by Kelman and Kreps (2014) who varied the Trolley Problem in by making the one either a stranger or a family member. These investigators noted a much greater reluctance to redirect under the family member scenario.

Bleske-Rechek et al. (2010) varied age of the one in the Trolley Problem. They observed that decision-makers were less willing to redirect for an extremely young individual (34% for age two), but were more willing if the one was older (62% for age 70; Bleske-Rechek et al., 2010, p 121). This study also found that decision-makers were less willing to redirect when the one was a romantic partner vs. a stranger. Combined, the studies displayed how the nature or value of the one can indeed affect the propensity to make utilitarian, redirect choices in the Trolley problem scenario. The sampling of studies reviewed above also show the relative ease with which aspects and parameters of
the Trolley and Footbridge Problems can be manipulated using the original paper and pencil methodology; therefore, making these problems popular tools in the study of moral decision-making (Christensen & Gomila, 2012).

1.3 Understanding Trolley and Footbridge Problem Decisions in a Broader Context

Recent theorizing and research has been devoted to identifying and understanding the cognitive and emotional factors involved in making dilemmic decisions. In this section, we will briefly consider two broad lines of work and examine how they might apply to Trolley and Footbridge Problem decisions.

1.3.1 Intuitive versus Reflective Thinking

Since at least the 70’s, cognitive psychology researchers have distinguished between two types of thinking processes (Evans, 2003). In recent years, this distinction has coalesced into a so-called dual-process theory of cognition, which many believe provides a useful framework in which to understand decision-making, especially dilemmic decisions with moral overtones (Cao et al., 2017; Conway & Gawronski, 2013; Evans, 2010; Greene et al., 2008; Hofmann & Baumert, 2010; Starcke & Brand, 2012). The dual-process theory posits that thinking in general, and decision-making in particular, is supported by one of two types of cognitive processing (Evans, 2010; Evans & Stanovich, 2013). System 1 processing is thought to be largely automatic and unconscious, only rising to the level of conscious awareness after a product (e.g., a decision or reaction) has been produced. This type of processing is thought to have more ancient evolutionary origins and to rely heavily on past experience or learning history, thereby proceeding in an autonomous and often rapid way with little or no input from
higher-level cognitive control centers and without imposing demands on cognitive resources like attention or working memory. System 1 processing is thought to produce our “default” responses in most situations, which commonly are characterized as intuitive or gut-based reactions (Evans & Stanovich, 2013).

In contrast, System 2 processing is believed to be a reflective form of thinking that is evolutionarily newer than System 1 and more uniquely developed in humans. This form of processing is thought to be related to general intelligence and to make heavy use of cognitive resources like attention and working memory for deliberate purposes. System 2 processing often is slower than System 1, but it is believed to be capable of supporting more abstract and hypothetical thinking. A hallmark of System 2 processing is that it can intervene to provide a conscious form of cognitive control over our default, System 1 reactions and/or decisions (Evans & Stanovich, 2013).

1.3.2 The Interplay between Emotion and Reason

The work of Joshua Greene and his colleagues (e.g. Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004, 2008) has emphasized the importance of considering the interplay between emotion and reason in efforts to understand dilemmic decision making when confronted with Trolley and Footbridge Problems. Greene’s work is informed by the well-established fact that emotions are important drivers of many reactions and choices made by humans and animals. Both positive and negative emotional reactions to objects, other organisms, and situations fuel learning by experience and give rise both to the direction (e.g., approach or avoidance) and intensity (e.g., speed, frequency) of behavior. Many neuroscientists believe that emotional reactivity is a capability of
humans supported by evolutionarily ancient brain structures (the so-called “limbic” or emotional brain) common across many species (MacLean, 1990; Panksepp, 1998).

Greene also has appealed to the importance of reason in understanding responses to Trolley and Footbridge Problems (e.g. Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004, 2008). Greene has characterized reason as a higher-order cognitive process capable of deliberation, abstraction, and executive control. The latter process is thought to operate when conflicting tendencies must be resolved as in the case of the Stroop effect wherein the meaning of a word dictates one reaction, while the color of that word’s typeface may dictate a conflicting response. Neuroscientists generally agree that such higher order cognitive processes are supported by brain structures (neocortex or the so-called “thinking” brain) that are evolutionarily newer and reach their epitome in human development (MacLean, 1990; Panksepp, 1998).

For Greene, the interplay between emotion and reason is most apparent in the different patterns of decision making observed in response to Trolley and Footbridge Problems. As noted above, with the Trolley Problem, 80% or more of decision makers opt for the redirect (utilitarian) choice to save the five. In contrast, with the Footbridge Problem, only a minority of decision-makers elect to push the large man into the path of the trolley to save the five. Why do decision-makers accept the utilitarian choice in the former situation, but reject it in the latter? For Greene, the difference lies in the contrasting roles of reason and emotion across the two scenarios. As mentioned above, in the Footbridge Problem the “redirect” action is “personal” because decision-maker (ME) needs to become the perpetrator of a pushing action that will kill (HURT) the large man (YOU). According to Greene, the prospect of taking this action evokes strong negative
emotions for people whose default (deontological) position is that killing is wrong, emotions that serve to deter the utilitarian choice (save the five). In this case, then, the emotional reaction to the prospect of violating one’s deontological mandate (do not kill) is a prepotent response that is not overturned by reason.

In contrast, as previously indicated, the standard Trolley Problem can be viewed as impersonal because, although either choice results in death, the decision-maker is not the perpetrator, but rather the modulator of pre-existing harm. According to Greene, the prepotent response in this situation is reason (minimize the harm), rather than emotion, such that the utilitarian choice wins out. In other words, in the Trolley Problem, the most logical (reasonable) choice is the lesser of two evils.

Greene has gathered support for his view of the contrasting roles of emotion and reason in response to personal and impersonal dilemmic problems by examining which brain regions became active in decision-makers as they solved these problems. Greene (2001) reported the results of two experiments using fMRI methods to compare brain activation regions in participants that were exposed to three types of dilemmas: Personal (e.g., the Footbridge-type dilemmas), Impersonal (e.g., Trolley-type dilemmas), and a control condition involving pseudo-dilemmas (e.g., choosing between train and bus travel). Results of fMRI tests in both experiments indicated that during Personal dilemmas, decision-makers showed more activation in brain areas associated with emotional reactivity (i.e. medial frontal gyrus, posterior cingulate gyrus, and left and right angular gyrus), while during impersonal dilemmas, areas associated with cognitive processing were more active (i.e. middle frontal gyrus, and left and right parietal lobe).
Activation patterns during non-moral dilemmas were more like those of impersonal dilemmas, though with less activation in cognitive-processing areas.

1.3.3 Common Threads across Dual-Process Views

The dual-process distinction between intuitive and reflective thinking described above shares features in common with Greene’s distinction between emotion and reason. For instance, the System 1 processing proposed by dual-processing theorists (Evans & Stanovich, 2013) resembles the emotion-based reactivity identified by Greene et al. (Greene, 2001; Greene et al., 2004). Both System 1 and emotion-based reactivity supposedly depend on evolutionarily older brain structures that generate default/intuitive reactions in most situations (i.e. amygdala, limbic system). Both conceptions also share the idea that System 1/emotion-based responses are different from the System 2/rational reactions generated by evolutionarily newer brain areas (i.e. anterior cingulate cortex, dorsolateral prefrontal cortex). Moreover, in both views, System 2/rational processes may compete with default/intuitive responding and/or may serve to hold it in check. Obviously, therefore, both of these theories are dual-process accounts in which lower-level intuitive, emotion-based default reactions may compete with higher-level cognitive/reasoning processes for control over responding and decision-making in certain situations. For present purposes, then, we will use the term “dual-process theory” to refer to Greene’s (2008) distinction between emotion and reason, recognizing that it shares much in common with the dual-process account proposed by Evans and others (Carmona-Perera, Reyes del Paso, Pérez-García, & Verdejo-García, 2013; Evans, 2003; Evans & Stanovich, 2013; Hofmann & Baumert, 2010; Manfrinati et al., 2013; Navarrete,
McDonald, Mott, & Asher, 2012; Starcke & Brand, 2012; Ugazio, Lamm, & Singer, 2012; Valdesolo & DeSteno, 2006).

1.3.4 Implications for Decision-making in Personal and Impersonal Dilemmas

As used here, dual-process theory offers an explanation of how decisions are made when people are confronted with personal and impersonal dilemma choices. For example, when dilemma situations elicit default reactions that are strongly emotional, as personal dilemmas are believed to do for many people (Manfrinati et al., 2013; Starcke, Polzer, Wolf, & Brand, 2011), then these default reactions are likely to overpower any competition from reason, resulting in a final choice consistent with the dictates of the default response. That is why, when confronted with supposedly personal Footbridge-like Problems, a large majority of decision-makers choose to allow the five to be sacrificed rather harming the one. In this situation, the default, emotionally-charged mandate not to kill the large man predominates. This common outcome over a large number of studies suggests to some that the emotionally-charged default reactions in personal dilemma situations are driven primarily by deontological considerations (Carmona-Perera et al., 2013; Cikara, Farnsworth, Harris, & Fiske, 2010; Conway & Gawronski, 2013; Evans & Stanovich, 2013; Greene et al., 2004; Navarrete et al., 2012).

In contrast, when dilemma situations do not elicit strong default emotional responses, as is thought to be the case for impersonal dilemmas, rational processes are likely to prevail and the resulting choices will be consistent with the dictates of reason. This possibly explains why decision-makers confronted with impersonal Trolley-like Problems overwhelmingly make utilitarian, redirect choices to save the five. In these types of dilemmas, rational processes are thought to predominate with little or no
competition from intuitive emotional reactions. This finding across a variety of studies has been interpreted to indicate that choices in impersonal dilemma situations are driven by utilitarian, cost-benefit considerations favoring the greater good (Manfrinati et al., 2013). In sum, personal dilemma contexts are believed to provoke emotional reactions leading to deontological choices, whereas impersonal dilemma contexts are thought to stimulate rational reactions leading to utilitarian choices (Carmona-Perera et al., 2013; Cikara et al., 2010; Conway & Gawronski, 2013; Evans & Stanovich, 2013; Greene et al., 2004; Navarrete et al., 2012; Manfrinati et al., 2013; Starcke et al., 2011).

Of course, not everyone in any given dilemma context (personal or impersonal) makes the same choice. While the vast majority of those confronted with the impersonal Trolley Problem make the utilitarian, redirect choice that would be expected based on the context, some make the unexpected deontological, non-redirect choice. Likewise, in the personal Footbridge Problem, some decision-makers elect the unexpected utilitarian choice to push the large man to his death, though most select the expected deontological option. Based on the expected outcomes in these two contexts, the actual choices made can be characterized as either context “congruent” or “incongruent.” Congruent choices are those one would expect based on the context, while incongruent choices are those unexpected in that context. With the Footbridge Problem, a deontological choice is expected, so the congruent choice is to do nothing, thereby saving the one and sacrificing the five. The incongruent choice in this context is to push the large man to his death, thereby sacrificing the one and saving the five. With the Trolley Problem, a context in which a utilitarian choice is expected, the congruent choice is the redirect option that
saves five and sacrifices one, while an incongruent choice is to do nothing (non-redirect), which saves the one but sacrifices the five.

An interesting asymmetry has been observed across these two types of dilemmic contexts in the decision times (DTs) associated with congruent and incongruent choices. Greene (2001) reported results from their second fMRI study that DTs were significantly longer for incongruent than for congruent choices, but only in contexts involving personal rather than impersonal dilemmas. The explanation for this finding provided by the researchers was that only personal dilemma contexts involve a significant potential conflict between reason and emotion, as evidenced through activation in the anterior cingulate cortex, since those situations are the only ones in which a strong emotional response presumably is the default reaction. Thus, for an incongruent response to occur in that situation (i.e., push the large man off the bridge for the greater good), cognitive control and conflict resolution is required since reason must compete with emotion. Accordingly, as with other paradigms such as the Stroop task, where the presence of supposedly competing tendencies is associated with slower DTs (Brugnera et al., 2017; Manfrinati et al., 2013; Youssef et al., 2012); incongruent choices should take longer than congruent ones in this personal dilemmic context. In contrast, for impersonal dilemma situations, where the default response is not supposed to be as emotionally charged, there should be little to no competition between reason and emotion for either choice option, thereby producing comparable DTs for both congruent and incongruent choices.

Greene et al. (2004) provided further evidence in support of the notion that reason and emotion compete in circumstances where unexpected utilitarian choices are made by decision-makers. In this study, fMRI techniques were used to examine which brain areas
were most active during emotionally charged personal dilemmas when decision-makers needed to elect either a deontological choice (don’t kill anyone) or a utilitarian choice (kill one for the greater good). Results indicated that trials with long DTs for either choice (i.e., presumably trials with more conflict) were associated with greater activity in both the anterior cingulate cortex (ACC), an area previously associated with conflict resolution, and the dorsolateral prefrontal cortex (DLPFC), an area linked to reasoning and cognitive processing (Carmona-Perera et al., 2013; Cikara et al., 2010; Conway & Gawronski, 2013; Evans & Stanovich, 2013; Greene et al., 2004; Navarrete et al., 2012). In addition, when comparing long DT trials were subdivided by final decision into those that resulted in congruent deontological choices (the one was not killed for the greater good) compared to those that resulted in incongruent utilitarian choices (one was killed to save others), the DLPFC area was significantly more active on utilitarian choice trails than on deontological choice trials. Greene et al. (2004) interpreted these findings to indicate that when decision-makers struggle with difficult choices in emotionally charged dilemmas, brain areas implicated in the control of conflict and reason are both recruited. Moreover, activity in the area commonly connected with reason and cognitive processing (DLPFC) seems uniquely linked to the occurrence of utilitarian choices (Greene et al., 2004; Hofmann & Baumert, 2010; Moll et al., 2002; Narvaez, 2008).

If, as the Greene et al. (2004) study suggests, utilitarian choices depend preferentially on rational/cognitive resources needed to assess the greater good, and counteract any default emotion evoked by the dilemma context, then any added interventions further taxing those resources during the decision-making process also might alter the resulting utilitarian decisions in some way. Greene et al. (2008) tested
this possibility using a cognitive load intervention in a study in which they manipulated load while decision-makers simultaneously were considering emotionally charged personal dilemmas. The load condition involved reporting the occurrences of target numbers in a stream of numbers that continued throughout the dilemma presentation and during the choice period. Results indicated that load selectively increased DTs only for utilitarian choices. DTs for deontological choices were not affected by load. These results were interpreted by the researchers as consistent with the view that load interfered with the supposed cognitive processing underlying incongruent utilitarian decisions in the personal dilemma context, thereby prolonging those decisions (i.e., increasing the DTs), but not precluding them, as indicated by the fact that the proportion of utilitarian decisions was not affected by load.

Conversely, incongruent utilitarian decisions during personal dilemmas might actually be enhanced under circumstances that reduce the default competitive emotional responses presumably evoked by those contexts. Evidence in support of this possibility has been reported in studies of patients with brain damage in areas that blunt emotional reactivity. For example, Mendez, Anderson, and Shapira (2005) found that patients with frontotemporal dementia, a condition associated with hypo-emotionality, are more willing to push the large man to his death in the Footbridge Problem than are healthy controls. Also, Koenigs et al. (2007) reported that patients with emotion-related damage to the ventromedial prefrontal cortex (VMPFC) were especially prone to utilitarian decisions in response to personal dilemmas.

Finally, Valdesolo and DeSteno (2006) conducted a behavioral study in which they induced positive or neutral affective states in participants before being presented
with both the footbridge dilemma and the trolley dilemma that were embedded in a set of non-moral distractor tasks. It was found that, when a positive affective state was induced, congruent utilitarian decisions were increased for the personal footbridge problem, which seemed to indicate that the induced positive emotions counteracted the normal negative emotional response induced by this dilemma.

In summary, the dual-process account of decision-making in personal (e.g., Footbridge-Problem-type) and impersonal (i.e., Trolley-Problem-type) dilemma contexts has the following key implications for the types of decisions that will be made, as well as for the factors that will affect those decisions (Greene et al., 2004; Manfrinati et al., 2013; Starcke & Brand, 2012):

- Personal dilemmas usually lead to decisions based on deontological considerations because the emotionally-charged prospects of taking personal actions that directly cause someone’s death usually do not outweigh the rational utilitarian benefits of sacrificing one for the greater good of many.

- Impersonal dilemmas usually lead to decisions based on utilitarian considerations because any death that occurs in this context does not result from the personal agency of decision-makers, but instead is the result of pre-existing circumstances. Consequently, absent of the emotional burden of personal culpability for death, the choice is about how many unavoidable deaths will occur, a decision that often will be influenced by a rational cost-benefit analysis.

- Different brain areas appear to be recruited during decision-making associated with these two dilemmic contexts. During personal dilemmas, brain areas related to both emotion and cognition/reason are activated, along with areas related to conflict resolution. With impersonal dilemmas, the main brain areas activated are those associated with reason/cognition.

- Deontological decisions seem to be mediated more by the occurrence and influence emotional factors, while utilitarian decisions seem more related to the influence of cognitive/rational factors.
Not everyone makes the same decision in either personal or impersonal dilemmic contexts. Individual differences lead to decisions that are either congruent or incongruent with what is expected based on the context. Incongruent decisions in both personal and impersonal dilemma contexts likely involve some level of conflict resolution mediated by executive control functions, but this conflict is much more apparent for incongruent decisions in response to personal dilemmas. These decisions are markedly slower than their congruent counterparts in that same context, but the congruent-incongruent difference in decision times is not so apparent for impersonal contexts. This asymmetry likely is due to an overall lower level of emotion provoked by impersonal contexts that reduces the intensity of conflict even when incongruent decisions occur in that context.

1.4 A New Dilemma Context for the Present Study

The purpose of the present study is to follow up on some of the above-noted implications of the dual-process account of dilemmic decision making in a newly developed context described in detail below. This new context was employed so as to address several important limitations inherent in the original Trolley Problem research.

1.4.1 The Need to Increase Engagement and Actionability

As described earlier, much of the research on the Trolley Problem and other dilemmas comes from paper and pencil surveys involving imaginary conceptual scenarios usually presented in textual format. At least two important problems with this original methodology have been identified. One is a lack of realism that may limit engagement of decision-makers in the situation. Several recent studies have addressed this problem by
creating more visually compelling and realistic computer-based simulations of the Trolley Problem and other dilemmas.

For example, Navarrete et al. (2012) developed a 3-D virtual reality (VR) simulation of the Trolley Problem in which the decision-maker was immersed in an environment where they could see and hear a train moving on the tracks and also visualize avatars of the potential victims. In this VR environment, decision-makers could literally pull a switch to redirect the train or not corresponding to the two options in the original Trolley problem. Results with the simulation indicated that, as with the questionnaire format, over 90% of the decision-makers choose to redirect the train by flipping the switch to save the five (the utilitarian choice) and sacrifice the one (Navarrete et al., 2012). This study also included an interesting alternative scenario in which not pulling the switch automatically resulted in the utilitarian outcome of saving the five and sacrificing the one. Results with this “omission” condition, where inaction caused the one to be sacrificed to save the five, were essentially the same as with the traditional “action” condition in that over 88% elected to do nothing, thereby saving the five. Interestingly, however, the action condition was associated with greater emotional arousal as measured by electrodermal activity in decision-makers than was the case for the inaction condition.

Patil et al. (2014) used a within-subject design to compare a text-based Trolley Problem to a 2-D computer simulation of the problem. Results showed that the simulation not only evoked greater emotionality in decision-makers, as indicated by skin conductance changes, but also led to more utilitarian redirect choices than in the text-based version. The authors interpreted the emotionality differences to indicate that their
simulated Trolley Problem was more realistic and engaging than the text-based version. They also pointed to the increased utilitarian responses in the simulated version as evidence of a judgment-action discrepancy across the two versions.

The possibility of discrepancies between a decision-maker’s conceptual judgments about alternative choices given hypothetical text-based scenarios and overt actions that are taken given actual response opportunities is the second potential problem associated with the traditional paper and pencil methods used to study Trolley Problems and related dilemmas. As noted by Francis et al. (2016), there is a long history in human experience of discrepancies between saying and doing, or between preaching and practicing what is preached. In terms of dilemmic situations like the Trolley Problem, this means that what one says is appropriate or not (i.e., do nothing or redirect the trolley), may not be the same as what one does when given an actual opportunity to pull the switch.

Evidence suggests that a discrepancy between saying and doing in dilemmic scenarios may be a two-layered problem. The first layer is a difference clearly demonstrated by Tassy et al. (2012) between what one thinks is an acceptable course of action in a situation, and what action one would actually do in that same situation. When confronted with text-based moral and non-moral dilemmas in this study, decision-makers were asked separately about whether or not certain actions were acceptable as well as whether or not they would endorse those actions. Tassy et al. (2012) found a significant discrepancy for moral dilemmas, but not for non-moral control dilemmas, in favor of people who were willing to endorse utilitarian actions they had already judged were unacceptable. A second layer, demonstrated by Francis et al. (2016), is a discrepancy
between what actions people say they endorse in a situation, and what actions they actually take in that situation give a response opportunity. Using computer-simulated moral dilemmas, Francis et al. (2016) found actions endorsed in text format did not match actions taken in the simulation when choices were made actionable. Specifically, this study demonstrated more utilitarian actions taken than utilitarian choices endorsed, a finding fully consistent with the view that saying and doing are not the same.

The studies reviewed here indicate that 2- or 3-D, computer-based simulations of moral dilemmas not only will enhance realism and decision-maker engagement, but also the actionability they afford may yield a more accurate picture of how decision-makers actually will respond to dilemma choices. Accordingly, to capitalize on these potential advantages, the present study will employ a computer simulation format to present decision-makers with dilemma choices.

1.4.2 The Need to Devise a More Contemporary/Believable Dilemma Scenario

Pan and Slater (2011) have noted that traditional moral dilemma problems based on runaway trains very likely are implausible for most people, which may be a separate source of disengagement no matter how realistically those problems are presented. Thus, as Maule et al. (2000) has suggested, there is a need to devise dilemma scenarios that are more contemporary and believable in order to extend the generality of findings that have been obtained with Trolley Problems and related scenarios. Accordingly, in the present research, a computer-based dilemma simulation using a remotely-piloted aircraft (RPA) scenario was employed. In recent years, RPA (aka, “drone”) utilization in military and civilian operations has received increasing public attention (Enemark, 2013; McCrisken, 2013; Sauer & Schornig, 2012). By embedding Trolley-Problem-like choices in the RPA
context, we hoped to achieve a modern and engaging dilemmic scenario in order to further examine dual process theory and replicate basic findings obtained using traditional moral dilemmas.

1.4.3 Dilemmas in an RPA Context

In military operations, RPA operators can be called upon to make difficult decisions about whether or not to inflict harm on individuals or groups. These decisions may involve moral dilemmas where the RPA operator and crew must choose between (a) taking the lives of notorious terrorists, who have and will continue to perpetrate horrible crimes against humanity, but in doing so also to sacrifice nearby innocent civilian bystanders likely to be injured or killed by the strike, or (b) doing nothing which will spare the civilian bystanders but enable the terrorists to commit future acts of violence. Unfortunately, in military operations, these kinds of tragic choices must be made all too often, but rarely have they been the subject of empirical research.

Civilian uses of RPAs for public safety or disaster management (e.g., combatting wild fires) or surveillance (e.g., traffic monitoring) almost never involve the taking of lives and thus represent RPA contexts that contrast markedly with military uses of these vehicles. Thus, an RPA simulation scenario can involve multiple contexts that allow the generality of dilemmic choice behavior to be compared and extended across situations with different default purposes (military, disaster management, and surveillance). The RPA simulation developed for the present research used all three of the above RPA contexts as separate scenarios, each experienced by a different group of participants and each containing dilemmic choices embedded within the scenarios at various points. Each of those three separate contexts is described below.
Military/combat scenario. The backstory for this scenario was a country involved in a war against terror. The RPA pilot’s objective was to find groups of terrorists using directions given by the simulation. For every mission, when the RPA reached a defined target location, a missile was fired towards a group of five persons who were suspected terrorists. However, in some of these missions, after the missile was fired, the pilot was informed that the original target group was misidentified by intelligence as terrorists and were really friendly soldiers. The choices available to the pilot at that point were to do nothing, which would kill the five friendly soldiers, or to redirect the missile to another target within ten seconds, which would result in the death of one person who was at the redirected location. Thus, this scenario involved a dilemma patterned after the Trolley Problem such that the choices were to save the five and sacrifice the one (redirect decision) or save the one and sacrifice the five (non-redirect decision).

Firefighting/disaster management scenario. The backstory for this scenario was a country threatened by large forest fires. The RPA pilot’s objective was to navigate to high intensity fires that needed to be hit by water missiles to extinguish the fire. For some missions, five firemen suddenly appeared on scene and would be hit by the missile, if no decision is made to redirect it. As in the military scenario, redirecting the missile resulted in the death of one person but saved five.

Surveillance scenario (pseudo-dilemma control condition). The backstory for this scenario was a census that needed to be conducted in a national park. The RPA pilot’s mission was to find groups of persons in the park and photograph them. The
pseudo-dilemmic choice presented here was to photograph five persons or redirect the camera to photograph only one.

These three conditions allowed for a comparison of the effects of exposure to a pseudo-dilemma scenario (surveillance) with the effects of two other scenarios involving similar dilemmic choices but in very different contexts. With the military scenario, pilots knew from the beginning that they were involved in missions that might involve the death of terrorists, whereas in the disaster management scenario, deaths were the sudden unintended consequence of pure accidents. Despite these differences in original mindsets, both military and firefighter scenarios involved comparable dilemmic choices in which one innocent person could be sacrificed to save five innocent people.

1.4.4 Making it More Personal

Because the basic dilemmas used in the present research are versions of the original Trolley Problem, they may be viewed as impersonal choices in the sense described above. As noted earlier, Greene et al. (2004) and others have characterized impersonal choices as those thought to be driven primarily by cognitive/rational processes based on a form of cost-benefit accounting, which usually leads to the selection of utilitarian (save the five) outcomes. In contrast, personal choices are those thought to be influenced more by emotion, which usually lead to deontological (save the one) outcomes. It follows from this distinction that any manipulation of parameters in a Trolley-Problem-like context that serves to decrease the utilitarian choices in favor of deontological alternatives, also serves to make the deontological choice more personal. Such a manipulation was included in present study by creating three different dilemmic missions in each of the three separate RPA conditions (military, firefighter, surveillance).
Across these three missions, the “value” of the single victim was increased from being a peer of the other five persons (the “Peers” mission--P), to being a commander (“Commander” mission--C), to being a family member of the decision-maker (“Family Member” mission--FM). Thus, potentially escalating the personal nature of the utilitarian choice (save the one) across missions. As mentioned earlier, this type of manipulation has been shown in traditional Trolley Problem research to reduce utilitarian choices in favor of the deontological alternative (Bleske-Rechek, et al., 2010; Kelman & Kreps, 2014; Tassy et al, 2012).

1.4.5 Comparing Populations

As an additional effort in the present research to extend the generality of findings with dilemmic choices in an RPA context, two different populations were compared. Previous research has shown that population characteristics can influence moral decision-making based on differences in education, training, and experiences (Luini & Marucci, 2015). In the present study, two populations were included that also may have differed in important ways with respect to background and education. Notre Dame (ND) undergraduates were compared to a group of cadets at the United States Air Force Academy (USAFA). The cadet population was selected as a comparison group for two reasons. First, cadets have a general military orientation that may distinguish them from typical undergraduates at ND. This orientation, marked by such potential features as enhanced respect for authority and more in-depth exposure to military theories such as Just-War Doctrine, may cause cadets to react differently than ND students to features of the simulation like the Military scenario or the peer vs. commander vs. family member manipulation. Second, cadets likely are more similar to actual RPA pilots and crews than
are typical ND students. Indeed, USAFA cadets are a primary feeder population from which RPA pilots are selected. This aspect of the comparison group may help to improve the ecological validity of findings with the RPA simulation.

1.5 Expected Outcomes of the Present Research

1.5.1 Dilemmic Decisions in Peers Mission

In the present study, the mission in each of the three scenario conditions (Military, Firefighter, Surveillance) most closely resembling the original Trolley Problem was the P mission, in which decision-makers had to choose between one or five peers. For the two dilemma conditions (Military & Firefighter), the choice was between saving the one and sacrificing the five (non-redirect, deontological choice), or the reverse (redirect, utilitarian choice). For the control, pseudo-dilemma (Surveillance), the choice was between taking a picture of one person alone or five in a group. Based on the studies reviewed above, we expected to find a similar preponderance of redirect, utilitarian choices in both Military and Firefighter conditions, but no particular preference among the choices for the Surveillance condition. Such outcomes would be consistent with the results of the previously reviewed Trolley Problem studies using either text-based (e.g., Greene, 2001; Greene, et al., 2004, 2008) or computer-simulated (e.g., Navarrete, et al., 2012) dilemma presentations.

In terms of population comparisons for the P mission, there is little reason to expect differences between ND and USAFA decision-makers, except perhaps for the military scenario. For instance, we expect the USAFA cadets to value the lives of soldiers more than typical ND students. Moreover, USAFA cadets likely have more
exposure to the Just-War Doctrine, which emphasizes, as noted above, the importance of minimizing casualties. These possible differences might serve to enhance utilitarian responding for cadets in the Military scenario despite the Doctrine’s emphasis on saving civilian casualties, as that is not an option within this mission. However, ceiling effects might preclude detecting such differences.

1.5.2 Decisions in Commander and Family Member Missions

The present study involved two additional choice situations after the P mission in each scenario (Military, Firefighter, Surveillance). The purpose of these two choice missions was to escalate the value of the one for decision makers, thereby potentially making the non-redirect, deontological choice option in the two dilemmic conditions (Military, Firefighter) more probable, as the dilemma was more personal. For those conditions, based on other studies reviewed above (e.g., Kelman & Kreps, 2014), we expected the percentage of redirect, utilitarian choices (save the five) to be highest in the P mission and significantly lower (i.e., an increased proportion of non-redirect, deontological choices) in the FM mission. For the pseudo-dilemma Surveillance condition, we did not expect the proportion of choices for taking pictures of one or five to change systematically across missions.

Our expectations for where the C mission would fall in relation to P and FM missions in terms redirect, utilitarian choices was unclear. To the extent that a commander in the Military and Firefighter scenarios was regarded by decision-makers as being more important than a single peer soldier or firefighter, then a drop-off in redirect, utilitarian responding would be expected in the C mission, relative to the P Mission. However, that drop-off would not be as great as for the FM mission. In other words, the
proportion of redirect, utilitarian choices in the C mission was expected to be somewhere in between that observed for the P and FM missions, but likely closer to peers than to family member. Again, we expected no systematic changes across missions for the Surveillance condition.

As for population differences, because of their respect for authority and the normal importance of their superior officers, commanders might hold more significance for cadets than for ND students. In that case, the proportion of redirect, utilitarian choices were expected to have a greater separation between P and C missions for USAFA cadets than for ND students, with less utilitarian and more deontological decisions being made. In other words, for cadets, commanders would more closely resemble FM mission outcomes than they would for ND students.

1.5.3 Emotionality

According to Greene’s dual-process theory, the standard Trolley Problem embedded in the P mission is an impersonal dilemma that should be decided largely on the basis of rational/cognitive cost-benefit accounting (i.e., saving five peers is better than saving one) (Greene et al., 2004). Default emotional responses should be minimized for decision-makers in this mission, regardless of their choice (Greene et al., 2004). In contrast, if the C and FM missions were more personal and evoked more non-redirect, deontological responding, then signs of emotionality in decision-makers should be more evident in these missions than in the P mission since deontological choices are presumed to be driven more by emotion than reason (Greene et al., 2004).

In the present study, emotional responding throughout each mission was gauged through an ongoing measure of heart rate. Others have shown that heart rate is
influenced by emotionality in decision-making tasks. For example, Yamakawa, Ohira, Matsunaga, and Isowa (2016) found a significantly larger deceleration in heart rate during decision-making tasks that involved more risk, and presumably more emotion, than during tasks that involved lower risk (Abercrombie, Chambers, Greischar, & Monticelli, 2008). Also, Carmona-Perera et al. (2013) found a clear deceleration in heart rate as a response during personal dilemmas, which was much more apparent and dramatic than the responses to impersonal dilemmas. Based on these previous studies, we expected to see greater overall heart-rate decelerations evident in missions that involved more personal dilemmic choices (possibly C and, for sure, FM missions) than for the more impersonal P mission. However, we expected such a pattern across missions to be apparent only for the dilemmic conditions (Military, Firefighter), and not the pseudo-dilemma control condition (Surveillance).

An interesting question here is how well the overall heart rate patterns for each group (Military, Firefighter, Surveillance) will characterize the decision-making patterns for the two subgroups of decision makers (redirect and non-redirect) in these conditions. For the Military and Firefighter conditions, the P mission is impersonal so that the expected congruent decision would be the redirect, utilitarian choice, while the non-redirect, deontological choice would be incongruent. If incongruent choices involve more conflict, and if emotionality attends conflict, then incongruent, non-redirectors might show more heart-rate deceleration than redirectors in this situation. For the FM mission, if indeed it is more personal than the P mission, then the congruent response in this mission should be the non-redirect, deontological choice, whereas the redirect, utilitarian alternative would be incongruent. Accordingly, for this mission, redirectors
might exhibit more conflict and greater heart-rate deceleration than non-redirectors. It is unclear where the C mission will fall in this regard. Moreover, we have no reason to expect Military and Firefighter conditions to differ with respect to the overall and subgroup patterns of deceleration, except potentially for the USAFA population wherein more conflict might attend incongruent decisions regarding both peers and commanders. For the Surveillance condition, heart-rate decelerations should not vary systematically across missions or populations.

1.5.4 Decision Times

As noted by Greene et al. (2004, 2008; Greene, 2001), Decision Times (DTs) in dilemma situations can provide key insights regarding the interplay of emotion and reason. In the present study, DTs were available only for redirect choices since non-redirect responding was passive in nature (i.e., no response) and therefore was assigned the maximum DT based on a decision time limit of 10-14 secs. (see Method for details). Considering only redirect, utilitarian choices, then, we expected to see a progressive increase in overall DTs across missions in both Military and Firefighter conditions, but not for Surveillance. This expectation was based on two considerations. First, as noted by Carmona-Perera et al. (2013), impersonal decisions are made more quickly than personal choices. Second, conflicted decisions are slower than those that are not conflicted (Greene, 2001; Greene et al., 2004). Taken together, these considerations led us to expect that as missions moved from P to C to FM, there would be an increase in both the personal nature of the decision and in the degree of conflict attending it, which would mean increasing average DT across missions. Redirectors should be the most
conflicted in the FM mission because that utilitarian decision would be incongruent in that presumably more personal context.

Considering the two populations, cadets might evidence less of an increasing progression in DTs across missions than ND students due, as noted above, to the presence of greater decision conflict for them in P and C missions.

1.5.5 Decision Reasons and Justifications

The present research employed various self-report measures both before and after the studies that will be described in more detail below. Of these, three post-experiment self-report measures were developed for this study to further examine emotional and/or cognitive factors that may have influenced dilemmic decisions.

**Reasoning measure.** The first was a “moral reasoning” measure using Likert rating scales to determine how participants evaluated arguments that might justify redirect and non-redirect decisions in the original Trolley Problem dilemma. Arguments for both redirect (save the five) and non-redirect (save the one) decisions fell into three categories: Philosophical (e.g., utilitarian or deontological); Inflated victim value (e.g., there is a member of my family among the five, or the one is a member of my family); and Deflated victim value (one of the five has a terminal illness, or the one has a terminal illness). Each potential justification was evaluated on dimensions reflecting both cognitive and emotional components. The cognitive component assessed how universal and logical the justification was perceived to be, whereas the emotional component assessed how appealing and publicizable the justification was judged to be.

Since this reasoning measure was gathered after the experiment, it was employed to determine if scenario condition (Military, Firefighter, Surveillance) had any systematic
effects on perceived justifications for non-redirect and redirect decisions. We did not expect justification judgments of participants to differ across Military and Firefighter conditions, but both might differ from Surveillance in certain ways to the extent that experience with the Military/Firefighter dilemmas sensitized students to the reasons for their decisions. For example, exposure to either Military or Firefighter conditions might elevate ratings for Philosophical and Inflated victim value dimensions on this test, relative to the Surveillance condition for both populations.

Our reasoning measure also might reveal differences between majority redirectors and non-redirectors across all three missions. One way to define “majority” here would be two or more of either decision across all three missions. Other ways of defining redirectors and non-redirector subgroups will be considered below. However, using the present “majority” definition, we might expect majority redirectors to provide higher ratings for philosophical justifications for redirect decisions, while majority non-redirectors might display higher ratings for more emotional, value-based justifications for non-redirect decisions; such as the Upgraded or Downgraded Victim justifications. It is not clear that any population differences would be expected here.

**Values measure.** For this measure, we selected seven values based on a pilot study that were judged most germane to the present RPA scenarios: Aggressiveness, authority, cooperation, loyalty, obedience, responsibility, and security. These values and their descriptions were presented to participants, who then evaluated the values along the following four dimensions using Likert rating scales: (1) *moral* (the degree to which the value claims to be universally valid and corresponding actions are judged as right or wrong); (2) *official* (the degree to which the value relates to compliance towards internal
rules or laws); (3) *community oriented* (the degree to which the value supports the cooperative being-together of people); and (4) *emotional appeal* (the degree to which following the value feels right for the person).

As with the reasoning test, this values measure was employed to determine if scenario condition (Military, Firefighter, Surveillance) had any systematic effects on perceived applicability of the seven values. For ND students, the Military condition might align more than Firefighter or Surveillance with the moral and official dimensions for the values of aggressiveness, authority, obedience, and security since the expressed purpose of this scenario was to locate and eliminate terrorists. In contrast, the Firefighter condition might align more with the community and emotional dimensions for the values of cooperation, loyalty, and security since the purpose of this scenario was for disaster management. No particular alignment of values was expected for the Surveillance condition. Across populations, we might expect the USAFA cadets to endorse the moral and official dimensions for the values of authority, aggressiveness, obedience, and security in the Military condition to an even greater extent than ND students.

**Mission review debriefing.** In a final self-report measure, decision-makers were asked about their reasons for the decisions they made during the P, C and FM missions. The reasons provided were categorized as involving either a philosophical (e.g., it is wrong to kill anyone) or non-philosophical (e.g., I couldn’t kill my own family member) justification. With this measure, for the Military and Firefighter conditions, we expected to see a progressive shift across missions from largely philosophical justifications in the P mission for both redirectors and non-redirectors to largely non-philosophical justifications in the FM mission for non-redirectors. However, we believed there would
be continued philosophical justifications for redirectors in this mission. For the
Surveillance condition, we expected justifications to be largely non-philosophical across
all missions. We did not expect differences across populations in this justification
pattern.
The investigation was first run at ND which would serve almost as a “baseline” experimental population to be compared to the military-oriented population of USAFA cadets, who are much closer to our goal population of RPA pilots. Furthermore, this experiment also permitted us to determine what measures would be kept in the protocol for the USAFA experiment, as we knew that we would have limited run times at that location.

2.1 Experimental Design

This experiment used a between-subject experimental design to compare three simulation condition groups (Military, Firefighter, Surveillance). Each condition introduced a within-subject factor of dilemma mission (P, C, FM) which every participant experienced within each simulation scenario.

2.2 Participants

As mentioned above, undergraduates from ND were sampled for observation in the first part of this study. The ND sample included 172 participants ($M_{age} = 19.1$ years; 58% female) who volunteered for participation. ND participants volunteered through
SONA Systems, an online participant management and recruitment software, and were offered course credit or monetary compensation for their time. Within this sample, there were two Reserve Officer Training Corps (ROTC) cadets.

2.3 Simulation

The simulation used in the current study was developed in the video-game development system, Half-Life 2 SDK, and was based on the well-studied Trolley Problem (Foot, 1967; Thomson, 1985).

2.3.1 Trolley Problem RPA Scenarios

Our RPA simulation included three scenarios: Military, Firefighter, and Surveillance. These scenarios are described at length in Chapter 1. To review: the Military scenario involved a country involved in a war against terror in which participants were asked to shoot at misidentified targets (originally identified as terrorists, but found out last-minute to be friendly troops), the Firefighter scenario involved a country threatened by large forest fires and the participants use water bombs which could cause collateral damage, and the Surveillance scenario (pseudo-dilemma control) in which the participants take pictures across a national park to complete a census. As mentioned previously, the use of these three conditions was to disentangle the effects of exposure to a pseudo-dilemma scenario (surveillance) from the effects of two scenarios involving different, dilemmic Trolley problems. In each scenario, three of the five missions involved the opportunity to make redirection decisions. However, across these three, the emotional and social “value” of the single victim increased from being a peer of the other five persons, to being a commander, to being a family member (of the
participant). This change in value was intended to parallel what has been reported in the literature with the original Trolley Problem (Foot, 1967; Greene, 2001; Greene, et al., 2004, 2008; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Waldmann & Dieterich, 2007; Chelini et al., 2009).

2.3.2 Simulations: Operational Aspects

In the simulation, the participant used a joystick to “fly” through the 3D environment while taking on the role of an RPA pilot, guiding the RPA from launch to landing while completing exploration, training, and mission phases. During the simulation, missiles were auto-fired, thus the participants did not decide whether the target was legitimate nor did they launch the simulated weapon; however, in the dilemmic missions they were able to shift, or redirect, the missile target to an alternate path by pressing the joystick’s top button. During automatic targeting, camera controls were automated to follow the missiles flight path to detonation. Once the missile had detonated, camera view and movement control were returned to the participant. After impact, the pilots had to approach the scene and report the resulting damage. This damage assessment feature of the simulation was similar to the actions taken in real-life by RPA operators. All commands and prompts were given by a simulated higher command using both visual and audio modalities.

Each participant experienced one of the three scenarios described: Military, Firefighter, or Surveillance. All scenarios contained five missile-launch events, termed missions. Missions one and three served as successful baseline sessions and did not confront the participants with any decisions. Missions two, four, and five were dilemmic for Military and Firefighter scenarios, prompting the participant to make a Trolley-
problem-like decision. In these dilemmic decisions, participants were required to choose between doing nothing and letting five peers (i.e. soldiers, firefighters) die or actively redirecting the missile using the joystick button, causing one person to die. The one person changed in “value” with each mission. In mission two the one was another peer. Mission four placed the one in the role of a superior (i.e. commander, fire chief, or park ranger), outranking the five. Finally, in the fifth mission the one was a family member of the participant. Throughout the simulation, each redirect decision and decision time was recorded via the Half-Life SDK program. The Surveillance condition presented participants with pseudo-dilemmas for missions two, four and five in which the choice was between photographing one or five persons. As with the other scenarios, the value of the one changed across missions in this condition from a peer, to a park ranger, to a family member.

2.3.3 Participant Breakdown Across Simulation Conditions

Participants were assigned randomly to one of the three scenario conditions in the simulation: Military, Firefighting, and Surveillance. In Experiment 1, 53 ND participants completed the Military scenario, 52 completed Firefighting, and 67 completed the Surveillance/control condition. The elevated number in the Surveillance condition was a result of participants added to this condition to balance gender in this group.
2.4 Materials

2.4.1 Pre-Stimulus Measures

The pre-simulation scales included demographics, items related to video game experience, trait measures for altruism from the NEO Personality Inventory (Costa & McCrae, 1992), measures of dutifulness taken from the 16 Personality Factor Questionnaire (Conn & Rieke, 1994), war and peace attitudes (adaptation of Van der Linden, Bizumic, Stubager, & Mellon, 2011), perceived stress reactivity (Schlotz, Yim, Zoccola, Jansen, & Schulz, 2011), a measure of moral orientation based on the Triune Ethics Theory (Narvaez, Brooks, & Mattan, 2011; Narvaez & Hardy, 2016), and a measure of state aggression (Spielberger, 1999). All of the pre-simulation measures were employed as a way to verify that there were no baseline differences across the three groups within each Experiment or among populations across experiments (ND and USAFA) in traits or states that could potentially impact their performance. A copy of the pre-simulation survey can be found in Appendix B, for reference.

**Video Game Experience.** This measure involved questions related to the age of participants’ first video game experiences, hours of video games per week currently, overall hours of video games played, experience with 3D video games (such as flight simulations or games taking place in a 3D world), and the percentage of video games played which were 3D. None of these questions were open-ended and participants were given set answers with which to respond. For instance, the overall lifetime video game hours gave participants the following options: *I have never played video games, I have played very rarely, not more than 100 hours in total, I have played sometimes, maybe in total up to 1000 hours, I have played quite regularly, maybe up to 10,000 hours (the*
average time a person played until 21 in the US), and I have played a lot, i.e. more than 10,000 hours so far. Most other questions also presented ranges for answering the prompts. Averages will be calculated for first video game age, hours per week, and overall hours currently played. For the overall lifetime video game hours, options were assigned values 0-8; zero being assigned to never played and eight being assigned to more than 10,000.

**State-Trait Aggression Expression Inventory (STAX-2).** State-trait aggression was assessed both in the pre- and post-simulation batteries to determine if there were any effects of the scenario on the participant’s self-reported aggression state. The scale constituted of 15 items that contained statements such as “I am furious,” “I feel like shouting out loud,” and “I feel like breaking things.” Participants were asked to rate each statement on how much or how little their current state of mind fit these descriptions on a 4-point Likert scale.

**The Perceived Stress Reactivity Scale.** The Perceived Stress Reactivity Scale assesses an individual’s perception of their own responses to daily stressful situations by intensity and type of response (Schlotz et al., 2011). This scale consists of 23-items containing a scenario and three response options. For example, one scenario given is “When I fail at something…” to which a participant is given three options: “I usually find it hard to accept,” “I usually accept it to some degree,” and “In general, I hardly think about it.” All items covered similar everyday tasks such as getting into arguments, sleep and stress, and receiving criticism. Furthermore, every three-response set followed the similar pattern of a poor reaction, neutral reaction, and good reaction to the stress inducing situation. The measure consisted of 23 items of which 12 were reverse coded.
Once reverse scoring was completed, five subscale scores were calculated along with an overall score which was computed by adding the sub-scores together. Higher scores correlated with higher stress reactivity. The subscales included Prolonged Reactivity (long term stress-situations), Reactivity to Work Overload (multitude of tasks and limited time), Reactivity to Social Conflict, Reactivity to Failure, and Reactivity to Social Evaluation (perceived judgement). This measure was incorporated as reactivity to stress has been shown to affect our dual-processing strategies (Luini & Marucci, 2015; Matthews, Panganiban, & Hudlicka, 2010). For instance, under high emotional or psychological stress, decision-makers tend to make more System 2 type decisions as they are more prone to make gut reactions in their fight-or-flight state.

The Triune Ethics Theory. Narvaez and Hardy (2016) proposed a bottom-up theory of ethics, the Triune Ethics Theory (TET), which is rooted in evolved unconscious emotional systems involved in motivational orientations. The theory was created to achieve three goals:

1. It attempts to harvest critical findings from neurobiology, affective neuroscience, and cognitive science and to integrate them into moral psychology for the purpose of informing psychological research on the moral life of persons.
2. It seeks to explain differences in moral functioning through a person by context interaction.
3. It suggests the initial conditions for optimal human moral development (Narvaez, 2008, p 95).

This theory is similar to those like the Social Intuitionist Model, taking into account the individual’s psychology as well as the influence of development and other outside forces (Narvaez, 2008); in other words, how an individual is predisposed by experience to make
certain moral decisions and conduct certain moral actions. Furthermore, it also accounts for the neurobiological factors incorporated in decision making. The TET operates under three basic moral orientations, each with their own unique social and neurobiological profiles: self-protectionism, relational attunement, and imagination.

The current study’s version of the TET, from 2014, contains four moral orientations, two representing self-protectionism: Wallflower/Withdrawal and Bunker/Opposition; Engagement, and Reflective Imagination (see Appendix A for details on each). For each orientation there is a separate group of questions and participants were instructed to read a list of four characteristics used to describe a person with said orientation. Participants were then instructed to rate, on a 5-point Likert scale (strongly disagree (1) to strongly agree (5)), five statements which related the adjectives to the participant. The five statements were: “Being someone who has these characteristics is an important part of who I am,” “Other people I know think I have these characteristics,” “My friends think I have these characteristics,” “I strongly desire to have these characteristics,” and “My family thinks I have these characteristics.”

Each moral orientation group had a set of four characteristics assigned to them based on their definition under the Triune Ethics Theory. Wallflower/Withdrawal corresponded with Submissive, Unassertive, Withdrawing, and Timid. Bunker/Opposition corresponded with Combative, Tough, Vigilant, and Belligerent. The Engagement orientation was represented by characteristics such as Caring, Compassionate, Merciful, and Cooperative. Finally, Imaginative was represented by Reflective, Thoughtful, Inventive, and Reasonable. Likert scores were then summed per moral orientation group. As moral orientation can have effects on how a person would
decide in a morally charged scenario, such as our simulation, this measure was included to verify that there were no differences among the three groups prior to simulation exposure.

**Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI).** A subset of the Neuroticism-Extraversion-Openness to experiences (NEO) Inventory was used in this study to measure altruism—willingness to help. The altruism subscale consisted of ten items which were evaluated on a 5-point Likert scale. Each item presented a short phrase that participants would evaluate on how accurately it applied to them personally. Half of the items were truly altruistic statements such as “I make people feel welcome,” while the other half were non-altruistic statements like “I turn my back on others;” non-altruistic statements were reversed scored. Higher scores indicated a higher alignment with altruistic qualities. This measure was chosen as it was posited to relate to the likelihood of making more altruistic, or utilitarian, decisions as both concepts work towards the goal of the greater good (Cao et al., 2017; Carmona-Perera et al., 2013; Conway & Gawronski, 2013; Moll et al., 2002; Starcke, Polzer, Wolf, & Brand, 2011).

**The 16 Personality Factor Questionnaire.** A subset of Conn and Rieke’s (1994) measure was used in order to assess a participant’s willingness to obey orders, or dutifulness. Similar to the altruism scale, this subset consisted of 10 item-statements that participants assessed for relevance with their personalities via a 5-point Likert scale (not at all applicable to very applicable). Statements were halved again between dutiful phrases such as “I believe laws should be strictly enforced” and non-dutiful phrases such as “I oppose authority” which were reverse scored. Higher scores on this scale indicated
higher endorsements for dutiful behaviors. This measure was posited to correlate with utilitarian decision-making: when dutifulness characteristics are higher it was hypothesized that the likelihood of making the socially endorsed utilitarian choice would increase.

**Social Representation Correlates of Attitudes towards Peace and War.** This scale was constructed through an adaptation of Van der Linden et al.’s (2011) study on cross-cultural attitudes on war and peace. The scale consisted of ten statements which participants rated based on how much they agreed or disagreed on a 9-point Likert scale. Half of the statements were pro-war, such as “Being in war forms your character” and half were pro-peace, “War is a futile struggle resulting in self-destruction.” Separate scores were calculated for War and Peace attitudes, respectively, by summing the appropriate items together. Since attitudes toward War and Peace could influence decisions to redirect or not in the trolley scenarios in this study, this measure was included to verify that there were no differences among the three groups prior to simulation exposure.

2.4.2 Post-Simulation Scales

The post-simulation scales included a moral reasoning test using Trolley-problem-like scenarios, a moral values evaluation (Christen, Narvaez, Tanner, & Ott, 2016), as well as a repeat of the state-trait aggression measure. The first two measures were developed specifically for this study to assess the cognitive and emotional justifications participants would provide for decisions similar to those they encountered across the dilemmic missions. Of special interest here was whether or not redirectors and non-redirectors would provide different cognitive and emotional justifications for
hypothetical decisions similar to the ones they encountered across missions. The aggression measure was repeated here to see if pre-post differences in this measure were observed for any or all groups or for subgroups based on their redirect and non-redirect decisions. A copy of the post-simulation survey can be found in Appendix C.

**Hypothetical Reasons Measure.** This measure was developed to assess participant ratings of reasons for decisions in hypothetical Trolley Problem scenarios. This measure asked participants to rate justifications for twelve separate, pre-determined hypothetical Trolley Problem scenarios, six that had been decided in favor of redirection (saving five, sacrificing one) and the other six that had been decided in favor on no redirection (saving one, sacrificing five). There were three types of justifications provided: Philosophical, Upgraded victim (increased value of whomever was saved), and Downgraded victim (decreased value of whomever was sacrificed) arguments. The structure of the measure is summarized in Figure 2.1.
Each justification was presented through two redirect decisions and two non-redirect decisions which gave participants two examples of the same justification principle. Participants rated each justification using four scales according to whether the justification was universalizable, logical, appealing, and publicizable. These four scales could also be grouped into two components: cognitive and emotional. The cognitive component was derived from the universalizable (i.e., my justification depends on one’s personal opinion vs. everybody should support this argument) and logical (i.e., my argument doesn’t support the decision at all vs. my argument clearly supports the
decision) scales. The emotional component was derived from the appealing (i.e., my justification does not at all feel right for me vs. my justification feels completely right for me) and publicizable (i.e., I would not use this argument in public at all vs. I certainly would use this argument in public) scales. For purposes of this study, all four scales scores were combined into a single score for each reason category within each hypothetical decision type. See results chapter below for the specific measures.

**Values Measure.** As with the Hypothetical Reasons Measure, the Values measure was created specifically for this study based on research done by Christen et al. (2016). Participants were asked to rate seven different values identified from pilot work as being potentially relevant to Trolley Problem decision-making (Aggressiveness, Authority, Cooperation, Loyalty, Obedience, Responsibility, Security). Participants were asked to rate each value on four dimensions: moral (the degree to which the value claimed to be universally valid and corresponding actions were judged as right or wrong); official (the degree to which the value related to compliance towards internal rules or laws); community oriented (the degree to which the value supported the cooperative being-together of people); and emotional appeal (the degree to which adhering to this value felt right for the person). In all, there were 28 Likert ratings (7 values by 4 scales) provided by each participant. All 28 ratings were included in the analysis of this measure (see Figure 2.2).
Figure 2.2. This infographic depicts the structure of the Moral Values Measure. For each Value (blue) there were four dimensional scores (pink) on which they were rated.

2.4.3 Actual Reasons Measure

A debriefing survey was administered after the completion of the post-simulation scales. In Experiment 1 at ND, this portion of the protocol was done verbally. The first three items surveyed the participants’ general feelings toward their simulation experience: “Overall and after this experience, would you be interested in becoming a real RPA pilot,” “How realistic was the scenario for you,” and “How confident were you in flying the RPA.”

The remainder of the survey contained questions pertaining to each of the five missions separately. Participants were asked if they considered the two control missions successful and were given prompts to remind participants of the mission’s scenario. The
same was done for the dilemmic missions (two, four, and five), with the addition of what their decision was (redirect—one person or did not redirect—five people) as well as an open-ended question asking for the reasoning behind their decision.

This verbal survey was administered by the experimenter. The informal interview was recorded, transcribed, and coded by two experimenters. Answers were first coded by Mission decision, redirect or non-redirect, and then by whether or not a philosophy-based argument was used in their justification. The philosophy-based arguments were determined by multiple sub-codes which were more specific in nature and grouped into philosophical-based and non-philosophical-based categories. For example, some philosophy-based codes included: Utilitarian—better to kill one over five and Kill five didn’t want civilian casualty. Non-philosophy-based codes included: Easiest/Fastest Option and Curious to see what would happen. Many of the codes applicable to the Surveillance Scenario fell under the non-philosophical-based umbrella due to the general nature of the decisions made during the scenario (i.e. Better to photograph more people).

Through this coding scheme, the verbal and online version of this survey was easily comparable between study populations. Interrater reliability was calculated using Cohen’s Kappa and a 64% agreement rate was found for our sample, a level of agreement considered highly acceptable for social science research (Cohen, 1977; Landis & Koch, 1977). A copy of the debrief survey can be found in Appendix D, for reference.

2.4.4 General Set-up

At the University of Notre Dame, the experiment took place in an acoustic booth containing a large 60-inch LED monitor. The booth was utilized to ensure immersion into the simulation scenarios. Participants also wore headsets with microphones in order to
stay in contact with the experimenter while receiving prerecorded mission orders and responding, as needed. A joystick was used to operate the RPA during the simulation which was exchanged for a mouse for the purpose of completing the pre- and post-simulation scales.

A measure of pulse rate was obtained from a finger pulse-ox monitor attached to the index finger of the participant’s non-dominant hand which was slightly restrained to minimize movement artifacts. Pulse rate was determined based on photoplethysmography (PPG) measurement of changes in blood flow volume during the cardiac cycle (Shelley, 2007). This measurement is most sensitive in the fingers and detects changes in the sympathetic nervous system (Awad et al., 2001).

2.4.5 Procedure

Participants began the experiment after a briefing from the experimenter and signing a consent form. Participants were randomly assigned, prior to arrival, to one of the three scenario groups: Military, Firefighter, and Surveillance. The participants were then brought over to the experiment area where they completed the pre-simulation scales.
Participants then watched an introductory video which explained the general framework of the simulation task as well as prime the participant for the scenarios and missions. This was done through the use of narration paired with a photographic presentation to set the stage for each scenario. Participants then began the flight simulator, starting with an exploration phase which assimilated the participants to the simulation environment. During the exploration phase, participants were given commands via the headset to fly to designated landmarks that were later used during the mission phase. After the exploration phase, the training phase began and explained the mechanics of firing the missile and redirecting its course to the participants. It also assimilated them to recording the resulting damage. This was slightly different in the surveillance condition as missile launches were replaced with pictures taken.
Figure 2.4. Screen capture from Practice Phase of Simulation for either the Military or Firefighter mission. The Surveillance mission was altered in script to say, “Decide whether or not to REDIRECT the camera. If you redirect, one object will be photographed. If you do not redirect, five objects will be photographed.”

Lastly, the mission phase began which took the participant through the five missions. To review, mission two, four, and five were dilemmic, based on the Trolley Problem and required participants to choose between doing nothing (five casualties) and redirecting (one casualty). Through each of the three dilemmic missions, the “value” of the single casualty increased in each mission from being a peer to the other five persons, to a superior, to the participant’s family member. Upon completion of the simulation, the post-simulation test battery would be administered.
Once the post-simulation scales were completed, a debriefing survey was administered verbally. The experimenter first started the audio recorder and then joined the participant in the experiment booth where they would start the debrief interview-survey. After the completion of the debriefing survey, participants were then escorted out of the simulation area and received a standard debriefing by the experimenter. Participants were then informed that they would receive their study credit at the completion of their timeslot, or they received monetary reward before leaving the experimental area. Participants were then dismissed and the study was complete.
CHAPTER 3:
ND RESULTS AND DISCUSSION

3.1 Independent Variables

Across both experiments in this report (Experiment 2, USAFA, discussed in the next two chapters), our primary objective was to understand the effects of three different real-world, modern Trolley Problem scenarios involving military, firefighting, and surveillance contexts on decision making. Furthermore, multiple dilemmic missions were employed within each scenario to progressively alter the social and emotional value of the one in order to investigate the effects of this factor on choices made. Thus, in both experiments, the Trolley Problem Simulation Scenarios (Military, Firefighter, Surveillance) served as a between-subjects independent variable, while Mission (Peer-P, Commander-C, Family Member-FM) served as a within-subject, independent variable (see below for an exception). A decision-based grouping factor determined by participant choices to redirect or not (see description below) was used for some analyses as an additional between-subjects factor. Finally, an overarching between-subject independent variable of Population (ND vs. USAFA) was examined in Experiment 2. This variable allowed for comparisons across the two experiments in this study.
3.2 Choice-based Grouping Variable

Based on participant choices, grouping variables were created so that Redirectors and Non-Redirectors could be examined separately within each Scenario and Mission. There are three possible ways to create a grouping variable based on participant choices. The most obvious is the “mission specific” approach in which the redirect (R) or non-redirect (NR) decision within a mission creates a grouping factor for all the R and NR participants within that mission. Using this approach, there would be a different grouping factor for each mission based on choices for that mission. A second approach would be to create a grouping factor based on the “majority choices” made by a participant across all three missions. Here, two out of three decisions for a participant would define that person’s grouping category such that majority redirectors (MRs) would be those participants making at least two R decisions across the three missions while majority non-redirectors (MNRs) would be those with at least two NR decisions. A final way would involve grouping based on unanimity of decisions across the three missions. Here unanimous redirectors (URs) would be those with three redirect decisions across missions, whereas unanimous non-redirectors (UNRs) would be those with three non-redirect decisions.

There are implications of using each of these three grouping methods. The mission-specific categorization is complicated by the fact that participants making redirect decisions in one mission might not redirect in another mission. Thus, the “redirector” and “non-redirector” groups in each mission might be made up of different participants. This complication is problematic for purposes of including this grouping factor in analyses across missions. Strictly speaking, it would not be a within-subjects
factor since each R and NR group would not consist of the same participants in each mission. The majority approach gets around this problem by assigning one grouping (MR or MNR) to each participant based on two out of three of their choices. The complication here is that any majority participant with only two of the same choice out of three will be misclassified in the mission where their actual choice was opposite to their assigned grouping. The unanimous approach resolves this issue by insisting that all three choices must be the same in each grouping, but it eliminates all participants (most in fact) that do not have three identical choices across missions.

For purposes of the present study, we decided to use different grouping strategies for different dependent variables, depending on the purpose of the analysis. These strategies are explained below in each dependent variable section.

3.3 Dependent Variables

3.3.1 Pre-Simulation Scales

Several measures were administered in the pre-simulation test battery as a way to compare baseline measures for groups (Military, Firefighter, and Surveillance) and Populations (ND and USAFA). These comparisons served to verify that the different groups involved in this study were comparable before exposure to the simulations on key attitudes and dispositions that were potentially relevant to simulation performance and reactivity. These baseline measures are described below.

**Video Game Experience.** This baseline measure was based on questions related to the age of participants first video game experience, hours of video games per week currently, overall hours of video games played, experience with 3D video games (such as
flight simulations or games taking place in a 3D world), and the percentage of video games which were 3D. The primary measures analyzed here were age of first video game use, hours per week played, and overall hours currently played.

**STAX-2.** The STAX-2 Aggression scale was completed by participants before the simulation to assess group comparability and again after the simulation to assess any possible change in aggression state-trait that might have resulted from simulation exposure. Scores were calculated by summing the various items in this scale into a total score. Higher total scores correlated with higher aggression-states (maximum score 60) while lower scores signified the opposite. The difference between pre- and post-simulation total scores was taken as a measure of change in aggression produced by exposure to each Simulation Scenario.

**Perceived Stress Reactivity Scale.** This pre-simulation measure produced five subscale scores: Prolonged Reactivity, Reactivity to Work Overload, Reactivity to Social Conflict, Reactivity to Failure, and Reactivity to Social Evaluation. Items were summed together (some reverse coded) to produce five subscale scores (maximum scores ranged from 12-15 depending on subscale). From there, the overall score (maximum score 69) was created by summing these five subscale scores. Higher scores across all six scores indicated higher stress reactivity.

**Triune Ethics Theory (TET) Measure.** The items from this scale were grouped and summed creating four subscale scores for each participant corresponding to the four moral orientation types encompassed by the theory: Wallflower, Bunker, Engagement, and Imagination (Narvaez & Hardy, 2016). Higher scores (out of 25 for each orientation) signified higher alignment with that particular moral orientation.
**Altruism.** This measure, based on the 10 items in the Neuroticism-Extraversion-Openness to experience’s (NEO) scale related to altruistic behaviors, a summed score across all items (maximum score 50). Higher scores indicated a greater tendency to make altruistic decisions.

**Dutifulness.** The ten items in this scale were summed for a max score of 50. Higher scores indicated higher endorsement of dutiful behaviors.

**War and Peace Attitudes.** From these items, two separate summed scores were calculated for both War attitudes and Peace attitudes. Each attitude score ranged up to 45, separately. Higher attitude scores indicated more positive sentiments toward war or peace.

### 3.3.2 Simulation Data

**Mission choices.** Dependent variables here included the choices made in each mission either to Redirect or Not Redirect. For each Scenario (Military, Firefighter, and Surveillance) and Mission (P, C, FM), the proportion of participants making either Redirect or Not Redirect decisions was computed.

**Heart rate.** As is a common methodological practice, heart-rate change was used as a measure of emotional engagement in this study. The specific measure used here was the change in heart rate from a baseline period to the end of the 15-sec. interval following the start of the redirect decision period during each mission. To calculate this measure, mean heart rate was determined for each 1-second interval during the decision period. Pre-stimulus baseline heart rate was defined as the heart rate during the 1-second period starting 3 secs. prior to the start of each redirect decision period. Using procedures similar to those reported by Gamer, Rill, Vossel, and Gödert (2006; Gamer, Verschuere,
Crombez, & Vossel, 2008), heart-rate difference scores were calculated by subtracting the pre-stimulus baseline heart rate from the last one-second heart rate during the 15-sec. interval (Carmona-Perera, Reyes del Paso, Pérez-García, & Verdejo-García, 2013). A decrease in heart rate will be referenced as deceleration and an increase in heart rate will be referenced as acceleration across these analyses.

For the heart-rate analyses below, we did not include a grouping factor in the overall analysis, instead including only Scenario (Military, Firefighter, and Surveillance) as a between-subject factor and Mission as a within-subject factor. For this analysis, all the same participants were present in each mission. However, to evaluate the effects of decision-based grouping for heart rate, we followed up the overall analysis with separate 2 (Mission-specific: R vs NR) X 3 (Scenario groups) ANOVAs for each Mission. The separate ANOVAs allowed us to assess the effects of decision grouping within each mission, but not across missions.

**Decision Times (DT).** This measure often is thought to relate to emotional engagement and conflict (Carmona-Perera et al., 2013; Greene, 2001; Greene et al., 2004, 2008). DT was computed during the simulations as the time needed to make a decision from the point where the simulation introduced the trolley problem choice (“If you redirect, one soldier will be killed. If you do not redirect, five soldiers will be killed. 10 seconds to decide”) to the time when the participant clicked the trigger button on the joystick, enacting the redirect decision. For the analyses using this variable, only redirect decisions were used as they were the only active choice in our Simulation; non-redirect decisions were assigned the maximum DT for a particular mission and, therefore, did not vary. In the analysis of DT data, we wanted to evaluate the change in DT across
missions. However, since only the DT data for redirectors was used, and because, as noted above, redirectors were not the same for each mission, we elected to treat Missions as a between-subjects factor in an overall DT analysis along with Scenario. This was deemed to be a conservative strategy that would permit an examination of DT changes across missions, especially given the fact that the redirectors in one mission were not necessarily the same participants as the redirectors in another mission. This is further discussed within the analysis below.

3.3.3 Post-Simulation Scales

**Hypothetical reasons measure.** From the various items involved in this scale as described above (see Fig. 1, Chapter 2), a single score was computed for each reason category (Philosophical, Upgrade, Downgrade) within each hypothetical decision (redirect or non-redirect) scenario. In all, there were six summed scores, three (Philosophical, Upgrade, Downgrade) for the hypothetical Redirect and three (Philosophical, Upgrade, Downgrade) for the hypothetical non-redirect scenarios. Each score summed across the two examples and each of the four scales within that reason category (maximum score 40).

Through the use of this measure, we wanted to understand how redirectors in this study justified hypothetical redirect decisions, as well as how non-redirectors justified hypothetical non-redirect decisions. Therefore, hypothetical reasons to redirect were examined only for MR (i.e. those with at least two redirect decisions across missions), while hypothetical reasons not to redirect were examined only for MNR (i.e. those with at least two non-redirect decisions across missions). The majority grouping strategy was used here since we wanted to maximize the number of participants available in each
grouping category and because our primary interest was to determine how Scenario (Military, Firefighter, and Surveillance) affected the reasons given for Hypothetical Trolley Problem decisions.

**Values measure.** As noted above in Figure 2, there were 28 Likert ratings (7 values by 4 scales) provided by each participant for this measure. All 28 ratings were included in the analysis of this measure as indicated below. As with the reasons measure, this instrument was used to determine if Scenario (Military, Firefighter, and Surveillance) exposure or pattern of decision making within a Scenario (MR, MNR) influenced participant value ratings. Also, as with reasons, the majority grouping strategy was deemed most appropriate here, given the goals of this analysis.

**Actual reasons measure.** From the coded reasons each participant provided for each mission as described above, proportion of participants giving philosophical justifications for each Scenario group (Military, Firefighter, and Surveillance) within each mission was computed. Also, proportions of redirector and non-redirectors (by mission) providing philosophical justifications was calculated for this measure.

### 3.4 Overall Analysis Plan

Several types of analysis strategies were employed in this study depending on the types of dependent variables considered. The binary (redirect or not) choices made in dilemmic decisions and in the actual reasons measures (philosophical or not) were evaluated in two ways. Between group comparisons of the proportions of choices made across scenarios (Military, Firefighter, and Surveillance) or across populations (ND, USAFA) were assessed using chi-squared tests of independence. Within-group
comparisons of these proportions across missions (P, C, FM) were made using Cochran’s $Q$ test. Pairwise comparisons were used to evaluate any significant overall chi-square or $Q$ tests involving multiple groups. Alpha levels for all comparisons were set at the 0.05 level.

Measures involving continuous data (HR and RT) or ratings were analyzed using appropriate ANOVA models. Scenario (Military, Firefighter, and Surveillance), Decision-based groupings (Redirectors and Non-redirectors), and Population (ND, USAFA) were considered between-subject factors, while Missions (P, C, FM) or ratings categories/scales from the same instrument/test were treated as within-subject factors in these ANOVAs, unless otherwise noted. All main effects and interactions were followed up with post-hoc paired comparisons evaluated using the Fisher’s Least Significant Difference (LSD) test. Fisher’s LSD test was employed as it is more powerful than the Bonferroni procedure, despite not controlling as well for family-wise error rates (Williams & Abdi, 2010). A less conservative test was deemed most appropriate for this exploratory study since it employed novel Trolley Problem scenarios. Moreover, the practical implications of this study made a less conservative test more appropriate so as to detect true differences, which is a more important goal in this type of study than rejecting false differences (Maxwell & Delaney, 2004). All ANOVA related tests and follow ups used an alpha level of 0.05.

Effect sizes were calculated for all ANOVAs as partial eta squared ($\eta$), a measure reflecting the degree of association between the independent and dependent variables. Partial eta squared values between .01 and .06 are considered small effects, between .06 and .14 medium effects, and above .14, large effects (Cohen, 1992).
3.5 Experiment 1 Findings

3.5.1 Pre-Simulation Scales

As noted above, a variety of measures were administered to assess the comparability of the three groups in this study (Military, Firefighter, and Surveillance) prior to their exposure to the simulation. Given the exploratory nature of this first study, it was prudent to include measures that might potentially have a bearing on participant reactions to or performance in the simulations to be employed. Table 3.1 shows the baseline measures used in Experiment 1 and summarizes the results described below.

One-way ANOVAs were used to determine if any of the three groups (Military, Firefighter, and Surveillance) differed on any of the overall or subscale scores for the baseline measures shown in Table 1. The only significant difference found between groups was for the Imaginative subscale within the TET ($F(2, 141) = 3.41, p = 0.04$). Pairwise comparisons among the groups using Fisher’s LSD showed that the only significant comparison was between Military and Surveillance groups ($p=0.01$) such that Surveillance had a higher score on this scale ($M_S = 22.21$) than did the Military group ($M_M = 20.98$). As a reminder, the Imaginative orientation correlated with the description Reflective, Thoughtful, Inventive, and Reasonable.
TABLE 3.1.

THE BASELINE MEASURES USED IN EXPERIMENT 1.

<table>
<thead>
<tr>
<th>Measures</th>
<th>ND Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression State Scale</td>
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</tr>
<tr>
<td>Triune Ethics (TET)Scale</td>
<td></td>
</tr>
<tr>
<td>Wallflower</td>
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<tr>
<td>Bunker</td>
<td>No Differences</td>
</tr>
<tr>
<td>Engagement</td>
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</tr>
<tr>
<td>Imaginative</td>
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</tr>
<tr>
<td>Stress Reactivity Scale</td>
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<tr>
<td>Prolonged Reactivity</td>
<td>No Differences</td>
</tr>
<tr>
<td>Reactivity to Work Overload</td>
<td>No Differences</td>
</tr>
<tr>
<td>Reactivity to Social Conflict</td>
<td>No Differences</td>
</tr>
<tr>
<td>Reactivity to Failure</td>
<td>No Differences</td>
</tr>
<tr>
<td>Prolonged Reactivity</td>
<td>No Differences</td>
</tr>
<tr>
<td>War and Peace Attitudes Scale</td>
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</tr>
<tr>
<td>Peace Attitudes</td>
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</tr>
<tr>
<td>War Attitudes</td>
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</tr>
<tr>
<td><strong>Altruism</strong></td>
<td>No Differences</td>
</tr>
<tr>
<td><strong>Dutifulness</strong></td>
<td>No Differences</td>
</tr>
<tr>
<td>Video Game Experience</td>
<td></td>
</tr>
<tr>
<td>Age of first video game</td>
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</tr>
<tr>
<td>Hrs. of video games/week</td>
<td>No Differences</td>
</tr>
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<td>Hrs. of video games overall</td>
<td>No Differences</td>
</tr>
<tr>
<td>Experience with 3D video game</td>
<td>No Differences</td>
</tr>
</tbody>
</table>

*Main measures/scales are in Bold. Subscales are below.*
3.5.2 Simulation Data

3.5.2.1 Dilemmic Decisions in Peers Mission

The first dilemmic mission (P) in this study closely corresponded to the traditional Trolley problem (sacrifice one or five) for Military and Firefighter scenarios and was a pseudo-dilemma (take a picture of one or five) for the Surveillance scenario. Figure 3.1 shows the proportion of redirect decisions made for the P mission. This figure shows that a large majority of participants made redirect decisions, sacrificing the one and saving the five, in the two dilemmic scenarios (Military and Firefighter), but not in the pseudo-dilemma scenario (Surveillance). Military and Firefighter scenarios did not appear different from one another in this figure, but both differed from Surveillance.
Figure 3.1. Proportion of Redirect Decisions made within the first simulation missions, the Peers Mission. The Peers Mission most closely resembled the classic Trolley Problem. The Military and Firefighter scenarios were dilemmic as they involved the death of one or five actors in the simulation; the Surveillance was a control as it did not involve death.

Proportions for the three groups were compared using an overall chi-square test of independence, which revealed a significant difference among the Simulation Scenarios, $X^2 (2, N = 144) = 67.58, p < 0.05$. Pairwise follow up comparisons revealed that Military and Firefighter conditions were not different from each other, but both significantly differed from Surveillance (both $t$’s (144) > 7.8, $p$’s < 0.01).

The outcome of the P Mission analysis across the dilemmic scenarios (Military and Firefighter) is consistent with that of past literature which revealed a majority of
redirect decisions when both the group of five and the one were equally valued (Chelini et al., 2009; Foot, 1967; Greene, 2001; Greene, et al., 2004, 2008; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Waldmann & Dieterich, 2007). Further, it not only matches the outcomes for these traditional paper-and-pencil Trolley Problem applications, but more modern applications which involved computer and VR simulations (Navarrete et al., 2012; Patil et al., 2014). This finding suggests that the P scenario used here for Military and Firefighter groups presented a dilemma comparable to that in the traditional Trolley Problem, despite its more modern situation and modification. Furthermore, the P mission can be considered a baseline against which to compare the other two missions (discussed below), in which the value of the one was increased. Finally, as a pseudo-dilemma scenario, the Surveillance group was expected to be statistically different than the Military and Firefighter groups. As expected, the Surveillance group was at about a 50/50 split (40/60, to be exact) for redirect decisions in the baseline Trolley Problem mission. These differences lend credence to our argument that the Surveillance scenario serves as non-dilemmic control condition.

It can be noted that the use of a non-dilemmic control condition is a novel contribution to the literature. While past studies have done an excellent job of uncovering the differences in decision-making patterns when looking at personal versus impersonal decisions, or changing the background of the various characters in the Problem (Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010; Cao et al., 2017; Chelini et al., 2009; Hauser et al., 2007), few, if any, have compared these kinds of variations to Trolley Problem-structured scenarios that do not present a moral dilemma. The use of the
Surveillance scenario as a control condition for the Military and Firefighter scenarios is therefore a useful feature for the present studies.

3.5.2.2 Decisions Across all Three Missions

Figure 3.2 shows the proportion of redirect decisions for ND participants across all three missions (P, C, FM) for the three Scenario groups (Military, Firefighter, and Surveillance) which includes the data presented in Figure 3.1. As can be noted, the proportion of redirect decisions decreased progressively across missions for dilemmic scenarios but remained relatively steady across missions for Surveillance. That is, both Military and Firefighter groups showed a drop off of redirect decisions from P to C to FM missions. In contrast, redirect decisions remained consistently low across missions for the Surveillance group. Figure 3.2 also indicates that there were no major differences between proportions of redirect decisions for Military and Firefighter conditions across missions until the FM mission where the Firefighter group had a much higher proportion of redirect decisions.
Figure 3.2. Proportion of Redirect Decisions across all three Scenarios within each Mission. The value of the one increased across three missions which added emotional weight to the decision being made; unique from the traditional Problem.

The proportions shown in Figure 3.2 were compared in two ways: Between group tests across the three groups (Military, Firefighter, and Surveillance) within each mission (P, C, FM), performed using chi-square tests, with follow up t-tests; within group tests for each Scenario group over the three dilemmic missions were performed using Cochran’s Q tests. First, considering the between group comparisons for C and FM missions, the overall three group test was significant for both the C mission, $X^2 (2, N = 144) = 48.47, p < 0.01$, and for the FM mission, $X^2 (2, N = 144) = 19.11, p < 0.01$. Follow up tests within the C mission showed that the difference between Military and Firefighter groups was only marginally significant ($p < 0.10$), but that both Military and
Firefighter groups differed significantly from the Surveillance group, \( t(114)=6.07, p<0.01 \), and \( t(114)=8.37, p<0.01 \), respectively. Follow ups within the FM mission indicated that the difference between the Military and Firefighter groups was significant, \( t(144)=4.47, p<0.01 \), as was the difference between Firefighter and Surveillance groups, \( t(114)=6.07, p<0.01 \), but not the difference between Military and Surveillance groups.

Follow-up Cochran’s Q tests within the Military and Firefighter groups showed that there was a significant decrease in redirect decisions across the three missions in both scenarios \( (Q_M(2) = 60.65, p_M < 0.01; Q_F(2) = 35.27, p_F < 0.01) \). These analyses were followed up with paired t-tests. For the Military scenario, the P mission differed significantly from both the C mission \( (t(92) = 3.46, p < 0.001) \) and FM mission \( (t(92) = 14.65, p < 0.001) \). Within group comparisons for the Firefighter scenario produced the same significant differences between P and C, \( (t_{PvC}(98) = 2.24, p < 0.05) \), as well as between P and FM missions, \( t_{PvFM}(98) = 5.95, p < 0.001 \). In contrast, the Surveillance group showed no significant differences in redirect decisions across the three simulation missions.

Again, these outcomes align with what has been reported in past Trolley Problem literature. That is, as dilemmas become more personal (when the one’s value is increased) participants become less likely to make the utilitarian choice (Bleske-Rechek et al., 2010; Cao et al., 2017; Chelini et al., 2009). This was the exact pattern of results in the present study—the proportion of redirect decisions decreased as the value of the one increased, but only for the dilemmic scenarios (Military and Firefighter). This outcome further supports the use of our more modern version of the Trolley Problem which uses
situations more familiar and common for current participant populations as a comparable alternative to the original Trolley problem scenario.

The lack of consistent changes found within the Surveillance scenario across missions helps to further establish this scenario as an acceptable non-dilemmic control condition for these types of experiments. It can be noted in this regard that the choice to take a picture of the larger group or the family member in the Surveillance FM mission was a much different kind of choice than that presented to both the Military or Firefighter scenario participants. As noted by the Surveillance participants themselves in the final debrief survey, those who choose to capture an image of the five were doing so in order to get a more complete survey of park guests. Since the family member was described as living in the park, those participants who choose to take a picture of the five also noted that, since the family member was not a park guest, it did not fit their job description to take a picture of the one in this instance. It seems clear from such reports that this type of decision was not dilemmic despite the similar outcomes to the Military scenario, in particular.

The significant difference within the FM missions between the Military and Firefighter scenarios is of particular interest here. Results confirm that participants were more likely to make the redirect choice, to save the five, in the Firefighter scenario than they were in the Military scenario. Thus, participants were more willing to sacrifice their family member to save five firefighters, than they were to save five soldiers. This outcome suggests that these two groups of professionals may not be viewed equivalently by our civilian participants, a view that might also be shared by civilians and society at
large in terms of public perception. This possibility may be further illuminated by findings within our other measures (discussed in Chapter 6).

The use of a “commander” to increase the value of the one is a unique feature of this study. There is, of course, existing literature which increases the value of the one, as this study does, but not in the same personal and professional way as by using a commander or fire chief (Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010; Cao et al., 2017; Chelini, Lanteri, & Rizzello, 2009). The closest one can find in contemporary literature is that of a universal figure head, such as a world leader, but not a “personal” figure head, such as a boss or superior. This use of a “personal” figure head introduces a potentially new kind of dilemma in need of further exploration. For instance, if the one was the president or prime minister of the decision-maker’s country, would such a “global” commander be a more obvious candidate to be saved? The value we attach to global (e.g., Presidents) vs. personal (e.g., bosses) leaders needs to be better understood. In terms of our original expectations, it was not clear where a “commander” would fit in. Would a commander be more like a peer or more like a family member? The present findings suggest the former rather than the latter, but the other measures and populations considered below may help to shed further light on this important question.

3.5.2.3 Heart-Rate Change

Figure 3.3 depicts the heart-rate change score across each Mission within each Simulation Scenario. This figure shows that heart-rate deceleration occurred for Military and Firefighter groups in each mission, but not for Surveillance. Moreover, it appears that from P to FM the deceleration decreased for Firefighter group, but not in the Military
group. The only marked difference between the amount of deceleration for Military and Firefighter groups in any mission was for the Peers mission.

Figure 3.3. Displays Mean heart-rate change across all three Scenarios within each Mission. Change is measured in beats per minute and error bars indicate standard error of the mean. Negative changes represent heart-rate decelerations.

The trends evident in Figure 3.3 across missions were examined statistically using a 3 (Scenario: Military vs. Firefighter vs. Surveillance) X 3 (Mission: P vs. C vs. FM) mixed ANOVA, using scenario as a between-subject factors and mission as a within-subject factor. The only effect to emerge significant from this analysis was the main effect for Scenario, $F(2, 142) = 7.8, p < .001, \eta^2_p = 0.09$. Follow-up LSD tests indicated that the main effect occurred because the average change in heart rate across all missions for the Military and Firefighter groups, while not different from one another, were both significantly different from the Surveillance group (both $p's < 0.01$).
As noted above, separate 2 (Mission Decision type: R vs. NR) X 3 (Scenario: Military, Firefighter, and Surveillance) ANOVAs were used for each mission to see if differences occurred for any mission based on the decision-type groupings (R vs. NR) for that mission. These analysis failed to find any significant effects of involving Decision-type for any mission, but they did reveal a marginally significant main effect of Scenario for the P mission, $F(2, 140) = 2.68, p = 0.07, \eta^2_p = 0.04$, and a significant main effect of Scenario for the C mission, $F(2, 140) = 4.79, p < 0.01, \eta^2_p = 0.06$, but not for the FM mission. Follow-up tests showed that for the P mission only the Firefighter group was significantly different from Surveillance ($p = 0.06$), whereas both Military and Firefighter groups were different from Surveillance for the C mission (both $p$’s < 0.01).

These results are again consistent with previous work showing that dilemmic scenarios (Military and Firefighter) provoke emotion (Carmona-Perera et al., 2013; Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004, 2008). Specifically, in this study we saw that only the dilemmic scenarios appeared to evoke emotional engagement (as evidenced by decelerative HR change), which is consistent with the patterns reported by Carmona-Perera et al. (2013) who noted that dilemmic and personal choice-scenarios evoked greater deceleration in heart rate after the decision was made. The control, Surveillance, scenario did not show this significant deceleration, but instead showed, if anything, a small heart-rate acceleration after the decisions were made.

As noted above for the proportions of redirect decisions, this heart-rate change measure shows the Firefighter scenario created unique and significantly different patterns when compared with the Military scenario. Specifically, the Firefighter group in the P mission showed evidence of more emotional engagement (more deceleration) than was
evident for the Military group in the P mission. As mentioned previously, this could reflect on how these two groups of professionals are viewed by civilians and society in so far as their prestige and roles. This increased emotional engagement within the Firefighter P mission, where all characters are equal, may imply that civilians feel more emotional when Firefighters are involved than they do for members of the Military (Murphy, 2014; Correll, 2000). Such feelings could come from the idolization of Firefighters as our everyday heroes, especially in a post 9-11 United States. It will be interesting to see if this is further confirmed below with additional measures as well as in Experiment 2 with a military population.

The Military scenario also yielded interesting, significant results when comparing emotional engagement between P and C missions. That is, more emotional engagement was seen for the Military group in the C mission than in the P mission. This finding would imply that the increase of the one’s value from Military peer to Military commander increased emotional engagement, even though it did not result in a significant drop off in redirect decisions made (see Fig. 3). However, this same pattern was not seen for emotional engagement in Firefighter scenario, which remained high in terms of deceleration from P to C. This could mean, as discussed earlier, that firefighters, whether peers or a chief, had more practical, social importance to participants than did members of the military.

Interestingly, within the last mission (FM), there was less emotional engagement overall than expected. Given that the FM mission was designed to be the most “personal” in this study, and based on the results obtained by other researchers for personal dilemmas such as the footbridge dilemma (Bleske-Rechek et al., 2010; Chelini et al.,
2009; Christensen, Knezek, & Tyler-Wood, 2015; Hauser et al., 2007), we expected that this mission would provoke the greatest degree of emotional engagement and the greatest degree of heart-rate change. However, in retrospect, there are two possible reasons why the FM dilemma might not be as emotionally engaging as expected. First, despite its personal nature, this dilemma may not be that emotion provoking. That is, the FM decision might be so obvious to many that the emotional response is stunted; “Of course,” the participant thinks, “I have to save my family member despite the loss of five lives. It is a no-brainer.” This way of thinking may be very different from that involved the Footbridge dilemma, where the choice may not be a no-brainer at all. In that dilemma there is no personal attachment either to the one or the five, so other factors such as personal culpability due to the active role in killing may need to considered and weighed to reach a decision. These factors may provoke emotions that the family member decision used here do not. Further research will be needed to sort this out.

A second reason for the apparent lack of emotion in the FM decision may be due to order effects, as the FM mission was always last. Therefore, participants may have adapted to dilemma decision being made by that point, taking some of the emotion out of an otherwise personal decision. Further work will be needed to remove the influence of order effects from this situation. Decision time considered below should be informative in this regard, however. If the FM mission is indeed the most personal of the three in this study, albeit less emotional, it should still be associated with the longest decision times to reach a final conclusion to redirect.
3.5.2.4 Decision Times

As was mentioned previously, only redirect decision times were examined here as participants choosing not to redirect in any mission were assigned the maximum time for that mission. By definition, then, non-redirectors would not be expected to show any variation in decision times across missions.

Figure 3.4 depicts the mean decision times for redirectors in each Scenario group (Military, Firefighter, and Surveillance) for each Mission (P, C, FM). This figure shows two important outcomes. First, decision times increased notably across missions for Military and Firefighter groups, but not for Surveillance. In terms of these increases for Military and Firefighter, it appears that the decision time for Military increased greatly from P to C then again from C to FM. In contrast, Firefighter did not appear to increase notably from P to C but did from C to FM. Second, the three groups within each mission all appeared to differ from one another, except for the FM mission where Military and Firefighter groups were comparable and both differed from Surveillance. That is, Military and Firefighter groups made quicker decisions than Surveillance within the P mission but took longer than Surveillance for both C and FM missions, in part due to the steady increases for Military and Firefighter groups across missions and in part due to a decrease for Surveillance from P to C missions.
To examine the pattern of effects in Figure 3.4 statistically, a 3 (Mission) X 3 (Scenario) ANOVA was applied to the DT data. However, for the reasons noted above regarding changes in the composition of redirector and/or non-redirector groupings across missions, the present analysis treated the Mission variable as a between-subjects factor since the same participants were not redirectors for each mission represented in Figure 3.4. Therefore, treating Missions as a between-subjects factor in this case was a more conservative choice as between-subject factors typically have more variability than do within-subjects factors.

In this analysis, there were significant main effects of both Scenario and Mission \((F(2, 241) = 12.37, p < 0.001, \eta^2_p = 0.09; F(2, 241) = 17.31, p < 0.001, \eta^2_p = 0.13;\)
respectively), as well as the interaction effect between Mission and Scenario ($F(4, 241) = 19.49, p < 0.001, \eta^2_p = 0.24$). LSD follow-up tests within and across missions revealed that all three Scenario groups (Military, Firefighter, and Surveillance) were significantly different from one another (all $ps < 0.01$) within each mission, except for FM where Military and Firefighter groups were not different. In addition, follow-up tests showed that the Military group increased significantly from P to C and again from C to FM missions (all $ps < 0.01$), but Firefighter differed across missions only from C to FM ($p < 0.001$). Surveillance decreased significantly only from P to C missions ($p = 0.002$).

An even more conservative analysis was run as a check on our use of missions as a between-subject factor above. In the analysis, only unanimous redirectors (i.e. redirect choice for each mission) were included, which reduced the sample to only 34 participants. However, in this sample, all of the same participants served in each mission. A 3 (Mission) X 3 (Scenario) ANOVA revealed a strongly significant Mission X Scenario interaction, $F(4, 64) = 4.47, p = 0.003, \eta^2_p = 0.22$). The pattern of this interaction was identical to that reported above including all redirectors. Taken together, both analyses confirm that DT increased across missions only for Military and Surveillance groups. It also confirms that the FM mission was associated with the longest decision times for the two dilemmic groups (Military and Firefighter).

These results are consistent with other findings reported in the literature. That is, decision-making-scenarios that involve higher emotionally valued victims or scenarios that involve more personal dilemmas (i.e., the Footbridge dilemma) produce longer decision times (Carmona-Perera et al, 2013; Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004, 2008). Therefore, since the dilemmic missions (C and FM) were
observed in this study to have higher decision-making times, both significantly different from the traditional Trolley Problem mission of P, there is reason to argue that C and FM missions were more personal dilemmas than was the P mission in this study. Moreover, even within the P mission, the decisions within the Firefighter scenario were significantly slower than those in the Military scenario. This difference parallels the differences in heart rate which also showed evidence that the Firefighter P mission was much more emotionally engaging than the Military P mission. This could again reflect on the overall view and level of societal reverence and respect for firefighters over soldiers.

3.5.3 Post-Simulation Scales

3.5.3.1 Hypothetical Reasons Measure

Figure 3.5 shows the reasons for hypothetical redirection endorsed by MR (left panel) and the reasons for hypothetical non-redirection endorsed by MNR (right panel) in each Scenario group (Military, Firefighter, and Surveillance). The left panel shows that MR endorsed philosophical reasons for hypothetical redirection decisions to a much greater extent than upgrade or downgrade reasons. Moreover, Military and Firefighter groups had much higher summed scores in this reason category than the Surveillance group. In comparison, Military, Firefighter, and Surveillance groups really did not differ within either the upgrade and downgrade reasons categories.
Figure 3.5. Summed scores across the four items within each reason type for hypothetical redirection reasons endorsed by majority redirectors (left panel) and for hypothetical non-redirection endorsed by majority non-redirectors (right panel) in each Scenario group (M, F, S).

Statistical confirmation for the pattern of effects shown in the left panel of Figure 3.5 was obtained by applying a 3 (Reasons: Philosophical, Upgrade, Downgrade) X 3 (Scenario: Military, Firefighter, and Surveillance) ANOVA to the summed scores (across all four items) for each reason category only for MR (i.e., those who made at least two redirect decisions across the three missions in this study). Scenario was a between-subjects factor in this analysis while Reasons was within-subjects. The main effect of reason category was significant in this analysis, $F(2, 166) = 32.81, p < 0.001, \eta^2_p = 0.28$, as was the Reasons X Scenario interaction, $F(4, 166) = 2.39, p = 0.05, \eta^2_p = 0.05$. The
main effect occurred because the average summed score for Philosophical reasons was significantly higher than the average scores for both Upgrade and Downgrade reasons (both $p < 0.001$), but the latter two means did not differ from one another, as shown by a follow-up LSD test. LSD follow-up tests also showed that the significant interaction occurred because Military and Firefighter groups did not differ from one another, but both differed from Surveillance (both $p < 0.001$), but only within the Philosophical reason category.

The right panel of Figure 3.5 shows that, for MNR, summed scores for hypothetical non-redirect reasons were generally higher for each Scenario group in the Upgrade reason category than in the other two categories. In that category, the Military group was higher than either Firefighter or Surveillance in terms of endorsing upgrade reasons for hypothetical non-redirect decisions. Within the other two reasons categories, Military, Firefighter, and Surveillance groups did not appear to differ.

A 3 (Reasons: Philosophical, Upgrade, Downgrade) X 3 (Scenario: Military, Firefighter, and Surveillance) ANOVA was applied to the summed scores (across all four items) in the right panel of Figure 3.5 for each reasons category only for MNR (i.e., those who made at least two non-redirect decisions across the three missions in this study). Again, Scenario was a between-subjects factor in this analysis while Reasons was within-subjects. The main effect of reason category also was significant in this analysis, $F(2, 110) = 33.90, p < 0.001, \eta^2_p = 0.38$, as was the Reasons X Scenario interaction, $F(4, 110) = 3.51, p = 0.009, \eta^2_p = 0.11$. The main effect occurred because the average summed score for Upgrade reasons was significantly higher than the average scores for both Philosophical and Downgrade reasons (both $p < 0.001$), and the average score for
Downgrade reasons was significantly lower than the other two means (both $p < 0.001$), as shown by follow-up LSD tests. LSD follow-up tests also showed that the significant interaction occurred because Firefighter and Surveillance groups did not differ from one another within the Upgrade reason category, but both differed from Military (both $p < 0.001$). However, Military, Firefighter, and Surveillance groups did not differ within the other reasons categories.

These overall outcomes for the hypothetical reasons measure show that MR in both Military and Firefighter groups (i.e., those that made at least two out of three redirection decisions across the three missions) endorsed more philosophical reasons when they were asked to justify hypothetical redirect decisions. This outcome is consistent what was hypothesized above as well as what can be concluded from previous studies of utilitarian decision-makers (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati, Lotto, Sarlo, Palomba, & Rumiati, 2013; Waldmann & Dieterich, 2007). Evidence from past studies shows that redirectors within the traditional Trolley Problem often base their choices on more philosophical arguments, not rooted in emotions. This is what we observed for MR in this study.

In contrast, we found a different pattern for MNR when they were asked to justify hypothetical non-redirect decisions. These individuals endorsed more reasons falling into the victim upgrade category. These reasons for hypothetically not redirecting to save the five and instead opting to saving the one included “The single person is a close family member of mine” and “The single person is a scientist working on breakthrough cancer research.” Both of these reflect a more emotional and social value-based class of reasons which would likely appeal to non-redirect decision-makers. This outcome reflects what
was hypothesized and is consistent with past literature describing how non-redirectors who follow deontological rules make dilemmic decisions (Cao et al., 2017; Conway & Gawronski, 2013).

It is interesting to note here that this tendency for MNRs to endorse victim upgrade reasons for hypothetical decisions to not redirect was especially pronounced for MNRs in the Military group. Again, this may be consistent with the previous suggestion that Military people may be less emotionally valued than Firefighters. If so, then it might be more necessary to find personal redeeming features for this population than for other groups. Perhaps the Actual Reasons Measure considered below will shed further light on this possibility.

3.5.3.2 Values Measure

An overall 3 (Scenario: Military, Firefighter, and Surveillance) X 3 Decision pattern (MR, MNR) X 7 (Values) X 4 (Scales) ANOVA was applied to participant ratings using Scenario and Decision pattern as between-subject factors and Values along with Scales as within-subject factors. No significant effects related either to Scenario or Decision pattern emerged from this analysis. Only effects involving Values and Scales effects emerged significant, but these effects did not interact with either of the variables of interest in this study (Scenario or Decision pattern) so they are not discussed further here.
3.5.3.3 Actual Reasons Measure

This measure was based on a final participant interview conducted at the end of the study in which each participant was asked to provide a specific justification for their actual redirect or non-redirect decisions in each of the three Missions (P, C, FM). These justifications were coded as either being philosophical (e.g., It is not right to kill) or non-philosophical (e.g., I wanted to see what would happen). This measure was used along with the previous reasons and values measures to better understand how Scenario exposure and actual decision type (redirect or non-redirect) related to justifications for the choices made in each mission.

Figure 3.6 depicts the proportions of Philosophical Justifications for each Scenario group (Military, Firefighter, and Surveillance) across each of the three Missions (P, C, FM). It is evident from this figure that Military and Firefighter groups provided much higher proportions of philosophical justifications than the Surveillance group in each mission. Note that the Surveillance group provided zero or near-zero proportions for each mission. Moreover, it seems that there were no major differences between Military and Firefighter groups for any mission.
Figure 3.6. Proportion of Philosophical Justifications across all three Scenarios within each Mission which were collected after the experiment’s completion. Justifications were based on the participants’ choices made during the simulation.

The impressions gained from Figure 3.6 were confirmed statistically with chi-square comparisons of the three scenario groups (Military, Firefighter, and Surveillance) within each mission (P, C, FM), and Cochran’s Q test comparisons of each group across missions. For each mission, the overall chi-square comparison of groups was significant, $X^2 (2, N = 84) = 65.37, p < 0.001$, $X^2 (2, N = 84) = 62.20, p < 0.001$, and $X^2 (2, N = 84) = 68.46, p < 0.001$, for the P, C, and FM missions, respectively. Follow up tests within the P mission show that Surveillance was significant different than both the Military ($t(63) = -18.23, p < 0.001$) and Firefighter scenario justifications ($t(66) = -15.93, p < 0.001$). The same outcome was obtained for the C mission ($t_{SvM}(63) = -18.23, p < 0.001$; $t_{SvF}(66) = -11.37, p < 0.001$) and the FM mission ($t_{SvM}(63) = -18.26, p < 0.001$; $t_{SvF}(66) = -15.79, p < 0.001$).
0.001). The surveillance condition always produced the lowest proportion of philosophical justifications. Finally, the two dilemmic scenarios were not significantly different within any of these missions. No significant changes across missions within each scenario findings were detected through the Cochran’s Q tests.

Figure 3.7 depicts the proportion of Philosophical and non-Philosophical Justifications offered by redirectors (Rs) and non-redirectors (NRs) across all three missions. Rs and NRs were determined on a mission by mission basis here. From this figure, it appears that redirect decisions prompted more philosophical justifications than non-philosophical reasons, while the opposite was true for non-redirect decisions.
To confirm these results statistically, a chi-square was conducted to compare the proportion of philosophical justifications for all redirect decisions across all missions with that of all non-redirect decisions. This analysis yielded a significant outcome, $X^2 (1, N = 252) = 40.32, p < 0.001$. Individual t-tests were then completed to compare differences found within the chi-square. First, redirect decisions and non-redirect decisions were compared to determine the difference in philosophical justification use. It was found that there was a significant difference ($t(250) = 6.90, p < 0.001$) with redirect decisions being more often justified with philosophical reasons. Similarly, significantly more non-redirect decisions were justified through non-philosophical reasons ($p < 0.001$). Finally, when comparing philosophical decisions by decision type (R vs. NR) the same
significant differences were seen ($p < 0.001$) with outcomes matching the observations from Figure 3.7.

These results reflect what was found in the Hypothetical Reasons Measure, as redirectors in that instance endorsed Philosophical Trolley Problem arguments over other more personal-social types of arguments. This again follows what was hypothesized as well as what was concluded in previous literatures for utilitarian, redirect, decisions (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati, Lotto, Sarlo, Palomba, & Rumiati, 2013; Waldmann & Dieterich, 2007). Decisions that are categorized as utilitarian (i.e., redirect decisions) typically use philosophical logic arguments whereas non-redirect decisions have cited more emotion-based (non-philosophical) reasons.

These observations for the hypothetical and actual reasons measure in this study may help to interpret what was found in the previous heart rate and decision time analyses. In both of those earlier measures of emotional engagement, there seemed to be a distinct difference in reaction to the decisions being made in the two dilemmic scenarios (Military and Firefighter). The heart rate and decision time outcomes for the Firefighter P missions showed evidence of significantly more emotional engagement than was seen for its Military counterpart; higher heart-rate deceleration was evident as well as longer decision-making times. These results, taken together with the hypothetical and actual reasons results showing more philosophical and less emotion-based justifications in the Military scenario, give support to the possibility that civilians could indeed find it easier to personalize firefighters (Murphy, 2014).
3.5.4 Baseline Measures Revisited

It was noted above that several baseline measures were included because of their potential relevance to understanding dilemmic decision making in situations like those used in the present study to understand how participants might have been affected by exposure to the simulation experience. Specifically, the aggression state measure was administered twice, once in baseline and again after the simulation exposure. Also, the Altruism, Dutifulness, War and Peace, and TET baseline measures were included as they might be predictive of whether or not participants would make redirect decisions. We have already noted that, with one exception (TET Imagination), there were no baseline group differences in these measures. Below, we will consider how these measures related to decision pattern after the fact. To do this, we compared how these baseline measures differed for either the two extreme decision pattern groups (unanimous redirectors, URS, and non-redirectors, UNRs) in this study or majority decision pattern groups; groups used for each measure are noted throughout.

Aggression Pre-Post. Pre-post aggression change scores are shown in Figure 3.8 for the MRs and MNRs in each Scenario group (Military, Firefighter, and Surveillance). Higher numbers indicate increased aggression after simulation exposure. The Majority grouping factor was used here, rather than the Unanimous grouping factor, so as to include all participants. This figure shows that for each Scenario group, redirectors showed a larger increase in aggression than non-redirectors. However, Scenario type did not seem to make a difference within either grouping (MRs or MNRs).
Figure 3.8. Pre-post difference in Aggression State score across all three Scenarios within each Mission. Aggression state was which measure both before and after the simulation was completed.

These effects in Fig. 3.8 were examined using a 3 (Scenario) X 2 (Majority grouping) ANOVA. The only significant effect to emerge from this analysis was for the main effect of Majority Decision-maker Type, $F(1, 138) = 5.62$, $p = 0.02$, $\eta^2_p = 0.04$. This effect reflected the fact that regardless of Scenario group, MRs exhibited a greater change in aggression score ($M = 2.05$) than did MNRs ($M = -0.22$).

These results indicate that those participants who made a majority of redirect choices had an increase in the state trait of aggression as a result of their exposure to the simulation. This pattern could relate to what was observed by Greene (2001) in his observation of the effects of personal versus impersonal moral dilemmas, but this possibility is diminished because increased aggression applied to all Scenario groups including Surveillance. An alternative possibility here may be related to the active
choice. At least for Military and Firefighter groups, redirectors were the only participants making an active choice, sacrificing one to save five. We know from other work (Navarette et al., 2012) that active choices in dilemma conditions generate more emotional responses than do passive choices. However, this would not explain the elevated change for the Surveillance group.

**Triune Ethics Theory.** The Triune Ethics Measure was used to assess each participant’s alignment with four different moral orientations: Wallflower, Bunker, Engagement, and Imagination. To see if Moral orientation was a useful tool in predicting a participant’s willingness to make redirect or non-redirect decisions, separate 3 (Scenario) X 2 (Unanimous Decision-maker) ANOVAs were run for each moral orientation framework. No significant effects emerged from any analysis, a finding that suggests that Moral orientation did not play a role in guiding decisions in this study, at least for the unanimous decision groups (UR and UNR). The Unanimous grouping was used here as it was believed that participants who made the same choices across the whole scenario would be much more indicative when describing a “pure” Utilitarian-type or other decision-maker type.

**Altruism.** Altruism, or willingness to help, was another measure investigated to determine its predictive value for unanimous decision-making patterns. It is possible that participants higher in Altruism would be more likely to make utilitarian, altruistic, decisions based on the concept of the greater good, especially in the P Mission. The trait of altruism is one often observed in participants who make the utilitarian choice across various Trolley Problem tasks (Cao et al., 2017; Carmona-Perera et al., 2013; Conway & Gawronski, 2013; Moll et al., 2002; Starcke et al., 2011) which is why Unanimous
decision types were used here. However, a 3 (Scenario) X 2 (Unanimous Decision-maker) ANOVA of this measure failed to reveal any significant effects. Thus, in this study altruism was not predictive of decision pattern, at least for unanimous decision makers.

**Dutifulness.** Dutifulness, or willingness to obey orders, was also included as a measure because of its potential to predict utilitarian decision-making (i.e., redirecting in this study) which is why Unanimous decision type was used here. Based on previous studies (Cao et al., 2017; Conway & Gawronski, 2013), it is possible that higher levels of dutifulness would predict a greater likelihood that participants would make the greater-good decision of redirecting to save the five. To assess this, a 3 (Scenario) X 2 (Unanimous Decision-maker) ANOVA was conducted. Again, no significant findings were obtained suggesting that willingness to obey orders was not related to decision making in this study.

**War and Peace Attitudes.** A measure looking at war and peace attitudes was also utilized in this experiment which produced two separate scores for each attitude. It was possible that attitudes on this scale could influence the decisions to redirect or not within our simulation. For instance, if a participant were to have more positive attitudes towards peace with significantly lower levels in their attitude towards war, they might display more passivist actions, deciding not to redirect in order to not have to take responsibility for the death of another as framed by the ME HURT YOU heuristic discussed above (Chelini et al., 2009; Choe & Min, 2011; Greene et al., 2008, 2004; Valdesolo & DeSteno, 2006).
To test their predictive values, two separate 3 (Scenario) X 2 (Unanimous Decision-maker) ANOVAs were run for War attitudes and Peace attitudes. No significant findings were observed for War attitudes. However, there was a significant interaction effect seen for Peace Attitudes between Scenario and Unanimous Decision-maker type, $F(2, 48) = 4.60, p = 0.01, \eta^2_p = 0.16$. Follow up tests showed that this interaction occurred because Peace attitude scores were significantly higher ($p=0.01$) for the UNRs than for URs, but only within the Firefighter scenario group.

Overall, it also appeared that non-redirectors displayed higher Peace attitude scores than their redirector counterparts within the Firefighter scenario group. The above explanation of the effect of Peace attitudes might make sense here as those who did not redirect, the deontologists, had more positive attitudes toward Peace ideals which aligns with passivity. This passive tendency may correlate with the fact that the non-redirect choice in our simulation was an inactive choice. Furthermore, it aligns with the basic moral rule that it is wrong to kill and to make the active choice of redirecting the missile would straying from that rule. It is interesting, however, that this pattern only occurred within the Firefighter scenario. Perhaps this was the case since this scenario is less associated with the dichotomy of war and peace, while the Military scenario forces the participant to confront this as war-time characters are present.
CHAPTER 4:
USAFA METHODS

Results from Experiment 1 confirm much of what was hypothesized regarding emotional engagement throughout the simulation. Furthermore, results confirm the validity in the use of this simulation as a more modern version of the classic Trolley Problem (Chelini et al., 2009; Greene, 2001; Greene et al., 2004, 2008; Hauser et al., 2007; Navarrete et al., 2012; Waldmann & Dieterich, 2007). Additionally, the method by which the one in the Problem is increased in value confirms findings from past literature which examined how emotional engagement changes Trolley Problem behaviors (Bleske-Rechek et al., 2010; Cao et al., 2017; Chelini et al., 2009), but also introduced a potentially new value used, the personal figure head (C Mission). The C Mission might be of particular interest within Experiment 2 which exposed our Trolley Problem simulation to the unique population of USAFA cadets.

As cadets of the Air Force, USAFA cadets help to highlight how military-oriented populations approach moral decision-making, especially when compared to a non-military population (ND sample). As mentioned in our introduction, cadets have an enhanced respect for authority and an in-depth understanding of military theory which might dictate how they approach morally-charged situations (e.g. Just-War Doctrine). Furthermore, while this population was not technically full-fledged officers at the time of
this experiment, they are more similar to actual RPA pilots and crews which could improve the ecological value of this simulation and its findings moving forward.

Much of the methods and procedures used within Experiment 2 mirror what was done within Experiment 1. However, some adjustments had to be made due to time restraints at the USAFA location. All adjustments and changes are highlighted throughout this methods chapter.

4.1 Experimental Design

The experimental design used for Experiment 1 was replicated for Experiment 2. However, Experiment 2 results explored another between-subjects factor which was Population (ND, USAFA) used to investigate the differences in outcomes between the two Experiments.

4.2 Participants

As mentioned above, undergraduates from USAFA were sampled for observation in this study. The USAFA sample included 73 cadet participants ($M_{age} = 19.9$; 23% female) who volunteered for the study. USAFA participants similarly volunteered through SONA Systems and were offered course credit and extra credit towards their course grades. Within the USAFA population, there were two Reserve Officer Training Corps (ROTC) cadet exchange students.

4.2.1 Participant Breakdown Across Simulation Conditions

Participants were assigned randomly to one of the three scenario conditions in the simulation: Military, Firefighting, and Surveillance. In Experiment 2, 22 USAFA cadets
completed the Military scenario, 26 completed the Firefighting, and 27 completed the Surveillance/control condition.

4.3 Materials

4.3.1 Differences in USAFA Test Batteries

The test batteries were shortened for USAFA participants due to time constraints in the cadets’ academic schedules which required that the total protocol take less than, or exactly, one hour. To accomplish this, the measurements for altruism, dutifulness, and war and peace attitudes from Experiment 1 were dropped in Experiment 2. The measures dropped at USAFA were the least relevant to the goals and purposes of the present study, but prevented us from comparing populations (or groups within Experiment 2) on these measures.

4.3.2 Actual Reasons Measure

For ease of administration, analysis, and time at USAFA, the actual reasons debriefing survey was conducted through an online survey system. The debrief survey consisted of 16 items and mirrored the verbal version used in Experiment 1. The first three items surveyed the participants’ general feelings towards the simulation using a 7-point Likert scale (1—extremely negative, 7—extremely positive). Items asked about interest in becoming an RPA pilot, realism, and confidence when using the simulation. The rest of the questions asked about the five simulation missions, the two control and the three dilemmic missions (Peer--P, Commander--C, Family Member--FM). For missions one and three, the controls, only two questions were asked using the same 7-
point Likert scale: whether they considered the two control missions successful and how much moral engagement they felt was required for the mission. These same two questions were also asked for the dilemmic missions (two, four, and five), with the addition of what their decision was (redirect—one person or did not redirect—five people) as well as an open-ended question asking for the reasoning behind their decision. There was no word limit to the participants’ open-ended responses so as to give them enough space to fully answer the question and to reflect the verbal debrief survey given at ND.

The open-ended responses were coded using the same scheme used in Experiment 1. Answers were first coded by Mission decision (which was gleaned from the survey response), redirect or non-redirect, and then by whether or not a philosophical-based argument was used in their justification. The philosophical-based arguments were determined by multiple sub-codes which were more specific in nature and grouped into philosophical-based and non-philosophical-based categories. For example, some philosophical-based codes included: Utilitarian—better to kill one over five and Kill five didn’t want civilian casualty. Non-philosophical-based codes included: Easiest/Fastest Option and Curious to see what would happen. Many of the codes applicable to the Surveillance Scenario fell under the non-philosophical-based umbrella due to the general nature of the decisions made during the scenario (i.e. Better to photograph more people). Through this coding scheme, the verbal and online version of this survey was easily comparable between study populations. Interrater reliability was calculated using Cohen’s Kappa and a 64% agreement rate was found for our sample, a level of agreement
considered highly acceptable for social science research (Cohen, 1977; Landis & Koch, 1977).

4.4 General Set-up

At USAFA, the study took place in a flight simulator featuring an 80-inch high-fidelity monitor. This was constructed to ensure immersion into the simulation scenarios. Participants also wore headsets in order to stay in contact with the experimenter while receiving prerecorded mission orders and responding, as needed, via a built-in microphone. A joystick was used to operate the RPA during the simulation which was switched out with a mouse for the purpose of completing the pre- and post-simulation scales. The same configuration was used to measure pulse rate throughout the simulation.

4.5 Procedure

The only difference within the Experiment 2 procedure came during the debriefing survey. While this was done verbally at ND, for ease of administration, analysis, and time at USAFA, this survey was conducted through an online survey system which was linked to after the completion of the post-simulation battery.
CHAPTER 5:
USAFA RESULTS AND DISCUSSION

5.1 Experiment 2 Findings

5.1.1 Survey Measures

A variety of measures were used to assess comparability of the three condition
groups in this study (Military, Firefighter, and Surveillance). Table 5.1 shows the
summarized baseline measures and results used within Experiment 1 and Experiment 2.
For experiment 2, one-way ANOVAs were run to determine the difference in baseline
scores across the three simulation Scenario groups (Military, Firefighter, Surveillance).
The outcome of these analyses found few significant differences; however, there was a
significant difference within scenarios for the TET Orientation of Engagement \( (p = 0.05) \)
with Firefighter participants showing higher alignments than Military participants (see
Table 5.1). As a reminder, the Engagement orientation is described as Caring,
Compassionate, Merciful, and Cooperative.
TABLE 5.1.

THE BASELINE MEASURES USED IN EXPERIMENT 2.

<table>
<thead>
<tr>
<th>Measures</th>
<th>ND Groups</th>
<th>USAFA Groups</th>
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* Main measures/scales are in Bold. Subscales are below. ND groups comparisons are from Experiment 1. USAFA and Population comparisons are from Experiment 2. N/A means scale was not used in Experiment 2.
Comparisons between the Experiment groups were also completed and are summarized in Table 5.1. Significant differences were seen across the TET measure and were examined via a 3 (Scenario) X 2 (Population) ANOVAs for each moral orientation type. For the Bunker orientation type, significant differences were found for the Population Main effect \( (F(1, 212) = 73.42, p < 0.001, \eta^2_p = 0.26) \). Follow up LSD showed that this was indeed different as USAFA participants aligned more with this type which is described as Combative, Tough, Vigilant, and Belligerent \( (p < 0.001) \); this is close to the definition of Aggression in the values scale (Persons that honor this value are combative, pugnacious and tough) and again could align with the type of people drawn to this field. A significant main effect of Population \( (F(1, 212) = 51.88, p = 0.005, \eta^2_p = 0.04) \) and Scenario \( (F(2, 212) = 3.61, p < 0.05, \eta^2_p = 0.03) \) for Engagement was also found. The LSD for population showed that ND participants displayed higher alignment with this orientation \( (p < 0.005) \). Finally, a Condition main effect was found for the Imaginative orientation \( (F(2, 212) = 3.37, p < 0.05, \eta^2_p = 0.03) \).

Population differences were also seen across the stress reactivity scale, including the overall score and all subscales, except Prolonged Reactivity, \( (F_{overall}(1,216) = 27.66, p < 0.001, \eta^2_p = 0.11; F_{RWO}(1,216) = 24.97, p < 0.001, \eta^2_p = 0.10; F_{RSC}(1,216) = 23.41, p < 0.001, \eta^2_p = 0.10; F_{RFA}(1,216) = 7.36, p < 0.01, \eta^2_p = 0.03; F_{RSE}(1,216) = 22.59, p < 0.001, \eta^2_p = 0.09) \). Across all of these scales, the ND population was significantly higher (all \( ps < 0.01 \)). These differences could be influenced by the training USAFA cadets receive which might better equip USAFA cadets with techniques to reduce stress reactivity or based on individual differences related to the different types of students attracted to these two institutions.
Finally, differences were seen within the video game experience questionnaire, namely USAFA had more hours of video games overall as well as more experience with 3D games ($F_{\text{hours}}(1,216) = 4.51, p < 0.05, \eta^2_p = 0.02$; $F_{\text{experience}}(1,216) = 4.84, p < 0.05, \eta^2_p = 0.02$). Follow-up tests indicate that a significantly higher score for USAFA in both of these (both $ps < 0.05$). This might have something to do with USAFA cadets’ experience with flight simulators throughout their training and education, especially for the 3D game experience. This question specifically cites flight simulators as an example of a 3D video game, so more USAFA participants would be apt to respond in the affirmative with this question.

5.1.2 Simulation Data

5.1.2.1 Dilemmic Decisions in Peers Mission

The right panel of Figure 5.1 shows the proportion of redirect choices for each of the scenario groups (Military, Firefighter, Surveillance) for Experiment 2 during the Peers (P) Mission. The pattern indicates that a larger proportion of cadet participants appeared to make the redirect choice in the Peers Missions for both dilemmic Scenarios (Military, Firefighter). Furthermore, there appears to be a similar proportion of participants who chose to redirect in the dilemmic Scenarios (Military, Firefighter), a little over 90%.
Figure 5.1. Proportion of Redirect Decisions made within the first simulation missions for Experiment 1 (Left panel) and Experiment 2 (Right panel), the Peers Mission. The Peers Mission most closely resembled the classic Trolley Problem. The Military and Firefighter scenarios were dilemmic as they involved the death of one or five actors in the simulation; the Surveillance was a control as it did not involve death.

A chi-square test was completed to verify these group differences for the USAFA sample (right panel). The overall chi-square for the three groups was significant ($\chi^2 (2, N = 74) = 12.95, p < 0.05$). Pairwise follow up comparisons showed that, while the dilemmic scenarios did not differ significantly from one another, both significantly differed from Surveillance ($t_{\text{MvS}} (45) = -3.04, p < 0.01; t_{\text{FvS}} (46) = -3.12, p < 0.01$).

A visual comparison across Experiments using Figure 5.1 reveals almost identical patterns. It appears from this figure that the two populations (ND, left side; USAFA, right
side) are nearly identical with respect to the proportions of redirect decisions made across scenario groups. To compare the populations statistically, pairwise chi-squared tests were applied to the two population groups within each Scenario condition (e.g., ND Military vs. USAFA Military). None of these comparisons were significant.

The lack of population differences across Experiments 1 and 2 for the P Mission, which matches the traditional Trolley Problem, serves to further solidify the use of our simulation as an appropriate, modern option for this dilemma. The results of both experiments showed that basic, dilemmic Trolley Problem scenarios produced a majority of redirect decisions from participants (Foot, 1967; Greene, 2001; Greene, et al., 2004, 2008; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Navarrete et al., 2012; Patil et al., 2014; Waldmann & Dieterich, 2007). Moreover, the concordance across experiments for the Surveillance scenario groups strengthens the case that this pseudo-dilemma served as an appropriate control condition in relation to Military and Firefighter dilemmas.

5.1.2.2 Decisions Across all Three Missions

The right panel of Figure 5.2 shows the proportion of redirect decisions for USAFA participants across all the three missions (P, Commander--C, Family Member--FM) for the three scenarios (Military, Firefighter, Surveillance), including the data presented in Figure 5.1 for the P mission. A steady decrease in the proportion of redirect decisions is evident for all three scenarios across missions.
Figure 5.2. Proportion of Redirect Decisions across all three Scenarios within each Mission for Experiment 1 (Left panel) and Experiment 2 (Right panel). The value of the one increased across three missions which added emotional weight to the decision being made; unique from the traditional Problem.

These trends in proportions of redirect decisions for Experiment 2 (right panel) were investigated across the three groups (Military, Firefighter, and Surveillance) within each mission (P, C, FM), using chi-square test, as well as with follow-up Cochran’s Q tests. Considering the between group comparisons for C and FM missions, significant outcomes occurred only for the C mission ($X^2 (2, N = 74) = 16.97, p < 0.001$). Follow up t-tests conducted for the C mission showed that there was no significant difference between Military and Firefighter participants. However, both of the dilemmic groups
differed significantly from Surveillance: Military ($t(45)=-3.77, p<0.01$) and Firefighter ($t(46)=-4.32, p<0.001$). As was discussed in the previous section, this same pattern of significant tests was found within the P mission, $X^2 (2, N = 74) = 12.95, p < 0.05$.

For the Military Scenario group, significant decreases in proportions were found across the three missions, $Q(2) = 19.14, p < 0.001$. Follow up analyses revealed that the FM mission was significantly different than the P mission ($t(50) = 5.77, p < 0.001$) and the C mission ($t(50) = 3.30, p < 0.01$) with a lower proportion of redirect decisions within the FM mission; P and C were not significantly different. Significant differences were also found for the Firefighter scenario group, $Q(2) = 16.42, p < 0.001$. This scenario group showed a similar pattern of differences with P and C mission proportions not differing significantly, but both being significantly different from FM ($t_{PVFM}(52) = 4.75, p < 0.001; t_{CVFM}(52) = 2.93, p < 0.01$). Finally, significant differences were also found for the Surveillance group, $Q(2) = 7.88, p < 0.05$. This scenario group showed no differences between C and FM mission, but both of those missions for this group were significantly different from P ($t_{PV}(40) = 2.28, p = 0.03; t_{PVFM}(40) = 3.16, p < 0.01$).

Figure 5.2 also presents a side-by-side comparison of the two populations. Comparing the left and right panels of this figure, it appears again that very similar patterns are evident in both populations. To investigate any possible populations differences statistically, chi-squared tests were completed for each scenario mission. No significant differences between Experiment populations were found for any group in any of the missions.

The significant differences observed across dilemmic missions within the Experiment 2 population coincides with what was found in Experiment 1 and reflects
what has been seen in past literature, as moral dilemmas become more personal (because of the increased value of the one) the likelihood of making a utilitarian decision decreases (Bleske-Rechek et al., 2010; Cao et al., 2017; Chelini et al., 2009). This pattern was evident in both panels of Figure 5.2. That is, for the dilemmic scenarios in this study (Military and Firefighter), as the value of the one increased, a significant decrease in redirect decision proportions was observed. This pattern was not nearly as pronounced or consistent across populations for the Surveillance group. While there was some change across missions within the Surveillance scenario, especially for Experiment 2, this scenario was significantly different from the two dilemmic scenarios in each mission for each population.

5.1.2.3 Heart-Rate Change

Figure 5.3 depicts the heart-rate change score across each Mission within each Simulation Scenario for both Experiment 1 (left) and Experiment 2 (right). The right panel of this figure shows very different trends in heart-rate change across both the Military and Firefighter scenarios. For the Military scenario, it appears that heart rate accelerated modestly within the P mission, then decelerated during C mission, and then further decelerated within the last mission, FM. In contrast, the Firefighter scenario showed a deceleration within the P mission with acceleration in the C and a lesser deceleration within the FM mission. The Surveillance group was different from both of the other groups for the first two missions, but similar to the Firefighter group in the last mission.
Figure 5.3. Displays Mean heart-rate change score across all three Scenarios within each Mission for Experiment 1 (Left panel) and Experiment 2 (Right panel). Deceleration is measured in beats per minute and error bars indicate standard error of the mean.

These trends for Experiment 2 were examined using a 3 (Scenario) x 3 (Mission) ANOVA, using scenario as a between-subjects factor and mission as a within-subject factor. No significant effects were observed, although LSD comparisons showed that there was a significant drop between the P and FM heart-rate changes within the Military scenarios (p=0.04).

Separate 2 (Mission Decision type: R vs. NR) X 3 (Scenario: Military, Firefighter, and Surveillance) ANOVAs were used for each mission to see if differences occurred for
any mission based on the decision-type groupings (R vs. NR) for that mission. However, no significant differences were found.

Comparing the left and right panels of Figure 5.3, the most pronounced differences related to the Military condition in the P mission and the Firefighter condition in the C mission. For the Military condition in the first mission, ND participants showed a modest deceleration while USAFA participants showed an acceleration. For the Firefighter condition in the second mission, ND participants showed a marked deceleration while USAFA participants showed a slight acceleration.

These population differences were examined statistically through a 3 (Scenario) X 3 (Mission) X 2 (Population: ND, USAFA) ANOVA where Scenario and Population were between-subject factors and Mission was within-subjects. Results of this analysis did not show any significant effects involving population, but did show a marginally significant main effect of Scenario, $F(2, 162) = 2.39, p = 0.09, \eta^2_p = 0.03)$. Follow up tests indicated that both Military and Firefighter groups, averaged across missions and populations, showed significantly more deceleration than the Surveillance group (both $p$s < 0.01). The former groups did not differ from one another, however.

It should be noted that only 23 participants had complete heart-rate data in the USAFA population due to run-time errors as well as software/hardware malfunctions. Therefore, it is possible that, if these errors had not occurred, a more comparable pattern of effects might have occurred when comparing populations. However, as it stands, the two populations did not differ from one another statistically. Moreover, across both populations and all missions, the statistics show that the dilemma scenarios in this study (Military, Firefighter) exhibited significantly more deceleration in connection with their
decisions than the Surveillance group, an outcome consistent with the view that the
dilemma conditions used here were more emotionally engaging than the pseudo-dilemma
used as a control condition; a finding consistent with previous work in this area (Bleske-Rechek et al., 2010; Carmona-Perera, Reyes del Paso, Pérez-García, & Verdejo-García, 2013; Chelini et al., 2009; Christensen, et al., 2015; Greene, 2001; Greene et al., 2004, 2008; Hauser et al., 2007).

5.1.2.4 Decision Times (DT)

As with Experiment 1, only redirect DTs were used in the analysis of decision
times for this study. The right panel of Figure 5.4 shows the mean decision times across
Missions and Scenarios for Experiment 2. One can observe a progressive increase in DT
in both the Military and Firefighter Simulation Scenarios across missions. However, the
Surveillance scenario group did not exhibit the same increasing trend across missions.
Moreover, Military and Firefighter groups appeared to differ from one another only for
the P and FM missions, but in opposite directions for these two missions.
These trends for Experiment 2 were confirmed using a 3 (Scenario: Military, Firefighter, Surveillance) X 3 (Mission: P, C, FM) ANOVA which was applied to the DT data in which both Scenario and Mission were between-subjects factors. Treating Missions as a between-subjects factor here as deemed to be a conservative strategy, consistent with the procedures used in Experiment 1. Main effects of Scenario, \((F(2, 34) = 4.41, p = 0.019, \eta^2_p = 0.21)\), and Missions, \((F(2, 34) = 4.11, p = 0.025, \eta^2_p = 0.19)\) emerged significant in this analysis, along with a marginally significant Scenario X Missions interaction, \((F(4, 34) = 2.44, p = 0.065, \eta^2_p = 0.22)\). LSD follow-up tests for the
main effect of Scenario indicated that average DT for Military ($p=0.05$) and Firefighter groups ($p=0.01$) differed from Surveillance, but did not differ from one another. Likewise, follow ups to for the main effect of Mission indicated that the average DT for all three missions differed significantly from each other (all $ps<0.05$). Additional follow ups indicated that the marginally significant interaction occurred because DTs changed significantly from P to FM missions for both Military and Firefighter groups (both $ps<0.02$), but not for Surveillance. Moreover, the difference between Military and Firefighter was marginally significant for the P mission ($p=0.08$), but was not significant for either of the other two missions.

As with the ND analysis, the strategy of using Mission as a between-subject factor instead of within deemed appropriate due to the conservative nature of using between-subject factor. As was noted within Experiment 1, between-subject factors typically have more variability than do within-subject factors, so their use should not unduly skew our results towards confirmative outcomes. Furthermore, this strategy was the only practical way to investigate the question of how redirection effects decision-making time as there were very few unanimous redirectors in general ($N = 13$) for the USAFA sample. Further, there were no unanimous redirectors in some of the groupings. Finally, since the two strategies’ outcomes were identical in Experiment 1 and population differences were insignificant (see below), the unanimous strategy was deemed unnecessary here.

It is apparent from Figure 5.4 that the overall patterns of effects in the left panel for Experiment 1 is almost identical to those in the right panel for Experiment 2 with only minor, negligible differences. To examine the population difference in the left and right panels statistically, a 3 (Scenario: Military, Firefighter, Surveillance) X 3 (Mission: P, C,
FM) \( X 2 \) (Population: ND, USAFA) completely between-subjects ANOVA was applied to the DT data for both experiments. The results of this analysis indicated that neither the main effect of Population nor any of the various interactions involving this factor were significant. Neither of the minor differences mentioned above proved to be significant.

These results from Experiments 1 and 2 for DT parallel results from past literature showing increased decision times as dilemmic scenarios involved more highly valued victims (Carmona-Perera et al., 2013; Greene, 2001). The significant difference between DT within the P and FM missions in both Experiments, specifically, confirms these past findings. The more value the one victim gained across the three missions, the longer DT became due to the higher emotional engagement and personal-ness of the dilemmic.

Moreover, in both experiments, the Military and Firefighter scenarios overall differed significantly from Surveillance overall. These findings, like the heart-rate data across populations considered above, further support the notion that our Military and Firefighter dilemmic scenarios were more emotionally engaging than was Surveillance pseudo-dilemma.

5.1.3 Post-Simulation Scales

5.1.3.1 Hypothetical Reasoning Measure

Recall that this measure presented participants with already decided Trolley Problem scenarios wherein a decision already had been made to redirect or not redirect the trolley. Our participants were asked to rate justifications for these different decisions based on three different argument types: Philosophical, Inflated victim (victim was whoever was saved), and Deflated victim. These were rated using four scales.
(universalizable, logical, appealing, and publicizable) which were summed to create one score for each argument type. In Experiment 2, as with Experiment 1, we looked at how majority redirectors (MR) justified hypothetical redirect decisions based on summed scores for each argument type. We also looked at how majority non-redirectors (MNR) justified hypothetical non-redirect decisions using these same summed scores.

Figure 5.5 shows the data for Experiment 1 (top two panels) in relation to the same data for Experiment 2 (bottom two panels). The left panel of each pair (top and bottom) shows reasons for hypothetical redirection endorsed by MR, while the right panel of each pair shows reasons for hypothetical non-redirection endorsed by MNR. Considering the bottom two panels for Experiment 2, the left panel indicates that MR mainly endorsed philosophical reasons for hypothetical redirect decisions, especially within the dilemmic scenario groups (Military, Firefighter). In contrast, the bottom right panel shows that MNR showed higher overall endorsements of arguments in the Upgraded victim category.
Figure 5.5. Summed scores across the four items within each reason type for hypothetical redirection reasons endorsed by majority redirectors (left panel) and for hypothetical non-redirection endorsed by majority non-redirectors (right panel) in each Scenario group (M, F, S) for both Experiment 1 (top panels) and Experiment 2 (bottom panels).

For the bottom left panel data (MR data), a 3 (Reason: Philosophical, Upgrade, Downgrade) X 3 (Scenario: Military, Firefighter, and Surveillance) ANOVA was applied to the summed scores for each reason category only for MR (i.e., those who made at least two redirect decisions across the three missions in this study). This analysis revealed a significant main effect for Reason ($F(2, 88) = 5.51, \ p = 0.006, \ \eta^2_p = 0.11$) and a marginally significant Reason X Scenario interaction ($F(4, 88) = 2.35, \ p = 0.06, \ \eta^2_p = 0.10$). Follow-up tests for Reason main effect indicated that Philosophical reason
endorsements were significantly higher than both Upgraded and Downgraded Victim reasons (both $ps < 0.001$), but Upgraded and Downgraded were not significantly different from one another.

The same analysis was applied to the justifications of hypothetical non-redirect decisions in right panel for MNR. Again, a significant main effect of Reasons was found ($F(2, 48) = 6.41$, $p = 0.003$, $\eta^2_p = 0.21$). Follow-up tests for this main effect showed that Upgraded Victim endorsements were significantly higher than reasons in the other two categories (both $ps < 0.001$), which were not significantly different from one another.

Comparing across our two experiment populations (top vs. bottom panels), similar patterns in reason endorsements were evident for both (top and bottom) panels on the left and both panels on the right. While minor differences existed for specific groups across populations (e.g., higher Upgraded victim endorsements for the ND Military group of majority non-redirectors on the top right compared to the same USAFA group on the bottom right), the overall patterns in both experiments were the same. That is, MR in both populations seemed more likely to endorse philosophical reasons for hypothetical redirect decisions, while MNR were more likely to endorse upgraded victim argument for hypothetical non-redirect decisions.

To compare populations statistically, separate 3 (Reason) X 3 (Scenario) X 2 (Population) ANOVAs was applied to the data for the two left panels (MR data) and the two right panels (MNR data) of Figure 5.5. For the analysis of MR, a significant main effect was found for Reason ($F(2, 254) = 25.05$, $p < 0.001$, $\eta^2_p = 0.16$) and a significant interaction effect was found for Reason and Scenario ($F(4, 254) = 4.26$, $p = 0.002$, $\eta^2_p = 0.06$). However, no significant effects were found involving the population factor. For the
analysis applied to the data for MNR, only a significant main effect was found for Reason
\( F(2, 254) = 29.68, \ p < 0.001, \ \eta^2_p = 0.27 \); no population effects were significant.

Overall, these population comparisons indicate that the same reason patterns are
evident in both experiments for MR and MNR. For the former, hypothetical redirect
decisions are more likely to be attributed to philosophical reasons, while for the latter,
hypothetical non-redirect reasons are more likely to be attributed to victim upgrade reasons. These outcomes are consistent with previous literature which indicates that
utilitarian redirect decisions made in the context of Trolley Problems often use
philosophical arguments when making those decisions instead of emotions (Cao et al.,
2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati, Lotto,
Sarlo, Palomba, & Rumiati, 2013; Waldmann & Dieterich, 2007). Past literature also
shows, as already noted, that deontological, non-redirect decisions often are made based
more on personal and/or emotional considerations (Cao et al., 2017; Conway &
Gawronski, 2013), which is consistent with the present findings that such decisions by
non-redirectors were more often attributed to personal characteristics of the victim.

5.1.3.2 Values Measure

As a reminder, this measure had participants rate 7 values across 4 dimensional
scales which were moral, official, community oriented, and emotional appeal (see
Chapter 2 for more details). The seven values measure were selected based on a pilot
study that determined what values were most germane to the present RPA scenarios:
aggressiveness, authority, cooperation, loyalty, obedience, responsibility, and security.
Composite scores for each value were created by summing the four dimension scores together, creating seven total scores per participant.

As with Experiment 1, this measure was examined for Experiment 2 using an overall 3 (Scenario: Military, Firefighter, Surveillance) X 2 (Majority Decision type: MR, MNR) X 7 (Values) X 4 (Scales) ANOVA using Scenario and Decision pattern as between-subject factors and Values along with Scales as within-subject factors. Once again, no significant effects related either to Scenario or Decision patterns emerged from this analysis. Only effects involving Values and Scales effects emerged significant for Experiment 2, but these effects did not interact with either of the variables of interest in this study (Scenario or Decision type).

To compare populations on this measure, a 2 (Population: ND, USAFA) X 3 (Scenario: Military, Firefighter, Surveillance) X 2 (Majority Decision type: MR, MNR) X 7 (Values) X 4 (Scales) ANOVA was used in which Population, Scenario and Decision type were between-subject factors while Values and Scales were within-subject factors. In this analysis, the only effect involving Population that emerged significant was the Population X Values Interaction, $F(6, 1236) = 2.81, p = 0.01, \eta^2_p = 0.01$. Follow up tests indicated that this interaction occurred because ND and USAFA differed significantly for the values of Aggressiveness and Authority (both $p < 0.05$), but not for the remaining values. The direction of these differences was such that USAFA population has a greater endorsement for these values than the ND population.

The population differences in values endorsements makes sense given the overall backgrounds and career paths of USAFA cadets. One would assume that a person joining the military would have higher endorsements for Aggressiveness and Authority, as was
shown here. Aggressiveness was defined in our values measure with adjectives such as combative, pugnacious, and tough, which may align well with the physical nature of someone joining any military branch. The higher endorsement of Authority also aligns with the career path of a USAFA cadet, especially since this group is made up of people who are surrounded by authority figures within the classes and training.

5.1.3.3 Actual Reasons

For the USAFA study, similar coding assignments were used for the final debriefing survey to identify philosophical and non-philosophical reasons. However, for some analyses, these codes were broken down further to include Just-War reasons, philosophical reasons, and non-philosophical reasons. We did find that a number of the cadets surveyed at USAFA specifically cited the Just-War Doctrine in their justifications. However, for the comparisons reported here between philosophical and non-philosophical-based arguments, the Just-War justifications were grouped in the philosophical-based arguments as Just-War Doctrine is a philosophical framework.

The right panel of Figure 5.6 depicts the proportion of philosophical justifications for the USAFA Population across the three Missions within the three Simulation Scenarios. As is evident from this panel, Philosophical justifications for Surveillance group decisions are close to zero, while Firefighter and Military decisions seem to be predominately attributed to philosophical justifications across all three Missions. No marked differences between Military and Firefighter groups appear for any mission.
Figure 5.6. Proportion of Philosophical Justifications across all three Scenarios within each Mission which were collected after the experiment’s completion. Justifications were based on the participant’s choices made during the simulation for Experiment 1 (left panel) and Experiment 2 (right panel).

The proportions shown in the right panel of Figure 5.6 were compared across the two the scenario groups (Military, Firefighter, Surveillance) within each mission (P, C, FM), using chi-square tests, as well as within each group across dilemmic missions, using Cochran’s Q tests. Proportion differences were found to be significant for all missions when comparing across all three scenarios: $X^2_P (2, N = 87) = 49.60, p < 0.001$; $X^2_C (2, N = 87) = 41.95, p < 0.001$; $X^2_{FM} (2, N = 87) = 44.94, p < 0.001$. Follow up tests within the P mission show that Surveillance was significantly different than both the Military ($t(54) =$
-12.36, *p* < 0.001) and Firefighter scenario justifications (*t*(56) = -8.29, *p* < 0.001). The same was true for the C mission (*t*\_SVM\(54\) = -8.69, *p* < 0.001; *t*\_SvF\(56\) = -8.29, *p* < 0.001) and the FM mission (*t*\_SVM\(54\) = -10.79, *p* < 0.001; *t*\_SvF\(66\) = -7.63, *p* < 0.001). The surveillance condition was associated with the lowest proportion of philosophical justification in all missions. Additionally, the two dilemma scenarios were not significantly different within any of the missions. Cochran’s Q results did not identify any significant changes in any group across missions.

When compared to the left panel, which depicts ND observations, USAFA trends seem fairly similar for these data with some slight variations in proportions. These population data were compared via chi-squared tests for each scenario mission. No significant population differences were found for any group in any mission across the two experiments.

An additional analysis was conducted for this population, in particular, as USAFA cadets are required to meet philosophy education requirements, mentioned previously, where they become familiar with the Just-War Doctrine in particular. The proportion of cadets who cited the Just-War Doctrine to explain their simulation choices was calculated as well as its relationship to philosophical education. However, the proportions of Just-War citation recorded was quite low (around 12%) overall and no significant patterns were seen in any of our analyses. However, across all three missions and scenarios, cadets appeared to cite philosophical reasoning more generally, instead of the Just-War Doctrine specifically.

Figure 5.7 depicts the proportion of Philosophical Justifications used by participants for individual redirect and non-redirect decisions across all three missions.
The right panel displays the proportions for the USAFA sample. This figure shows a more pronounced proportion of philosophical justifications made by USAFA redirectors when compared to non-philosophical justification. The reverse occurred for non-redirect decisions.

![Figure 5.7](image.png)

Figure 5.7. Compares proportion of Philosophical Justifications for overall Redirectors and Non-Redirectors based on Mission Decision. Justifications were based on the participant’s choices made during the simulation for Experiment 1 (left panel) and Experiment 2 (right panel).

The trends in the right panel of Figure 5.7 were verified using a chi-square to compare the proportions of philosophical justifications of all redirect decisions across all missions with that of all non-redirect decisions. This analysis yielded significant results, $X^2 (1, N = 255) = 47.30, p < 0.001$. Individual t-tests were then completed to compare differences found within the chi-square. First, it was seen that philosophical justifications
for redirect decisions were significantly different from those for non-redirect decisions \((t(253) = -7.56, p < 0.001)\), with redirect decisions being more often attributed to philosophical reasons. Similarly, significantly more non-redirect decisions were justified through non-philosophical reasons \((p < 0.001)\). When comparing philosophical decisions by decision type the same significant differences were obtained \((ps < 0.001)\) with outcomes matching the observations from Figure 5.7.

Overall, trends across our two experiment populations were fairly similar in Figure 5.7. To investigate these differences, chi-squared tests were used to compare each group within each mission across populations. No significant differences were found in these measures across experiment populations.

As was noted for the hypothetical reasons measure, philosophical choices were highly endorsed by cadets when making redirect decision in Experiment 2, which further supports what was hypothesized based on past literature \((Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati et al., 2013; Waldmann & Dieterich, 2007)\). As noted earlier, past studies show that philosophically-based arguments have typically been used to justify utilitarian, redirect decisions. Conversely, past studies have shown that non-redirect decisions often are attributed to non-philosophical arguments. Similar to the Experiment 1 population, USAFA cadets using non-philosophical arguments to justify non-redirecting in the Military and Firefighter dilemma scenarios often cited emotional arguments.

As with Experiment 1, these debrief results help to confirm what was found within the heart rate and decision time analyses. Considering that the dilemma scenarios (Military and Firefighter) were consistently different than the Surveillance scenario
across analyses, it makes sense that such a distinct difference also was reflected in the justification types provided, especially for redirect decisions. The use of philosophical justifications for these two scenarios is fully consistent with the notion that they truly are dilemmic scenarios. In contrast, Surveillance had significantly low (close to zero) instances of philosophical justifications, probably due to its lack of dilemmic content.

5.1.4 Baseline Measures Revisited

Baseline measures were further examined in this study, as in Experiment 1, to determine if differences in these measures were related to decision making within the simulation.

**Pre-Post Aggression.** Pre-post aggression change scores are depicted in Figure 5.8 which compares Majority Redirectors and Non-Redirectors (MRs and MNRs) within each Scenario group (Military, Firefighter, and Surveillance). Higher numbers indicate increased aggression after simulation exposure. The Majority grouping factor was used as it was in Experiment 1. It appears that, for both MRs and MNRs, Firefighter participants had the highest change scores, however there does not appear to be much differences across Majority Decision-types.
Figure 5.8. Pre-post difference in Aggression State score across all three Scenarios within each Mission for Experiment 1 (left panel) and Experiment 2 (right panel). Aggression state was which measure both before and after the simulation was completed.

The effects noted in the right panel of Figure 5.8 were examined through a 3 (Scenario) X 2 (Majority grouping) ANOVA. No significant nor marginally significant findings were obtained. Looking at population differences in Aggression change scores, it appears that ND students had significantly higher change scores than did USAFA cadets. To test this a 3 (Scenario) X 2 (Majority grouping) X 2 (Population) ANOVA, but no significant effects emerged. Effectively, this means that the populations did not differ for this measure.

**Triune Ethics Theory.** The Triune Ethics Measure was again examined to see if it predicted a participant’s willingness to make redirect or non-redirect decisions in Experiment 2. The Majority grouping factor was used here, rather than the Unanimous
grouping factor, so as to include more participants as there was significantly fewer within this population (N = 13). Separate 3 (Scenario) X 2 (Majority Decision-maker Type) ANOVAs were conducted to explore this. A significant a main effect for Scenario \( (F(2, 68) = 3.282, p < 0.05, \eta^2_p = 0.09) \) was found only for the Engagement orientation (Caring, Compassionate, Merciful, and Cooperative) such that Firefighter participants aligned more with this orientation than Military \( (p = 0.05) \). A significant main effect of majority decision-maker type also was seen for the Imaginative orientation (Reflective, Thoughtful, Inventive, and Reasonable; \( F(1, 68) = 7.25, p < 0.01, \eta^2_p = 0.10 \)) such that Majority Non-Redirectors had greater alignment with this orientation than did Majority Redirectors \( (p < 0.01) \). This outcome could have something to do with the emotional engagement involved with these decisions, specifically in considering the reflective component of the Imaginative orientation’s definition.
6.1 Summary of Main Findings in Relation to Expectations and Prior Work

Across both Experiments, similar results were found as evidenced by very few significant differences across population groups. In regards to the Peers (P) mission, our hypothesis was that more participants would choose to redirect across the two dilemma scenarios (Military and Firefighter) within the P mission. Also, in the control scenario, Surveillance, it was hypothesized to be close to a fifty-fifty split. As with other studies, the outcomes of the P mission in our simulation corroborated the basic Trolley Problem finding that a majority of decision-makers chose to redirect towards the one to save the five, an outcome that validates this component of the simulation as a reliable option for moral decision-making research and as an acceptable variation on this classic dilemma (Foot, 1967; Greene, 2001; Greene et al., 2004, 2008; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Navarrete, McDonald, Mott, & Asher, 2012; Patil et al., 2013; Skulmowski, Bunge, Kaspar, & Pipa, 2014; Waldmann & Dieterich, 2007).

Also, in this study, we increased the social and emotional value of the one across three consecutive dilemma scenarios. Our hypothesis here was that we would replicate findings reported throughout moral decision-making literature with personal versus impersonal moral dilemmas such as the Trolley versus Footbridge Problem (Chelini,
Lanteri, & Rizzello, 2009; Choe & Min, 2011; Greene et al. 2004, 2008; Valdesolo & DeSteno, 2006) showing that, as moral dilemmas became more personal in nature, the number of redirect decisions decrease. This outcome was indeed observed in the present study as evidenced by significant drops in proportions of redirect decisions across our missions as the one’s social and emotional value increased across the Commander (C) and Family Member (FM) missions.

While a drop-off in redirect decisions across missions was expected within the dilemmic scenarios for both populations, it was not clear where the C mission redirect proportions would fall between the P and FM missions due to its unique and unexplored qualities. In the C mission, the value of the one was increased to a supervisor role, which represented a unique manipulation of value inasmuch as most studies of this sort alter value by increasing just the emotional value of the one (i.e. family member or significant other) or by enhancing value through increased universal social importance of the one (i.e. world leaders or scientists; Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010; Cao et al., 2017; Chelini, Lanteri, & Rizzello, 2009). As such, we were unsure as to whether or not this unique mission would produce different outcomes between our two dilemmic scenarios—Military and Firefighter.

When the value of one changed from peer to commander, we found a significant drop in redirect decisions from participants within both the Military and Firefighter scenarios. These outcomes suggest a difference in engagement for the C mission, compared to the basic P mission, a difference that may be related to the personal vs. impersonal moral decisions discussed in previous literature (Chelini, Lanteri, & Rizzello, 2009; Choe & Min, 2011; Greene et al., 2004, 2008; Valdesolo & DeSteno, 2006). For
the ND group, there was a marginally significant difference between the Military and Firefighter scenarios for the C mission, in favor of more redirect decisions for the Firefighter C mission, which could suggest a difference between the way “commanders” were perceived within these two scenarios by our civilian population. The USAFA group showed no significant differences for the C mission between Military and Firefighter scenarios which may be consistent with our original expectation that more value might be assigned to the commander role in a military-oriented population due to their respect towards authority (suggested also by Values Measure results).

The value of the one was further increased from commander to family member. This particular increase was hypothesized to create the most significant drop-off in redirect decisions when compared to the P mission. This outcome was obtained since proportions of redirect decisions significantly dropped within both the Military and Firefighter scenarios from those evident in the C mission. However, a surprising difference occurred between these two dilemmic scenarios that was not expected. Participants in the Firefighter scenario were significantly more likely to redirect, sacrificing their family member, than were those in the Military scenario. This outcome also may reflect the civilian view on military and firefighter personnel that was alluded to in the C mission, which will be discussed further below.

Based on work by Greene (2001) and Carmona-Perera et al. (2013), we also hypothesized that heart rate and decision time (DT) measures would be affected in specific ways by the dilemmas embedded in our simulations. Regarding heart rate, we expected that the most emotionally engaging dilemma (which we believed would be the FM mission) would lead to the most pronounced heart-rate decelerations for both
Military and Firefighter scenarios in both populations. However, we did not find that the FM mission provoked the largest heart-rate decelerations through overall analyses. Instead, we found the more general finding that, when collapsed across missions and populations, the Military and Firefighter scenarios each provoked more deceleration than did the Surveillance control scenario, regardless of mission.

In retrospect, several factors might have contributed to this outcome including the fact that the FM mission might not have been as emotionally engaging as we first supposed. In addition, the loss of a considerable amount of heart-rate data for the USAFA population undoubtedly affected our ability to detect differences across missions. Furthermore, order effects may also be at play here considering the FM mission was always last in the simulation. Nonetheless, our finding that the dilemmic scenarios produced more heart-rate change than the non-dilemmic control scenario is consistent with extensive literature tying heart-rate change to dilemmic decision making (Carmona-Perera et al., 2013; Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004; Koenigs et al., 2007; MacLean, 1990; Mendez, et al., 2005; Panksepp, 1998; Valdesolo & DeSteno, 2006; Yamakawa et al., 2016).

In regards to DT, we hypothesized that, based on previous research by Carmona-Perera et al. (2013) and Greene et al. (2004, 2008; Greene, 2001; Greene & Haidt, 2002;), more personal dilemmas in the present study would result in longer DTs. Accordingly, we expected that redirect decisions in FM mission would take longer than similar decisions in the P mission, with the C mission falling in between. We expected these increases across mission would occur mainly within our two dilemmic conditions, not in the pseudo-control condition. These expectations were confirmed for both populations in
the present study with the finding that DTs for Military and Firefighter redirect decisions were significantly longer for the FM mission when compared to the P mission. This pattern across missions was not evident for the surveillance groups in either population. Redirect DTs in the C mission indeed were in between those of the P and FM missions for both Military and Firefighter scenarios, the FM mission produced significantly longer DT than the C mission for the two dilemmic scenarios in both populations.

This outcome is consistent with previously reported findings on personal dilemmas which found that DTs increased as the personal-ness of a dilemma increased (Carmona-Perera et al., 2013; Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004, 2008). According to Greene et al. (2004, 2008; Greene, 2001), this serves as evidence of the interplay of emotion and reason, especially within redirect decisions which rely heavily on philosophical arguments where time is added when emotional evaluation has to be considered.

Finally, we were interested in how participants would justify the decisions made within the RPA simulation. We employed two measures to assist with understanding and collecting these justifications: a hypothetical reasons measure and an actual reasons measure. Our general expectations, based on previous work (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati et al., 2013; Waldmann & Dieterich, 2007), was that utilitarian, redirect, decisions would be justified more by philosophical arguments based on the goal of considering the greater good. Deontological, non-redirect, decisions would be attributed more to victim-specific arguments, such as value of life or the value of the potential victim.
Both participant pools, ND and USAFA, confirmed this hypothesized pattern with majority redirectors more highly endorsing Philosophical Justifications and majority non-redirectors more highly endorsing Upgraded Victim arguments within the hypothetical reasons measure. The actual reasons measure also showed that redirectors used more philosophical justifications than did non-redirectors when looking at the simulation decisions specifically. The predominant reasons for redirection in this study relied upon logical arguments related to the amount of life lost as well as frameworks used for wartime maneuvers (Just-War Doctrine or JWD). This outcome contrasted with the justifications used for non-redirect decisions which had low levels of endorsement or use of philosophical arguments. Instead, the hypothetical reasons measure showed that non-redirect decisions were heavily justified by arguments involving an upgraded victim value (e.g. cancer researcher or family member). The drop-off in redirect decisions in the FM missions in this study paralleled the hypothetical reasons outcomes as decision makers more often elected to save the upgraded victim (family member) when not redirecting.

The combined findings in this study for both the hypothetical reasons measure as well as the actual reasons measure aligns with previous investigations (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser et al., 2007; Manfrinati, Lotto, Sarlo, Palomba, & Rumia, 2013; Waldmann & Dieterich, 2007). Much of this literature draws upon the dual-process theory (discussed below) through which one can view redirect decisions as System 2 processing involving areas of the brain which are evolutionarily newer and are responsible for cognitive reasoning. System 1 processing, on the other hand, has been linked to non-redirect decisions which involve gut reactions usually
motivated by emotion. This theoretical framework aligns with what we have found in the present study through our investigation of justifications.

The values measure, like the hypothetical reasons measure, was created for this study to investigate any effects that exposure to our simulation scenarios might have on the perceived importance of key values potentially related to redirect or non-redirect decisions. However, in both populations all three scenario groups perceived these values in similar ways. Furthermore, contrary to our expectations, majority redirectors did not differ from majority non-redirectors in terms of perceived values. In hindsight this makes some sense as moral values tend to be deeply rooted into a person’s character and it takes a lot of time and education to change endorsements of those types of values (Gentile, 2010; Leming, 1981; Thompson, 2011).

Yet, some interesting population differences in values endorsements were found in this study. As hypothesized, USAFA cadets more strongly endorsed the values of authority and aggressiveness than their ND counterparts, though we also expected the values of obedience and security to be higher in the USAFA population as well. The higher endorsements for aggressiveness and authority are consistent with the career path cadets have chosen compared to ND students. In retrospect, however, everyone may be more security conscious these days than in the past, and ND students may have their own non-military-related reasons for valuing obedience.

6.1.1 On the Perception of Military Personnel and Firefighters

Interesting differences, both quantitative and qualitative, were found in this study when comparing Military and Firefighter scenario results across both populations. These differences were most apparent within the C and FM Missions.
6.1.1.1 Commander Mission

A marginally significant difference was seen within the ND population when comparing the Firefighter and Military redirect proportions within the C mission. More Firefighter participants chose to redirect within this mission, saving the five and sacrificing the one, than did Military participants. Therefore, fire chiefs were sacrificed more often than military commanders. While not significantly for the USAFA population, the same differences can be seen numerically between these two groups.

While no significant differences were obtained with heart-rate measures for either of the experiment populations within the C mission, there were significant differences in DTs. It was found that, within the ND population, Military redirectors took significantly longer to decide on the C mission than their Firefighter redirector-counterparts; this difference was not found to be significant within the USAFA population, but there was a longer average DT for the Military group there.

For the ND population, these patterns might reflect the civilian understanding of the difference between Military Commanders and Fire Chiefs. For most civilians, exposure to these two types of roles occurs largely through the media—entertainment and news. News media surrounding war and military topics tend to more often make distinctions between a squadron and their commander in explicit ways; often featuring interviews and acts of these leaders. Furthermore, military-themed video games and movies often highlight these commander characters as either a main character or in another visible role. On the other hand, fire chiefs don’t necessarily get the same distinction in media where firefighters are often talked about as a group (Murphy, 2014;
Therefore, the decision to sacrifice the military commander might become a more significant choice due to more knowledge of the role.

Looking at the qualitative data showing the reasoning for this decision, it was found that more Military participants who chose to save the commander used justifications surrounding their status than was seen for Firefighter non-redirectors. Common justifications noted such things as: “I saved the commander because hopefully the commander would be able to save more lives in the future,” and “I didn’t redirect because the commander would be important for the general community.” A majority of Firefighter participants used other arguments such as the age of the chief and inclinations not to take the active choice (deontology). From this qualitative data, it can be seen that the understanding of a military commander’s role may be much more common within a civilian population that is the case for a fire chief’s role.

While the C mission did not produce significant differences between Military and Firefighter scenarios within the USAFA population, numerical differences were still observed between the two scenarios. A lower proportion of Military participants chose to redirect in that population and it took them longer to make that decision than their civilian counterparts, which could be attributed to the fact that military commanders hold a more obvious meaning to this population than do Fire Chiefs. USAFA cadets have interactions with commanders and other military leaders on a day-to-day basis and learn to rely on these individuals for guidance, safety, and mission completion. Therefore, this decision might be more emotionally and practically weighted for this group in particular. This is potentially evidenced by the visual (although not statistical) difference in heart-rate change within this mission for the USAFA group, where only the Military C mission
shows negative change; a difference not seen for ND. Looking at differences in DT, longer DTs add to this observation and could be associated with weighing the loss of less lives as well as the importance of their commander to the Military scenario objectives.

The qualitative data for the USAFA population supports this general argument as well. A lower proportion of philosophical arguments were used, especially within the Military scenario, for the C mission when compared to the ND population. It appeared that these non-philosophical arguments not only cited the importance of the commander to the simulated mission, but the importance of the commander, overall, and the security these individuals lend. One participant stated it thusly, “The commander may have critical information to the mission and the survival of the country.” Similar justifications were even seen in the Firefighter scenario with participants noting that the fire chief was important to organizing the other firefighters and putting out the fires within the country. Overall, it appears that USAFA cadets viewed figures of authority with much higher levels of esteem than did ND participants, valuing their roles as leaders no matter who their followers were, as was reflected within our Values measure, which showed USAFA cadets endorsed the value of Authority significantly higher than that of ND participants.

6.1.1.2 Family Member Mission

The increased value of the one within the FM mission was intended to produce an obvious personal and emotional increase. As such it is not surprising that this mission produced significant differences when compared to the other dilemmic missions. However, it was somewhat surprising to see differences between the two dilemmic scenarios (Military, Firefighter) here as well. Most notably, significantly larger
proportion of ND participants chose to sacrifice their family member to save the five firefighters than to save the five soldiers. However, it appeared the emotional salience of these two decisions were equivalent within these scenarios as reflected in heart-rate change and DT as there were no overall significant effect findings across either of our populations.

Examining the debrief survey qualitatively helped to shine some light on these differences. Throughout the debrief analyses, a clear difference was found between Firefighter and Military participant justifications, especially within the FM mission. To sort out these perceptions, individual responses were reviewed qualitatively. Overall, we found that more participants appealed to personal, victim-related arguments when making the common non-redirect decision in this mission. However, it appeared that the role of military personnel was a primary factor considered when making the choice of sacrificing the five soldiers. For instance, one participant noted “I went with not to kill my family member because I guess soldiers have the understanding of the risk of death and what not and what they are signing up for.” This was a view held by other participants as well, who noted that a military officer’s job was one of sacrifice. Firefighters, however, seemed to have been more easily personalized by participants. For instance, a firefighter-scenario participant gave this reason for sacrificing their family member for the five firefighters: “I had to kill my family member because the firemen have families too.” Overall, firefighters were often personalized by participants as evidenced by the types of non-philosophical justifications that were used.

As with the C mission, many of the observed differences within the USAFA population for the FM mission were not significant (more than likely this was due to the
smaller sample size), but fewer redirect decisions were similarly observed within this group for the Military FM mission than for the Firefighter FM mission. Unlike the ND population, however, a very clear difference in heart-rate change was seen for this population’s FM mission, although again not significant. A larger negative heart-rate change was observed for Military FM decision-makers than for Firefighter, pinpointing higher emotional salience within the Military FM mission. Similarly, a visible difference was also seen within DTs, with the Military participants showing a longer DT in this mission than Firefighter participants. These outcomes may be indicators of personal engagement within the FM that could reflect on the familial attitude the cadet might have towards their squadrons, making the Military decision less about soldiers versus family members and more brothers-in-arms versus actual family members.

Interesting qualitative data for cadets were revealed from an examination of their justifications within the debrief for the FM mission as well. Firstly, similar to what was seen within some of the ND justifications, a number USAFA cadets who decided to sacrifice the five over their family member noted that soldiers knew the risk of their positions; one cadet clearly stated “My family didn't sign up to serve, the military members did. We are there to protect civilians.” Furthermore, a few cadets also cited that their loyalties lie with their families first, citing “God, Family, Country” at times. It seems that cadets as well as civilians view this particular mission decision similarly, as is also seen in the amount of redirect decisions made overall.
6.1.1.3 Overall

It does seem that civilians may depersonalize military personnel, viewing these figures in a more practical light when compared to firefighters. Results for the C mission within the ND population suggest that the utility and importance of the commander role in a military context is much better understood since participants saved these individuals more often using citations of the commander’s role in mission success. Furthermore, as was evidenced in the FM mission, civilians viewed sacrifice as the soldier’s duty (it’s their job, their duty, they do what needs to be done), an idea echoed in recent surveys as well.

In a Pew Research poll taken in 2011, adult civilians were asked about their opinions on various areas associated with active military personnel. The poll reported that about 83% of adults polled stated that military personnel had to make a lot of sacrifices, only 26% describing it as an unfair burden. A larger percentage, 70%, noted that sacrifices are just part of the job, reflecting what was noted by the participants above (Pew, 2011, p 2). This Pew poll as well as our own findings, show evidence that there is some sort of emotional disconnect between civilian participants and the military personnel depicted in our simulation.

On the other hand, as is seen especially in the FM mission, participants seem to have a much easier time personalizing and saving the firefighters. Both populations, although it was especially apparent in the ND sample, seemed to be much more able to personalize the firefighters within the FM mission, as evidenced by the participant who noted that the firemen had families at home. This type of argument for saving the five soldiers was not reported; most redirectors in this mission continued to use strict citations
of utilitarianism. It is observed that civilians in particular feel more emotional
engagement to scenarios involving firefighters than they do military personnel (Murphy,
2014; Pew, 2011). As noted in a previous section, this personalization shift may be a
byproduct of a post 9-11 United States.

6.2 Relevance of the Present Findings to Dual-Process View

The concept of dual-process theory was coined by Evans (2003) and was further
extrapolated upon by Greene et al. (2008), whose research has been a focal point
throughout this thesis. The framework was used as it is a useful lens through which one
can understand decision-making, especially as it applies to dilemmic decisions
surrounding moral issues (Cao et al., 2017; Conway & Gawronski, 2013; Evans, 2010;
Greene et al., 2008; Hofmann & Baumert, 2010; Starcke & Brand, 2012). To review, this
dual-process theory divides our thought processes into two distinct systems. System 1
processing is thought to be largely automatic and unconscious; this system is thought to
produce our “default” responses (Evans & Stanovich, 2013). System 2 processing is
believed to be a reflective form of thinking that is evolutionarily newer and is often
slower than System 1 as it supports more abstract and hypothetical thinking. System 2
processing is a conscious form of cognitive control over our default, System 1, reactions
and decisions (Evans & Stanovich, 2013).

This systems-view of decision-making was relied upon by Greene in much of his
work exploring the interplay of emotions and reason within the realm of dilemmic
decision-making when confronted with moral scenarios such as the Trolley Problem. It
was noted that, under emotional stress and engagement, System 1 decisions become
much more common which correlates with rash, emotional, and gut reactions resulting in
more non-redirect decisions within Trolley Problem type decisions (Evans, 2003;
Hofmann & Baumert, 2010; Greene, 2001; Greene & Haidt, 2002; Greene et al., 2004,
2008; Luini & Marucci, 2015; Shapiro, Jazaieri, & Goldin, 2012; Starcke, Ludwig, &
Brand, 2012; Yamakawa et al., 2016). Greene was deliberate in highlighting the
importance of reason within most redirect Trolley Problem decisions and characterized it
as a higher-order, System 2, cognitive process. This System 2 processing seen within the
classic Trolley Problem produces a majority of utilitarian choices from participants
(around 80% in most studies).

However, a change in the usage of this higher-order system was observed by
Greene in his various studies surrounding the impersonal nature of the Trolley Problem
and its manipulated counterparts, such as the Footbridge Problem. The latter situation
creates a more personal decision-making situation, playing off the ME HURT YOU
heuristic; this was similarly created within the current study through the increasing value
of the one. The simple change in emotional salience of who the decision-maker is (ME)
in the situation, how personally culpable the action leaves them (HURT), and the
specificity of the victim (YOU) can drastically change outcomes within this moral
decision-making framework. This personal manipulation, changes the prevalence of
utilitarian choices to the point where it becomes a minority choice; reflected in our own
work by the significant decreases seen in utilitarian decisions made across our missions
and scenarios.

Furthermore, in the dual-process view, the act of making the non-utilitarian,
deontological choice is much more emotionally weighted. These decisions are processed
through our emotional centers (limbic system) whose activity is reflected through many physiological measures such as heart rate and behaviorally via DT (Carmona-Perera et al., 2013; Greene, 2001; Greene & Haidt, 2002). Furthermore, as is evidenced by the overwhelming majority of utilitarian choices in the traditional Trolley Problem, this moral framework is the natural response for many. Therefore, going against this when making the more emotional choice through the deontological framework creates a certain moral stress that can build-upon and heighten the physiological and psychological burdens of this choice.

This was noted by Greene (2001) through his experiments using fMRI methods: more activation was seen in areas associated with emotional reactivity (i.e. amygdala, limbic system) when confronting personal dilemmas, while impersonal dilemmas spurred activation associated with cognitive processing (i.e. dorsolateral prefrontal cortex, anterior cingulate cortex). While our study did not have access to this type of imaging, evidence for this type of emotional activation was seen through our measure of heart rate; similar to the methods used by Carmona-Perera et al. (2013) who found clear deceleration patterns in heart rate during personal dilemmas.

This type of activation is also associated with longer DTs which Greene et al. (2004) associated with the dorsolateral prefrontal cortex (DLPFC), specifically, highlighting the decision-maker’s struggle with difficult choices involved in emotionally-charged dilemmas (Carmona-Perera et al., 2013; Conway & Gawronski, 2013; Evans & Stanovich, 2013; Greene et al., 2004; Navarrete et al., 2012). These decisions have connection with reason and cognitive processing as the participant struggles between what emotionally feels right and what is societally acceptable. Utilitarian choices in
personal dilemmas depend on assessing the greater good and which sometimes counteract default emotions evoked by the dilemma context. Therefore, manipulations which add more emotional engagement to this already taxing task may alter the resulting utilitarian decisions. We saw this in action within our own study as the value of the one increased, creating a more personal moral conundrum. Fewer participants seemed willing to make the utilitarian choice across the three missions and, thus, emotional engagement patterns (heart rate and DT) shifted significantly.

The activation of dual-process systems is also altered by our backgrounds, education, and training. Luini and Marucci (2015) showed that professionals trained to overcome emotional and physiological stressors might develop the ability to overcome the tendency to rely on System 1 strategies in these tense situations for more well-thought-out plans and actions (System 2). This could extend to military officers and cadets whose training might allow them to keep a level-head during combat and enable them to consider all their options before pulling the trigger, using a System 2 process (Keinan, 1987; Matthews, Panganiban, & Hudlicka, 2011).

Evidence for such a difference between our populations in the present study is subtle, at best. Most obviously, we saw differences in populations across a number of different baseline and post-simulation measures which may lend some evidence to a difference in approach these two groups may have to moral decision-making in our RPA context. First, within the Triune Ethic Theory (TET) measure, we saw that the USAFA population had a higher affinity towards the Bunker orientation while the ND population had higher affinity towards Engagement. The Engagement orientation (Appendix A) works from the “mammalian emotional systems” which plays off of the actor’s natural
tendency to seek contact with others both emotionally and physically (Narvaez, 2008; Narvaez & Hardy, 2016). Therefore, it could be argued that the ND population was using a more System 1-heavy framework, basing their decisions more on emotion than reason, even though both factors were employed.

The USAFA affiliation with the Bunker orientation describes these individuals as actors focused on preservation. These individuals base their decisions on personal and in-group gains (Narvaez, 2008; Narvaez & Hardy, 2016). So, while this group may take actions for the greater good more often, it may not necessarily be based in moral frameworks, but instead on the goal of not losing group dominance or numbers. Therefore, this orientation also lends itself to a System 1 framework since it relies on an instinctual need for group dominance, despite the utilitarian choice made. It is not surprising that this orientation would be highest for those in the USAFA grouping as military servicemen often work in units and take on a group orientation when tackling missions.

The differences obtained through the Stress Reactivity measure also lends itself to our discussion of System 1 and 2 usage between our two groups. Across most of the Stress Reactivity Measure, including the overall measure, ND participants scored significantly higher (See Table 1 in Chapter 5). Stressful decision-making often lends itself to more System 1 decisions being made as it can trend us towards emotional reactions as well gut, fight-or-flight, responses (Luini & Marucci, 2015; Matthews, Panganiban, & Hudlicka, 2010). USAFA participants scored significantly lower on the Stress Reactivity Scale which may point toward a higher ability for making System 2 decisions, despite stressful circumstances. It would be interesting to see how these two
populations would differ if one were to inflict a stressor upon participants before or
during the Trolley Problem simulation which could reveal differences in the dual-process
frameworks used by these two groups as it relates to stress reactivity.

Overall, it seemed that the redirect decisions in the present study often called
upon System 2 frameworks, as evidenced by the significantly high proportion of
philosophically-based justifications used for these decisions (Evans & Stanovich, 2013).
These more reflective justifications mirror what is seen in System 2 processing which
uses attention and working memory to formulate more formal arguments for decisions.
This was clearly observed within our philosophical arguments; in which some even went
so far as to cite the moral framework they were using explicitly. Non-philosophical
arguments, however, were more based in emotions and gut-reactions which lends itself to
the System 1 framework, our immediate intuitions. This was evidenced in the present
study by the justifications provided for non-redirect decisions, as they often used
phrasing such as “it felt wrong to sacrifice my family member” or “of course I would
choose to save them,” all alluding to their choice being obvious or a no-brainer which is
evidenced in System 1 thinking.

6.3 Relevance of the Present Findings for Moral Decision-Making

A cornerstone of this study was the Trolley problem which is often considered a
moral dilemma because it requires a difficult choice between two courses of action, both
of which may be viewed as violations of accepted moral principles regarding the taking
of life (Cao et al., 2017; Conway & Gawronski, 2013; Foot, 1967; Hauser, Cushman,
Young, Kang-Xing Jin, & Mikhail, 2007; Manfrinati, Lotto, Sarlo, Palomba, & Rumiati,
Thus, the dilemma lies in the choice between doing nothing and letting five people die or redirecting the Trolley to the other track where only one person will die.

Within the context of the Trolley Problem we were able to examine the two most common decision-making frameworks: Utilitarianism and Deontology. As a reminder, Utilitarianism emphasizes the “utility” of an action when evaluating its morality (Mill, 1863; Smart, 1961). In the Trolley Problem, this Utilitarian choice is to redirect the trolley, letting the one die in order to allow five to live (the greater good). This framework most agrees with the concept introduced by the JWD followed by military personnel as well as the doctrine of double effect which is commonly interpreted as suggesting it is morally permissible for individuals to inflict fatal harm if it is done for the good of many (i.e., the five), despite the additional, unintended consequence of death for others (i.e., the one; Foot, 1967; Hauser, Cushman, Young, Kang-Xing Jin, & Mikhail, 2007; Waldmann & Dieterich, 2007). In contrast Deontology focuses on whether or not an action accords with moral “norms” or rules of conduct (Kant, 1785; Nagel, 1986). Therefore, because killing violates social moral norms, duties, or rules, it is morally impermissible for someone confronted with the Trolley Problem to elect the redirect choice; the only permissible action is to do nothing.

As has been noted, the Trolley Problem is advantageous for examining specific populations and scenarios because its parameters are easily manipulated. By manipulating the value of the one, the present simulation’s moral dilemma went from impersonal, like the traditional Trolley Problem, to personal, more like the Footbridge Problem. The manipulation which transformed our dilemma from impersonal to personal
helped to illustrate the interplay of emotions and reasoning within the moral decision-making process (Cao et al., 2017; Chelini, Lanteri, & Rizzello, 2009; Choe & Min, 2011; Greene et al., 2004, 2008; Valdesolo & DeSteno, 2006). Our change in the value of the one was similar to many studies which change the personal characteristics of the potential victim (the one) of a redirect decision such as varying age and genetic relatedness (Bleske-Rechek et al., 2010). Past studies, as well as our own, show that the increase in the value of the one does affect the number of Utilitarian choices made within a Trolley Problem scenario. This is especially seen when the one is changed to a family member, or one who is genetically related to the participant, which had the lowest proportion of redirect decisions across both of our scenarios.

Greene notes the importance of emotions in contributing to the decrease in proportion of redirect decisions within the dilemmic scenarios when things become more personal or emotionally charged, as discussed above. Summarized, personal dilemma contexts are believed to provoke emotional reactions leading to deontological choices, whereas impersonal dilemma contexts are thought to stimulate rational reactions leading to utilitarian choices. The decisions made by participants in the present study could also be characterized as either “congruent” or “incongruent” within each scenario and mission.

Congruent choices are those one would expect based on the context, while incongruent choices are those unexpected in that context. Therefore, with a personal moral dilemma, such as our FM mission, a deontological choice is expected and congruent to the situation; an FM redirect choice would be incongruent. With the Trolley Problem and our P mission, the opposite would be the case. DT results showed an
interesting asymmetry between congruent and incongruent decisions, when viewing solely the redirect decisions which were active and recordable. Reflecting what was reported by Greene (2001), redirectors making the congruent choice in the P mission exhibited shorter DTs than those who redirected as an incongruent choice in the FM mission. So, when the redirect choice was congruent with the scenario, it took less time for the participant to reason through their decision. On the other hand, it took more reasoning time to decide on the incongruent choice in the FM mission. For an incongruent response to occur, cognitive control and conflict resolution is required since reason is competing with emotion (Brugnera et al., 2017; Manfrinati et al., 2013; Youssef et al., 2012).

The current study adds to this literature which examines the relationship between redirect decisions and emotional engagement. This was primarily exhibited when redirecting was the incongruent choice within the FM mission as well as the Military C mission. While we did see philosophical justifications being used here, replicating past literature, we also saw significant increases in emotional engagement either through DTs or heart-rate changes. This was also reflected in work by Choe and Min (2011) who ran a standard Trolley Problem task alongside a battery of emotional-state measures. They found that the state-trait anger was significantly and positively correlated with utilitarian choices. Empathy, which has been associated with deontological choices, was negatively associated with utilitarianism. So, while utilitarian decision-making is not necessarily associated with emotional processing, it does have some distinct correlates that should be examined and have started to be investigated here.
Finally, Pan and Slater (2012) have noted that traditional moral dilemma problems based on runaway trains very likely are implausible for most people to come across in real life, which may be a separate source of disengagement no matter how realistically those problems are presented. Thus, as Maule (2000) has suggested, there is a need to devise dilemmic scenarios that are more contemporary and believable in order to extend the generality of findings that have been obtained with Trolley Problems and related scenarios. Accordingly, the present research sought to strengthen participants’ engagement with the Trolley Problem with a modernized, computer-based dilemma simulation using a remotely-piloted aircraft (RPA) scenario.

6.4 Relevance of the Present Findings to RPA Research

As was noted in the introduction of this thesis, an RPA context was used in the simulations created for the present study, in part, because this context has gained increased notoriety in the public space within the past few years (Enemark, 2013; McCrisken, 2013; Sauer & Schornig, 2012) and, in part, because it is a novel and heretofore unused dilemmic context. By embedding Trolley-Problem-like choices in an RPA context, a modern and engaging dilemmic scenario was achieved and allowed us to examine dual-process theory within these decisions and replicate basic findings obtained using traditional moral dilemmas.

In military operations, RPA operators can be called upon to make difficult decisions about whether or not to inflict fatal harm on individuals or groups in order to achieve a mission goal. A major argument in support of these systems within military operations is that they do not endanger the life of a pilot and potentially are more precise
in their strike capabilities. However, the use of weaponized RPAs in several theaters of wars and counterinsurgency actions has given rise to many discussions focusing on their ethical, legal, and strategic implications. These considerations surrounding weaponized RPAs have been a key topic of discussion across the nation since their use has become more publicized (Enemark, 2013; McCrisken, 2013; Sauer & Schornig, 2012). Many civilians have used the term “armchair pilots” in describing these men and women, a concept that spurred unsettling images of pilots treating their jobs as they would a video game. However, recent empirical work has shown that this is not the case and evidence shows that these individuals are affected greatly by their duties, especially with regard to their operational efficiency and cognitive capacities like executive function (System 2 traits). Some researchers, however, note that RPA pilots may be affected by their missions in ways that go beyond operational efficiency and executive function.

In a recent study, Bumiller (2011) found that nearly half of US Air Force RPA operators (weaponized and surveillance) exhibited signs of “high operational stress.” Furthermore, a smaller, but significant, number of operators suffered from “clinical distress,” including symptoms of anxiety, depression, and/or stress severe enough to affect the operator’s job performance and/or family life (Bumiller, 2011). In addition, RPA operators have been reported to experience physical exhaustion, and have been labeled as the most fatigued flight crews in the military (Trimble, 2008). There are reports of RPA crews suffering from post-traumatic stress induced by constant exposure to high-resolution images of real-time killing and the after-action inventory of body parts (Lindlaw, 2008). A study by the US Armed Forces Health Surveillance found that,
among RPA pilots, the incidence of stress disorders was similar to those who pilot manned aircraft (Otto & Webber, 2013; Ortega, 2013).

One potentially important source of stress for RPA pilots and crews comes from the moral and ethical implications of remote piloting when weapons and killing are involved. RPA pilots and crews often pursue “highly valued” individuals that have been targeted for elimination because of the terror and damage they coordinate, direct, or inflict on innocent civilian populations. Not only is the pursuit of highly valued targets an intricate and time-consuming process, it also normally eventuates in difficult decisions for RPA pilots and crews about when and where to perform the elimination in a way that minimizes collateral damage and further loss of innocent life. The moral and ethical overtones of these decisions surely must be a source of psychological and emotional stress for RPA pilots, but to date this possible source of stress remains poorly understood.

We believe exposure to dilemmas that might call upon the JWD and other combat decision frameworks may have distinct psychological or emotional effects on the decision maker. One possible effect is an emotional reaction that can be labeled “moral stress,” which we believe is a unique form of arousal that results from exposure to dilemmic choices between conflicting moral values. This form of stress is likely different from “moral distress,” which is the psychological disequilibrium and negative feeling state experienced when a person makes a moral decision but does not follow through by performing the moral behavior indicated by that decision (e.g. because institutional settings does not allow one to do so; Wilkinson, 1987). Moral stress could be seen in the application of the JWD when factors surrounding a military choice muddy the goal of
causing the least amount of harm. For instance, when an extremely high value target is using a young child as a human shield.

Thus, while the deployment and operational circumstances associated with RPAs may contribute to the finding that operators experience more psychological disorders than otherwise would be expected, it is also possible that “moral stress” may contribute significantly to these problems. As noted above, “moral stress” is more a function of the moral dilemmas imposed by actual mission goals than by the operational aspects of RPA deployment. Many persuasively argue that RPA operations do not reduce the combat space to a remote and distant location (Gregory, 2011), but instead create an engagement zone in which the target’s constant visibility produces an enhanced form of intimacy (Lee, 2012). These circumstances may well exacerbate rather than mitigate the intensity of any moral dilemmas that arise, thereby possibly increasing any emotional or psychological impacts of moral stress, altered perceptions, and altered justifications.

Past literature, as well as our own results, show the potential effects of military rules of engagement (e.g. JWD) on how decisions were made throughout our Trolley Problem simulation as well as emotional engagement through heart-rate change and DT. While cadets were the military personnel used in this study, this population is similar to actual RPA pilots as they are a primary feeder population from which RPA pilots are selected. This aspect of the comparison group, therefore, improves the ecological validity of findings with the RPA simulation as well as serves as a springboard for future research with active military participants, including actual RPA pilots. Additionally, the results we obtained could relate to conclusions on emotional regulation and decision-making which could be imperative to understanding the circumstances in which RPA
pilots and crews operate, and may also aid in creating screening and training protocols for these crews (Heilman, Crișan, Houser, Miclea, & Miu, 2010). This kind of research is critical in order to enhance public understanding as well as understanding within the military itself in order to better serve those taking on this new combat role.

Furthermore, the properties of emotional regulation and other personality measures, including the TET and values measure, also could inform RPA screening and training tools (Heilman et al., 2010). While it did not appear from results of the present study that completing the philosophical education course at the Academy created a boost in philosophical arguments or redirect decisions made by cadets, it could also be said that individuals within the military have an instinctual response towards making decisions based on the group preservation (i.e., a Bunker Orientation), which may not always favor the greater good. Indeed, our personality measures (TET and values) did show that these individuals were distinctly different than their ND, civilian counterparts.

6.5 Limitations

The present study has several limitations which should be noted. Broadly, these limitations fall into the categories of study design and data collection/management.

6.5.1 Design Limitations

The Trolley Problem Simulation was fairly long for participants to complete, especially those who got lost or lacked video game experience. Overall, without mistakes, the Simulation took 25 minutes to complete from first take-off to final landing. Furthermore, at least 20 participants in each sample ended up getting lost during the simulation due to user error which usually meant at least 10 minutes would be added to
the Simulation run time. This was one cause for dropped participants due to loss of time and inability to finish the study. Furthermore, participant fatigue was a concern with this study due to the length of the Simulation plus the surveys. A good proportion of Simulation time was spent in the Practice and Exploration phases which, in hindsight, may not have been essential for participants to complete.

Another design issue was that the order of the three missions within the Simulation was fixed. The P Mission was always first, followed by the C Mission, and then the FM Mission. This led to concerns of order effects within the Simulation. By having the Missions in the same order throughout, it is possible that participants would become desensitized to the Trolley Problem decision by the time the FM Mission occurred which could have affected outcomes within our measures of emotional engagement (heart rate and DT). Furthermore, keeping the length of the Simulation in mind, if any participants were suffering from participant fatigue, this would most greatly affect results for the FM mission. In fact, some evidence of this was provided by responses to the Mission Review Debrief. Some honest participants noted that they made the active redirect choice because they noticed that it made each mission shorter (as they didn’t have to wait out the 10 second timer). This behavior also raises concerns in regards to DT findings and, perhaps, heart-rate measures.

Additionally, in terms of the missions, a limitation occurred due to the go/no-go nature of responses to simulation decisions. Therefore, across all three missions, in all three scenarios, the active choice was always paired with the choice to redirect. Consistently making the inactive choice the non-redirect choice was problematic on several counts and prevented us from making many solid conclusions about the nature of
these deontological decisions. For instance, we were unable to record DTs for these decisions as they occurred as a default when time ran out; so, all were ten seconds. Furthermore, as Navarrete et al. (2012) concluded in their study, active responses inherently produce different outcomes in terms of emotional activation and investment in decision than to inactive responses. This could, therefore, not only effect the measures taken during the simulation for non-redirect decisions, but in the actual reasons surveys as well.

A fourth design issue relates to the fact that the hypothetical reasons and values measures were administered only at the end, which means these measures could not properly detect any effects that were due to specific missions. At best, these measures reflected a participant’s overall experience with all of the missions to which they were exposed.

6.5.2 Data Limitations

The first and most obvious data-related limitation of this study was the missing data and small sample size within the USAFA Experiment Population. Overall, 98 participants were run of which only 18 had complete data for all parts: pre-simulation scales, simulation report log, heart-rate information, post-simulation scales, and debrief. Of those, a subset of 74 participants were flagged as having pre-simulation scales, simulation log, and post-simulation scales, some of these missing the heart-rate information and debrief. The largest hurdle for USAFA runs was due to heart-rate data, only 30 participants had this data which was primarily due to software and hardware errors as well as experimenter error during set-up. Also, missing data within the post-simulation scales, debrief, and some simulation logs can be attributed to the limited run
time available to the USAFA research team. Due to cadets’ busy and concise schedules, our USAFA team only had an hour window to run each participant. Therefore, if a participant struggled with the simulation or took a longer time period to complete the pre-simulation scales, the post-simulation scales may not have been completed nor the simulation. Cadets were also sometimes sent home and were instructed to complete surveys on their own time which did not always happen. Because of the shear amount of missing data, analyses had to be run with the data that was available for each data point. Therefore, different sample sizes can be seen throughout the USAFA results. Additionally, due to the lower sample size (especially in the heart-rate data), power throughout the analyses was low for this experiment.

The runtime constraints for USAFA also meant that some of the original surveys and measures used in the ND Experiment had to be dropped. These included the measures on War and Peace Attitudes, Altruism, and Dutifulness. These were chosen to be dropped based on preliminary data from the ND study which showed that these measures yielded the least significant patterns and relationships to our simulation’s outcome variables. Therefore, we were unable to do Population comparisons for these measures.

The Notre Dame participants also had some incomplete data. Of the 172 participants run, 144 had complete data for all parts except the Debrief survey. Across most of the ND analyses covered here, this 144-participant sample size was used. However, only 85 participants had complete Debrief Survey data. As was mentioned previously, the ND Experiment conducted its debrief verbally, recording the interviews between the experimenter and participant, which was then transcribed and coded. Much
of the missing data for the debrief survey is explained by experimenter error (i.e. forgetting to start the recorder) or software/hardware error; there were a few recorded interview sessions that either were too quiet to understand and transcribe or that resulted in empty data files.

6.6 Future Directions

In response to the limitations listed above, there are a few simple fixes that can be implemented. First, our research group has already begun to develop a version of our simulation which randomizes the order of the Dilemmic missions in order to rule out any order effects that might have occurred in the current iteration. Furthermore, the practice and exploration phases have been cut out, as it was deemed unnecessary to include them. However, one practice mission will be kept and run before the five Missions in order to familiarize the participant with the overall mechanics within the simulation. These changes will create the following order of events within our simulation: take off, practice mission, non-choice mission one, dilemmic mission (P, C, or FM), non-choice mission two, dilemmic mission (P, C, or FM), dilemmic mission (P, C, or FM), and landing. Finally, scenarios have been considered which have both redirect and non-redirect decisions being active choices, instead of just the redirect decision being the active choice.

A more modern and flexible simulation-creating software could also be used in order to create a more immersive and unique Trolley Problem Scenario. Steam’s Source SDK, Hammer Editor, was released in 1996 and was maintained by the company until 2011. The package includes objects and character skins from games such as Half Life,
which was the primary objects pool used to create this simulation. The use of the package, therefore, somewhat limited our choices in characters and had some potential for participants recognizing a character or object from the game which could inadvertently counteract the immersive goal we had for our simulation. To solve this issue, program packages such as the Unity game engine are being considered in order to create a new simulation using objects and characters unique to our simulation. However, for now, a simulation has been created using the Hammer Editor to do initial tests on the aforementioned new simulation timeline.

Aside from the Unity game engine the professional, military-endorsed Simulation software Virtual Battlespace (VBS3) by Bohemia Interactive Simulations has been considered. VBS3 is used in creating virtual training environments for purposes such as experimentation and can be used for land, air, or sea-based simulations. A huge upside to using VBS3 is that it comes with a large library of objects, characters, and scenes which can be used to make any variation of simulation scenario. Furthermore, as it is used by the military for actual simulation training, this may serve to be more immersive for any other military populations we employ in future iterations.

An issue in the way our study looked at emotional engagement was that specific emotional states were never primed or measured through self-report scales. While our method of measure emotional engagement, through heart-rate change, is well-supported empirically, no solid claims could be made regarding the exact emotion that was being engaged; as such, we could conclude that emotional engagement was occurring, but nothing further. Therefore, in future iterations of this study, methods for measuring
specific emotions expressed could be instituted. One such method is facial expression analysis.

Facial expression analysis is a technique which uses software to recognize facial motions and facial feature changes using visual information with various identification points across the observed participant’s face (Tian, Kanade, & Cohn, 2003). Facial expression analysis most often uses the six basic emotions when identifying facial expressions, including: anger, happiness/joy, surprise, disgust, sadness, and fear (Cohn, Schmidt, Gross, & Ekman, 2002; Tian et al., 2003). Based on previous literature, it is likely that participants will exhibit disgust and fear especially when confronting highly moral and emotional decisions (Blasi, 1999; Cheng, Ottati, & Price, 2013; Haidt, 2001; Haidt & Bjorklund, 2008; Heilman et al., 2010; Hofmann & Baumert, 2010; Pizarro, 2000). We can more solidly investigate these correlates by using this measure technique as participants progress through our simulation task and be better able to see not only that emotional engagement is occurring, but also what emotion may be engaged.

Further, additional measures could also be taken throughout the RPA simulation. Firstly eye-tracking would be another fruitful endeavor. Existing literature implementing eye-tracking into the Trolley Problem pair well with the dual-process framework which the current study utilizes, although use of eye tracking within the Trolley Problem overall is generally understudied (Fiedler & Glöckner, 2015; Skulmowski, Bunge, Kaspar, & Pipa, 2014). Skulmowski et al. (2014), for instance, not only used eye tracking techniques to determine its role in decision-making within the Trolley Problem, but was able to use this technique to investigate affective responses these decisions as well. Using pupillary data, Skulmowski et al. found that participants experienced increased emotional arousal
and cognitive load after the moment of decision, which was exhibited in significant pupil diameter increase. Furthermore, participants appeared to spend more time looking at the victim who was going to be sacrificed over the victims who weren’t, or vice versa (Fiedler & Glockner, 2015; Skulmowski et al., 2014). Skulmowski et al. (2014) used this methodology in a VR version of the Trolley Problem which bodes well for its use in our own simulation and any subsequent versions.

Another interesting avenue that this research could explore more thoroughly would be the effect of physiological stress on decisions made in Trolley Problem Simulation as it pairs with moral stress. This could be used to further explore the environments experienced by the RPA pilots who inspired this work. Physiological stress could be successfully introduced through the Trier Social Stress Test (TSST) before the experiment begins. Stress can then be measured through self-report questionnaires such as the State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970; Starcke et al., 2011; Yamakawa et al., 2016) as well as salivary cortisol concentrations taken throughout the tasks. The TSST, like the Trolley Problem, can be easily modified to fit the experiment scenarios. As the speech section of the task is flexible, it could be structured to make the topic involve relevant subjects to the simulation about-to-be experienced (i.e. “Why would you make a good RPA pilot?”). This could help to increase the immersion felt by participants throughout our study.

Finally, new scenarios and other paradigms could also be implemented to investigate differences in victim value, numbers, and more militaristic frameworks. For instance, a shoot/no shoot decision could be created relating to a particular enemy target
which would help our simulation parallel RPA situations more closely. This could span across multiple manipulations:

- Type of target—person or unmanned facility
- Level of “badness”—low, moderate, high defined by crimes the target is responsible for
- Collateral damage involved—none, minimal, more within target kill radius
- Type of innocent lives—child, adult family member, acquaintance, unrelated, etc.
- Prior knowledge of target history—none, partial, complete
- Rank of person issuing the order—Shift Supervisor, Base Commander, Secretary of Defense, etc.
- Level of trust in intelligence—low, medium, high
- Prior experience with target—following for some time, just acquired
- Personal experience immediately prior to session—negative, neutral, positive

Many of these manipulations would be easy to implement via changes in simulation script or to the briefing video given before the start of the simulation. This change in pre-simulation briefing could be accomplished via programs such as jsPsych, DirectRT, or EPrime and would allow us to use the same simulation across each manipulation scenario, only having to change the pre-simulation prompt.

A trade-off paradigm could also be utilized which would present the participant with information about a target including information such as “badness” and prior history and a situation where some civilian casualties are inevitable. From there, the participant would be tasked to indicate how many innocent casualties are acceptable when taking out the target. The participant’s response would likely be recorded via a slider and could also
be done in the opposite direct (what target value level is acceptable if X number of civilians would die). This could be easily incorporated in the shortened RPA simulation.

6.7 Conclusions

First and foremost, it can be confidently concluded that the Trolley Problem simulation used here was a successful iteration of the famous moral decision-making task. Our results strongly align with other Trolley Problem literature by observing majority redirect decisions through our basic P mission. Further, our strategies for increasing the value of the one are unique, especially in our use of the commander, and show a shift in the proportion of utilitarian decisions made. Further, an interesting pattern of disparate findings can be seen between our C and FM missions within the Firefighter and Military scenarios which shed light on the possible differences in perspective that civilians and cadets may have towards military and firefighter personnel. In future study, it might be beneficial to explore these differences more thoroughly by including surveys to investigate overall opinions toward different hypothetical victims.

While this study is not the first of its kind to take advantage of Philippa Foot’s Trolley Problem (1967), it does so in a unique way. First, it introduces two variations of the dilemmic scenario, Military and Firefighter, to uncover the differences in presentation of the problem (i.e. Cao et al., 2017). It also incorporates a control scenario which presents non-dilemmas, something less visible within the literature. Second, we confront our participants with three dilemmic decision tasks, beginning with the traditional Trolley Problem as a control; going into the second, unique mission involving the personally-socially valued commander; ending with the final, emotionally-charged FM mission.
While the investigation of personal moral dilemmas is not new, this method of steady escalation is a unique concept to this study, creating a within-subject factor which can concretely compare these factors across individual, moral decisions. All this taken together uncovers a plethora of interesting outcomes in regards to the interplay of emotional engagement and moral decision-making. Furthermore, the comparison of our two populations uncovers how civilians and military personnel differ from each other due to their innate backgrounds and formal training. Certainly, this study has created a strong foundation for future research of relevance to real-world service men and women.

The possible relevance of the methods used here for real-world RPA research is an exciting prospect. The use of USAFA cadets was the first step towards a goal of using this research in helping to build up the little-attended field and understanding of RPA pilots active today. Recruitment of RPA pilots has sky-rocketed, increasing each year (Enemark, 2013; McCrisken, 2013; Sauer and Schornig, 2012). Furthermore, these pilots have been cited as undergoing “high operational stress,” suffering from stress disorders at similar rates to “traditional” pilots (Bumiller, 2011; Otto & Webber, 2013; Ortega, 2013). However, despite these facts, little research has focused on understanding these individuals and their hardships in order to build materials to help safeguard them through their stressful positions. This study could help open a doorway to do just that. By using simulation technologies, we have created an easy-to-implement Trolley Problem simulation which could be used to research how this unique pilot makes decisions in a remote situation. Furthermore, our methodology is simple and cost-efficient through the use of measurements such as heart rate and DT which could be applied in most research spaces.
APPENDIX A:

TRIUNE ETHICS THEORY

A.1 Overview of Orientations

**Bunker.** The first moral orientation covered in the TET is Security (called Bunker in the version used in the present study) which is described as an actor focused on self-preservation. These actors often focus on personal and in-group dominance (Narvaez, 2008; Narvaez & Hardy, 2016). The underlying structures active when the Security individual is acting in a morally charged setting is the fight or flight centers of the brain. Narvaez (2008) states that these individuals are less responsive to enacting morality to help others because of their overwhelming fearfulness of their own safety.

**Engagement.** The second orientation is Engagement, where actors are driven by relationships and emotional affiliation with others (Narvaez, 2008; Narvaez & Hardy, 2016). This orientation works off of “mammalian emotional systems” such as play, panic, and care via the actor’s natural tendency to seek contact with others both emotionally and physically. We would see this played out in moral decisions when actors bend towards socially popular moral decisions, not to violate social norms and potential isolate themselves.

**Imagination.** The third orientation, Imagination, has the actor “think with feelings” coming from the external world (Narvaez, 2008; Narvaez & Hardy, 2016). This
construct allows the actor to problem solve by using these external stimuli and act with deliberative learning and reasoning. We see maximum involvement of the frontal lobes in this orientation as well as activation in the PFC. These imaginative actors exhibit more thoughtful reasonings behind moral decisions made, not tending toward explanations involving gut reactions or intuition.

**Wallflower.** A forth orientation, Wallflower, was also present in the current study’s version of the TET. However, in the most up to date version, the concepts covered in this orientation have been lumped into both the Imagination and Engagement orientations of the updated TET.
APPENDIX B:

PRE-SIMULATION SURVEY

Introduction

Enter the participant number: ________

Instruction
You will perform a survey that consists of four parts: First, you will answer a few questions on how you feel right now. Second, you will provide some general information about yourself. Third, you will answer some questions regarding your video game experience. Fourth, you will answer some personality questionnaires.

In doing this task, there is no right or wrong answer - please answer all questions according to your own valuation.

As instructed, you can always contact the experimenter by using your headphones, if anything is unclear.

Please press the button below to start the survey.

State-Trait Aggression Expression Inventory (STAX-2; Spielberger, 1999)

A number of statements that people use to describe themselves are given below.

Read each statement then select the appropriate circle to indicate how you feel right now. There are no right or wrong answers.

Do not spend too much time on any one statement, but give the answer which seems to best describe your present feelings.
<table>
<thead>
<tr>
<th>Feeling Description</th>
<th>I feel not at all (1)</th>
<th>I feel somewhat (2)</th>
<th>I feel moderately so (3)</th>
<th>I feel very much so (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am furious. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel irritated. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel angry. (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like yelling at somebody. (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like breaking things. (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am mad. (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like banging on the table. (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like hitting someone. (8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like swearing. (9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel annoyed. (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like kicking somebody. (11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like cursing out loud. (12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like screaming. (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like pounding somebody. (14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel like shouting out loud. (15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Demographics

We would now like to gather some general information about you.

What is your gender?

- Male (1)
- Female (2)

Please enter your age:

▼ Below 18 (1) ... over 30 (15)

In what college year are you?

▼ Freshmen (1) ... Not in college (6)

Are you an Air Force Cadet or part of the “Reserve Officers Training Corps” (ROTC)?

- Yes, Air Force ROTC (1)
- Yes, Army ROTC (2)
- Yes, Navy ROTC (3)
- No (4)
- Air Force Cadet (5)

Are you left or right handed?

- Left (1)
- Right (2)
How many hours of Remotely Piloted Aircraft (RPA / drone) experience do you have?

- None (1)
- 1 to 20 hours (2)
- 21 to 50 hours (3)
- 50 to 100 hours (4)
- More than 100 hours (5)

Have you ever taken Philosophy 310? (Only asked during Experiment 2)

- Yes (1)
- No (2)

Are you familiar with the Trolley Dilemma?

- Yes (1)
- No (2)

Do you consider yourself politically liberal or politically conservative? (Only asked during Experiment 2)

- Liberal (1)
- Conservative (2)
- Rather not say (3)

A "tragic decision" is a decision such that the resulting action involved harming a person physically (injury or death) in order to benefit other persons.

In your lifetime, did you ever have to make such a tragic decision?

- Yes (1)
- No (2)

Video Game Experience

In the following we ask you about your experiences with video games.
At what age did you start to play video games of any kind (including games like Tetris, SimCity etc.)?

▼ I never played (1) ... 25 (24)

How many hours do you currently spend playing videogames in a typical week?

▼ 0 (1) ... More than 40 (25)

Overall, how many hours have you played videogames in your life (rough estimate)?

- I have never played video games (1)
- I have played very rarely, not more than 100 hours in total (2)
- I have played sometimes, maybe in total up to 1000 hours (3)
- I have played quite regularly, maybe up to 10’000 hours (the average time a person played until 21 in the US) (4)
- I have played a lot, i.e. more than 10’000 hours so far (5)

Do or did you play 3-D video games (flight simulators, action games that include exploring a 3-D game world, etc.)?

- Yes (1)
- No (2)

If yes, please provide an estimate in % of the proportion of your gaming experience with 3-D games compared to all video games you have played. For example, if you mostly play Halo, you might answer 90%. If you mostly play Tetris, you might answer 10%.

▼ 0% (1) ... 91-100% (11)

Perceived Stress Reactivity Scale (Schlotz et al., 2011)

The next five pages contain questions on how you deal with everyday problems.

Please indicate, which of the given options best describe you as a person.

When tasks and duties build up to the extent that they are hard to manage . . .

- I am generally untroubled (1)
- I usually feel a little uneasy (2)
- I normally get quite nervous (3)
When I want to relax after a hard day at work . . .
• This is usually quite difficult for me (1)
• I usually succeed (2)
• I generally have no problem at all (3)

When I have conflicts with others that may not be immediately resolved . . .
• I generally shrug it off (1)
• It usually affects me a little (2)
• It usually affects me a lot (3)

When I make a mistake . . .
• In general, I remain confident (1)
• I sometimes feel unsure about my abilities (2)
• I often have doubts about my abilities (3)

When I’m wrongly criticized by others . . .
• I am normally annoyed for a long time (1)
• I am annoyed for just a short time (2)
• In general, I am hardly annoyed at all (3)

When I argue with other people . . .
• I usually calm down quickly (1)
• I usually stay upset for some time (2)
• It usually takes me a long time until I calm down (3)

When I have little time for a job to be done . . .
• I usually stay calm (1)
• I usually feel uneasy (2)
• I usually get quite agitated (3)

When I make a mistake . . .
• I am normally annoyed for a long time (1)
• I am normally annoyed for a while (2)
• I generally get over it easily (3)
When I am unsure what to do or say in a social situation . . .
- I generally stay cool (1)
- I often feel warm (2)
- I often begin to sweat (3)

When I have spare time after working hard . . .
- It often is difficult for me to unwind and relax (1)
- I usually need some time to unwind properly (2)
- I am usually able to unwind effectively and forget about the problems of the day (3)

When I am criticized by others . . .
- important arguments usually come to my mind when it is too late to still make my point (1)
- I often have difficulty finding a good reply (2)
- I usually think of a reply to defend myself (3)

When something does not go the way I expected . . .
- I usually stay calm (1)
- I often get uneasy (2)
- I usually get very agitated (3)

When I do not attain a goal . . .
- I usually remain annoyed for a long time (1)
- I am usually disappointed, but recover soon (2)
- In general, I am hardly concerned at all (3)

When others criticize me . . .
- I generally don’t lose confidence at all (1)
- I generally lose a little confidence (2)
- I generally feel very unconfident (3)

When I fail at something . . .
- I usually find it hard to accept (1)
- I usually accept it to some degree (2)
- In general, I hardly think about it (3)
When there are too many demands on me at the same time . . .
- I generally stay calm and do one thing after the other (1)
- I usually get uneasy (2)
- Usually, even minor interruptions irritate me (3)

When others say something incorrect about me . . .
- I usually get quite upset (1)
- I normally get a little bit upset (2)
- In general, I shrug it off (3)

When I fail at a task . . .
- I usually feel very uncomfortable (1)
- I usually feel somewhat uncomfortable (2)
- In general, I don’t mind (3)

When I argue with others . . .
- I usually get very upset (1)
- I usually get a little bit upset (2)
- I usually don’t get upset (3)

When I am under stress . . .
- I usually can’t enjoy my leisure time at all (1)
- I usually have difficulty enjoying my leisure time (2)
- I usually enjoy my leisure time (3)

When tasks and duties accumulate to the extent that they are hard to cope with . . .
- My sleep is unaffected (1)
- My sleep is slightly disturbed (2)
- My sleep is very disturbed (3)

When I have to speak in front of other people . . .
- I often get very nervous (1)
- I often get somewhat nervous (2)
- In general, I stay calm (3)
When I have many tasks and duties to fulfill . . .
  • In general, I stay calm (1)
  • I usually get impatient (2)
  • I often get irritable (3)
APPENDIX C:

POST-SIMULATION SURVEY

(USAFA Version: No Altruism, Dutifulness, or War & Peace Measure)

Introduction

Enter the participant number:________

Instruction
You will perform a survey that consists of four parts: First, you will answer a few questions on how you feel right now. Second, you will be asked about your experience and memory of your missions. Third, you will evaluate reasons that justify decisions in tragic dilemmas. Fourth, you will evaluate values along several descriptive dimensions.

In doing this task, there is no right or wrong answer - please answer all questions according to your own valuation.

As instructed, you can always contact the experimenter by using your headphones, if anything is unclear.

Please press the button below to start the survey.

State-Trait Aggression Expression Inventory (STAX-2; Spielberger, 1999)

A number of statements that people use to describe themselves are given below.

Read each statement then select the appropriate circle to indicate how you feel right now. There are no right or wrong answers.

Do not spend too much time on any one statement, but give the answer which seems to best describe your present feelings.
<table>
<thead>
<tr>
<th>Feeling Description</th>
<th>I feel not at all (1)</th>
<th>I feel somewhat (2)</th>
<th>I feel moderately so (3)</th>
<th>I feel very much so (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am furious. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I feel irritated. (2)</td>
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<td></td>
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<tr>
<td>I feel angry. (3)</td>
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<tr>
<td>I feel like yelling at somebody. (4)</td>
<td></td>
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<tr>
<td>I feel like breaking things. (5)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>I am mad. (6)</td>
<td></td>
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<tr>
<td>I feel like banging on the table. (7)</td>
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<tr>
<td>I feel like hitting someone. (8)</td>
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<tr>
<td>I feel like swearing. (9)</td>
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<tr>
<td>I feel annoyed. (10)</td>
<td></td>
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<tr>
<td>I feel like kicking somebody. (11)</td>
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<tr>
<td>I feel like cursing out loud. (12)</td>
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<tr>
<td>I feel like screaming. (13)</td>
<td></td>
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<tr>
<td>I feel like pounding somebody. (14)</td>
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<tr>
<td>I feel like shouting out loud. (15)</td>
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</tbody>
</table>
Psychological Distance Measure (Not covered in this Thesis)

On a scale of 1 to 100 where 100 is very high up and 1 is very close to the ground, how high did you appear to be flying above the surface of the ground? Move the slider to match your perception.

...very close to ground | ...very high above ground
---|---
0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100

I was flying... (1)

On a scale of 1 to 100 where 100 is very large and 1 is very small, how large did the people on the ground appear to be? Move the slider to match your perception.

...very small | ...very large
---|---
0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100

The people on the ground were... (1)

On a scale of 1 to 100 where 100 is very large and 1 is very small, how large did the non-person objects on the ground appear to be? Move the slider to match your perception.

...very small | ...very large
---|---
0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100

The objects on the ground were... (1)
Hypothetical Reasons Measure

A tragic dilemma is a situation, in which it is inevitable that persons are harmed or even killed, although you can influence how many persons are harmed or killed. An exemplar case is the so-called Trolley Dilemma, which is described as follows:

Suppose that you are the driver of a runaway trolley which you can only steer from one narrow track onto another. Five persons are working on one track and one person on the other. Anyone on the track you enter is bound to be killed. The runaway trolley is heading towards the five persons. The decision is whether you would steer the trolley to the other track (saving five, killing one person), or whether you would not do anything (saving one, killing five person).

The graphic below illustrates the dilemma.

![Trolley Dilemma graphic]

In the following, you will be presented with reasons that justify either choice in this dilemma. Your task is then to evaluate this argument along four aspects. The next page shows an example. After the example, you will be provided with 12 reasons that have to be evaluated.

Example (just read, no need to answer the questions)

In the following, it will be assumed that one has decided to redirect the trolley.

Then, an argument is given intending to support this decision. For example (this is just a "nonsense illustration"):

The five persons wear shoes, the single person does not wear shoes.

Your task is then to evaluate this argument along four aspects. The sequence of these aspect changes after each argument, so please read each of them carefully.

One aspect concerns the distinction between not universalizable and universalizable: If you think that supporting this given argument is completely a matter of personal taste and opinion, you mark the box on the left side, if you think that everybody should support...
this argument, you mark the box on the right side, if you think that it is more or less universalizable, you mark a box in-between.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not universalizable</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
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<td>o</td>
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</tbody>
</table>

One aspect concerns the distinction between **illogical** and **logical**: If you think that this given argument is surely not supporting the decision to redirect (i.e. it contradicts the decision), you mark the box on the left side, if you think that the argument clearly supports the decision, you mark the box on the right side, if you are unsure in that respect, you mark a box in-between.

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</thead>
<tbody>
<tr>
<td>Illogical</td>
<td>o</td>
<td>o</td>
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<td>o</td>
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</tbody>
</table>

One aspect concerns the distinction between **not appealing** and **appealing**: If this argument evokes very negative emotions in you when you would use it for supporting the decision to redirect, you mark the box on the left side, if you feel very positively in using this argument, you mark the box on the right side, if your feelings are somehow mixed, you mark a box in-between.

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<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not appealing</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

One aspect concerns the distinction between **not publicize** and **publicize**: If you would never use this argument in public (although you may agree with it) for supporting the decision to redirect, you mark the box on the left side, if you would have no problem to speak out this argument in public, you mark the box on the right side, if it depends on
how much you know your counterpart, you mark a box in-between (the more anonymous your counterpart is, the publicized is the argument).

<table>
<thead>
<tr>
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<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not publicizable (1)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I would not use this argument in public at all.</td>
</tr>
</tbody>
</table>

**Redirect 1:** If I can minimize an evil outcome, then I have to do so.

This argument is: *(This scale was used for all Redirect and Non-Redirect prompts)*

<table>
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<tr>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not universalizable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Supporting this argument depends on your personal opinion.</td>
</tr>
<tr>
<td><strong>Illogical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This argument doesn’t support the decision at all.</td>
</tr>
<tr>
<td><strong>Not appealing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This argument does not at all feel right for me.</td>
</tr>
<tr>
<td><strong>Not publicize</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I would not use this argument in public at all.</td>
</tr>
</tbody>
</table>

**Redirect 2:** The death of the single person is an unintended consequence of saving five Persons.

**Redirect 3:** One of the five persons is a close family member of mine; the single person is not a member of my family.

**Redirect 4:** Among the five persons is a scientist working on a breakthrough in cancer research; the single person is an ordinary person.
Redirect 5: The single person has a terminal illness; none of the other five persons has a disease.

Redirect 6: The single person has committed a severe crime; none of the five persons has ever committed a crime.

Non-Redirect 1: The things that happen reflect god’s will, I shall not intervene.

Non-Redirect 2: When I redirect, I caused the death of a person; but I do not cause the death of five persons when I do not intervene, this is an accident.

Non-Redirect 3: The single person is a close family member of mine; none of the five persons is a member of my family.

Non-Redirect 4: The five persons are normal workers; the single person is a scientist working on a breakthrough in cancer research.

Non-Redirect 5: Among the five is a person with a terminal illness; the single person is healthy.

Non-Redirect 6: Among the five is a person that has committed a severe crime; the single person has never committed a crime.

Values Measure

In the following, you will be provided with 7 values. Each value is briefly described such that you have a better understanding of what the value means.

We will then ask you to evaluate the value along four aspects in a similar way as you have evaluated the reasons before.

However, the four dimensions are not the same as the ones used to evaluate the reasons - so please read each question carefully.

Aggressiveness
Persons that honor this value are combative, pugnacious and tough.
This value is, according to your opinion… (This scale was used for all Values)
...moral, i.e. claims to be universally valid and corresponding actions are judged as right or wrong.

...emotionally appealing, i.e. following this value feels completely right for me.

...official, i.e. relates to the compliance to given internal rules or laws.

...community-oriented, i.e. supports the cooperative being-together of people.

...non-moral, i.e. does not claim to be universally valid and corresponding actions are not subject of evaluations as right or wrong.

...emotionally not appealing, i.e. following this value does not feel good for me.

...non-official, i.e. does not relate to the compliance to given internal rules, or laws.

...individualistic, i.e. supports the focused achievement of individual goals.

Authority: Persons that honor this value aim for control, influence and power.

Cooperation: Persons that honor this value provide assistance and help to other people.

Loyalty: Persons that honor this value are faithful and abiding towards persons belonging to the same group.

Obedience: Persons that honor this value are humble and meek towards the claims and orders of others.

Responsibility: Persons that honor this value are accountable and answerable towards their actions and duties.

Security: Persons that honor this value want to be safe and protected and act in a precautious way.
End of Survey

You have reached the end of the second survey. Press the button below to transmit the data. Then, contact the experimenter using your headphones. The experimenter will ask you a few debriefing questions.
APPENDIX D:
DEBRIEF SURVEY

University of Notre Dame & United States Air Force Academy

Introduction

Subject Number: __________

Simulation Experience

Overall and after this experience, would you be interested in becoming a real RPA pilot?

• 7--Extremely Interested
• 6--Mostly Interested
• 5--Somewhat Interested
• 4--Neither Interested nor Uninterested
• 3--Somewhat Uninterested
• 2--Mostly Uninterested
• 1--Extremely Uninterested

How realistic was this scenario for you?

• 7--Extremely Realistic
• 6--Mostly Realistic
• 5--Somewhat Realistic
• 4--Neither Realistic nor Unrealistic
• 3--Somewhat Unrealistic
• 2--Mostly Unrealistic
• 1--Extremely Unrealistic
How confident were you in flying the RPA?

- 7--Extremely Confident
- 6--Mostly Confident
- 5--Somewhat Confident
- 4--Neither Confident nor Unconfident
- 3--Somewhat Unconfident
- 2--Mostly Unconfident
- 1--Extremely Unconfident

**First Mission--Car Dump (Non-Dilemmic)**

Did you consider the first mission at the Car Dump a success?

- 7--Extremely Successful
- 6--Mostly Successful
- 5--Somewhat Successful
- 4--Neither Successful nor Unsuccessful
- 3--Somewhat Unsuccessful
- 2--Mostly Unsuccessful
- 1--Extremely Unsuccessful

How much moral engagement was required for this mission?

- 7--Extremely Engaged
- 6--Mostly Engaged
- 5--Somewhat Engaged
- 4--Neither Engaged nor Unengaged
- 3--Somewhat Unengaged
- 2--Mostly Unengaged
- 1--Not Engaged at all
Second Mission—Lookout Tower (Peers Mission)

Did you consider the second mission at the Lookout Tower a success?
- 7--Extremely Successful
- 6--Mostly Successful
- 5--Somewhat Successful
- 4--Neither Successful nor Unsuccessful
- 3--Somewhat Unsuccessful
- 2--Mostly Unsuccessful
- 1--Extremely Unsuccessful

What was your decision?
- Redirect--One Person
- Did Not Redirect--Five People

Why did you decide that?______________________

How much moral engagement was required for this mission?
- 7--Extremely Engaged
- 6--Mostly Engaged
- 5--Somewhat Engaged
- 4--Neither Engaged nor Unengaged
- 3--Somewhat Unengaged
- 2--Mostly Unengaged
- 1--Not Engaged at all

Third Mission—Barn (Non-Dilemmic)

Did you consider the third mission at the Barn a success?
- 7--Extremely Successful
- 6--Mostly Successful
- 5--Somewhat Successful
- 4--Neither Successful nor Unsuccessful
- 3--Somewhat Unsuccessful
- 2--Mostly Unsuccessful
- 1--Extremely Unsuccessful
How much moral engagement was required for this mission?
- 7--Extremely Engaged
- 6--Mostly Engaged
- 5--Somewhat Engaged
- 4--Neither Engaged nor Unengaged
- 3--Somewhat Unengaged
- 2--Mostly Unengaged
- 1--Not Engaged at all

Fourth Mission—Factory (Commander Mission)

Did you consider the fourth mission at the Factory a success?
- 7--Extremely Successful
- 6--Mostly Successful
- 5--Somewhat Successful
- 4--Neither Successful nor Unsuccessful
- 3--Somewhat Unsuccessful
- 2--Mostly Unsuccessful
- 1--Extremely Unsuccessful

What was your decision?
- Redirect--One Person (Park Ranger/Fire Chief/Commander)
- Did Not Redirect--Five People

Why did you decide that? ________________________________

How much moral engagement was required for this mission?
- 7--Extremely Engaged
- 6--Mostly Engaged
- 5--Somewhat Engaged
- 4--Neither Engaged nor Unengaged
- 3--Somewhat Unengaged
- 2--Mostly Unengaged
- 1--Not Engaged at all
Fifth Mission--Family Home (Family Member Mission)

Did you consider the fifth mission at the Family Home a success?
- 7--Extremely Successful
- 6--Mostly Successful
- 5--Somewhat Successful
- 4--Neither Successful nor Unsuccessful
- 3--Somewhat Unsuccessful
- 2--Mostly Unsuccessful
- 1--Extremely Unsuccessful

What was your decision?
- Redirect--One Family Member
- Did Not Redirect--Five People

Why did you decide that?_________________________

How much moral engagement was required for this mission?
- 7--Extremely Engaged
- 6--Mostly Engaged
- 5--Somewhat Engaged
- 4--Neither Engaged nor Unengaged
- 3--Somewhat Unengaged
- 2--Mostly Unengaged
- 1--Not Engaged at all

End of Survey


Champaign, IL: Institute for Personality and Ability Testing.


Mockenhaupt, B. (2009). We’ve seen the future, and it’s unmanned. *Esquire, September.*


