THE EFFECTS OF DELIBERATING MORAL DILEMMAS ON DECISION-MAKING

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ABSTRACT

The purpose of this study was to determine if active deliberation of either Personal Moral (PM) dilemmas or Impersonal Moral (IM) dilemmas would have an effect on performance during the Iowa Card Task (ICT), a measure of decision-making. Males typically outperform females on the ICT (Bolla et al., 2004; Overman et al., 2004). In men, the predominant areas of the brain that increase in activation during the ICT are the right lateral OFC (BA 47), the right dorsolateral prefrontal cortex (PFC) (BA 9, 10) and the right parietal lobe (BA 40). In women, the predominant area of the brain that shows increased activation during the ICT is the left medial OFC (BA 11) (Bolla et al., 2004).

Functional magnetic resonance imaging (fMRI) studies reveal that, in contrast to Non Moral (NM) dilemmas, deliberation of IM dilemmas increase neuronal activity the right medial dorsolateral prefrontal cortex (PFC) (BA 46), an area associated with working memory, as well as bilateral areas of the parietal lobe (BA 40) (Greene et al., 2004). In addition, deliberation of PM dilemmas increased activation in the medial PFC (BA 9/10), an area involved in social-emotional processing and "higher cognition", (Greene et al., 2004) and the anterior cingulate cortex (ACC) (BA 24/32), an area associated with the detection of conflict (Moll et al., 2005).

In the present experiment, participants performed the ICT while deliberating either an NM dilemma, an IM dilemma, or a PM dilemma after ever 10 trials of the ICT. The main hypothesis is that purported increased activation of areas in the PFC associated with moral deliberation will improve performance of women on the ICT to the level of men. The results support this hypothesis, as women perform the ICT significantly better in the PM condition then either the IM or NM conditions.

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INTRODUCTION

Both emotions and higher cognitive functions in the prefrontal cortex are used to guide actions and organize behavior needed for survival (Greene et al., 2004). Rolls defines emotions as the "states elicited by rewards and punishers" (Rolls, 1999). Unconscious emotions can trigger behavioral reactions, but when unconscious emotions are processed to a certain level they become conscious feelings, and these feelings activate our attention and enable us to focus and respond appropriately to situations (Palombo Weiss, 2000). Good decision making depends on a moderate level of emotional activation. In fact, an abnormal reduction in emotion, according to Damasio's Somatic Marker Theory, contributes to impaired decision making as measured by the Iowa Card Task (ICT) and constitutes a source of irrational behavior (Bechara et al., 2000). Alternatively, it makes sense that too much emotion would interfere with decision-making, as during extreme fear and panic attacks.

The Iowa Card Task: A Measure of Decision-making

The Iowa Card Task (ICT) developed in 1994 by Bechara, is a computerized card task designed to measure decision making abilities and to assess cognitive impairment of the VM prefrontal cortex. In addition, performance on the ICT depends upon a plethora of cognitive functions: working memory; response reversal; contingency learning; associative learning; set shifting (Manes et al., 2002). The task is intended to mimic real life situations by manipulating uncertainty, reward and punishment. The goal of the ICT is to maximize profits on a "loan" of pretend money by selecting cards, one at a time for 100 trials, from any of the four decks and the participant may switch decks at any time. Every time the participant selects a card from the yellow or blue decks they receive $100,

and every time they select a card from the red or green decks they receive $50. Although the yellow and blue decks have higher rewards in the short term (representing immediate gratification), after every 10 cards chosen the participant receives a loss of $1,250, but in the red and green decks, the loss after every 10 cards is only $250. Thus in the long run, the yellow and blue decks are disadvantageous because they result in greater losses, whereas the red and green decks are advantageous because they result in overall gains (Bechara, 1994). Normal performance consists of learning to choose $50 cards instead of $100 cards because the former ones payoff in the long run. Choosing more disadvantageous cards then advantageous ones constitutes abnormal performance and results in greater losses in the long run.

Decision-making Process: Cortical Regions of Interest

Positron emission tomography (PET) studies show the areas of the brain that become activated during decision-making on the ICT are the ventromedial prefrontal cortex (VMPFC), which includes both the orbital prefrontal cortex (OFC: BA 10, 11, 13, 14, and 47/12) and the anterior cingulate cortex (ACC: BA 24/32), the dorsolateral prefrontal cortex (DLPFC: BA 9, 46, 8a), the inferior parietal cortex, and the thalamus predominantly on the right side (Ernst et al., 2002) Fig. 1. For the present study the regions of interest are the OFC, DLPFC, and the ACC and each of these areas can be subdivided.

The Ventromedial Prefrontal Cortex (VMPFC): General

The ventromedial (VM) region of the prefrontal cortex (PFC) is thought to be a critical part of the cortical system that monitors emotions or “feelings”, regulates behavior (Bechara et al., 2000) and, as such, is implicated in decision-making. The VM

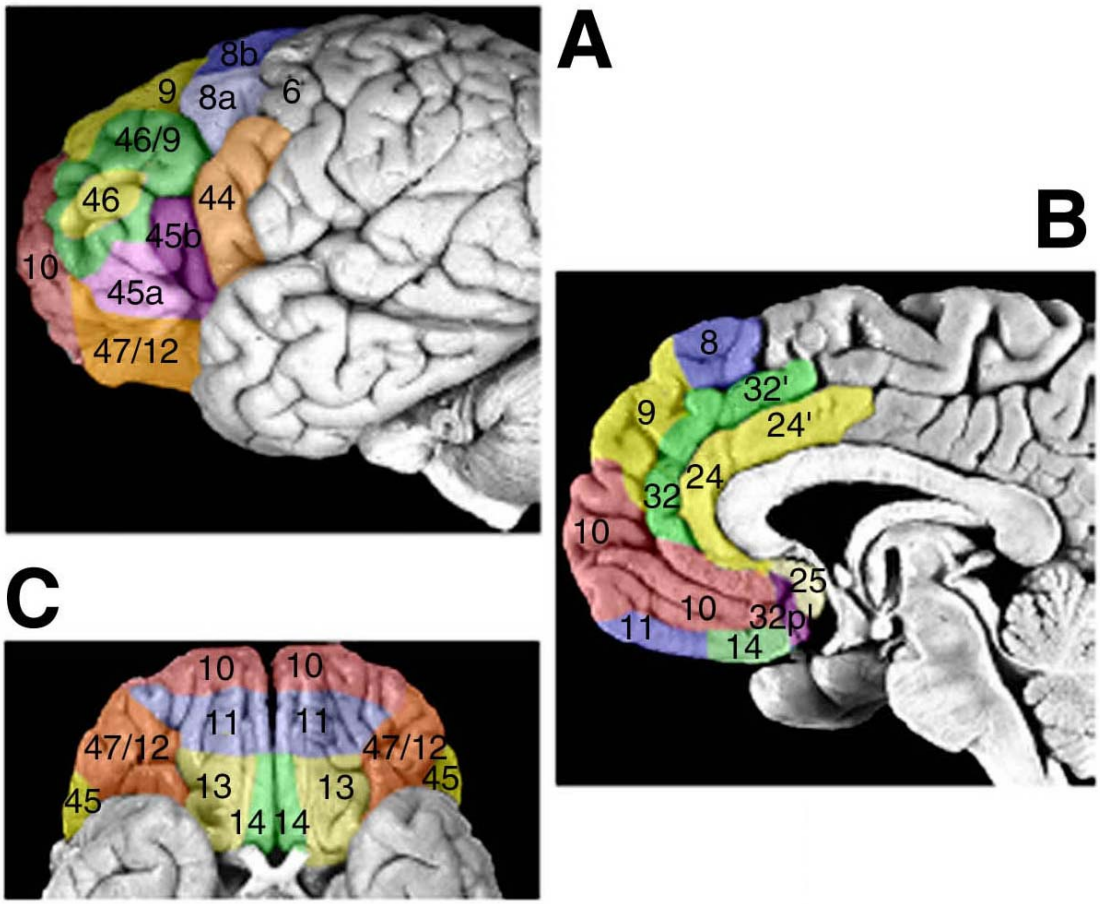

Figure 1. Three cytoarchitectonic maps of the Brain: A: Lateral PFC; B: Medial Wall (midsaggital view); and C: Orbitofrontal Cortex. Dorsolateral PFC: BA 8a, 9, 9/46, and parts of 10; Ventrolateral PFC: BA 44,45a, and 45b; Inferior Frontal Junction: Where BA 8a, 6, and 44 come together; Medial OFC: BA 11; Ventral OFC: BA 13 and 14; Lateral OFC: BA 47/12; Frontopolor: BA 10. Taken from Ridderinkhof et al. (2004).

PFC includes medial cortical regions (BA 10, 11, 13, 14) and lateral cortical regions (BA 47/12) OFC, BA 25, and lower parts (BA 24, 32) of the ACC (Figure 1) (Bechara, 2004). Even though there are some functional differentiations between these latter two areas (OFC and ACC), both regions are critical for evaluating and making advantageous decisions especially when the outcome is uncertain (Cohen et al., 2005).

The VMPFC receives both internal (from the striatum, amygdale, vascular and visceral systems) and external (from the environment) stimulation (Greene et al., 2001). This system initiates changes in behavior when contingencies alter, and contributes affective information about decisions based on rewards (Krawcyk 2002). All sensory systems send input to the OFC. A PET study by Royet et al., 2000, noted enhanced activity in the VMPFC when exposed to either pleasant or unpleasant olfactory, visual, and auditory stimuli. The activation of the same neuronal network by each of these modalities suggests that this system contributes to behavior, both the approach toward pleasure and the avoidance of unpleasant stimuli. Thus, this network is critical for guiding reward / punishment related behaviors and moods (Ongur et al., 2000). In turn, the VM then sends efferent signals to a number of subcortical structures, including the limbic system, the hypothalamus, striatum, mediodorsal thalamus, and the brainstem.

This sensory / limbic system is involved with the identification of the emotional significance of a stimulus and the production of affective states (Phillips et al., 2003) via the activation of subcortical somatic organs and the regulation of autonomic responses through projections to the vascular, visceral, and endocrine systems (Krawczyk 2002) (Phillips et al., 2003). Considering that all sensory systems as well as two emotion-sensitive sub cortical nuclei, the amygdala and the basal ganglia, send input directly to

the OFC and the ACC (BA 24/32), Damasio surmised that the VM area must be expressly engaged with bio-regulatory feed back (emotional state) and the assessment of current situations based on the internal (subjective) and external (environmental) stimuli associated with previous experiences. He reasoned that this interchange must be critical for making appropriate "on-line" decisions about real life situations (Bechara et al., 2000).

Orbital Prefrontal Cortex (OFC): Multimodal Sensory System

Because OFC (BA 10,11,13,14, and 12) (Figure 1) receives information from every sensory modality, it is crucial for stimulus reinforcement and is connected to the rest of the brain in a distinct way (Kringelbach et al., 2004). Of all the sensory systems only olfaction functions will be reviewed here as it is important later in the paper.

General Function of OFC: The primary function of the OFC is to maintain stimulus reward associations (Rolls 2004). It is also involved in rapid learning and reversal of associations once contingencies in environment have changed (Kringelbach et al., 2004; Fellows et al., 2004). The OFC sends messages to the striatum that stimulate appropriate behaviors during changing contingencies (Rolls 2004). Besides subcortical structures such as the amygdale and the ventral striatum (Phillips et al., 2003), the OFC is reciprocally connected to areas within the DLPFC, BA 9 and 46 (Kringelbach et al., 2004). The OFC appears to modulate performance by both emotional (affective) and motivational (reward/punisher) factors (Ursu et al., 2005). According to Rolls, the OFC is involved with emotion because it represents rewards and punishers (Rolls, 2004). The OFC is purported to store recent rewards without the need for on-going firing of neurons

for reinforcement (Rolls 2004) and the OFC is also activated during social-emotional situations (Moll et al., 2005).

Performance on the Iowa Card Task (ICT) depends upon the functional integrity of the OFC. The ability to make "good" decisions is determined by the number of "advantageous" cards chosen during the task (Bechara, 1994) See below. In a study by Bechara et al. (2000), patients with damage to the medial OFC performed poorly on the ICT and switched decks after punishers. They returned more often to the cards yielding high immediate rewards and only sporadic losses. Patients with OFC damage were unable to make the association between bad decks and long term punishers. Some patients could verbalize which were the advantageous decks, but were unable to act on their knowledge as they continued to choose disadvantageous cards (Bechara et al., 1994; Bechara et al., 2000).

Damage to the OFC (BA 10/11) is also associated with poor impulse control: inability to inhibit behavior, inability to delay gratification, rapid processing of information and novelty seeking (Horn et al., 2003). Animal studies reveal that the OFC mediates reversal learning but not set shifting (McAlonan et al., 2003). Patients with damage to their OFC are unable to inhibit or modify their behavior even when it is followed by negative outcomes (Moll et al., 2005). Although damage to the OFC does not effect social "knowledge", it is often associated with anti social behavior and an inability to empathize with other people (Moll et al., 2002), that is sometimes referred to as "acquired sociopathic" syndrome (Horn et al., 2003).

FMRI studies have further disclosed that there is a distinction between the medial (BA 11, 47)(Bolla et al., 2004) and the lateral OFC (BA 10)(O'Doherty et al., 2001).

Medial OFC: Medial OFC (BA 11,47) activation is correlated with primary reinforcement rewards such as pleasant odor (Krawczyk 2002), and secondary reinforcement such as monetary gains (Rogers et al., 2004). The medial OFC (BA 11, 47) becomes bilaterally activated in the presence of rewards (Northoff, 2000) and is purported to monitor and retain reward values (O'Doherty et al., 2001; Elliott et al., 2000). This region is thought to keep track of the magnitude of the reinforcement verses expectation (Elliott et al., 2003) through stored associations from prior events (Krawczyk 2002). Bilateral activation of the medial OFC is positively correlated with the magnitude of monetary rewards and negatively correlated with losses (O'Doherty et al., 2000) (O'Doherty et al., 2001). An fMRI study revealed that following reward outcome verses punishing outcome, when the medial OFC is activated by monetary gain/rewards, the lateral OFC is depressed (O'Doherty et al., 2001).

Assessing the emotional perspective of another person, what they are "feeling", is attributed to the medial OFC (BA 11 & 25) (Hynes et al., 2005). During moral judgments Moll et al. (2001) found greater activation in the left medial OFC (BA 10/11). See below.

Olfactory Function of Medial OFC: The medial OFC is extensively involved with the sense of olfaction. No other sensory system has such direct contact with the neural substrates involved in emotion and memory. The olfactory nerve is separated from the medial orbitofrontal cortex by only two synapses, from the amygdala by two synapses, and from the hippocampus by three synapses (Herz, 1997). The primary olfactory cortex (POC), located at a junction between the anterior section of the medial temporal lobes and the posterior section of the ventral frontal lobes, projects to the posterior and central

medial orbitofrontal cortex (BA 11), thus this area is viewed as a secondary cortical association area for the olfactory system (Tanabe et al., 1975). During a positron emission tomography (PET) study by Dade et al. (1998) the OFC area became activated when previously presented odors were recognized, but not during the encoding (learning) of new odors. The right OFC appears to be dominant in processing certain types of olfactory information as patients with lesions to the right OFC have greater olfactory deficits than patients with damage to the left OFC. However, in olfactory aversion studies, activation to the left OFC was dominant (Zatorre et al., 1991). Also, noteworthy is the fact that in an experiment by Sobel et al. (2000) the OFC showed prolonged activation to odorants, where as the POC showed transient and habituating responses to odors (Zald et al., 2000).

Lateral OFC: Activation of the lateral OFC (BA 10) is correlated with punishment (Northoff, 2000) and it is specifically involved with the evaluation of punishers. Activation of the right lateral OFC is positively correlated with the amount of monetary loss and negatively correlated with reward (O'Doherty et al., 2000; O'Doherty et al., 2001; Kringelbach et al., 2004). An fMRI study revealed that following punishing outcome verses reward outcome, when the lateral OFC is activated by monetary losses/punishers, the medial OFC is depressed (O'Doherty et al., 2001).

Activation of the right lateral OFC also correlates with arousal / excitement (Krawczyk 2002) and the right anterior lateral OFC (BA 10/11) is activated during response inhibition (Horn et al., 2003). Ursu et al. (2005) found that counterfactual effects of punishers were represented in the lateral OFC as well. Cues signaling the absence of monetary incentives elicited more activation in the lateral OFC than did cues

signaling monetary incentives, thus the lateral OFC was involved with potential penalties as well (Ursu et al., 2005) and the anticipation of disappointment "feeling" associated with a negative outcome.

Cognitively determining the actions of another individual, what they are doing, is attributed to the lateral OFC (BA 47) and the anterior OFC (BA 10) (Hynes et al., 2005). During moral judgments Hauke et al., (2001) noted greater activation in the right lateral OFC (BA 9) as well as bilateral activation of the VMPFC (BA 10/11).

Anterior Cingulate Cortex (ACC) Functioning

The ACC (Figure 1) is purported to convey information that conflict has occurred and that cognitive control processes are needed (Botvinick et al., 2001). Conflict occurs when mutually exclusive responses overlap processing pathways (Braver et al., 2000) such as is present in the "Stroop" exercise (Barch et al., 2000), or when two conflicting tendencies are activated simultaneously (Fassbender et al., 2004). The ACC is associated with mediating such response conflicts (Greene et al., 2004; Botvinick et al., 2001) and deploying cognitive control when needed (Greene et al., 2004). An fMRI study revealed that the ACC (BA 24/32) is involved with the control and selection of appropriate behavior and conflict/error monitoring (Cohen et al., 2005).

During "high" levels of conflict, the ACC becomes greatly activated (Botvinick et al., 1999; Rubia 2004). During event related fMRI studies, there is increased activation bilaterally of the ACC when subjects have to over-ride pre-potent response tendencies (Carter et al., 1998; Garavan et al., 2005). During unsuccessful inhibition of a behavior, the ACC and the lateral OFC (BA 10) are activated (Rubia 2004) and during high risk choices vs low risk choices, the ACC and the OFC both show increased activation

(Cohen et al., 2005). As inhibitory difficulty decreases, the ACC decreases in activation and the right DLPFC increases (Garavan et al., 2005).

During the deliberation of Personal Moral dilemmas (see below) an fMRI study showed increased activation of the ACC (BA 32) (Greene et al., 2004). Under differing situations, regional activation within the ACC is revealed: conflict monitoring is purported to be controlled by the caudal area of the ACC (Fassbender et al., 2004); the rostral ACC is purported to be associated with error detection (Fassbender et al., 2004; Rubia 2004); the dorsal ACC is predominantly involved with error monitoring (Cohen et al., 2005); and the ventral ACC becomes activated during high risk choices (Cohen et al., 2005). Individual feelings and attention to subjective emotional responses activates the dorsal/rostral ACC (BA 24/32) (Davidson et al., 1999; Rubia 2004).

Dorsolateral Prefrontal Cortex (PFC) Functioning

The DLPFC (BA 9, 10/46) (Figure 1) is purported to mediate cognitive functioning (Moll et al., 2001), maintain relevant information and deliberate during decision-making tasks (Krawczyk 2002). During cognitively demanding tasks, activation in the DLPFC correlates with greater concentration (Gray et al., 2001) and attention is directed away from emotions (Phillips et al., 2003). Performance on the ICT is correlated with working memory (Bechara 2004) and the DLPFC (especially BA 46) is the predominate area associated with working memory (Bechara 2004). The DLPFC is reciprocally connected to the OFC (BA 10,11,12,14) (Kringelback et al., 2004). An fMRI study revealed that during the ICT, the DLPFC (BA 6,8,9,10) is significantly activated predominantly in the right hemisphere (Rogers et al., 2004). Damage to the DLPFC (BA 9) impairs performance on both the ICT (Fellows et al., 2005) and the WCST (Bechara et al., 2000).

Patients with DLPFC damage also show deficits in making interpersonal judgments such as evaluating accurately emotional facial cues and other non verbal information conveyed during social interaction (Mah 2004).

The left DLPFC is involved with goal planning (Davidson et al., 1999), maintenance of task setting (Garavan et al., 2005) and it has been implicated in accurate response inhibition (Fassbender et al., 2004). The right DLPFC is specifically purported to be involved with working memory and monitoring of information (Elliott et al., 1999) and increased activation is associated with ambiguous / uncertain situations (Krawczyk et al., 2002).

A study using both an fMRI and an EEG implicated the DLPFC (BA 9, 46, 6) in deliberate or "controlled" response inhibition, switching to a more appropriate response over pre-potent motor responses (Garavan et al., 2005). During "difficult" (multiple choices) decision-making, where inhibitory control is required, increased activation occurs in the DLPFC, the ACC, and the inferior parietal cortex (BA 40), in predominantly the right hemisphere (Garavan et al., 2005; Rogers et al., 2004). In general, over-riding a response is accomplished by the right DLPFC, unless urgency is required in which case the ACC (BA 24) becomes activated (Garavan et al., 2005). Both increased attention (DLPFC) and conflict detection (ACC) are needed to over-ride emotional responses to personal moral dilemmas (Moll et al., 2005).

During an economic task in which subjects were told to think of themselves as managing director of a firm that produces a consumer product, patients with discrete damage to the DLPFC, as measured by an fMRI, were given advice and asked to evaluate it, rate the advisors, and predict an economic outcome. Patients with right DLPFC, not

OFC, lesions were able to assess information accurately but were unable to use it, and the patients with damage on the right side were significantly worse at using the information (Gomez-Beldarrain et al., 2004). Whereas patients with OFC damage could neither assess nor use information and those patients damaged on the right side were significantly worse at assessing information (Gomez-Beldarrain et al., 2004).

Hemispheric Lateralization and Decision-making

Right Hemisphere

Compared to the left hemisphere, the right hemisphere is more involved with analogical reasoning, defined as the ability to draw conclusions from given information (Gomez-Beldarrain et al., 2004). Aversive emotional stimuli are known to activate the right prefrontal cortex (Davidson et al., 1999). The right DLPFC is also activated by ambiguous situations (Krawczyk 2002) which it resolves by using previously learned information (Gomez-Beldarrain et al., 2004). Semantic responses derived from memory also activate the right hemisphere (Gomez-Beldarrain et al., 2004). Sustained attention (Fassbender et al., 2004) and response inhibition (Garavan et al., 2005) are both associated with activation of the right PFC. Miller et al. (2005) discovered that when the right hemisphere of his "split brain" patient, JW, was ask to predict the next stimuli (faces), he matched the frequency probability, with which the stimuli previously had occurred (Miller et al., 2005). This may be a bit misleading as the "interpreter" is believed to reside in the hemisphere associated with the task, and faces are right brain dominant (Miller et al., 2005).

It is important to note that the ICT is considered to be a right hemispheric task (Ernst et al., 2002). Patients with damage to the right VMPFC choose more disadvantageous

cards than do patients with left VMPFC damage (Tranel et al., 2002). Patients with right side damage to the VMPFC alone are impaired in decision-making on the IGT (Clark et al., 2003) and chose more disadvantageous cards than patients with damage to the left VMPFC, although patients with damage to the left VMPFC choose more disadvantageous cards than controls. (Clark et al. (2003) uses the term VM without specifying the particular Brodman's Area). On the Cambridge Gamble Task, patients with lesions in the right hemisphere tend to place higher bets in the descending probability condition than in the ascending probability condition (Clark et al., 2003). The Cambridge Gamble Task

An fMRI study by Davidson and Irwin, 1999, revealed that increased neuronal activity in the right anterior medial prefrontal cortex (BA 24/32) was correlated with the processing of negative affect (Davidson et al., 1999), thus Davidson hypothesized that negative emotions were lateralized toward the right hemisphere. The right lateral PFC is involved with processing negative feedback (Jimura et al., 2004). Negative pictures activated the right VLPFC (Dolcos et al., 2004) which is dominant in processing negative emotions (Dolcos et al., 2004). Aversive emotional stimuli and aversive emotional responding particularly activated the right PFC (Davidson et al., 1999). Negative affect and avoidance behavior is associated with activation in the Right PFC, particularly in the right ACC (Davidson et al., 1999). When induced sad emotions were compared with neutral emotion, activation was noted in the right OFC (BA 11), the left VLPFC (BA 10/47) and the dorsomedial PFC (BA 8)(Keedwell et al., 2005).

Left Hemisphere

PET studies reveal that the left hemisphere is primarily engaged in emotional and sensory processing (Ernst et al., 2002). FMRI studies show that the left DLPFC (BA 8/9) is dominant in processing positive emotions and affects (Dolcos et al., 2004). In a PET study by Royet et al. (2000), the ventromedial prefrontal cortex (VM) in the left hemisphere appeared to be more dominant in the processing of emotions as the ventromedial prefrontal cortex in the right hemisphere was less activated during emotionally arousing stimuli. In an fMRI study, when induced happy emotions were compared with neutral emotion, activation was noted mainly in the left hemisphere (Keedwell et al., 2005). An fMRI study by Davidson and Irwin (1999) revealed that increased neuronal activity in the left anterior medial prefrontal cortex (BA 24/32) was correlated with the processing of positive affect (Davidson et al., 1999). Thus, Davidson hypothesized that positive emotions were lateralize toward the left hemisphere. Patients with damage to the left PFC were more likely to develop depressive symptoms purportedly because they are unable to experience positive rewards when compared with patients with lesions to the right PFC who were less able to attend to negative stimuli (Davidson et al., 1999).

The left hemisphere is guided by contextual cues and makes responses based on environmental factors (Gomez-Beldarrain et al., 2004). Patients with right DLPFC damage choose “context”, rather than “content” driven answers and the left brain becomes activated during “rule based” decisions (Gomez-Beldarrain et al., 2004). During behavior correction (Garavan et al., 2005) or as the difficulty of decisions increase, i.e. more choices are available, the left lateral PFC increases in activation (Elliott et al.,

1999). “Guessing” is primarily attributed to the left VM OFC. When Miller’s split brain patient JW was using his left brain to predict occurrence of stimuli, he claimed that he was only guessing (Miller et al., 2005). An fMRI study showed that during a guessing task in which there was no possibility of associative learning and the correct response occurred entirely by chance, the medial OFC (BA 11) was activated bilaterally and the lateral OFC (BA 47) was more activated in the left hemisphere than in the right (Elliott et al., 1999).

Cognitive Functions Involved During Decision-making

The process of making decisions involves several cognitive processes: goal detection; action selection, reward based association learning, response activation, response inhibition, performance monitoring, and performance adjusting (Ridderinkhof et al., 2004). These cognitive functions are supported by attention, working memory, and emotions (Bechara et al., 2000). Emotions stimulate prior information, feelings and thoughts, about the person, place or thing and help us recognize danger or opportunity in order to make an appropriate response (Bechara et al., 2000).

Specifically, the cognitive processes involved during the ICT are: the ability to attend; the ability to synthesize and remember complex reinforcement histories: and the ability to shift affect. Also, approach / avoidance conflicts arise from the decks of cards associated with both reward and punishments (Fellows and Ferah, 2005). There are other aspects of the task that need to be considered such as an analysis of the magnitude of rewards and punishments, the probability of rewards verses punishments, and the delay of rewards and punishments (Clark et al., 2004).

Damage to the OFC is associated with impaired performance on the ICT and poor decision-making in general (Elliott et al., 1999; Rogers et al., 2004). Bechara et al. (2000) found that insensitivity to future consequences was characteristic of impaired VM (OFC) patients in regard to decision making. The ICT is thought to be sensitive to future time perspective and since VM (OFC) patients have foreshortened future time perspective this is believed to be one of the reasons they perform poorly on the ICT (Fellows et al., 2004). Psychopaths (Blair et al., 2001) and pathological gamblers (Cavedini et al., 2001) appear similarly insensitive to future consequences and are impaired on the ICT. Alcoholics (Mazas et al., 2000) and poly substance abusers (Grant et al., 2000) also perform poorly on the ICT which parallels their inability to make good "personal" decisions in real life. And adolescents are impaired in their performance on the ICT relative to adults (Overman et al., 2004).

In a study by Bechara and Damasio (2001) the skin conductive responses (SCR) of substance dependent individuals (SDI) was measured during the ICT. The premise was that anticipatory SCRs during the ICT would reflect somatic responses induced by emotions preceding a selection from a previously punishing deck of card. In this study, Bechara et al., (2000) compared SDIs to "normal" participants and participants with VM lesions. They found that "normal" participants generated anticipatory SCRs, but 25, or 64%, of the 39 substance dependent individuals (SDI) showed reduced anticipatory SCRs similar to the participants with VM (OFC) lesions. Thus they concluded that impaired anticipatory SCR in SDIs was suggestive of a hypo-functioning, or under active, VM prefrontal lobe.

There is converging evidence that damage to the VM prefrontal cortex impairs reversal learning in both animals and humans (Rolls, 1994) (Fellows et al., 2003). In a recent experiment Fellows and Farah (2005) tested to see if impairment on the ICT was due to reversal learning deficits by shuffling the order of the cards. Normally VM (OFC) patients do not improve performance on repeated testing of the ICT, yet VM (OFC) patients improved performance on the "shuffle" version of the ICT, in fact, their performance was indistinguishable from controls. They tested both patients with damaged VMPFC and patients with damage to their DLPFC, only patients with damage to their DLPFC were persistently impaired in their performance. Thus they concluded that impairment on the ICT was due to reversal learning deficits and that impaired performance on the ICT could not be used to infer VM (OFC) damage.

In a study by Manes et al. (2002) they used structural neuroimaging to assess patients prior to testing and found that patients with damage to the right OFC, but not the left OFC, chose more disadvantageous cards than controls, in fact those patients with left OFC damage performed at the same level as controls on the ICT (Manes et al., 2002). Thus they concluded that performance on the ICT relies heavily on the integrity of the right OFC more so than the left OFC (Manes et al., 2002; Tranel et al., 2002).

The OFC mediates emotion driven responses (Ridderinkhof et al., 2004) and according to Fukui et al. (2005) the ICT uses an emotional component of decision-making since one way a subject can minimize the uncertainty of their responses is to develop a "hunch" as to the which are the advantageous cards (Fukui et al., 2005). VM patients have a deficit in emotions and are unable to generate autonomic responses (Green 2003). According to Bechara's Somatic Marker Theory, the reason VM patients

perform poorly on the ICT and make bad decisions in real life is because of failure a anticipate future outcomes due to an inability to generate SCRs to emotionally charged events (Bechara et al., 2000). Subcortical areas are not activated during risky decision on the ICT however, because long term anticipation is engaged, the ICT activates the medial frontal gyrus (Fukui et al., 2005) at least in men (Subjects: 14 male and 1 female). Manes et al compared the performance of four groups of patients and found that patients with damage to the dorsolateral and patients with dorsomedial prefrontal cortex damage performed poorly on the ICT, and specifically patients with lesions in the right hemisphere, more than left, were impaired in their decision making. (Manes et al., 2002). As a result of these studies, today impairment on the ICT is associated with right hemispheric damage outside of the VMPFC region (Clark et al., 2003).

Emotional Arousal, SCRs, and the ICT

Most studies regarding emotions, memory and the prefrontal cortex have used external stimuli for emotional arousal such as watching emotional film clips or pictures of raped and mutilated people (Bechara et al., 2000). Arousal from the emotionally charged pictures when compared with "neutral" pictures, correlated with an improved memory curve for both the normal participants and the patients with VM (OFC) lesions. These results indicate that even patients with impaired VM (OFC) areas can improve their cognitive functioning through the use of emotionally salient external stimuli. However, somatic signals need not be produced externally, and in fact are often generated internally or intra-cerebrally. Bechera et al. (2000) found that the recollection of highly emotional (angry) events when compared with a neutral situation generated physiological arousal in patients with VM (OFC) lesions. By measuring their SCRs and

heart rate, Bechera was able to determine that although VM (OFC) patients could easily re-experience anger, they were less able to re-experienced fearful situations (showed less physiological response) and most of them were not able to evoke happy or sad emotions from memory either. These results suggest that damage to the VM (OFC) area reduces the ability to re-experience emotions (other than anger) by simply remembering an event. Because of this inability to re-experience prior fearful/punishing situations, it is easy to understand how a patient with damage to the VM (OFC) area would not make good decisions, as measured by the ICT. Although patients with damage to their VM (OFC) area were not able to generate SCRs from (externally) looking at "emotional" pictures, when asked to (internally/subjectively) describe the "emotional" pictures, their SCRs were similar (increased) to the same level as those produced by normal participants and their performance on the ICT also improved to the level of controls (Bechara, Damasio, & Damasio, 2000).

Different Areas of the Brain Activated for Men and Women During the ICT

Males outperform females on the ICT (Overman 2002,2003,2004; Bolla et al., 2004). During the ICT, men activate extensive areas of the right lateral OFC (BA 47) and the left lateral OFC, as well as two regions of the right DLPFC (BA 9 &10) and the right parietal lobe (BA 40) (Bolla et al., 2004). Activation in the right DLPFC (BA 9) specifically correlates with the processing of stimuli with negative valence (Keedwell et al., 2005). Since, as previously mentioned, activation in the right lateral OFC correlates positively with arousal (Krawczyk et al., 2002) and the amount of money lost (O'Doherty et al., 2000; Kringelbach et al., 2004; O'Doherty et al., 2001). During the ICT, women showed smaller significant activation in the left medial OFC (BA 11), and greater

activation in the left DLPFC (BA 9) than men, and the temporal lobes (Bolla et al., 2004). Increased activation in the left hemisphere is correlated with increased difficulty of the decision (Elliott et al., 1999) and guessing is associated with activation in the left OFC (BA 47) as well as in the medial OFC (BA 11) (Elliott et al., 1999).

Moral Emotions and Judgment

Judgment as opposed to decision-making can be defined as an assessment of external stimulus on an internal, personal scale. Assessing a stimulus involves contrasting it with either semantic memory, previously stored information where there is an objectively correct response, or episodic memory, which requires self referencing of one's own attitudes and preferences based on previous experience where there is no absolute, only one, correct response (Zysset et al., 2002). Moral judgments rely on a comparison with psychological constructs such as principles and values, rights and responsibility, and justice that are true for all cultures (Moll et al., 2002). Thus there is a "wrongness" that exists independent of moral beliefs and values held by many cultures (Haidt, 2001).

Moral emotions often involve inferences about the mental states of others (Moll et al., 2002). Frequently moral judgments are based on intuitions, "gut feelings", about what is right or wrong within a specific context (Greene 2003). Thus moral judgments are influenced by emotional "feelings" rather than deliberate reasoning, and often times we have quick automatic "reactions" to social situations (Greene 2003). The superior temporal sulcus (STS) has a specific role in processing moral information (Moll et al., 2002) as it provides cues about the intentions and emotions of other people (Moll et al., 2002). Seeing oneself in a particular situation has direct impact on behavior and

decision-making is based more on social and emotional reasoning (Moll et al., 2002) than cognitive reasoning.

The Areas of the Brain Activated During Moral Cognition

Moral cognition is a combination of semantic facts, context motivations, and the emotional state of the person (Moll et al., 2005). Functional imaging studies show that the areas of the brain that are involved with moral cognition are the: anterior PFC (BA 9/10); OFC especially in medial BA 10/11/25; posterior STS (BA 21/39); anterior temporal lobes (BA 20/21/38); insula (BA 13); precuneus (BA 7/31); anterior cingulate cortex (BA 24/32) and the limbic system (Moll et al., 2005). Moral cognitive judgment about a behavior depends on the situation and cultural context in which the act occurred (Moll et al., 2005).

Moll et al. (2002) found that there were common areas of the brain activated while viewing both moral and non moral unpleasant stimuli (Moll et al., 2002) and males and females neurologically were activated similarly (Moll et al., 2001; Moll et al., 2002). The primary areas of the brain activated by unpleasant non-moral stimuli were the left lateral OFC as well as the left amygdale (Greene et al., 2002). In an fMRI study, Zysset et al. (2003) observed that the dorsal anterior medial PFC (BA 9/10) became activated during the determination of appropriate action that involved the formation of a response based on a feeling of "rightness" (Zysset et al., 2003). This particular area is also known to become activated during evaluating judgments and self-referential processing (Zysset et al., 2002).

Northoff et al. (2004) found that judging / assessing a situation from a photograph, with either emotional or non emotional undertones, increased activation in the VLPFC

(BA 10) and the DLPFC (BA 46/9) and decreased activity in the VMPFC (BA 11) and the DMPFC (BA 9). Another fMRI study revealed that cognitive tasks increased activation in the lateral PFC and decreased activation in medial PFC, and emotional processing increased activation in the medial PFC and decreased activation in the lateral PFC (Grimm et al., 2005). Goel and Dolan (2003) found a reciprocal relationship between lateral and ventral medial PFC during hot and cold reasoning. Enhanced activity was noted in the lateral/dorsal lateral PFC during "cold" reasoning condition with neutral content and greater activation was noted in the VMPFC during "hot" reasoning condition with emotionally salient content (Goel et al., 2003). Grimm et al. (2005) further segregated the neural activity within the PFC into areas that represented different emotional dimensions. Valence, which combines a quality and an affective aspect of the stimuli, significantly correlated with activation in the VMPFC and DLPFC. Pictures with negative valence were represented in the right DLPFC and pictures with positive valence were represented in the left DLPFC. Intensity of emotion significantly correlated with VLPFC and DMPFC (Grimm et al., 2005). They further observed that emotional judgment increased activation in the VLPFC and the DLPFC.

Areas of the Brain Activated During the Deliberation of Dilemmas

According to Greene et al. (2001), in order for a situation to be considered a Personal Moral dilemma (as opposed to a impersonal moral dilemma) it has to meet three criterions. It is a situation in which: it could reasonably be expected to lead to bodily harm to oneself or another individual; the harm is not the result of deflecting an existing threat onto another party; the harm is to a particular person or group of people. Greene found that during the deliberation of *Impersonal* Moral dilemmas verses Non Moral

dilemmas the right DLPFC (BA 46), and the bilateral inferior parietal lobe (BA 40) increased in activation. These are areas that are commonly associated with working memory and "cognitive" processes (Greene et al., 2004). But during the deliberation of *Personal* Moral dilemmas, in addition to the above mentioned "cognitive" areas, the medial PFC (BA 9/10), posterior cingulate/precuneus (BA 31/7), and bilateral superior temporal sulcus (BA 39) exhibited greater activity, but the amygdale was not activated (Moll et al., 2002). These are areas that are associated with emotional and social cognition (Greene et al., 2004). Normally there is a neurological "body loop" that signals both subcortical structures (amygdale) and cortical regions (the OFC) about the nature of our emotional state (Bechara 2004), but during Personal Moral dilemmas the amygdale were not activated (Moll et al., 2002). Moll speculated that the increased activation of the anterior medial OFC must decrease activation of the amygdale (Moll et al., 2002).

Observing fMRI results, Moll et al. (2002) noted that when moral emotions were provoked by viewing pictures with moral violations to self or others, activity of and connectivity between the medial OFC and the STS increased (Moll et al., 2002). The OFC is critical for integrating emotions with moral knowledge as it receives projections from the STS (Moll et al., 2002). During the process of deliberating PM dilemmas, cognitive and social emotional responses are integrated into the process of decision-making (Greene et al., 2002). Social emotional reactions drive people to disapprove of moral violations but cognitive responses drive people to approve of moral violations if they are for the greater good of the most people (Greene et al., 2004). There is an immediate emotional reaction in response to a violation against one's morals; of course you couldn't do that. But, if it were for some greater purpose or the salvation of many

people, then you might consider doing it. Greene suggests that social-emotional and cognitive processes are competing subsystems in the brain (Greene et al., 2004) and that the DLPFC becomes active during moral dilemmas in order to implement cognitive control (Greene et al., 2004) and to suppress emotional responses during moral reasoning (Greene et al., 2002). This is a key point with regards to this current study.

Greene further delineated the PM dilemmas into "difficult" and "easy" and then compared brain activation between the two groups. In this fMRI study he noted that "difficult" PM dilemmas activated areas associated with emotion in addition to the cognitive areas activated with the "easy" PM dilemmas (and the Impersonal Moral dilemmas) and the time it took to respond, answer the query, was increased. An example of a "difficult" PM dilemmas is: "Is it appropriate for you to employ your daughter in the child pornography industry in order to feed your family?" An example of an "easy" PM dilemmas is: "Your plane crashed in the Himalayas... Is it appropriate to kill a boy (with a broken leg whose chances of surviving are zero) and eat his remains so that you and another person will survive? Greene surmised that because of the need to violate a personal moral code in order to respond with a "utilitarian" decision, conflict was induced (Greene et al., 2004), and that the reason subjects' response times were increased during "difficult" PM dilemmas but not "easy" PM dilemmas, was because it took longer for them to overcome their emotional reactions to the situations (Greene et al., 2002). He concludes that areas BA 9 and 10 are responsible for the integration of emotion and cognition during complex decision-making (Greene et al., 2001).

PM Dilemmas: Integration of Social-Emotional-Cognitive Processes:

Both emotion and reason influence moral decisions. Greene believed that the degree to which emotional processes were engaged during moral judgments would influence the decisions that were made regarding a moral dilemma (Greene et al., 2001). Although people tend to have automatic responses to dilemmas with moral content, cognitive processes can override these reactions when necessary to make "utilitarian" decision (Kahneman, 2003). And it is this combination of cognitive and affective processing that drives our decisions about appropriate behavior in non normative ways (Gehring et al., 2002). In Greene's opinion, true morality involves both emotion and reason (Greene et al., 2002).

In an fMRI study by Greene et al. (2001), emotional arousal (activation of the VM prefrontal cortex) was internally generated by the deliberation of Personal Moral dilemmas, and the subsequent neuronal activation was analyzed. In this study, brain activity was compared during the deliberation of three different types of situations: Non Moral (NM) dilemmas, Impersonal Moral (IM) dilemmas, and Personal Moral (PM) dilemmas. (See appendix)

In Green's experiment, the PM condition activated the brain in a significantly different way than in the IM and the NM condition. Participants during the deliberation of PM dilemmas took a longer time to respond whether it was appropriate or not, and Greene speculated that this was due to an increased emotional response in conflict with rational cognitive thought processes (Greene et al., 2001). He also reported that areas in the brain associated with working memory, right DLPFC (BA 46) and bilaterally inferior parietal lobe (BA 40), were less active during PM decisions (Greene et al., 2001).

Generally speaking, areas associated with working memory become less active during emotional processing as compared with cognitive processing. In fact, within the OFC, when the medial area (BA 11 and 25) becomes activated during the assessment of the emotional "feeling" state of another person and the lateral / anterior area (BA 47 and BA 10), the area activated when making a cognitive attribute about another person (Hynes et al., 2005), becomes less activated. Thus Greene proposed that the deliberation of PM dilemmas must be driven by the social emotional sub system (Greene et al., 2004).

Likewise, Moll suggests that the OFC becomes activated due to the presence of the social-emotional situation portrayed in a personal moral dilemma. The DLPFC is employed to enforce cognitive control over the emotional response and the ACC becomes engaged due to the emotional / cognitive conflict (Moll et al., 2005). Both the DLPFC and the ACC are needed to override emotional reactions in order to generate a "utilitarian" response to personal moral dilemmas (Moll et al., 2005). Thus Moll conjectured that the cognitive phenomenon of morality comes from the integration of content and context dependent representations in the cortical limbic network.

It is important to note that according to Greene, personal moral judgments are driven by "social-emotional" responses while impersonal moral judgments are driven by more "cognitive" processes (Greene et al., 2004). Within the Personal Moral dilemmas, the appropriateness of a moral violation is considered, and cognitive control must be engaged to override the immediate elicited cognitive response of what is right or wrong long enough to consider the social-emotional aspects of a situation and the appropriate decision given the circumstances (Greene et al., 2004). In "difficult" Personal Moral dilemmas areas of the brain associated with both abstract emotional reasoning and

cognitive control (the DLPFC and the ACC) are recruited to solve the dilemma. By integrating emotional biases and cognitive evaluations, people are better able to assess the social consequences of their actions (Moll et al., 2002).

Within the prefrontal cortex, the orbitofrontal and dorsolateral cortex must work together to regulate human social behavior. Moll et al., 2001, speculated that there must be dissociation between knowing how to act and behaving in a socially acceptable way, since lesions to the OFC hinder a person's ability to behave in a socially acceptable way, but not their ability to judge moral situations accurately.

During the deliberation of PM dilemmas Greene noticed that reaction times were longer than for the other two categories of dilemmas. He hypothesized that the longer response time during the deliberation of Personal Moral dilemmas was related to having to integrate increased emotion with cognitive processing. Both cognitive and emotional processes play a role in "higher cognition" (Greene et al., 2004), and it is the integration of the two that drives behavior in non normative ways (Gehring et al., 2002). By integrating emotional biases and cognitive evaluation, humans are better able to judge the social consequences of their actions and other people's actions (Moll et al., 2002). Since cognitive processes favor utilitarian judgments, it is thought that increased "cognitive" activity in the DLPFC would be indicative of a utilitarian judgment (Greene et al., 2004).

Pochon et al. (2002) proposed a theory of emotional gating in which adverse emotional signals were inhibited so as to maximize cognitive functioning (Pochon et al., 2002). Northoff et al. (2004) found that there was indeed a reciprocal modulation / attenuation of neural activity in the ventral medial PFC (VMPFC) and the DLPFC. In non emotional cognitive judgment tasks they observed reciprocal modulation between

medial and lateral PFC with increased activation in the Ventral Lateral PFC (VLPFC) and DLPFC and decreased activation of the VMPFC/DMPFC. However the inclusion of an emotional component with the cognitive judgment task lead to smaller signal increases in the VLPFC/DLPFC and at the same time smaller signal decreases in the VMPFC/DMPFC (Northoff et al., 2004).

The Purpose of this Study

In summary, males outperform women on the ICT (Bolla et al., 2004; Overman et al., 2004). During the task, males activate the lateral OFC (BA BA 47) predominantly in the right hemisphere (Bolla et al., 2004) an area associated with the evaluation of punishers (O'Doherty et al., 2000) and the amount of money lost (O'Doherty et al., 2001; Krawczyk et al., 2002). Males also activate two regions of the right DLPFC (BA 9, 10) and these areas correlate with arousal / excitement (Krawczyk et al., 2002) and is associated with reasoning, the process of formulating opinions (Gomez-Beldarrain et al., 2004). Greater activation in the right hemisphere is associated with better performance on the ICT. For women, the medial OFC (BA 11) is predominantly activated in the left hemisphere during the ICT (Bolla et al., 2004) and this area is associated with the evaluation of rewards and representation of the magnitude of monetary gain (Rogers et al., 2004). Activation in medial OFC correlates with increased difficulty (more options) when making a decision and is associated with guessing (Elliott et al., 1999). In general, greater activation of the prefrontal cortex in the left hemisphere is associated with positive affect and emotional / feeling / sensory processing (Davidson et al., 1999). During the deliberation of Impersonal Moral dilemmas as opposed to Non Moral dilemmas, areas of the brain associated with cognitive processing (right DLPFC, BA 46,

bilateral inferior parietal lobe, and BA 40) are activated similarly in both males and females (Greene et al., 2004) and during the Personal Moral dilemmas in addition to the above areas, the following areas were also activated: bilateral medial PFC (BA 9/10), bilateral posterior cingulate/precuneus (BA 31/7), and bilateral superior temporal sulcus (STS)/inferior parietal lobe (BA 39).

The purpose of this study is to determine if the deliberation of moral dilemmas (IM and PM) will improve decision-making as measured by performance on the ICT (greater numbers of advantageous cards chosen) by purportedly engaging areas of the brain associated with cognitive processing (right DLPFC), in combination with areas associated with emotional processing (left medial PFC).

Hypotheses

Hypothesis 1

Males will outperform females in decision-making as measured by their performance on the ICT during the NM (control) dilemma condition. Specifically it is hypothesized that males will choose significantly more advantageous and significantly fewer disadvantageous cards than females while deliberating non moral dilemmas.

Hypothesis 2

Female decision-making performance on the ICT will rise to the level of male performance, equivalent number of advantageous cards chosen, in both the IM and PM condition.

Hypothesis 3

Female attraction to “plus” cards will decrease, and they will become more responsive to the valence of the “punishment” cards during the IM and the PM

conditions. Specifically it is hypothesized that females will choose fewer "plus" cards during the ICT in the IM and PM conditions than in the NM condition by purportedly changing their predominantly left hemispheric activation (associated with positive valence) to predominantly right hemispheric activation (associated with negative valence).

Hypothesis 4

Males will improve their decision-making as measured by their performance on the ICT when the areas of the brain associated with emotional / affective processing (left medial OFC) is engaged by the deliberation of personal moral dilemmas. Specifically it is hypothesized that male performance on the ICT will increase, more advantageous cards chosen in PM condition than in the NM condition.

Hypothesis 5

Participants, who answer non-normatively (below the mean number of normative answers) to PM dilemmas will make better decisions on the ICT, choose a greater number of advantageous cards, than those participants who answer normatively (above the mean number of normative answers).

METHODS

Participants

There were 199 participants in this study all of whom were young adults ages 18 to undergraduate classes. Each of the three conditions was balanced with approximately half males and half females. The groups consisted of the following: 65 subjects were given Non Moral (NM) dilemmas to read (33 females, 32 males); 70 subjects were given

Impersonal Moral (IM) dilemmas to read (36 females, 34 males); 64 subjects were given Personal Moral (PM) dilemmas to read (32 females, 32 males). IRB approval was obtained and each participant signed an informed consent form prior to the start of the experiment.

Materials

All of the information for each participant was kept in a manila folder, made up in advance, with the participant's name, gender (A-females or B-males), and assigned number written on the tab. Even numbered participants were assigned to the "Experimental" condition (PM dilemmas) and odd numbered participants were assigned to the "Control" condition (NM dilemmas). The Impersonal Moral (IM) dilemmas were added later. Prior to the beginning of the experiment, each participant was given an informed consent form, stating that all information obtained in the study would be held in confidence, and at the bottom of the page there was a place for their signature and the date. (*Appendix A*) Then they were given a brief confidential personal information questionnaire to fill out. (*Appendix B*). In addition every person was administered the Smell Identification Test™ (SIT ™) per the instructions in the SIT™ Administration Manual (*Appendix C*). (Sensonics, Inc, Haddon Hts, NJ). Each participant was given a passage instruction / answer sheet and asked to circle either 'yes' or 'no' as to whether it is appropriate or not to do (*Appendix D*).

Twenty, of the twenty-five, Personal Moral dilemmas, utilized in the study by Greene et al. (2001) were employed (*Appendix E*). The twenty Personal Moral dilemmas were rated for emotional impact from low to very high on a 5 point scale by ten UNCW lab students. Then the dilemma situations were selected based on reaction ratings and

pseudo randomly placed in each of the four 50-card-trial Blocks. Similarly, twenty Non Moral (NM) dilemmas were taken from the same afore mentioned study and used for the "control" condition. (*Appendix F*) (Green et al., 2001) And twenty Impersonal Moral (IM) dilemmas from the same study were used later as an additional "control" condition. (Appendix G). The different dilemmas were numbered and placed one per page in individual packets with separate cover sheets for each condition marked: 'even' for the PM condition, 'odd' for the NM condition, or 'new' for the IM condition.

The scale used to measure decision-making performance was a modified version of the Iowa Card Task (ICT). In the present version there were red and green decks of cards, comprised of low paying reward and punisher cards, that are consistently "advantageous" decks, and profitable over the long run, and yellow and blue decks of cards, comprised of high paying reward and punisher cards that are consistently "disadvantageous" decks, and not profitable over the long run. Decision making performance, as measured by the percent of "advantageous" cards chosen on the ICT across 200 trials, was the dependent measure (Bechara et al., 1994).

An additional measure of "plus" and "minus" cards was used to assess the subject's response to the card valence. In the present version, the red and yellow decks were designated the 'plus' cards as they yield 90% reward / reinforcement to 10% punisher cards and the green and blue decks were designated the 'minus' cards as they yield 50% reward / reinforcement to 50% punisher cards (Overman et al., 2004).

The ICT software was presented via a Macintosh computer, and the general instructions for the ICT were read out loud by the experimenter prior to the beginning of the task. (Appendix H) Finally, an ICT scoring sheet was designed to record the percent

of each color cards chosen for every 10 trials as well as the participant's statements as to which color decks were the "good" decks. There were 20-Ten Trial Blocks (4-Fifty Trial Blocks) on the ICT (Appendix I)

Procedure

Folders for the participants were numbered in advance, 1 through 60, with either A (female) or B (male) written on the tab. The even number participants were assigned to the "experimental" condition, Personal Moral (PM) dilemmas, and the odd numbered participants were assigned to the "control" condition, Non Moral (NM) dilemmas. The last 70 participants were assigned to the additional "control" condition, Impersonal Moral (IM) dilemmas.

Each subject was given an informed consent form, a confidential personal information questionnaire, a Smell Identification Test™ instruction sheet, a dilemma answer / instruction sheet, and an ICT scoring sheet. Each participant were alternately assigned by gender to one of the two conditions, either the Personal Moral dilemma "experimental" condition or the Non Moral dilemma "control" condition and were blind to the condition they were assigned. The individuals given even numbered folders were in the "experimental" group or Personal Moral dilemma condition and the individuals given odd numbered folders were in the "control" group or Non Moral dilemma condition. The last 70 individuals tested were in the "addition control" group or Impersonal Moral condition.

On the desk in front of the participants were four different colored (red, green, yellow, blue) decks of cards face down. After the experimenter had read the informed consent out loud and the participant had signed the form, the experimenter read the Smell

Identification Test™ instructions and administered the "SIT™" to the participant. Next the experimenter gave the participant a dilemma instruction / answer sheet. Then each participant heard the general instructions for the ICT and were reminded that if they constantly chose cards from the "good" decks, they would win more money than they would lose, but if they constantly picked cards from the "bad" decks, they would lose more money than they would win, and that the goal was to win as much money as possible. At the start of the game, the participant was given $2,000 in pretend money on the computer.

Then the subject turned to the first dilemma in their packet and they were instructed to, "Please read the following passage and circle yes or no next to the corresponding number on your answer sheet". Then the participant was instructed to turn one card over from any of the four different colored decks of cards (red, green, yellow or blue) and to tell the experimenter which color card they have chosen. Each card had either a reward of $100 (yellow and blue decks), or $50 (red and green decks) and/or a punisher of $1,250 (yellow deck) and either $150, $200, $250, $300, or $350 (blue deck), $250 (red deck) and either $25, $50, or $75 (green deck). The experimenter then clicked the corresponding color card on the computer monitor and the total amount of pretend money gained or lost was revealed. The resulting amount of money was automatically tabulated (deducted or added to the balance) by the computer. The monitor was in full view of the participant and at all times during the game the participant was able to view how well they were doing monetarily.

After every ten trials / card choices, the experimenter asked the participant which colored decks he/she thought were the "good" decks and noted it on the ICT scoring

sheet. Then the subject was instructed to turn to the next passage in the packet and read it. After the participant had circled yes or no next to the corresponding number of the passage on the instruction / answer sheet, the individual was asked to continue turning cards over and telling the experimenter which color card they had chosen. This procedure continued, stopping after every 10 trials / card choices to find out which two decks the participant thought were the "good" decks and to give them a new passage to read, until 20 ten-trial / card choices, or 200 total trials, had been made, and 20 passages read. At the end of the ICT, the participant was given a credit slip worth 1 credit and thanked for taking part in the experiment. Once they had left the room, the results from the ICT (the participant's card selections) were printed out and placed in their folder for later scoring.

RESULTS

Performance on the ICT was measured as the number of advantageous ($50 red and green) cards chosen across 200 trials.

Hypothesis 1

Males will outperform females in decision-making as measured by their performance on the ICT during the NM (control) dilemma condition. The following results confirmed hypothesis one, males chose a significantly greater number of advantageous cards across 200 trials than did females in the NM dilemma condition.

Hypothesis 2

Females will improve their decision-making during the deliberation of moral dilemmas (IM and PM), as measured by their performance on the ICT, to the level of

male performance, choose equivalent number of advantageous cards. The following results confirmed hypothesis two in the PM condition, but not in the IM condition. In the PM condition, there was not a significant difference found between males and females in the number of advantageous cards chosen across 200 trials.

Advantageous (Red and Green) $50 Cards

For both males and females, and in each condition, the Non Moral (NM) dilemma "control" condition, the Impersonal Moral (IM) dilemma "additional control" condition and the Personal Moral (PM) dilemma "experimental" condition, the number of cards chosen from the red and green decks of cards was collapsed (added together) to constitute the total number of "advantageous" cards chosen. And, for both males and females, and in each condition, within each of the four blocks of 50 trials / card choices, the number of cards chosen from the red and green deck of cards was added together to constitute the number of "advantageous" cards chosen in each block. An analysis of the number of advantageous cards chosen across the four "blocks / fifty trials" determined the decision making performance of participants in each of the three dilemma conditions, NM, IM and PM

Between Gender within Condition (Figure 2)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition to determine whether there was a significant gender or block effect for the number of advantageous cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.011$, $p = .915$, females ($M=33.975$), males ($M = 34.170$). There was a significant main effect of block for the mean number of advantageous cards chosen,

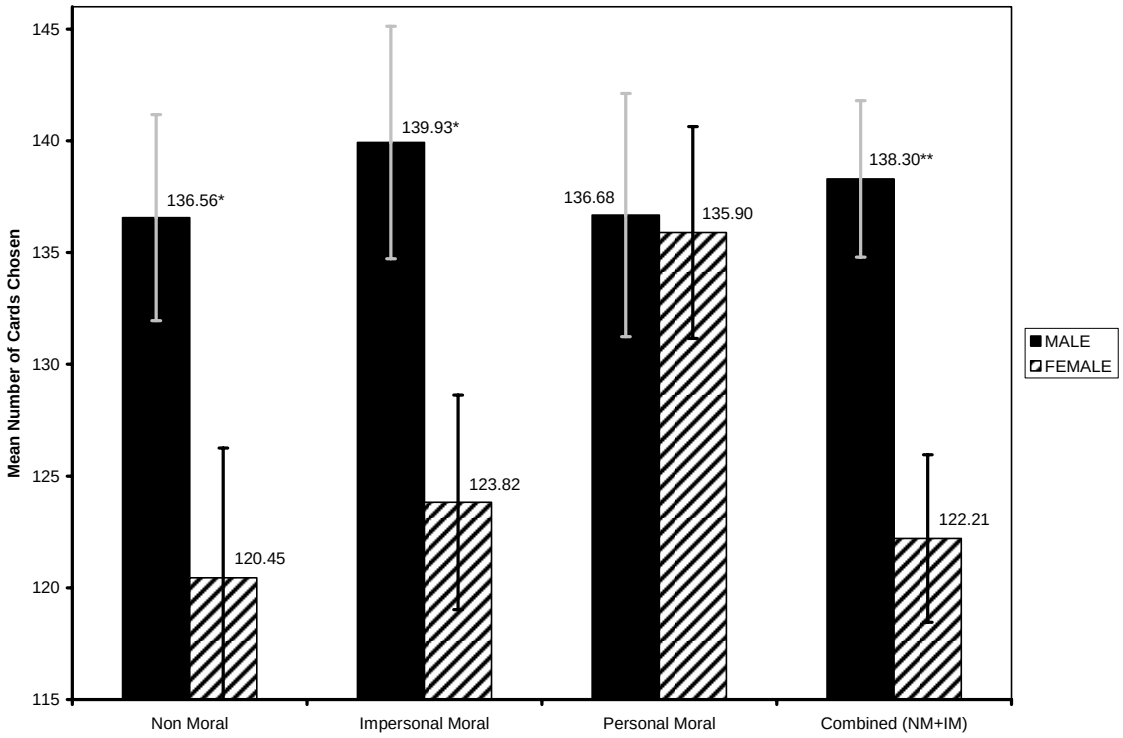

Figure 2. Mean number of advantageous (red and green) cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05, **p<.01

$F(3,186)=48.703$, p = .000, and a significant linear trend was indicated, $F(1,62)=98.400$, $p=.000$. A pairwise comparison revealed that the number of advantageous cards chosen was significantly less in Block 1 (M = 26.281), than in Block 2, (M = 34.188), $p=.000$, Block 3, (M = 35.891), $p=.000$, or Block 4, (M = 39.930), $p=.000$. There was not a significant difference in the number of advantageous cards chosen between Block 2 and Block 3, $p=.144$. Significantly fewer advantageous cards were chosen in Block 2 than in Block 4, $p=.000$, and in Block 3 than in Block 4, $p=.000$. There was not a significant interaction between gender and block, $F(3,186)=.184$, $p= .907$.

Impersonal Moral Condition: There was a significant difference found between genders, $F(1, 68) = 5.030$, $p=.028$, the number of advantageous cards chosen by females ($M=30.955$) was significantly less than the number of advantageous cards chosen by males ($M=34.982$). There was a significant main effect of block for the mean number of advantageous cards chosen, $F(3,204)=24.316$, $p=.000$ and a significant linear trend was indicated, $F(1,68)=41.585$, $p=.000$. A pairwise comparison revealed that significantly fewer advantageous cards were chosen in Block 1, ($M=27.496$) than in Block 2 ($M=33.594$), $p=.000$, or Block 3 ($M=34.446$), $p=.000$, or Block 4 ($M=36.337$), $p=.000$. There was not a significant difference in the number of advantageous cards chosen between Block 2 and Block 3, $p=.329$. Significantly fewer advantageous cards were chosen in Block 2 than in Block 4, $p=.018$, but there was not a significant difference between Block 3 and Block 4, $p=.116$. There was a marginally significant interaction between gender and block, $F(3,204)=2.277$, $p=.081$.

Non Moral Condition: There was a significant difference found between genders, $F(1,63)=4.529$, p = .037, the number of advantageous cards chosen by females

(*M*=30.112) was significantly less than the number of advantageous cards chosen by males (*M*=34.133). There was a significant main effect of block for the mean number of advantageous cards chosen, $F(3,189) = 31.481$, p = .000, and a significant linear trend was indicated, $F(1,63)=47.436$, $p=.000$. A pairwise comparison revealed that the number of advantageous cards chosen in Block 1 (*M*=24.915), was significantly less than the number of cards chosen in Block 2 (*M*=32.983), *p*=.000, and Block 3 (*M*=33.920), *p*=.000, and Block 4 (*M*=36.670), *p*=.000. Significantly fewer advantageous cards were chosen in Block 2, than in Block 4, *p*=.014, but not Block 3, *p*=.462. There was a significant difference between Block 3 and Block 4, *p*=.009. There was a significant interaction between gender and block, $F(3,189)=2.723$, p = .046.

Combined Group: Since the result of the between gender analysis for advantageous cards yielded a significant result in both the NM condition and the IM condition and there was no difference found with regards to advantageous cards chosen by males between the NM condition (*M*=136.69) and the IM condition (*M*=140.06), $F(1,64)=.228$, *p*=.635, and no difference found with regards to advantageous cards chosen by females between the NM condition (*M*=120.67) and the IM condition (*M*=124.03), $F(1,67)=.197$, *p*=.659, these two groups were combined into one group.

There was a significant difference found between genders, $F(1,133)=9.646$, p = .002, the average number of advantageous cards chosen by females (*M*=30.552) across blocks was significantly less than the average number of advantageous cards chosen by males (*M*=34.570) across blocks. There was a significant main effect of block for the mean number of advantageous cards chosen, $F(3,399) = 55.544$, p = .000, and a significant linear trend was indicated, $F(1,133)=88.819$, *p*=.000. A pairwise comparison revealed

that the number of advantageous cards chosen in Block 1 (M=26.253), was significantly less than the number of cards chosen in Block 2 (M=33.305), p=.000, and Block 3 (M=34.187), p=.000, and Block 4 (M=36.498), p=.000. Significantly fewer advantageous cards were chosen in Block 2, than in Block 4, p=.001, but not Block 3, p=.252. There was a significant difference between Block 3 and Block 4, p=.004. There was a significant interaction between gender and block, $F(3,399)=3.684$, p = .012. Post hoc analysis revealed that there was a significant difference between genders in Block 2, p=.000, Block 3, p=.017, and Block 4, p=.033, but there was no difference between genders in Block 1, $p>.329$.

Between Groups within Gender (Figures 3, 4)

Since there was no difference found with regards to advantageous cards chosen between the NM condition and the IM condition in the performance of males, $F(1,64)=.228$, p=.635, or females, $F(1,67)=.197$, p=.659, these two groups were combined into one group. A 2(Group: Personal Moral condition verses Combined condition) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of advantageous cards chosen.

Males: There was not a significant difference between groups, $F(1,96)=.063$, p=.802: Personal Moral condition, (M=34.170); Combined condition, (M=34.570). There was a significant main effect of block for the mean number of advantageous cards chosen, $F(3,288)=54.813$, p=.000, and a significant linear trend was indicated, $F(1,96)=91.839$, p=.000. A pairwise comparison revealed that the number of advantageous cards chosen was significantly less in Block 1, (M = 26.420), than in Block

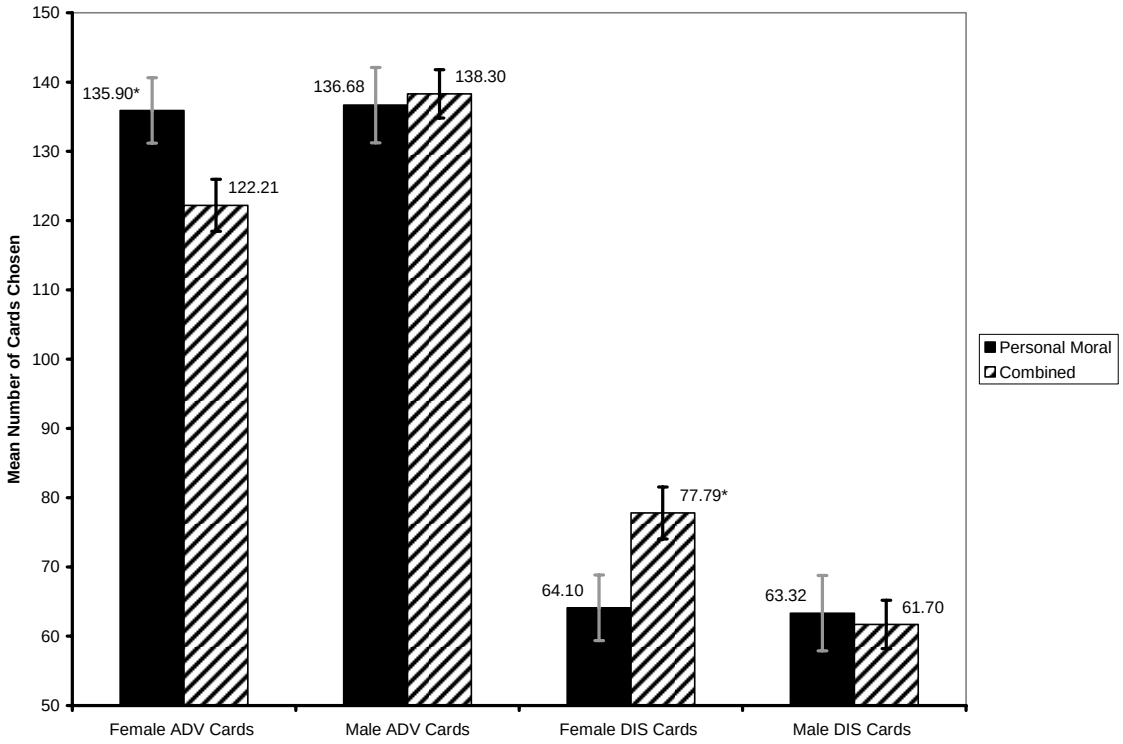

Figure 3. Mean number of advantageous (red and green) and disadvantageous (yellow and blue) cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05

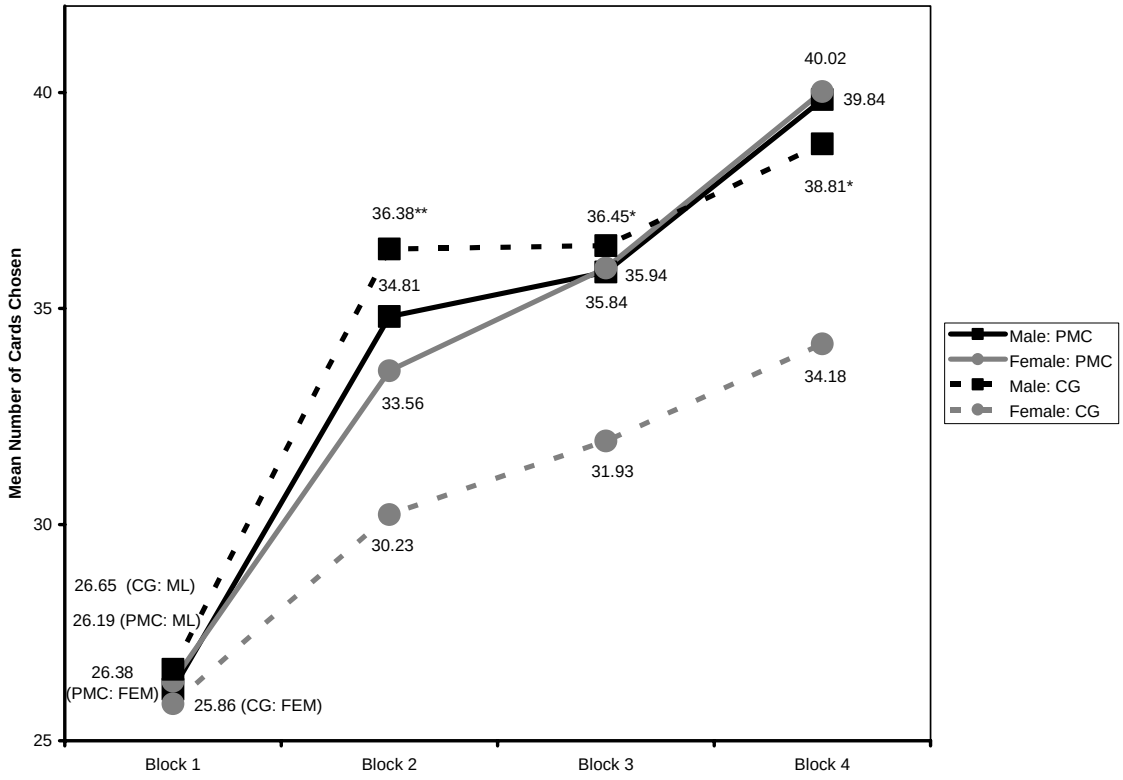

Figure 4. Mean number of advantageous (red and green) cards chosen across block as a function of gender and testing conditions. *p<.05, **p<.01

2, (M = 35.596), p=.000, Block 3, (M = 36.142), p=.000, or Block 4, (M = 39.323), p=.000. There was not a significant difference in the number of advantageous cards chosen between Block 2 and Block 3, p=.584. Significantly fewer Advantageous cards were chosen in Block 2 than in Block 4, p=.001, and in Block 3 than in Block 4, p=.002. There was not a significant interaction between group and block, F(3,288)=.509, p=.676.

Females: There was a significant difference between groups, F(1,99)=.4.513, p=.036. Significantly more advantageous cards were chosen in the Personal Moral condition, (M=33.975) than in the Combined condition, (M=30.552). There was a significant main effect of block for the mean number of advantageous cards chosen, F(3,297)=42.867, p=.000, and a significant linear trend was indicated, F(1,99)=77.760, p=.000. A pairwise comparison revealed that the number of advantageous cards chosen was significantly less in Block 1, (M = 26.115), than in Block 2, (M = 31.897), p=.000, Block 3, (M = 33.936), p=.000, or Block 4, (M = 37.104), p=.000. Significantly fewer advantageous cards were chosen in Block 2 than in Block 3, p=..032, or in Block 4, p=.000, and in Block 3 than in Block 4, p=.001. There was a marginally significant interaction between group and block, $F($3,297)=2.440, p=.065, and a significant linear trend was indicated in the interaction, $F($1,99)=.4.386, p=.039. Post hoc analysis revealed that there was a significant difference between genders in Block 4, p=.025, and a marginally significant difference between genders in Block 2, p=.088, and Block 3, p=.081. There was no difference between genders in Block 1, p=.592.

Yellow Cards

Between Gender within Condition (Figure 5)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition to

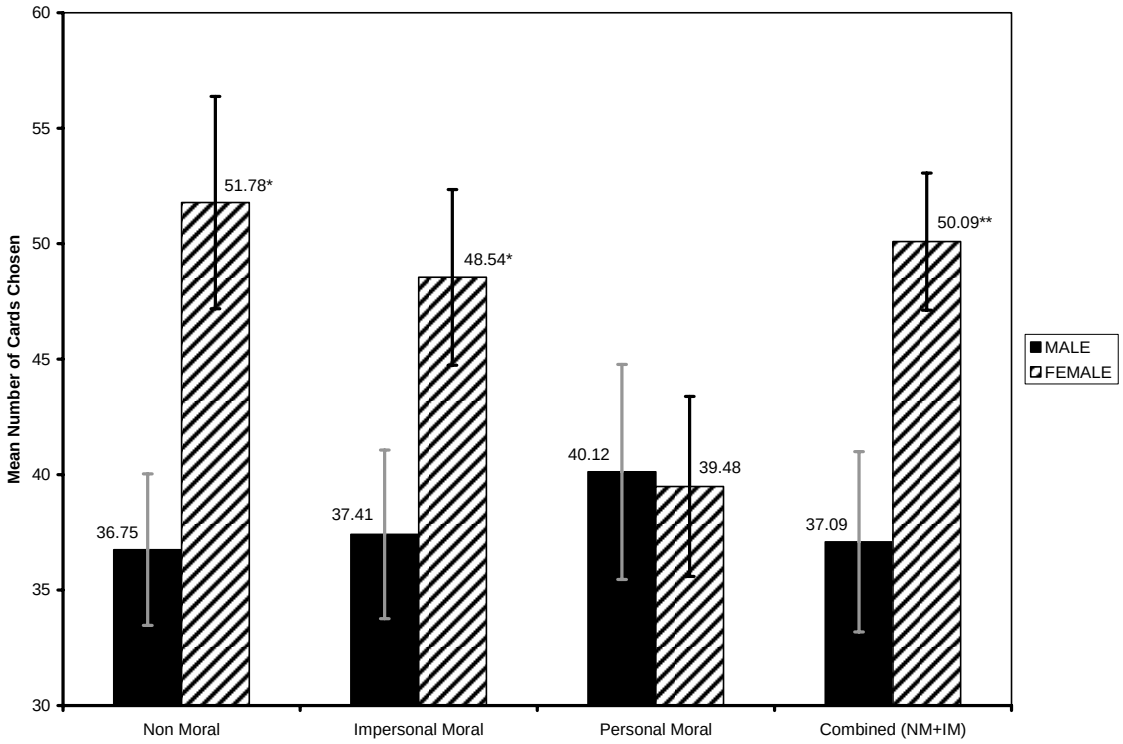

Figure 5. Mean number of yellow cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05, **p<.01

determine whether there was a significant gender or block effect for the number of Yellow Cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.010$, p = .919, females (M=9.871), males (M = 10.029). There was a significant main effect of Block for the mean number of yellow cards chosen, $F(3,186)=27.985$, p = .000, and a significant linear trend was indicated, $F(1,62)=53.820$, p=.000. A pairwise comparison revealed that the number of yellow cards chosen was significantly more in Block 1 (M = 14.609), than in Block 2, (M = 10.125), p=.000, Block 3, (M = 8.781), p=.000, or Block 4, (M = 6.285), p=.000. There was not a significant difference in the number of yellow cards chosen between Block 2 and Block 3, p=.121. Significantly more yellow cards were chosen in Block 2 than in Block 4, p=.000, and in Block 3 than in Block 4, p=.001. There was not a significant interaction between gender and block, $F(3,186)=.364$, p = .779.

Impersonal Moral Condition: There was a significant difference between genders, $F(1, 68) = 4.312$, p=.042, the number of yellow cards chosen by females (M=12.135) was significantly more than the number of yellow cards chosen by males (M=9.353). There was a significant main effect of Block for the mean number of yellow cards chosen, $F(3,204)=12.649$, p=.000 and a significant linear trend was indicated, $F(1,68)=26.079$, p=.000. A pairwise comparison revealed that significantly more yellow cards were chosen in Block 1, (M=14.328) than in Block 2 (M=10.110), p=.000, or Block 3 (M=9.833), p=.000, or Block 4 (M=8.705), p=.000. There was not a significant difference in the number of yellow cards chosen between Block 2 and Block 3, p=.754 or between Block 3 and Block 4, p=.156. There was not a significant difference between

Block 3 and Block 4, p=.331. There was not a significant interaction between gender and block, F(3,204)=1.231, p=.300.

Non Moral Condition: There was a significant difference found between genders, F(1,63)=6.769, p = .012, the number of yellow cards chosen by females (M=12.945) was significantly greater than the number of yellow cards chosen by males (M=9.788). There was a significant main effect of Block for the mean number of yellow cards chosen, F(3,189) = 13.158, p = .000, and a significant linear trend was revealed, F(1,63)=20.127, p=.000. A pairwise comparison showed that the number of yellow cards chosen in Block 1 (M=15.381), was significantly more than the number of cards chosen in Block 2 (M=10.785), p=.000, Block 3 (M=9.117), p=.000, and Block 4 (M=8.983), p=.000. There was not a significant difference between the number of yellow cards chosen in Block 2 and Block 3, p=.109 or between Block 2 and Block 4, p=.184. Nor was there a significant difference between the number of yellow cards chosen in Block 3 and Block 4, p=.905. There was not a significant interaction between gender and block, F(3,189)=2.025, p = .112.

Combined Group: Since the result of the between gender analysis for yellow cards yielded a significant result in both the Non Moral Condition and the Impersonal Moral Condition and there was no difference found with regards to yellow cards chosen by males between the Non Moral Condition (M=36.75) and the Impersonal Moral Condition (M=37.41), F(1,64)=.017, p=.895, and no difference found with regards to yellow cards chosen by females between the Non Moral Condition (M=51.78) and the Impersonal Moral Condition (M=48.54), F(1,67)=.289, p=.593, these two groups were combined into one group.

There was a significant difference found between genders, $F(1,133)=11.067$, p = .001, the number of yellow cards chosen by females ($M=12.523$) was significantly more than the number of yellow cards chosen by males ($M=9.273$). There was a significant main effect of Block for the mean number of yellow cards chosen, $F(3,399) = 25.627$, p = .000, and a significant linear trend was indicated, $F(1,133)=45.130$, $p=.000$. A pairwise comparison revealed that the number of yellow cards chosen in Block 1 ($M=14.836$), was significantly more than the number of yellow cards chosen in Block 2 ($M=10.429$), $p=.000$, and Block 3 ($M=9.490$), $p=.000$, and Block 4 ($M=8.836$), $p=.000$. Marginally significant more yellow cards were chosen in Block 2, than in Block 4, $p=.053$, but not Block 3, $p=.168$. There was not a significant difference between Block 3 and Block 4, $p=.416$. There was a marginally significant interaction between gender and block, $F(3,399)=2.423$, p = .065, and a significant linear trend was indicated for this interaction, $F(1,133)=2.922$, p = .090. Post hoc analysis revealed that there was a significant difference between gender in Block 2, $p=.001$, Block 3, $p=.006$, and Block 4, $p=.027$, but there was no difference in Block 1, $p=.242$.

Between Groups within Gender (Figure 6)

Since the result of the between gender analysis for yellow cards yielded a significant result in both the Non Moral Condition and the Non Personal Moral Condition, these two groups were combined into one group. A 2(Group: Personal Moral Condition verses Combined Condition) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of yellow cards chosen.

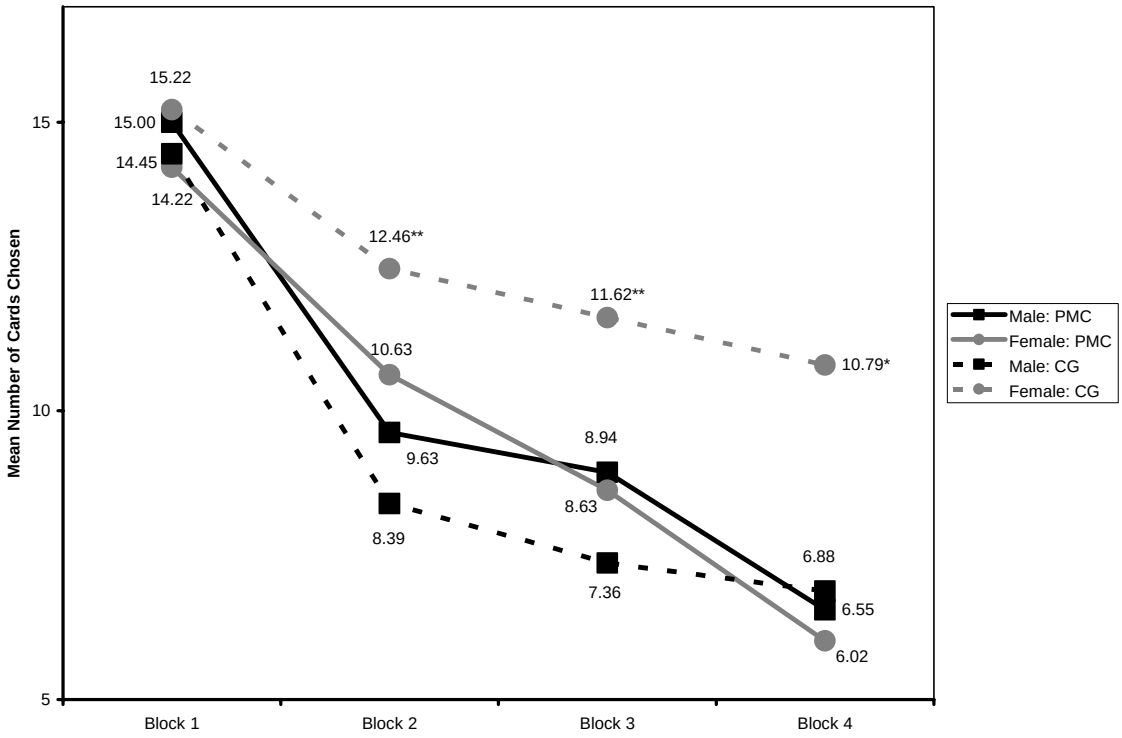

Figure 6. Mean number of yellow cards chosen across blocks as a function of gender and testing condition.

Males: There was not a significant difference between Groups, $F(1,96)=.389$, $p=.534$: Personal Moral Condition, ($M=10.029$); Combined Condition, ($M=9.273$). There was a significant main effect of Block for the mean number of yellow cards chosen, $F(3,288)=27.253$, $p=.000$, and a significant linear trend was indicated, $F(1,96)=49.484$, $p=.000$. A pairwise comparison revealed that the number of yellow cards chosen was significantly more in Block 1 (M = 14.727), than in Block 2, (M = 9.009), $p=.000$, Block 3, (M = 8.151), $p=.000$, or Block 4, (M = 6.717), $p=.000$. There was not a significant difference between the number of yellow cards chosen in Block 2 and Block 3, $p=.322$. Significantly more yellow cards were chosen in Block 2 than in Block 4, $p=.017$, but there was not a significant difference between Block 3 and Block 4, $p=.153$. There was

Females: There was a significant difference between groups, $F(1,99)=4.221$, $p=.043$: Personal Moral Condition, ($M=9.871$); Combined Condition, ($M=12.523$). There was a significant main effect of Block for the mean number of yellow cards chosen, $F(3,297)=19.964$, $p=.000$, and a significant linear trend was indicated, $F(1,99)=39.857$, $p=.000$. A pairwise comparison revealed that the number of yellow cards chosen was significantly more in Block 1 (M = 14.718), than in Block 2, (M = 11.544), $p=.000$, Block 3, (M = 10.120), $p=.000$, or Block 4, (M = 8.405), $p=.000$. Marginally significant more yellow cards were chosen in Block 2 than in Block 3, $p=.063$. Significantly more yellow cards were chosen in Block 2 than Block 4, $p=.001$, and in Block 3 than in Block 4, $p=.029$. There was not a significant interaction between group and block, $F(3,297)=1.866$, $p=.135$, however there was a marginally significant linear trend indicated in the interaction, $F(1,99)=3.748$, $p=.056$. Post hoc analysis revealed that

there was a significant difference between groups in Block 4, p=.018, but there was not a significant difference between groups in Block 1, p=.181, Block 2, p=.281, or Block 3, p=.117.

Blue Cards

Between Gender within Condition (Figure 7)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition to determine whether there was a significant gender or block effect for the number of Blue Cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.221$, p = .640, females (M=6.154), males (M = 5.801). There was a significant main effect of Block for the mean number of blue cards chosen, $F(3,186)=27.0228$, p = .000, and a significant linear trend was indicated, $F(1,62)=71.286$, p=.000. A pairwise comparison revealed that the number of blue cards chosen was significantly more in Block 1 (M = 9.109), than in Block 2, (M = 5.688), p=.000, Block 3, (M = 5.328), p=.000, or Block 4, (M = 3.785), p=.000. There was not a significant difference in the number of blue cards chosen between Block 2 and Block 3, p=.558. Significantly more blue cards were chosen in Block 2 than in Block 4, p=.001, and in Block 3 than in Block 4, p=.046. There was not a significant interaction between gender and block, $F(3,186)=.039$, p = .990.

Impersonal Moral Condition: There was not a significant difference between genders, $F(1, 68) = 2.293$, p=.135, females (M=6.910), males (M=5.665). There was a significant main effect of block for the mean number of blue cards chosen,

*F(*3,204)=11.360, *p*=.000 and a significant linear trend was indicated, *F*(1,68)=41.585,

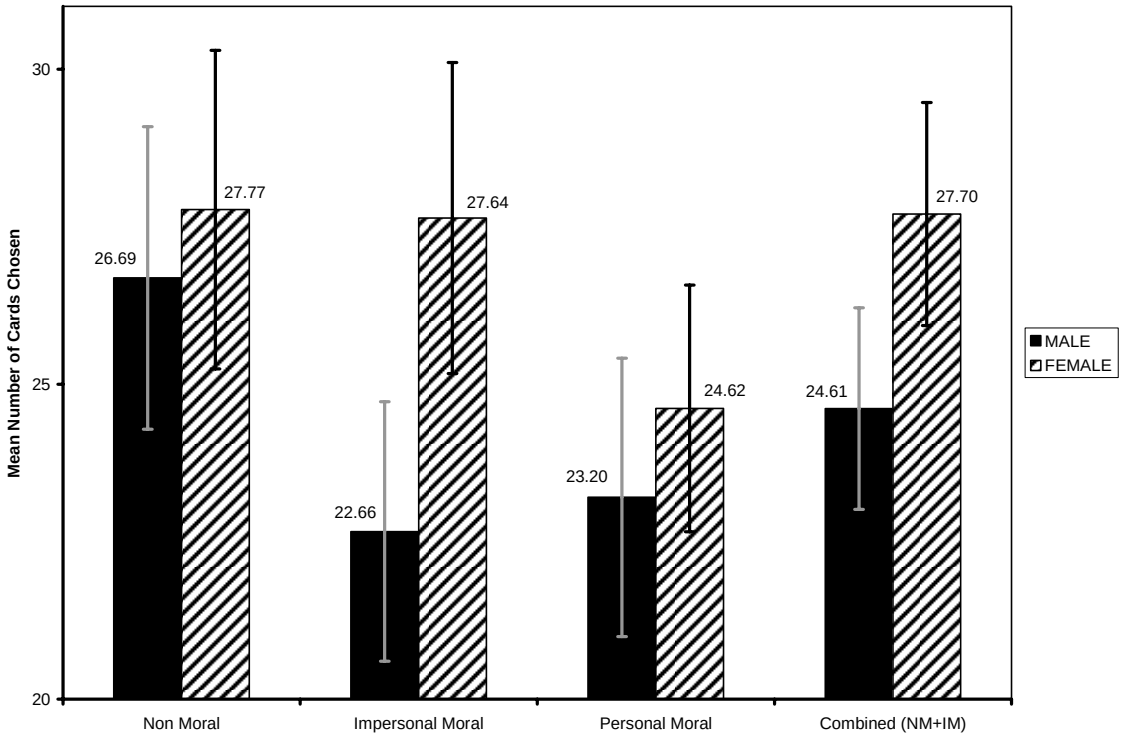

Figure 7. Mean number of blue cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means.

p=.000. A pairwise comparison revealed that significantly more blue cards were chosen in Block 1, (M=8.176) than in Block 2 (M=6.296), p=.000, or Block 3 (M=5.721), p=.000, or Block 4 (M=4.958), p=.000. There was not a significant difference in the number of blue cards chosen between Block 2 and Block 3, p=.286. Significantly more blue cards were chosen in Block 2 than in Block 4, p=.025, but there was not a significant difference between Block 3 and Block 4, p=.203. There was not a significant interaction between gender and block, F(3,204)=1.813, p=.146.

Non Moral Condition: There was not a significant difference found between genders, F(1,63)=.094, p = .760, females (M=6.943), males (M=6.672). There was a significant main effect of block for the mean number of blue cards chosen, F(3,189) = 20.010, p = .000, and a significant linear trend was revealed, F(1,63)=54.398, p=.000. A pairwise comparison showed that the number of blue cards chosen in Block 1 (M=9.705), was significantly different from the number of blue cards chosen in Block 2 (M=6.232), p=.000, Block 3 (M=6.947), p=.004, and Block 4 (M=4.347), p=.000. Significantly more blue cards were chosen in Block 2, than in Block 4, p=.000, but not Block 3, p=.418. There was significantly more blue cards chosen in Block 3 than in Block 4, p=.001. There was not a significant interaction between gender and block, F(3,189)=1.515, p = .212.

Combined Group: Since the result of the between gender analysis for blue cards did not yield a significant result in either the Non Moral Condition or the Impersonal Moral Condition and there was no difference found with regards to blue cards chosen by males between the Non Moral Condition (M=26.68) and the Impersonal Moral Condition (M=22.66), F(1,64)=1.5797, p=.2134, and no difference found with regards to blue cards

chosen by females between the Non Moral Condition (M=27.77) and the Impersonal Moral Condition (M=27.64), F(1,67)=.0014, p=.97, these two groups were combined into one group.

There was not a significant difference found between genders, F(1,133)=1.650, p = .201, the number of blue cards chosen by females (M=6.926) was not significantly more than the number of blue cards chosen by males (M=6.153). There was a significant main effect of block for the mean number of blue cards chosen, F(3,399) = 29.916, p = .000, and a significant linear trend was indicated, F(1,133)=69.460, p=.000. A pairwise comparison revealed that the number of blue cards chosen in Block 1 (M=8.911), was significantly more than the number of cards chosen in Block 2 (M=6.266), p=.000, and Block 3 (M=6.316), p=.000, and Block 4 (M=4.666), p=.000. Significantly more blue cards were chosen in Block 2, than in Block 4, p=.000, but not Block 3, p=.506. There was a significant difference between Block 3 and Block 4, p=.001. There was not a significant interaction between gender and block, F(3,399)=2.025, p = .110.

Between Groups within Gender (Figure 8)

Since the result of the between gender analysis for blue cards yielded a non significant result in both the Non Moral Condition and the Non Personal Moral Condition, these two groups were combined into one group. A 2(Group: Personal Moral Condition verses Combined Condition) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of Blue Cards chosen.

Males: There was not a significant difference between groups, F(1,96)=.256, p=.614: Personal Moral Condition, (M=5.801); Combined Condition, (M=6.153). There

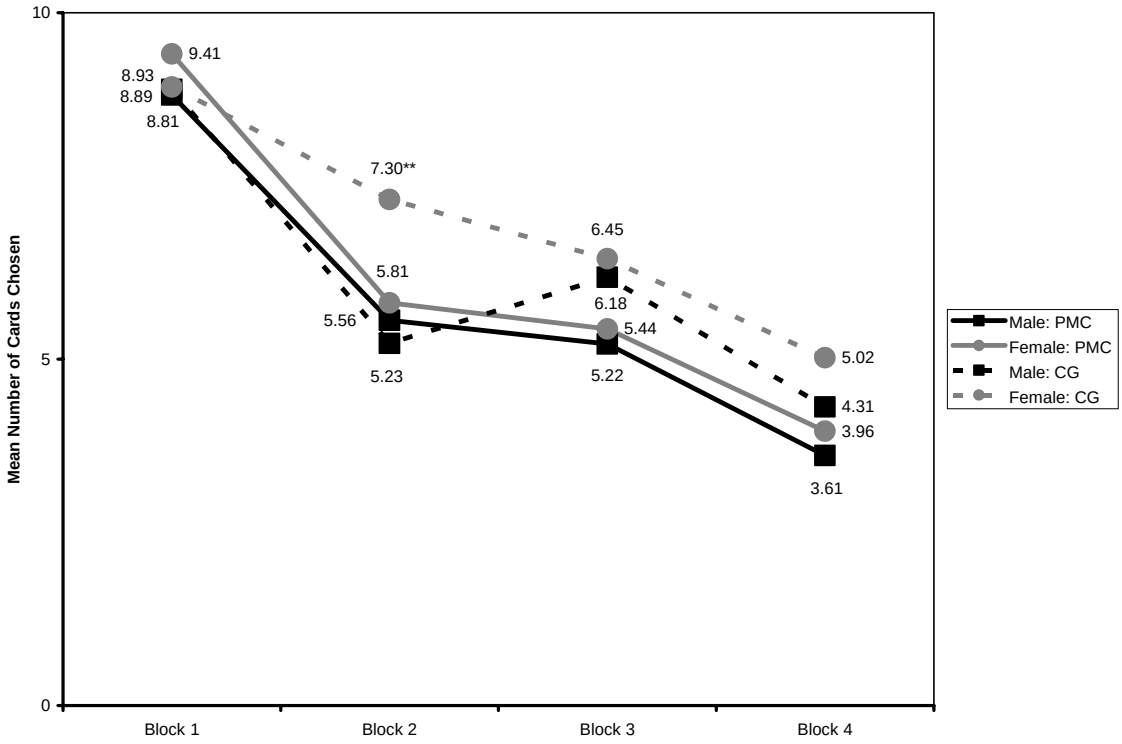

Figure 8. Mean number of blue cards chosen across blocks as a function of gender and testing condition.

was a significant main effect of block for the mean number of blue cards chosen, $F(3,288)=26.481$, $p=.000$, and a significant linear trend was indicated, $F(1,96)=72.155$, $p=.000$. A pairwise comparison revealed that the number of blue cards chosen was significantly more in Block 1 (M = 8.853), than in Block 2, (M = 5.395), $p=.000$, Block 3, (M = 5.700), $p=.000$, or Block 4, (M = 3.960), $p=.000$. There was not a significant difference between the number of blue cards chosen in Block 2 and Block 3, $p=.638$. Significantly more blue cards were chosen in Block 2 than in Block 4, $p=.003$, and in Block 3 than in Block 4, $p=.010$. There was not a significant interaction between group and block, $F(3,288)=.540$, $p=.655$.

Females: There was not a significant difference between groups, $F(1,99)=1.096$, $p=.298$: Personal Moral Condition, ($M=6.154$); Combined Condition, ($M=6.926$). There was a significant main effect of block for the mean number of blue cards chosen, $F(3,297)=26.186$, $p=.000$, and a significant linear trend was indicated, $F(1,99)=56.728$, $p=.000$. A pairwise comparison revealed that the number of blue cards chosen was significantly more in Block 1 (M = 9.167), than in Block 2, (M = 6.558), $p=.000$, Block 3, (M = 5.943), $p=.000$, or Block 4, (M = 4.491), $p=.000$. There was not a significant difference between the number of blue cards chosen in Block 2 verses Block 3, $p=.266$. Significantly more blue cards were chosen in Block 2 than in Block 4, $p=.000$, and in Block 3 than in Block 4, $p=.014$. There was not a significant interaction between group and block, $F(3,297)=1.271$, $p=.285$.

Red Cards

Between Gender within Condition (Figure 9)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition to determine whether there was a significant gender or block effect for the number of Red Cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.002$, p = .965, females ($M=19.051$), males ($M = 19.111$). There was a significant main effect of block for the mean number of red cards chosen, $F(3,186)=7.430$, p = .000, and a significant linear trend was indicated, $F(1,62)=11.336$, $p=.001$. A pairwise comparison revealed that the number of red cards chosen was significantly less in Block 1 (M = 15.625), than in Block 2, (M = 19.719), $p=.000$, Block 3, (M = 19.766), $p=.000$, or Block 4, (M = 21.215), $p=.001$. There was not a significant difference in the number of red cards chosen between Block 2 and Block 3, $p=.963$, nor between Block 2 and Block 4, $p=.310$. There was not a significant difference in the number of red cards chosen in Block 3 and Block 4, $p=.296$. There was not a significant interaction between gender and block, $F(3,186)=.666$, p = .574.

Impersonal Moral Condition: There was not a significant difference between genders, $F(1, 68) = 2.431$, $p=.124$, females ($M=16.736$), males ($M=19.298$). There was a significant main effect of block for the mean number of red cards chosen, $F(3,204)=4.567$, $p=.004$ and a significant linear trend was indicated, $F(1,68)=6.986$, $p=.010$. A pairwise comparison revealed that significantly fewer red cards were chosen in Block 1, ($M=16.381$) than in Block 4 ($M=20.393$), $p=.004$, but not in Block 2 ($M=17.858$), $p=.114$, or Block 3 ($M=17.436$), $p=.356$. There was not a significant

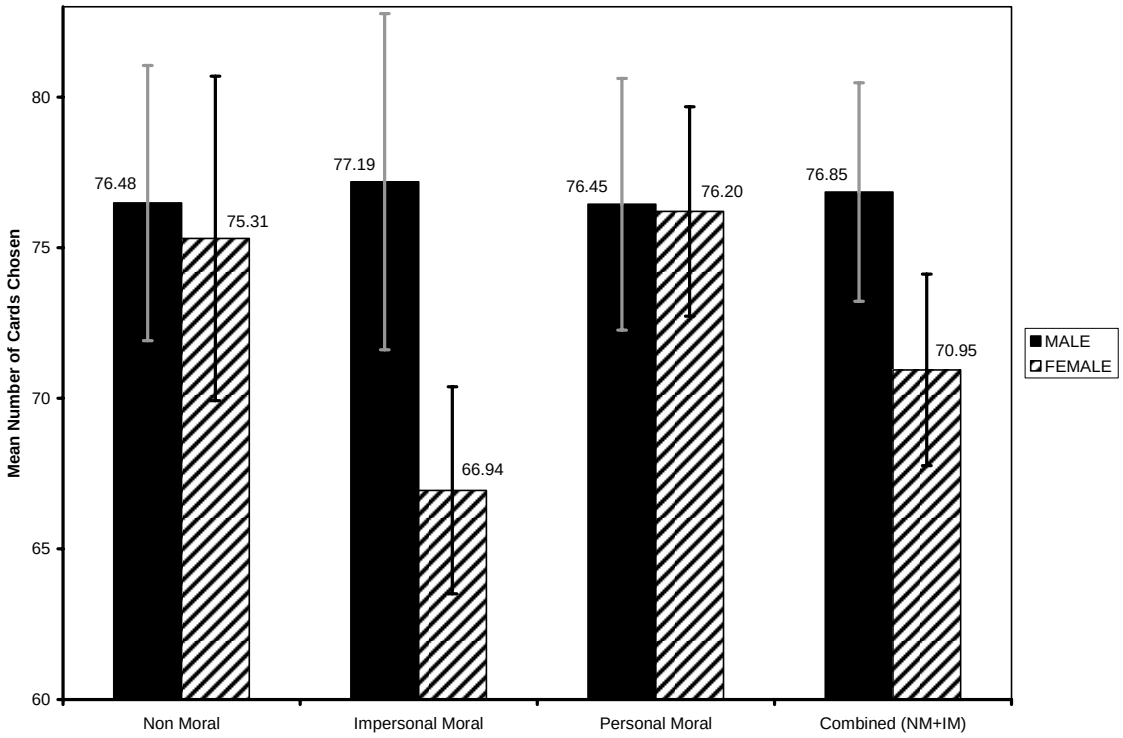

Figure 9. Mean number of red cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05, **p<.01

difference in the number of red cards chosen between Block 2 and Block 3, p=.699. Significantly fewer red cards were chosen in Block 2 than in Block 4, p=.031, and there was a significant difference between Block 3 and Block 4, p=.007. There was not a significant interaction between gender and block, $F(3,204)=1.694$, p=.170. There was a marginally significant linear trend indicated in the interaction, $F(1,68)=3.136$, p=.081.

Non Moral Condition: There was not a significant difference between genders, $F(1,63)=.027$, p = .871, females (M=18.828), males (M=19.121). There was a significant main effect of block for the mean number of red cards chosen, $F(3,189) = 11.957$, p = .000, and a significant linear trend was revealed, $F(1,63)=18.634$, p=.000. A pairwise comparison showed that the number of red cards chosen in Block 1 (M=14.267), was significantly less than the number of cards chosen in Block 2 (M=18.942), p=.000, and Block 3 (M=20.371), p=.000, and Block 4 (M=22.317), p=.000. Similarly significantly fewer red cards were chosen in Block 2, than in Block 4, p=.050, but not Block 3, p=.260. There was not a significant difference in the number of red cards chosen between Block 3 and Block 4, p=.123. There was not a significant interaction between gender and block, $F(3,189)=.649$, p = .585.

Combined Group: Since the result of the between gender analysis for red cards did not yield a significant result in either the Non Moral Condition or the Impersonal Moral Condition and there was no difference found with regards to red cards chosen by males between the Non Moral Condition (M=76.48) and the Impersonal Moral Condition (M=77.19), $F(1,64)=.00918$, p=.9239, and no difference found with regards to red cards chosen by females between the Non Moral Condition (M=75.31) and the Impersonal

Moral Condition (M=66.94), F(1,67)=1.7169, p=.1946, these two groups were combined into one group.

There was not a significant difference found between genders, F(1,133)=1.480, p = .226, the number of red cards chosen by females (M=17.736) was not significantly less than the number of red cards chosen by males (M=19.212). There was a significant main effect of block for the mean number of red cards chosen, F(3,399) = 14.719, p = .000, and a significant linear trend was indicated, F(1,133)=24.654, p=.000. A pairwise comparison revealed that the number of red cards chosen in Block 1 (M=15.360), was significantly less than the number of red cards chosen in Block 2 (M=18.382), p=.000, and Block 3 (M=18.844), p=.000, and Block 4 (M=21.311), p=.000. Significantly fewer red cards were chosen in Block 2, than in Block 4, p=.004, but not Block 3, p=.579. There was a significant difference in the number of red cards chosen between Block 3 and Block 4, p=.003. There was not a significant interaction between gender and block, F(3,399)=.915, p = .433.

Between Groups within Gender (Figure 10)

Since the result of the between gender analysis for red cards yielded a non significant result in both the Non Moral Condition and the Non Personal Moral Condition, these two groups were combined into one group. A 2(Group: Personal Moral Condition verses Combined Condition) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of red cards chosen.

Males: There was not a significant difference between groups, F(1,96)=.004, p=.947: Personal Moral Condition, (M=19.111); Combined Condition, (M=19.212).

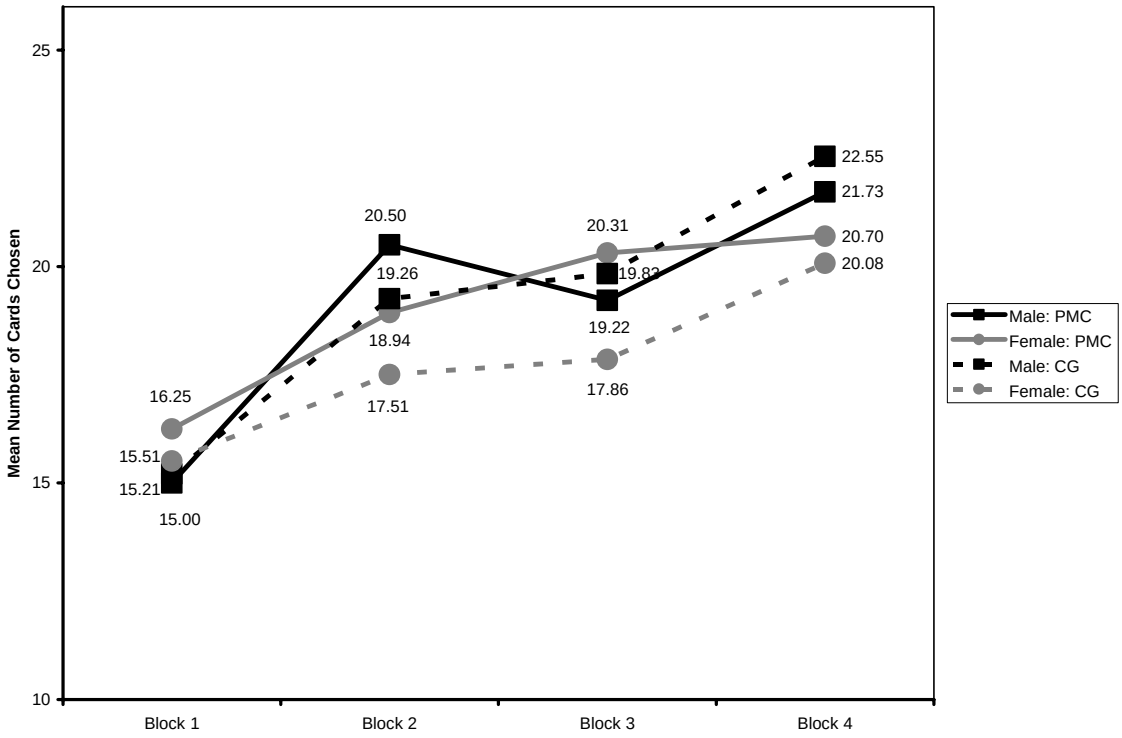

Figure 10. Mean number of red cards chosen across blocks as a function of gender and testing condition.

There was a significant main effect of block for the mean number of red cards chosen, $F(3,288)=11.823$, $p=.000$, and a significant linear trend was indicated, $F(1,96)=16.910$, $p=.000$. A pairwise comparison revealed that the number of red cards chosen was significantly less in Block 1, (M = 15.106), than in Block 2, (M = 19.879), $p=.000$, Block 3, (M = 19.526), $p=.000$, or Block 4, (M = 22.136), $p=.000$. There was not a significant difference in the number of red cards chosen between Block 2 and Block 3, $p=.743$. Marginally significant fewer red cards were chosen in Block 2 than in Block 4, $p=.096$, and significantly fewer in Block 3 than in Block 4, $p=.022$. There was not a significant interaction between group and block, $F(3,288)=.296$, $p=.828$.

Females: There was not a significant difference between groups, $F(1,99)=.986$, $p=.323$: Personal Moral Condition, ($M=19.051$); Combined Condition, ($M=17.736$). There was a significant main effect of block for the mean number of red cards chosen, $F(3,297)=7.239$, $p=.000$, and a significant linear trend was indicated, $F(1,99)=13.516$, $p=.000$. A pairwise comparison revealed that the number of Red cards chosen was significantly less in Block 1, (M = 15.879), than in Block 2, (M = 18.222), $p=.001$, Block 3, (M = 19.084), $p=.001$, or Block 4, (M = 20.390), $p=.000$. There was not a significant difference in the number of red cards chosen in Block 2 verses Block 3, $p=.335$, or in Block 3 verses Block 4, $p=.201$. Marginally significant fewer red cards were chosen in Block 2 than in Block 4, $p=.068$. There was not a significant interaction between group and block, $F(3,297)=.355$, $p=.786$.

Green Cards

Between Gender within Condition (Figure 11)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition

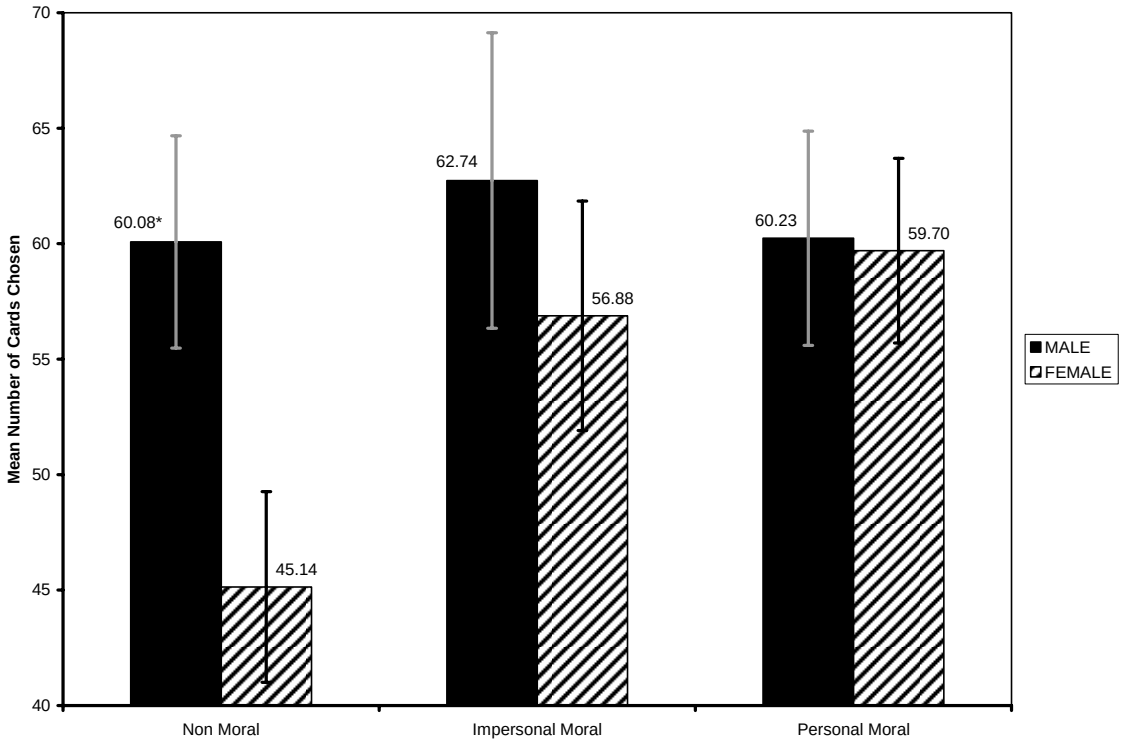

Figure 11. Mean number of green cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. The vertical bars are standard error of the means. *p<.05

to determine whether there was a significant gender or block effect for the number of green cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.007$, p = .931, females ($M=14.924$), males (M = 15.059). There was a significant main effect of block for the mean number of green cards chosen, $F(3,186)=13.799$, p = .000, and a significant linear trend was indicated, $F(1,62)=25.135$, $p=.000$. A pairwise comparison revealed that the number of green cards chosen was significantly less in Block 1 (M = 10.656), than in Block 2, (M = 14.469), $p=.000$, Block 3, (M = 16.125), $p=.000$, or Block 4, (M = 18.715), $p=.000$. There was not a significant difference in the number of green cards chosen between Block 2 and Block 3, $p=.150$. Significantly fewer green cards were chosen in Block 2 than in Block 4, $p=.003$, and marginally significant fewer green cards were chosen in Block 3 than in Block 4, $p=.060$. There was not a significant interaction between gender and block, $F(3,186)=.365$, p = .778.

Impersonal Moral Condition: There was not a significant difference between genders, $F(1, 68) = .514$, $p=.476$, females ($M=14.219$), males ($M=15.684$). There was a significant main effect of block for the mean number of green cards chosen, $F(3,204)=9.445$, $p=.000$ and a significant linear trend was indicated, $F(1,68)=10.440$, $p=.002$. A pairwise comparison revealed that significantly fewer green cards were chosen in Block 1, ($M=11.115$) than in Block 2 ($M=15.736$), $p=.000$, or Block 3 ($M=17.010$), $p=.000$, or Block 4 ($M=15.944$), $p=.001$. There was not a significant difference in the number of green cards chosen between Block 2 and Block 3, $p=.269$, or between Block 2 and Block 4, $p=.875$. There was not a significant difference between

Block 3 and Block 4, p=.298. There was not a significant interaction between gender and block, F(3,204)=1.293, p=.278.

Non Moral Condition: There was a significant difference found between genders, F(1,63)=5.867, p = .018, the number of green cards chosen by females (M=11.284) was significantly less than the number of green cards chosen by males (M=15.020). There was a significant main effect of block for the mean number of green cards chosen, F(3,189) = 3.610, p = .014, and a significant linear trend was revealed, F(1,63)=4.074, p=.048. A pairwise comparison showed that the number of green cards chosen in Block 1 (M=10.648), was significantly less than the number of green cards chosen in Block 2 (M=14.041), p=.001, and Block 3 (M=13.565), p=.020, and Block 4 (M=14.353), p=.024. But there was not a significant difference between the number of green cards chosen in Block 2 and in Block 3, p=.646, or between Block 2 and Block 4, p=.829. Nor was there a significant difference between Block 3 and Block 4, p=.523. There was not a significant interaction between gender and block, F(3,189)=.846, p = .470.

Combined Group: Since the between gender analysis for green cards did not yield the same result in the Non Moral Condition as in the Impersonal Moral Condition, these two groups were not combined into one group.

Between Groups within Gender (Figure 12)

Since the outcome of the between gender analysis for green cards yielded different results in the Non Moral Condition and the Impersonal Moral Condition, these two groups were not combined into one group. A 3(Group: Personal Moral Condition;

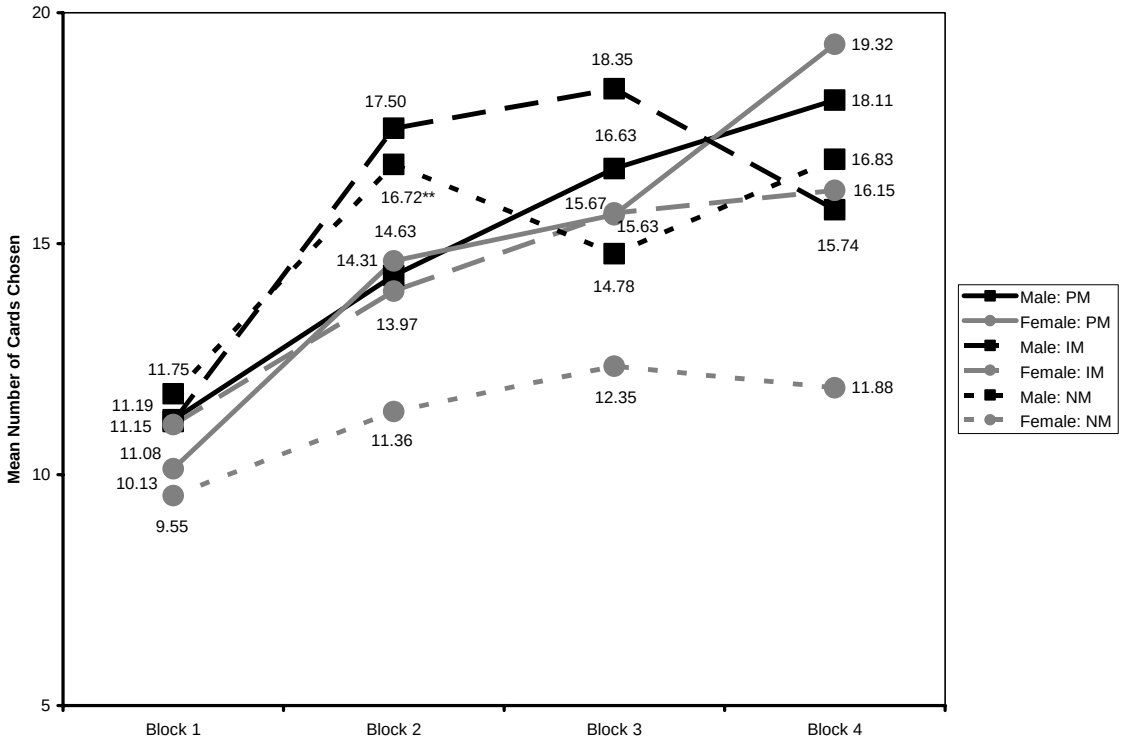

Figure 12. Mean number of green cards chosen across blocks as a function of gender and testing condition.

Impersonal Moral Condition; Non Moral Condition) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of green cards chosen.

Males: There was not a significant difference between groups, $F(2,95)=.078$, $p=.925$: Personal Moral Condition, ($M=15.059$); Impersonal Moral Condition, ($M=15.684$); Non Moral Condition, ($M=15.020$). A pairwise comparison revealed that there was not a significant difference between the number of green cards chosen in the Personal Moral Condition and the Non Moral Condition, $p=.984$, or the Impersonal Moral Condition, $p=.742$. There was not a significant difference between the Impersonal Moral Condition and the Non Moral Condition, $p=.726$. There was a significant main effect of block for the mean number of green cards chosen, $F(3,285)=10.741$, $p=.000$, and a significant linear trend was indicated, $F(1,95)=13.076$, $p=.000$. A pairwise comparison revealed that the number of green cards chosen was significantly less in Block 1, (M = 11.362), than in Block 2, (M = 16.177), $p=.000$, Block 3, (M = 16.586), $p=.000$, or Block 4, (M = 16.891), $p=.000$. There was not a significant difference between the number of green cards chosen in Block 2 and Block 3, $p=.682$ or between Block 2 and Block 4, $p=.567$, or between Block 3 and Block 4, $p=.769$. There was not a significant interaction between group and block, $F(6,285)=1.216$, $p=.298$.

Females: There was a marginally significant difference between groups, $F(2,98)=2.870$, $p=.062$: Personal Moral Condition, ($M=14.924$); Impersonal Moral Condition, ($M=14.219$); Non Moral Condition, ($M=11.284$), and a marginally significant linear trend was indicated for the interaction, $F(2,98)=2.679$, $p=.074$. A pairwise comparison revealed that the number of green cards chosen in the Personal Moral

Condition was significantly more than in the Non Moral Condition, p=.027, but not significantly different from the number of green cards chosen in the Impersonal Moral Condition, p=.658. There were marginally significant more green cards chosen in the Impersonal Moral Condition than in the Non Moral Condition, p=.066. There was a significant main effect of block for the mean number of green cards chosen, $F(3,294)=13.550$, p=.000, and a significant linear trend was indicated, $F(1,98)=24.751$, p=.000. A pairwise comparison revealed that the number of green cards chosen was significantly less in Block 1, (M = 10.251), than in Block 2, (M = 13.320), p=.000, Block 3, (M = 14.547), p=.000, or Block 4, (M = 15.784), p=.000. There was not a significant difference between the number of green cards chosen in Block 2 and Block 3, p=.133, or between Block 3 and Block 4, p=.133. Significantly fewer green cards were chosen in Block 2 than in Block 4, p=.015. There was not a significant interaction between group and block, $F(6,294)=1.616$, p=.142.

Hypothesis 3

Females will choose fewer "plus" (yellow and red) cards during the ICT in the IM and PM conditions than in the NM condition. The following results confirmed hypothesis three, females chose significantly fewer "plus" cards in the combined valence group (IM and PM) than in the NM condition.

"Plus" (Yellow and Red) Cards

For both males and females, and in each condition, the number of cards chosen from the red and yellow decks of cards were collapsed (added together) to constitute the total number of "plus" cards chosen. And, for both males and females, and in each condition, within each of the four blocks of 50 trials / card choices, the number of cards chosen from

the red and yellow decks of cards were added together to constitute the number of "plus" cards chosen in each block.

Between Gender within Condition (Figure 13)

A 2 (Gender) X 4 (Block) analysis of variance was conducted for each condition to determine whether there was a significant gender or block effect for the number of "plus" cards chosen.

Personal Moral Condition: There was not a significant difference between genders, $F(1,62)=.02$, p = .887, females ($M=28.922$), males (M = 29.141). There was a not a significant main effect of block for the mean number of "plus" cards chosen $F(3,186)=1.864$, p = .137, nor was there a significant linear trend indicated, $F(1,62)=3.058$, $p=.085$. A pairwise comparison revealed that the number of "plus" cards chosen was not significantly more in Block 1 (M = 30.234), than in Block 2, (M = 29.844), $p=.696$, Block 3, (M = 28.547), $p=.183$, or Block 4, (M = 27.500), $p=.108$. There was not a significant difference in the number of "plus" cards chosen between Block 2 and Block 3, $p=.213$ or between Block 2 and Block 4, $p=.107$, or between Block 3 and Block 4, $p=.406$. There was not a significant interaction between gender and block, $F(3,186)=.338$, p = .798.

Impersonal Moral Condition: There was not a significant difference found between genders, $F(1, 68) = .013$, $p=.910$, the number of "plus" cards chosen by females ($M=28.872$) was not different than the number of "plus" cards chosen by males ($M=28.651$). There was a significant main effect of block for the mean number of "plus" cards chosen, $F(3,204)=3.054$, $p=.030$ but there was not a significant linear trend indicated, $F(1,68)=1.416$, $p=.238$. A pairwise comparison revealed that significantly

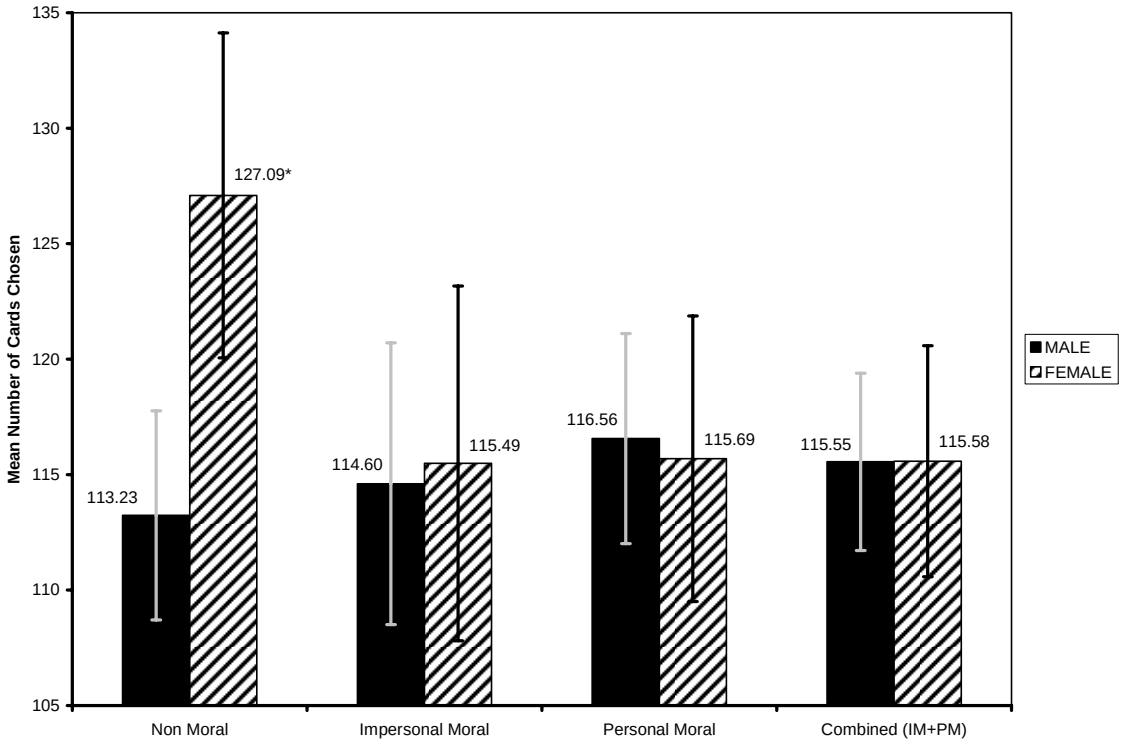

Figure 13. Mean number of plus (red and yellow) cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05

more “plus” cards were chosen in Block 1, (M=30.709) than in Block 2 (M=27.968), p=.009, and Block 3 (M=27.270), p=.014, but not Block 4 (M=29.098), p=.246. There was not a significant difference in the “plus” cards chosen between Block 2 and Block 3, p=.556 nor in Block 2 than in Block 4, p=.355, and there was not a significant difference between Block 3 and Block 4, p=.102. There was not a significant interaction between gender and block, F(3,204)=.687, p=.561.

Non Moral Condition: There was a significant difference found between genders, F(1,63)=4.555, p = .037, the mean number of “plus” cards chosen by females (M=31.773) was significantly more than the mean number of “plus” cards chosen by males (M=28.309). There was not a significant main effect of block for the mean number of “plus” cards chosen, F(3,189) = .757, p = .520, nor was there a linear trend indicated, F(1,63)=.710, p=.403. A pairwise comparison revealed that the number of “plus” cards chosen in Block 1 (M=29.648), was no different from the number of cards chosen in Block 2 (M=29.727), p=.936, or Block 3 (M=29.488), p=.912, or Block 4 (M=31.300), p=.336. Nor was the number of “plus” cards chosen in Block 2, different from Block 3, p=.822, or Block 4, p=.299. And there was no difference between Block 3 and Block 4, p=.206. There was not a significant interaction between gender and block, F(3,189)=.456, p = .713.

Combined Valence Group: Since the result of the between gender analysis for “plus” cards was not significant in both the Impersonal Moral Condition and the Personal Moral Condition, and there was no difference found with regards to number of “plus” cards chosen by males between the Impersonal Moral Condition (M=114.60) and the Personal Moral Condition (M=116.56), F(1,64)=.063, p=.80, and no difference found

with regards to the number of "plus" cards chosen by females between the Impersonal Moral Condition (M=115.49) and the Personal Moral Condition (M=115.69), $F($1,66)=.00099, p=.97496, these two groups were combined into one group.

There was not a significant difference found between genders, F(1,132)=.000, p = .996, the number of "plus" cards chosen by females (M=28.895) was no different than the number of "plus" cards chosen by males (M=28.888). There was no main effect of Block for the mean number of "plus" cards chosen, F(3,396) = 3.287, p = .021, however a significant linear trend was indicated, F(1,133)=4.434, p=.037. A pairwise comparison revealed that the number of "plus" cards chosen in Block 1 (M=30.482), was significantly more than the number of cards chosen in Block 2 (M=28.871), p=.026, and Block 3 (M=27.881), p=.006, and Block 4 (M=28.333), p=.046. There were no more "plus" cards chosen in Block 2, than in Block 3, p=.209, or Block 4, p=.568. Nor was there any difference between Block 3 and Block 4, p=.588. There was no interaction between gender and block, F(3,396)=.854, p = .465.

Between Groups within Gender (Figures 14, 15)

Since the result of the between gender analysis for "plus" cards did not yield a significant result for either the Moral Impersonal or the Personal Moral Condition, these two groups were combined into one group, called the combined valence group (CVG). A 2(Group: NM and CVG) X 4(Block) analysis of variance was conducted both for males and for females to determine whether there was a significant group or block effect for the number of "plus" Cards chosen.

Males: There was not a significant difference between groups, F(1,96)=.130, p=.719: Non Moral Condition, (M=28.309); Combined Valence Group, (M=28.888).

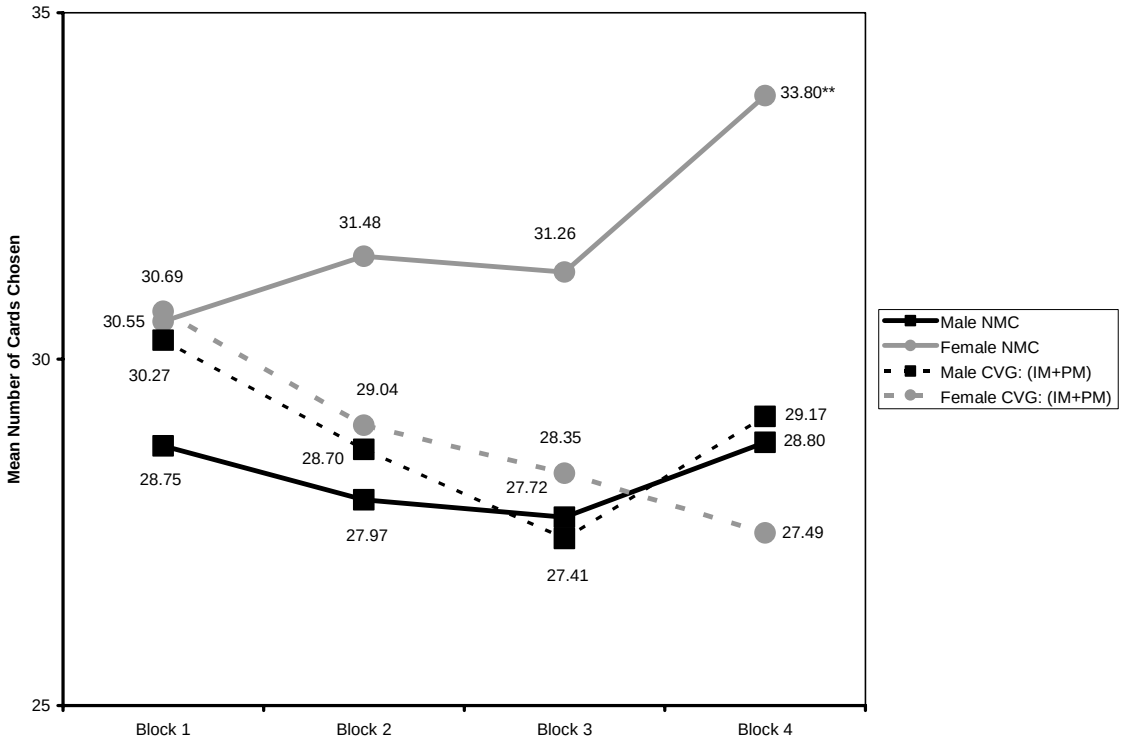

Figure 14. Mean number of plus (red and yellow) cards chosen across blocks as a function of gender and testing condition.

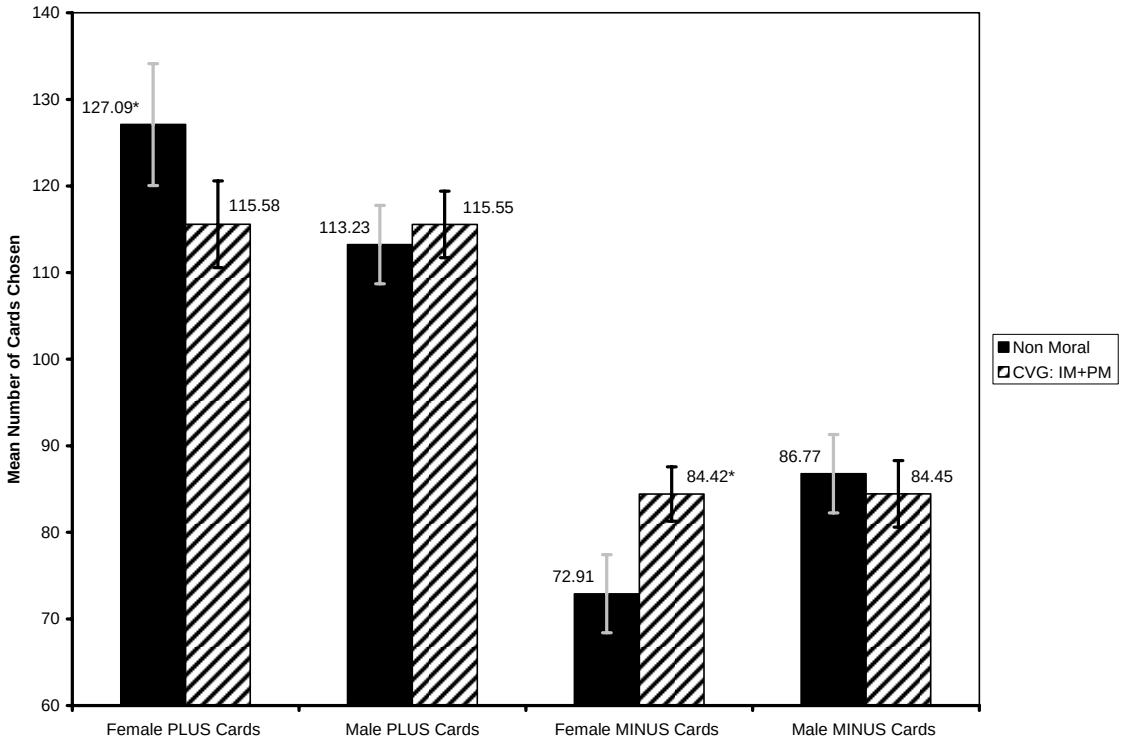

Figure 15. Mean number of plus (red and yellow) and minus (blue and green) cards chosen as a function of gender and testing condition. The vertical bars are standard error of the means. *p<.05

There was not a main effect of block for the mean number of "plus" cards chosen, $F(3,288)=.878$, $p=.453$, nor a linear trend indicated, $F(1,96)=.204$, $p=.653$. A pairwise comparison revealed that there was no difference between the mean number of "plus" cards chosen in Block 1, (M = 29.511), and Block 2, (M = 28.333), $p=.221$ or Block 3, (M = 27.564), $p=.138$, or Block 4, (M = 28.986), $p=.740$. There was no difference in the mean number of "plus" cards chosen between Block 2 and Block 3, $p=.486$ or Block 4, $p=.633$, nor between Block 3 and Block 4, $p=.250$. There was no interaction between group and block, $F(3,288)=.180$, $p=.910$, nor was a linear trend indicated in the interaction, $F(1,99)=.185$, $p=.668$.

Females: There was a significant difference between groups, $F(1,99)=4.298$, $p=.041$. Significantly more "plus" cards were chosen in the Non Moral Condition, ($M=31.773$) than in the Combined Valence Group, ($M=28.895$). There was not a main effect of block for the mean number of "plus" cards chosen, $F(3,297)=.330$, $p=.804$, nor was there a linear trend indicated, $F(1,99)=.010$, $p=.922$. A pairwise comparison revealed that the number of "plus" cards chosen was the same in Block 1, (M = 30.618) and Block 2 (M = 30.264), $p=.653$, Block 3, (M = 29.805), $p=.439$, or Block 4, (M = 30.648), $p=.979$. There was no difference in the number of "plus" cards chosen between Block 2 and Block 3, $p=.561$, or Block 4, $p=.713$, nor a difference in the number of "plus" cards chosen between Block 3 and Block 4, $p=.380$. There was a significant interaction between group and block, $F(3,297)=3.757$, $p=.011$, and a significant linear trend was indicated in the interaction, $F(1,99)=6.903$, $p=.010$. Post hoc analysis revealed that there was a significant difference between groups in Block 4, $p=.009$, but there was no difference in Block 1, $p=.866$, Block 2, $p=.118$, or Block 3, $p=.178$.

Hypothesis 4

Male performance on the ICT will improve in the PM condition, more advantageous cards chosen in the PM condition than in the NM condition. The results failed to confirm hypothesis 4, males did not choose more advantageous cards in the PM condition than in the NM or the IM condition.

Hypothesis 5

Participants, who answer non-normatively (below the mean number of normative answers) to PM dilemmas, will make better decisions on the ICT, choose a greater number of advantageous cards, than those participants who answer normatively (above the mean number of normative answers). The following results confirmed hypothesis 5 in part. In the PM condition females, but not males, who responded non-normatively performed marginally significantly better than those who answered normatively.

Analysis of Responses to Dilemmas (Table 1)

Within each condition and between genders, the way males and females responded to the query "Is it appropriate or not for you to do?" was analyzed. For every question in each of the conditions a modal response was determined (how most of the participants answered the question). Then for each participant, every response was assigned either a '1' if they answered with the group (normatively) or a '0' if they answered different from the group (non-normatively).

Between Genders within Condition

A total number of normative responses were obtained for each subject and a one way ANOVA was used to compare the mean number of normative responses between genders within groups.

Table 1.

Responses to Dilemmas: Personal Moral Condition

PMC	Question # 1		Question # 2		Question # 3		Question #4		Question # 5	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
MALE	**32**	0	6	**26**	**24**	8	12	**20**	**26**	6
FEMALE	**32**	0	7	**25**	**28**	4	9	**23**	**29**	3
Totals	64	0	13	51	52	12	21	43	55	9

PMC	Question # 6		Question # 7		Question # 8		Question # 9		Question # 10	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
MALE	5	27	5	**27**	**20**	12	**32**	0	**26**	6
FEMALE	4	**28**	7	**25**	**22**	10	**32**	0	**32**	
Totals	9	55	12	52	42	22	64	0	58	6

PMC	Question # 11		Question # 12		Question # 13		Question # 14		Question # 15	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
MALE	16	16	**31**	1	11	**21**	8	**24**	**29**	3
FEMALE	**22**	10	**32**	0	**18**	14	5	**27**	**32**	0
Totals	38	26	63	1	29	35	13	51	61	3

PMC	Question # 16		Question #17		Question # 18		Question # 19		Question # 20	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
MALE	**29**	3	**31**	1	**25**	7	**19**	13	**20**	12
FEMALE	**31**	1	**32**	0	**29**	3	**27**	5	**28**	4
Totals	60	4	63	1	54	10	46	18	48	16

Personal Moral Condition: There was a significant difference found, $F(1,62)=6.404$, $p=.014$, between the mean normative responses made by females ($M=17.19$) and males ($M=15.78$).

Impersonal Moral Condition: There as a marginally significant difference indicated, $F(1,68)=3.699$, $p=.059$, with females ($M=17.19$) making more normative responses than males ($M=16.24$).

Non Moral Condition: There was not a significant difference, $F(1,63)=.656$, $p=.421$ between males ($M=17.84$) and females ($M=18.30$) in the number of normative responses they made.

Between Conditions within Genders

A total number of normative responses were obtained for each subject and a one way ANOVA was used to compare the mean number of normative responses between groups for both males and females combined and for each gender.

Males and Females Combined: There was a significant difference between the three conditions for the mean number of normative responses made, $F(2,196)=9.569$, $p=.000$: Personal Moral Condition ($M=16.48$); Impersonal Moral Condition ($M=16.73$); and Non Moral Condition ($M=18.08$). A pairwise comparison revealed that the Non Moral Condition was significantly different from the Impersonal Moral Condition ($p=.002$) and the Personal Moral Condition ($p=.000$). But the Personal Moral Condition was not significantly different from the Impersonal Moral Condition ($p=.732$).

Males: There was a significant difference between the three conditions for the mean number of normative response made, $F(2,95)=6.313$, $p=.003$: Personal Moral Condition

(M=15.78); Impersonal Moral Condition (M=16.24); and Non Moral Condition (M=17.84). A pairwise comparison revealed that the Non Moral Condition was significantly different from the Impersonal Moral Condition (p=.024) and the Personal Moral Condition (p=.003). But the Personal Moral Condition was not significantly different from the Impersonal Moral Condition (p=.803).

Females: There was a significant difference between the three conditions for the mean number of normative response made, $F(2,98)=3.703$, p=.028: Personal Moral Condition (M=17.19); Impersonal Moral Condition (M=17.19); and Non Moral Condition (M=18.30). A pairwise comparison revealed that the Non Moral Condition was significantly different from the Impersonal Moral Condition (p=.049) and marginally significantly different from the Personal Moral Condition (p=.056). The way females responded to the dilemmas in the Personal Moral Condition was virtually identical to the way they responded in the Impersonal Moral Condition (p=1).

Analysis of ICT Performance Based on Responses to Dilemmas (Table 1)

The average number of normative responses for each condition (males and females together) and the average number normative responses within each condition for males and for females was determined. Then within each condition, the participants were divided up as either answering non-normatively (below average) or normatively (above average) and a t-test was used to compare performance on the ICT between the two groups (those who answered non-normatively and those who answered normatively). Performance on the ICT was measured as the total number of advantageous cards chosen across the 200 trials.

Personal Moral Condition

Males and Females Combined: The mean number of normative responses was M=16.48 and there was not a significant difference in ICT performance (number of advantageous cards chosen) between participants who answered normatively (above the mean) (M=137.59) and those who answered non-normatively (below the mean)(M=135), t=-.3539, p=.7246, with the two tail critical value for t=1.9989.

Males: The mean number of normative responses in the personal moral condition was M=15.78 and there was a marginally significant difference in ICT performance between participants who answered normatively (M=146.47) and those who answered non-normatively (M=125.67). Males who answered non-normatively to the personal moral dilemmas performed worse, chose marginally significantly less advantageous cards on the ICT, t=-1.9683, p=.05834, with the two tail critical value for t=2.0423.

Females: The mean number of normative responses in the Personal Moral condition was M=17.18 and there was a marginally significant difference in ICT performance between females who answered normatively (M=126.67) and those who answered non-normatively (M=144.29). Females who answered non-normatively to the Personal Moral dilemmas performed better, chose marginally significantly more advantageous cards, on the ICT, t=1.9119, p=.0655, with the two tail critical value for t=2.0423.

Correlation Results

A Pearson's correlation analysis was conducted between the percent (number smelled correct out of 40) on the SITTM and the number of advantageous cards chosen, and the percent stated correctly. An ordered Bonferonni 'p' value was used to determine significance.

Within Conditions: Advantageous, Disadvantageous, Percent Smelled Correctly, Percent Stated Correctly

Personal Moral Condition: A Pearson's one-tailed correlation analysis revealed that for males there was not a significant positive correlation between the percent smelled correctly and the number of advantageous cards chosen, r=.309, p=.042. For females there was not a significant correlation between the percent smelled correctly and the number of advantageous cards chosen, r=.037, p=.440. There was a significant positive correlation between the percent guessed correctly and the number of advantageous cards chosen for males (r=.734, p=.000), and females (r=.735, p=.000).

Combined Group Condition (NM + IM): A Pearson's correlation analysis revealed that for males there was not a significant correlation between the percent smelled correctly and the number of advantageous cards chosen, r=-.180, p=.085, but for females there was a significant positive correlation between the percent smelled correctly and the number of advantageous cards chosen, r=.326, p=.003. There was a significant positive correlation between the percent guessed correctly and the number of advantageous cards chosen for males (r=.602, p=.000), and females (r=.727, p=.000).

DISCUSSION

Previous literature has ascertained that males outperform women on the ICT (Bolla et al., 2004; Overman et al., 2004) a widely used measure of decision-making capabilities. (Bechara et al., 1994) This current experiment sought to determine if the intermittent deliberation of either Impersonal Moral dilemmas or Personal Moral dilemmas during performance of the ICT would improve performance for women on the

ICT. Performance on the ICT was measured as the number of advantageous ($50 red and green) cards chosen across 200 trials.

Hypothesis 1

Males will outperform females in decision-making as measured by their performance on the ICT during the NM (control) dilemma condition.

Consistent with previous literature, the present results showed that males chose significantly more advantageous and less disadvantageous cards than females while deliberating non moral dilemmas, thus confirming Hypothesis No. 1. This is interpreted to mean under the Non Moral dilemma (control) condition, different area(s) of the brain were activated during the ICT in males and in females.

In females during the ICT, the predominant area of the brain that is activated is the left medial OFC (BA 11) (Bolla et al., 2004). O'Doherty et al. (2001) noted from an fMRI study that activation in the left medial OFC was positively correlated with the magnitude of rewards. For females in the Combined condition (NM + IM), but not the PM condition, the percent smelled correctly on the SIT™ was positively correlated with the number of advantageous cards chosen which further substantiates the fact that females are using the left medial OFC (BA 11, olfactory area) during the ICT in the NM condition. In the NM condition we found that females chose significantly more "plus" (red and yellow) cards than did males, which yield a greater magnitude of monetary reward. This finding is interpreted to mean that, in general, females are more responsive to valence and frequency of the rewards than to the valence of the punishers and are using an area of the brain that is associated with emotion processing. (Northoff et al., 2004).

In men the predominant area the brain that is activated during the ICT is the right lateral OFC (BA 47), the right dorsolateral PFC (BA 9,10) and the right parietal lobe (BA 40). O'Doherty et al. (2001) noted from an fMRI study that activation in the right lateral OFC was positively correlated with magnitude of punishment. For males in the NM condition the percent smelled correctly on the SIT^{TM} was not significantly correlated with the number of advantageous cards chosen. This suggests that they were not using the left medial OFC (BA 11, olfactory cortex). In the Non Moral condition males chose significantly more "minus" (blue and green) cards than females. This is interpreted to mean that in general males are more motivated by the valence of the punishment cards than females and are using areas of the brain associated with cognitive processing (right DLPFC).

Hypothesis 2

Females will improve their decision-making during the deliberation of Moral dilemmas (IM and PM), as measured by their performance on the ICT, to the level of male performance, choose equivalent number of advantageous cards.

The major finding from this experiment was that during the deliberation of PM dilemmas, female performance on the ICT was raised to the level of male performance. Confirming the first part of hypothesis 2, males and females chose an equivalent number of advantageous cards in the PM dilemma condition. The deliberation of PM dilemmas has been shown to activate, in addition to the right dorsolateral (BA 46) an area activated by both IM and PM dilemmas, the medial PFC (BA 9, 10) an area of the brain associated with social-emotional functioning, (Greene et al., 2004) and the anterior cingulate cortex (BA 24, 32) (Moll et al., 2005), an area of the brain associated with conflict detection.

Through the deliberation of PM dilemmas, and the purported activation of the area in the brain associated with conflict detection (ACC), females altered their behavior / card choices and were able to inhibit previously rewarding responses (yellow cards) because they chose more "advantageous" cards than in the control (NM) condition. Thus this finding suggests that increased activation of these additional brain areas in women is crucial for improved decision-making as measured by the ICT.

The second part of hypothesis 2 was not confirmed as we found that during the deliberation of IM dilemmas, females continued to choose significantly less advantageous cards and more disadvantageous cards than men. According to Greene et al. (2004), deliberation of IM dilemmas activates the right dorsolateral (BA 46) as well as bilaterally activates the parietal lobe (BA 40), areas of the brain associated with cognitive processing. The ACC only becomes activated during the deliberation of PM dilemmas, especially the "difficult" ones, purportedly in response to the conflict associated with violating a personal moral code in order to respond with a "utilitarian" decision benefiting the greater number of people. One explanation for the failure to confirm the second part of hypothesis 2 is that the ACC is not activated during the deliberation of IM dilemmas and activation of this area of the brain is necessary for females to accurately detect, and respond to, the conflict present in the advantageous cards, high immediate monetary gains but greater long term losses.

Hypothesis 3

Females will choose fewer "plus" (yellow and red) cards during the ICT in the IM and PM conditions than in the NM condition.

Although, performance on the ICT did not change for females in the IM condition as hypothesized, the "type" of cards females chose did change. In the IM and the PM condition females chose significantly fewer "plus" cards, than in the NM condition and significantly more "minus" cards than in the NM condition. These results confirm, in part, the hypothesis that by purportedly changing women's predominantly left hemispheric activation during the ICT, the hemisphere associated with positive valence, to predominantly right hemispheric activation, the hemisphere associated with negative valence, female attraction to "plus" cards decreased. However, in the IM condition females apparently were unable to change their responses as they continued to choose more disadvantageous cards than males.

In an fMRI study it was noted that purely cognitive judgment tasks increased activation in the VLPFC (BA 10) and the DLPFC (BA 46/9) and concurrently decreased activation in the VMPFC (BA 11) and the DMPFC (BA 9)(Northoff et al., 2004). One interpretation of the present results is that, in females, while areas of the brain associated with cognitive processing increased activation by the deliberation of the IM dilemmas, areas of the brain associated with emotion processing and rewards became less activated. Thus in the IM condition for females there was both a hemispheric and regional shift away from predominantly left (hemisphere) medial OFC activation to greater activation in the right (hemisphere) lateral PFC. And during the deliberation of PM dilemmas, activation in areas of the brain associated with emotion processing (left BA 11) was reduced by greater activation in areas of the brain associated with cognitive processing (right BA 10, 46/9).

Hypothesis 4

Male performance on the ICT will be greater in the PM condition than in the NM condition, more advantageous cards chosen.

Hypothesis 4 was not confirmed as males did not choose more advantageous cards in the PM condition than in the NM or IM condition. One possible reason for this is that males were already performing at a maximum level on the ICT and utilizing the areas of the brain necessary for making good decision as indicated by Bolla et al. (2004).

Hypothesis 5

Participants, who answer non-normatively (below the mean number of normative answers) to PM dilemmas, will make better decisions on the ICT, choose a greater number of advantageous cards, than those participants who answer normatively (above the mean number of normative answers).

The present results confirmed, in part, hypothesis 5. In the PM condition females who responded non-normatively performed marginally significantly (p=.0655) better than those who answered normatively, but males who responded non normative did not perform significantly better than males who answered normatively. In fact, males who answered normatively chose marginally significant (p=.05834) more advantageous cards than those who answered non-normatively. Since only the "difficult" dilemmas are purported to activate both emotional and cognitive processes, these results are interpreted to mean that due to the combination of "easy" verses "difficult" dilemmas in the PM condition, the results were only marginally significant for females and not significant for males. A future study might be to use only "difficult" PM dilemmas for analysis of performance on the ICT with respect to normative / non-normative responses.

CONCLUSIONS

Since the area of the brain associated with cognitive processing was activated in males, but not in females, males outperform females on the ICT, choose more advantageous cards. In general, higher relative metabolic activation in the right hemisphere is correlated with better performance on tasks that are mediated by the right hemisphere (Bolla et al., 2004). In view of the fact that the ICT is considered a right hemispheric task (Ernst et al., 2002) and men show greater activation in the right hemisphere than females, it stands to reason they would outperform females on the ICT.

During the ICT, both males and females appear to be influenced by the valence of the cards. Females seem to be motivated to approach the "plus" (red and yellow) cards, and males seem to be motivated to avoid the "minus" (blue and green) cards. Perhaps men are more focused on, and motivated by, the punisher cards rather than the amount of money gained. This would fit since Bolla et al. (2004) noted that during the ICT men activated the right lateral OFC (BA 47) which is also activated by punishment (O'Doherty et al., 2000), and females activated the left medial OFC (BA 11) which is also activated by reward stimuli (O'Doherty et al., 2000). Because males and females are motivated by different factors of the ICT, different areas of the brain are activated.

Given that the area of the brain associated with emotion and positive affect processing is activated in females, but not in males, perhaps females are more focused on, and motivated by, the immediate amount of monetary gain. The results of this present study indicate that by purportedly manipulating the areas of activation within the brain through the deliberation of Personal Moral dilemmas from predominantly left to predominantly right hemispheric activation, female performance on the ICT was

improved. Females are clearly affected by the context in which decisions are made as reflected by improved performance on the ICT during the deliberation of PM dilemmas.

Since 1994, the ICT has been a widely used measure for decision making ability in both males and females. Both genders appear to be motivated by different aspects of the ICT. Additional studies investigating the different motivating factors between genders could prove beneficial to educators and disciplinarians. Further research to determine if the deliberation of moral dilemmas would improve performance on the ICT in "poor decision making" populations such as substance abusers and adolescents, would be beneficial, as would fMRI studies confirming the areas of the brain activated during the deliberation of PM dilemmas while performing the ICT. In addition, it would be interesting to see if viewing morally explicit pictures would have the same effect on performance during the ICT. Further research to learn if changing the context in which decisions are made has an effect on the outcome, as it apparently has in this study, would be fascinating.

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Appendices

Appendix A: Informed Consent Form

UNCW

THE UNIVERSITY OF NORTH CAROLINA AT WILMINGTON

CONSENT TO PARTICIPATE IN RESEARCH

PROCEDURES:

You are invited to participate in a two-part research project. In the first part you will be given a brief smell test and then asked to fill out a short personal survey.

In the second part, you will be asked to play a computer card game that involves making decisions about card choices. Before every 10 trial block you will be given a passage to read and asked to answer yes or no as to whether or not it is appropriate for you to do something.

PRIVACY AND CONFIDENTIALITY:

All information obtained in this study will be held in confidence. Names will not be used in any presentation or publication. You will be assigned a code number for data analysis.

You may choose to withdraw from the study at any time without penalty.

Your participation in this project may provide no immediate benefits to you as a participant; however, the results of the project may provide us with valuable knowledge about the process of decision making.

If you have any questions please do not hesitate to contact Dr. William Overman, director of the project at 962-3379 or Dr. Candace Gauthier, chair of the UNC-W Institutional Review Board at 962-3558.

Upon completion of the second part you will receive 1 credit for the General Psychology “research requirement”. You will be given a credit slip, saying that you participated in a research project, which should be turned into your Psychology instructor for credit.

I have read and understand this consent form and consent to participate.

_____ _____

Printed Name of Participant **Signature of Participant** **Date**

_____ _____

Printed Name of Witness **Signature of Witness** **Date**

Appendix B: Confidential Personal Information Questionnaire

Subject No._____

Confidential Personal Information Questionaire

Please read and either circle or fill in the space designated with your answers. All your answers will be held in **strict confidence** and **DO NOT PUT YOUR NAME** on this form.

1. **Gender: Male Female**
2. **What is your Date of Birth? _____Day_____Month_____Year**
3. **How old are you in years and months? _____Yrs _____Months**
4. **Are you currently taking any prescription medication? YES NO**
5. **If YES, what are you taking?_____**
6. **How often do you consume alcoholic Beverages?_____**
7. **How many drinks do you usually have when you consume alcohol?___**
8. **Do you indulge in recreational drug use? YES NO**
9. **What recreational drugs have you tried?_____**
10. **How often do you use recreation drugs?_____**

Instructions for the Smell Identification Test™

(To be read out loud to the subject carefully before beginning)

1) **Please print your name and the date on the back of this booklet**
2) **Open first page for them**
3) **This is a smell test**
4) **Use the pencil to scratch the brown label several times like this**
5) **Make a "Z" with two lines through it . . . . *then show them on a scrap of paper***
6) **Hold the label under your nose and sniff**
7) **Fill in the circle corresponding to the smell you experience in the column on the right. Erase mistakes completely**
8) **If the odor you smell is not represented, mark the closest answer to your experience**
9) **If no smell is present, guess and mark one answer**
10) **You must mark an answer for each question (even if you smell nothing) to make your test valid.**

Do you have any questions? . . . . . You can start now.

Appendix D: Passage Instruction / Answer Sheet

MPD / NMD Subject No._____

Passage Instructions / Answer Sheet

Before every 10 Trial Block (card choices) you will be asked to read a passage. After reading each passage you will be asked to answer the question "is it appropriate or not for you to do?" On the answer sheet provided, next to the number corresponding to the passage that you read, you are to circle yes or no.

1. YES / NO

2. YES / NO

3. YES / NO

4. YES / NO

5. YES / NO

6. YES / NO

7. YES / NO

8. YES / NO

9. YES / NO

10 YES / NO

11. YES / NO

12. YES / NO

13. YES / NO

14. YES / NO

15. YES / NO

16. YES / NO

17. YES / NO

18. YES / NO

19. YES / NO

20. YES / NO

Appendix E: Personal Moral Dilemmas

1. Transplant

You are a doctor. You have five patients, each of whom is about to die due to a failing organ of some kind. You have another patient who is healthy.

The only way that you can save the lives of the first five patients is to transplant five of this young man's organs (against his will) into the bodies of the other five patients. If you do this, the young man will die, but the other five patients will live.

Is it appropriate for you to perform this transplant in order to save five of your patients?

2. Footbridge

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

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

Is it appropriate for you to push the stranger on to the tracks in order to save the five workmen?

3. Lifeboat

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

The seas start to get rough, and the boat begins to fill with water. It seems to you that there is only one way to stop the boat from sinking, and that is to start throwing other passengers overboard, starting with old people who are too weak to resist.

Is it appropriate for you to throw some of your fellow passengers overboard in order to save yourself and the remaining passengers?

4. Hard Times

You are the head of a poor household in a developing country. Your crops have failed for the second year in a row, and it appears that you have no way to feed your family. Your sons, ages eight and ten, are too young to go off to the city where there jobs, but your daughter could fare better.

You know a man from your village who lives in the city and who makes sexually explicit films featuring small children such as your daughter. He tells you that in one year of working in his studio your daughter could earn enough money to keep your family fed for several growing seasons.

Is it appropriate for you to employ your daughter in the child pornography industry in order to feed your family?

5. Smother for dollars

You are in hospital lounge waiting to visit a sick friend. A young man sitting next to you explains that his father is very ill. The doctors believe that he has a week to live at most. He explains further that his father has a substantial life insurance policy that expires at midnight.

If his father dies before midnight, this young man will receive a very large sum of money. He says that the money would mean a great deal to him and that no good will come from his father's living a few more days. He offers you half a million dollars to go up to his father's room and smother his father with a pillow.

Is it appropriate for you to kill this man's father in order to get money for yourself and this young man?

6. Crying Baby

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

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

Is it appropriate for you to smother your child in order to save yourself and the other townspeople?

7. Plane Crash

Your plane has crashed in the Himalayas. The only survivors are yourself, another man, and a young boy. The three of you travel for days, battling extreme cold and wind. Your only chance at survival is to find your way to small a village on the other side of the mountain, several days away.

The boy has a broken leg and cannot move very quickly. His chances of surviving the journey are essentially zero. Without food, you and the other man will probably die as well. The other man suggests that you sacrifice the boy and eat his remains over the next few days.

Is it appropriate to kill this boy so that you and the other man may survive your journey to safety?

8. Hired Rapist

You have been dissatisfied with your marriage for several years. It is your distinct impression that your wife no longer appreciates you. You remember how she appreciated

you years ago when you took care of her after she was mugged. You devise the following plan to regain your wife's affection.

You will hire a man to break into your house while you are away. This man will tie up your wife and rape her. You, upon hearing the horrible news, will return swiftly to her side, to take care of her and comfort her, and she will once again appreciate you.

Is it appropriate for you to hire a man to rape your wife so that she will appreciate you as you comfort her?

9. Grandson

A young boy is visiting his grandmother for the weekend. Usually she gives him a gift of a few dollars when he arrives, but this time she doesn't. He asks her why not and she says something about how he doesn't write her as many letters as he used to. Angered by this, the boy decides to play a trick on her.

While his grandmother is busy cooking he removes a handful of pills from the medicine cabinet and puts them in his grandmother's teapot. Later that night, she makes her tea, and the dissolved pills make her sick. In the morning she is dead.

Was it appropriate for this boy to put pills in his grandmother's teapot in order to play a trick on her?

10. Infanticide

You are a fifteen-year-old girl who has become pregnant. By wearing loose clothing and deliberately putting on weight you have managed to keep your pregnancy a secret. One day, while at school, your water breaks. You run to the girls locker room and hide for several hours while you deliver the baby. You are sure that you are not prepared to care for this baby.

You think to yourself that it would be such a relief to simply clean up the mess you've made in the locker room, wrap the baby in some towels, throw the baby in the dumpster behind the school, and act as if nothing had ever happened.

Is it appropriate for you to throw your baby in the dumpster in order to move on with your life?

11. Modified Preventing the Spread

You are a waiter. You overhear one of your customers say that he is about to go to jail and that in his last forty-eight hours of freedom he plans to infect as many people as possible with HIV. You know him well enough to know that he is telling the truth and that he has access to many potential victims.

You happen to know that he has a very strong allergy to poppy seeds. If he eats even one he will go into convulsions and have to be hospitalized for at least forty-eight hours.

Is it appropriate for you to cause this man to have a serious allergy attack in order to prevent him from spreading HIV?

12. Modified Safari

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

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

Is it appropriate for you to kill one of your fellow hostages in order to escape from the terrorists and save the lives of the eight children?

13. Modified Bomb

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

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

Is it appropriate for you to break the terrorist's son's arm in order to prevent the terrorist from killing thousands of people with his bomb?

14. Submarine

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

The remaining oxygen is not sufficient for the entire crew to make it to the surface. The only way to save the other crew members is to shoot dead the injured crew member so that there will be just enough oxygen for the rest of the crew to survive.

Is it appropriate for you to kill the fatally injured crew member in order to save the lives of the remaining crew members?

15. Lawrence of Arabia

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

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

Is it appropriate for you to cut off this man's head in order to prevent the two tribes from fighting a war that will cost hundreds of lives?

16. Sophie's Choice

It is wartime and you and your two children, ages eight and five, are living in a territory that has been occupied by the enemy. At the enemy's headquarters is a doctor who performs painful experiments on humans that inevitably lead to death.

He intends to perform experiments on one of your children, but he will allow you to choose which of your children will be experimented upon. You have twenty-four hours to bring one of your children to his laboratory. If you refuse to bring one of your children to his laboratory he will find them both and experiment on both of them.

Is it appropriate for you to bring one of your children to the laboratory in order to avoid having them both die?

17. Sacrifice

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

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

Is it appropriate for you to kill your oldest son in order to save your husband and your other three children?

18. Vitamins

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

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

Is it appropriate for you to forcibly remove this man's kidney in order to save the lives of the six vitamin-deficient people?

19. Vaccine Test

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

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

person will live, the other will die, and you will be able to start saving lives with your vaccine.

Is it appropriate for you to kill one of these people with a deadly injection in order to identify a vaccine that will save millions of lives?

20. Euthanasia

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

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

Is it appropriate for you to shoot this soldier in order to prevent him from being tortured by the enemy?

Appendix F: Non Moral Dilemmas

1. Standard Turnips

You are a farm worker driving a turnip-harvesting machine. You are approaching two diverging paths.

By choosing the path on the left you will harvest ten bushels of turnips. By choosing the path on the right you will harvest twenty bushels of turnips. If you do nothing your turnip-harvesting machine will turn to the left

Is it appropriate for you to turn your turnip-picking machine to the right in order to harvest twenty bushels of turnips instead of ten?

2. Plant Transport

You are bringing home a number of plants from a store that is about two miles from your home. The trunk of your car, which you've lined with plastic to catch the mud from the plants, will hold most of the plants you've purchased.

You could bring all the plants home in one trip, but this would require putting some of the plants in the back seat as well as in the trunk. By putting some of the plants in the back seat you will ruin your fine leather upholstery which would cost thousands of dollars to replace.

Is it appropriate for you to make two trips home in order to avoid ruining the upholstery of your car?

3. Scheduling

You are in charge of scheduling appointments in a dentist's office. Two people, Mr. Morris and Mrs. Santiago have called to make appointments for next Monday. The only available times for next Monday are at 10:00 AM and at 3:00 PM.

Mr. Morris's schedule is rather flexible. He can have his appointment either at 10:00 AM or at 3:00 PM. Mrs. Santiago's schedule is less flexible. She can only have her appointment at 10:00 AM.

Is it appropriate for you to schedule Mr. Morris for 3:00 PM so that both he and Mrs. Santiago can have their appointments next Monday?

4. Generic Brand

You have a headache. You go to the pharmacy with the intention of buying a particular name-brand headache medicine. When you get there you discover that the pharmacy is out of the brand you were looking for.

The pharmacist, whom you've known for a long time and in whom you have a great deal of trust, tells you that he has in stock a generic product which is, in his words, "exactly the same" as the product you had originally intended to buy.

Is it appropriate for you to purchase the generic brand instead of searching further for the name-brand product you were looking for?

5. Brownies

You have decided to make a batch of brownies for yourself. You open your recipe book and find a recipe for brownies.

The recipe calls for a cup of chopped walnuts. You don't like walnuts, but you do like macadamia nuts. As it happens, you have both kinds of nuts available to you.

Is it appropriate for you to substitute macadamia nuts for walnuts in order to avoid eating walnuts?

6. Train or Bus

You need to travel from New York to Boston in order to attend a meeting that starts at 2:00 PM. You can take either the train or the bus.

The train will get you there just in time for your meeting no matter what. The bus is scheduled to arrive an hour before your meeting, but the bus is occasionally several hours late because of traffic. It would be nice to have an extra hour before the meeting, but you cannot afford to be late.

Is it appropriate for you to take the train instead of the bus in order to ensure your not being late for your meeting?

7. Computer

You are looking to buy a new computer. At the moment the computer that you want costs $1000. A friend who knows the computer industry has told you that this computer's price will drop to $500 next month.

If you wait until next month to buy your new computer you will have to use your old computer for a few weeks longer than you would like to. Nevertheless you will be able to do everything you need to do using your old computer during that time.

Is it appropriate for you to use your old computer for a few more weeks in order to save $500 on the purchase of a new computer?

8. Survey

A representative of a reputable, national survey organization calls you at your home while you are having a quiet dinner by yourself.

The representative explains that if you are willing to spend a half an hour answering questions about a variety of topics her organization will send you a check for $200.

Is it appropriate for you to interrupt your dinner in order to earn $200?

9. Coupons

You have gone to a bookstore to buy $50 worth of books. You have with you two coupons.

One of these coupons gives you 30% off of your purchase price. This coupon expires tomorrow.

The other coupon gives you 25% off your purchase price, and this coupon does not expire for another year.

Is it appropriate for you to use the 30%-off coupon for your present purchase so that you will have another coupon to use during the coming year?

10. Scenic Route

An old friend has invited you to spend the weekend with him at his summer home some ways up the coast from where you are. You intend to travel there by car, and there are two routes that you can take: the highway and the coastal road.

The highway will get you to your friend's house in about three hours, but the scenery along the highway is very boring. The coastal route will get you to your friend's house in about three hours and fifteen minutes, and the scenery along the coastal road is breathtakingly beautiful.

Is it appropriate for you to take the coastal route in order to observe the beautiful scenery as you drive?

11 Reversed Turnips

You are a farm worker driving a turnip-harvesting machine. You are approaching two diverging paths.

By choosing the path on the left you will harvest thirty bushels of turnips. By choosing the path on the right you will harvest fifteen bushels of turnips. If you do nothing your turnip-picking machine will turn to the left.

Is it appropriate for you to turn your turnip-harvesting machine to the right in order to harvest fifteen bushels of turnips instead of thirty?

12. Investment Offer

You are at home one day when the mail arrives. You receive a letter from a reputable corporation that provides financial services. They have invited you to invest in a mutual fund, beginning with an initial investment of one thousand dollars.

As it happens, you are familiar with this particular mutual fund. It has not performed very well over the past few years, and, based on what you know, there is no reason to think that it will perform any better in the future.

Is it appropriate for you to invest a thousand dollars in this mutual fund in order to make money?

13. Broken VCR

You have brought your broken VCR to the local repair shop. The woman working at the shop tells you that it will cost you about $100 to have it fixed.

You noticed in the paper that morning that the electronics shop next door is having a sale on VCR's and that a certain new VCR which is slightly better than your old one is on sale for $100.

Is it appropriate for you have your old VCR fixed in order to avoid spending money on a new one?

14. Choosing Classes

You are beginning your senior year of college. In order to fulfill your graduation requirements you need to take a history class and a science class by the end of the year.

During the fall term, the history class you want to take is scheduled at the same time as the science class you want to take. During the spring term the same history class is offered, but the science class is not.

Is it appropriate for you to take the history class during the fall term in order to help you fulfill your graduation requirements?

15. Raffle

You've decided to buy a raffle ticket to support a local charity. They are separately raffling off two different cars: Car A and Car B. You have decided to buy one raffle ticket. You are a serious and knowledgeable car enthusiast, and you think that these two cars are equally good.

Because there have been a lot of adds for Car B on TV recently, many more people have chosen to buy tickets for the Car B raffle. Since more people have bought tickets for the Car B raffle, your chances of winning are better in the Car A raffle than in the Car B raffle.

Is it appropriate for you to buy a ticket for the Car B raffle in order to win a car?

16. Jogging

You intend to accomplish two things this afternoon: going for a jog and doing some paperwork. In general you prefer to get your work done before you exercise.

The weather is nice at the moment, but the weather forecast says that in a couple of hours it will start to rain. You very much dislike jogging in the rain, but you don't care what the weather is like while you do paperwork.

Is it appropriate for you to do your paperwork now with the intention of jogging in a couple of hours in order to get your work done before you exercise?

17. Food Prep

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

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

Is it appropriate for you to cut the vegetables first and then start the water boiling in order to satisfy your slight urge to cut vegetables?

18. Shower

You are planning to attend a luncheon this afternoon, and before you go you will need to take a shower. You have some yard work that you would like to do before then, and doing this yard will cause you to perspire a fair amount.

If you shower before you do your yard work you will have to take another shower before the luncheon. At the present time you could enjoy taking a shower. At the same time, you have a very strong commitment to lowering your water bill and to showering no more than once a day.

Is it appropriate for you to shower before doing your yard work in order to enjoy a shower now?

19. Errands

You need to go to the bakery in the morning and the furniture store in the afternoon. You also need to go to the camera shop at some point. You prefer to do most of your errands in the morning, but you very much dislike doing unnecessary driving.

The camera shop is near the furniture store and far from the bakery. As a result you will have to do less driving if you go to the camera shop in the afternoon when you go to the furniture store.

Is it appropriate for you to go to the camera shop in the morning in order to do most of your errands in the morning?

20. New Job

You have been offered employment by two different firms, and you are trying to decide which offer to accept.

Firm A has offered you an annual salary of $100,000 and fourteen days of vacation per year. Firm B has offered you an annual salary of $50,000 and sixteen days of vacation per year. The two firms and the two positions are otherwise very similar.

Is it appropriate for you to take Firm B's offer in order to have two more days of vacation per year?

Appendix G: Impersonal Moral Dilemmas

1. Standard Trolley

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

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

Is it appropriate for you to hit the switch in order to avoid the deaths of the five workmen?

2. Standard Fumes

You are the late-night watchman in a hospital. Due to an accident in the building next door, there are deadly fumes rising up through the hospital's ventilation system. In a certain room of the hospital are three patients. In another room there is a single patient. If you do nothing the fumes will rise up into the room containing the three patients and cause their deaths.

The only way to avoid the deaths of these patients is to hit a certain switch, which will cause the fumes to bypass the room containing the three patients. As a result of doing this the fumes will enter the room containing the single patient, causing his death.

Is it appropriate for you to hit the switch in order to avoid the deaths of the three patients?

3. Donation

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

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

Is it appropriate for you to not make a donation to this organization in order to save money?

4. Vaccine Policy

You work for the Bureau of Health, a government agency. You are deciding whether or not your agency should encourage the use of a certain recently developed vaccine. The vast majority of people who take the vaccine develop an immunity to a certain deadly disease, but a very small number of people who take the vaccine will actually get the disease that the vaccine is designed to prevent.

All the available evidence, which is very strong, suggests that the chances of getting the disease due to lack of vaccination are much higher than the chances of getting the disease by taking the vaccine.

Is it appropriate for you to direct your agency to encourage the use of this vaccine in order to promote national health?

5. Environmental Policy

You are a member of a government legislature. The legislature is deciding between two different policies concerning environmental hazards.

Policy A has a 90% chance of causing no deaths at all and has a 10% chance of causing 1000 deaths. Policy B has a 92% chance of causing no deaths and an 8% chance of causing 10,000 deaths.

Is it appropriate for you to vote for Policy A over Policy B?

6. Environmental Policy

You are a member of a government legislature. The legislature is deciding between two different policies concerning environmental hazards.

Policy A has a 90% chance of causing no deaths at all and has a 10% chance of causing 1000 deaths. Policy B has an 88% chance of causing no deaths and a 12% chance of causing 10 deaths.

Is it appropriate for you to vote for Policy B over Policy A?

7. Sculpture

You are visiting the sculpture garden of a wealthy art collector. The garden overlooks a valley containing a set of train tracks. A railway workman is working on the tracks, and an empty runaway trolley is heading down the tracks toward the workman.

The only way to save the workman's life is to push one of the art collector's prized sculptures down into the valley so that it will roll onto the tracks and block the trolley's passage. Doing this will destroy the sculpture.

Is it appropriate for you to destroy the sculpture in order to save this workman's life?

8. Speedboat

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

The only way that you can ensure their safety is to warn them by borrowing a nearby speedboat. The speedboat belongs to a miserly tycoon who would not take kindly to your borrowing his property.

Is it appropriate for you to borrow the speedboat in order to warn the tourists about the storm?

9. Guarded Speedboat

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

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

Is it appropriate for you to lie to the guard in order to borrow the speedboat and warn the tourists about the storm?

10. Five-for-Seven Trolley

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

If you do nothing the trolley will proceed to the left, causing the deaths of the five workmen. The only way to save these workmen is to hit a switch on your dashboard that will cause the trolley to proceed to the right, causing the deaths of the seven workmen on the other side.

Is it appropriate for you to hit the switch in order to avoid the deaths of the five workmen?

11. Three-for-Seven Fumes

You are the late-night watchman in a hospital. Due to an accident in the building next door, there are deadly fumes rising up through the hospital's ventilation system. In a certain room of the hospital are three patients. In another room there are seven patients. If you do nothing the fumes will rise up into the room containing the three patients and cause their deaths.

The only way to save these patients is to hit a certain switch, which will cause the fumes to bypass the room containing the three people. As a result of doing this the fumes will enter the room containing the seven patients, causing their deaths.

Is it appropriate for you to hit the switch in order to avoid the deaths of the three patients?

12. Resume

You have a friend who has been trying to find a job lately without much success. He figured that he would be more likely to get hired if he had a more impressive resume.

He decided to put some false information on his resume in order to make it more impressive. By doing this he ultimately managed to get hired, beating out several candidates who were actually more qualified than he.

Was it appropriate for your friend to put false information on his resume in order to help him find employment?

13. Taxes

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

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

Is it appropriate for you to pretend that certain personal expenses are business expenses in order to lower your taxes?

14. Environmental Policy

You are a member of a government legislature. The legislature is deciding between two different policies concerning environmental hazards.

Policy A has a 90% chance of causing no deaths at all and has a 10% chance of causing 1000 deaths. Policy B has a 92% chance of causing no deaths and an 8% chance of causing 10,000 deaths.

Is it appropriate for you to vote for Policy B over Policy A?

15. Environmental Policy

You are a member of a government legislature. The legislature is deciding between two different policies concerning environmental hazards.

Policy A has a 90% chance of causing no deaths at all and has a 10% chance of causing 1000 deaths. Policy B has a 88% chance of causing no deaths and a 12% chance of causing 10 deaths.

Is it appropriate for you to vote for Policy A over Policy B?

16. Stock Tip

You are a management consultant working on a case for a large corporate client. You have access to confidential information that would be very useful to investors. You have a friend who plays the stock market. You owe this friend a sizable sum of money.

By providing her with certain confidential information you could help her make a lot of money, considerably more than you owe her. If you did this, she would insist on canceling your debt. Releasing information in this way is strictly forbidden by federal law.

Is it appropriate for you to release this information to your friend so that she will cancel your debt?

17. Illegal Lunch

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

You're quite sure that if you were to talk to him over lunch, you could jog his memory and he would begin to see you as an old buddy, which would be very good for

your work on this case. It's illegal for judges and lawyers working on the same case to meet socially.

Is it appropriate for you to meet with this judge socially in order to help you win your case?

18. Lost Wallet

You are walking down the street when you come across a wallet lying on the ground. You open the wallet and find that it contains several hundred dollars in cash as well the owner's driver's license.

From the credit cards and other items in the wallet it's very clear that the wallet's owner is wealthy. You, on the other hand, have been hit by hard times recently and could really use some extra money. You consider sending the wallet back to the owner without the cash, keeping the cash for yourself.

Is it appropriate for you to keep the money you found in the wallet in order to have more money for yourself?

19. Eyes

In the future, you are a veteran of a war during which both of your eyes were destroyed. Due to recent medical advances, it is now possible to perform eye transplants, but, much to your anger and amazement, there are no willing donors.

A sympathetic black-market surgeon offers to help you. If you hire him, he and his associates will kidnap a randomly selected stranger, carve out one of his eyes, and transfer it to you.

Is it appropriate for you to hire this surgeon to carve out a stranger's eye in order to help restore your vision?

Appendix H: General Instructions for the Iowa Card (Gambling) Task

Instructions for Iowa Card Task

You are to select cards from any of the four decks, one at a time, in any order you choose. As you turn the card over, tell me the color of the card so I can click on that color card on the computer screen, because the computer keeps score for us. I will tell you your total after every card is turned and you can look at the computer any time to see your total. You are free to switch from one deck to another at any time as often as you like. (Demonstrate). Remember that you can reuse the decks if you run out of cards. You will continue to select cards until I tell you to stop.

Each time you pick a card you will win some money. On some cards you will win some money and lose some money. The goal of the game is to win as much money as possible and to lose as little as possible. (Remember that you are not playing for real money.)

There are two kinds of decks in this game: “Good decks” and Bad Decks”. If you constantly pick from the good decks you will win more money than you lose. If you constantly pick from the bad decks you will lose more money than you will win. So your job is to figure out which are the good decks and which are the bad decks. The good and bad decks never change. The same two decks are always good decks and the other two are always bad decks.

Appendix I: Iowa Gambling Task Scoring Sheet

Iowa Card Task Scoring Sheet

Ten Trials: Block 1: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 2: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 3: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 4: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 5: Y = , B = , R = , G = , Good Deck Guess ____, ____

Trial Block I: Y = , B = , R = , G = ,

Ten Trials: Block 6: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 7: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 8: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 9: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 10: Y = , B = , R = , G = , Good Deck Guess ____, ____

Trial Block II: Y = , B = , R = , G = ,

Iowa Card Task Scoring Sheet (Continued)

Ten Trials: Block 11: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 12: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 13: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 14: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 15: Y = , B = , R = , G = , Good Deck Guess ____, ____

Trial Block III: Y = , B = , R = , G = ,

Ten Trials: Block 16: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 17: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 18: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 19: Y = , B = , R = , G = , Good Deck Guess ____, ____

Ten Trials: Block 20: Y = , B = , R = , G = , Good Deck Guess ____, ____

Trial Block IV: Y = , B = , R = , G = ,