THE EFFECTS OF POSITIVE AND NEGATIVE AFFECT ON IOWA GAMBLING TASK PERFORMANCE

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Abstract

In normal populations, males typically perform better than females on the Iowa Gambling Task (IGT). Previous studies have shown that deliberation of moral dilemmas during the IGT significantly improves the performance of females to the level of males and that smelling aromas during the IGT significantly reduces the performance of males to the level of females. Nevertheless, both moral dilemmas and aromas have an affective quality. In the present study, to test whether affect influenced IGT performance, participants viewed positive, negative, or neutral pictures during the IGT task. The results of this study showed the affective pictures had no effect on IGT performance. Males outperformed females and females chose one particular card type, as is typically the case. Thus, previous effects of dilemmas or aromas are not likely due to emotional factors.

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DEDICATIONS

I would like to dedicate this thesis to my grandparents, Preston and Ardelia Hardy. Without their continued support and encouragement, I would have never made it this far.

In Loving Memory of my grandfather, William Preston Hardy

December 2, 1926 – March 7, 2007

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Iowa Gambling Task (IGT)

“Real-life” decision-making has been widely measured by the Iowa Gambling Task (Bechara, Damasio, Damasio & Anderson, 1997). The Iowa Gambling Task (IGT) requires participants to choose from one of four decks of cards. Two of the decks (red and green) are advantageous and are associated with low monetary rewards ($50), but even lower sporadic losses. The remaining two decks (blue and yellow) are the disadvantageous decks, which are associated with high monetary rewards ($100), but even higher sporadic losses. A net gain of +$250 (per 10 trials) will result from consistently choosing from the advantageous (+$50; red and green) decks, whereas a net loss of -$250 (per 10 trials) will result from consistently choosing from the disadvantageous (+$100; yellow and blue) decks. In a normative population, participants will gradually learn to choose +$50 red and green advantageous cards about 70% over the course of 100-200 trials. Individuals that demonstrate poor performance on this task include pathological gamblers (Cavedini, Ribolodi, Keller, D’Annucci, & Bellodi, 2002), violent offenders (Fishbein, 2000), polysubstance abusers (stimulants or opoids) (Grant, Contoreggi, & London, 2000), patients with obsessive-compulsive disorder (Cavedini et al., 2002) and patients with ventromedial prefrontal cortex damage (Bechara, A. R. Damasio, H. Damasio, & Anderson, 1994). In addition, adolescents perform worse on the IGT than young adults but better than afore mentioned populations.

Damage to Prefrontal Cortex Impairs IGT Performance

The integrity of several regions of the PFC are required for optimal performance on this task. Damage to the orbital prefrontal cortex (OPFC) (Bechara et al., 1994), as well as damage to the dorsolateral prefrontal cortex (DLPFC) (Fellows & Farah, 2005; Manes et al. 2002) causes poor performance on the IGT. In addition, damage to the ventromedial prefrontal cortex impairs performance (Fellows & Farah, 2005). Clark et al., (2003) tested patients with right and left ventromedial prefrontal cortex damage on a battery of decision making tasks. The results demonstrated that individuals with lateralized right lesions performed significantly lower (i.e. chose less +$50 advantageous cards/red and green cards) than the healthy controls and patients with lateralized left lesions. Patients with left lateralized lesions scored significantly lower than healthy controls. Analysis of behavior throughout the task demonstrated that patients with left lateralized lesions began the task with performance similar to that of the healthy controls, however, as the task progressed, their behavior became more erratic. This difference in initial task performance was not found in patients with right lateralized lesions. This research suggests that the left and right ventromedial prefrontal cortex is a significant factor in advantageous decision making, however, with lateralized right lesions creating a larger deficit. Unfortunately, specific regions of the VMPFC were not identified in that study (Clark, 2003).

Laterality Effects of Damage in IGT Performance

In addition, it has been demonstrated that the DLPFC (Clark, Manes, Antoun, Sahakian, & Robins, 2003) and the OPFC (Tranel, Bechara, & Denenberg, 2002) show significantly more activation in the right hemisphere than the left with regards to decision making. Thus, deficits in performance on the IGT are also seen in patients with right DLPFC damage (Bechara, Damasio, Tranel, & Anderson, 1998).

Three Possibilities Have Been Ruled Out for Females Poor Performance

Typically, males significantly outperform females on IGT performance (Overman et al., 2004) Overman et al. (2006) investigated these differences and ruled out three possible reasons for female’s poor IGT performance: a)differential math ability, b)differential perservative behavior, and c) a control for generalized arousal.

In the first experiment, Overman et al. (2006) addressed the possibility that males show certain advantages in mathematical domains (Hedges & Nowell, 1995). The authors created a new version of the IGT so that there was calculation required for each card (i.e. each card had a “win” and “loss” value). The net outcome of each new card corresponded to the net outcome of the corresponding card in the original IGT (ex. first +$50 red advantageous card in regular deck was +$50, whereas the first red advantageous card in the new version was +$75 - $25; both result in a net gain of $50). It was thought that females would perform significantly worse than males and previously tested females *if* the reason for their deficit was poor math ability. The results of this experiment, found that women did not perform significantly different from men, however, the trend approached significance ($p = .08$). As is typical, females showed a significant preference for the +$100 yellow disadvantageous card. This card preference increased as the task progressed. This study concluded that math ability does not explain the gender differences found in the original task.

In the second experiment, Overman et al.(2006) addressed differential response perseveration. This study was based on previous literature that demonstrated female nonhuman primates (Clark & Goldman-Rakic, 1989) and infant female humans (Overman, Bachevalier, Schuhmann & Ryan, 1996) perseverate significantly more than do males on reversal tasks that rely on the orbital frontal cortex. Fellows & Farah (2005) have demonstrated that individuals with ventromedial prefrontal cortex damage performed as well as normal controls on the IGT when the penalty cards were moved to the front of the deck (Fellows & Farah, 2005). Overman et al. (2006) created a new IGT deck for this study. In the original version of the IGT, the -$1250 yellow disadvantageous penalty card is presented 9th in the yellow deck. Because participants initially explore all the decks they do not encounter that -$1250 penalty card until 25-30 cards have been drawn. This study theorized that females perseverate on this card because they attach a positive impetus to it that results from winning $100 on the yellow cards 8 times before encountering a penalty. Individuals with ventromedial prefrontal cortex damage encounter high-paying disadvantageous cards without penalty early in the task, and find it difficult to shift to the advantageous decks with low-paying rewards (Fellows and Farah, 2005). Overman et al. (2006) shifted the penalty cards toward the front of the decks and found that these manipulations did not alter performance on the IGT. Males still outscored females and females still showed a significant preference for the +$100 yellow disadvantageous card. Thus, differential perseveration is not an adequate explanation for poor performance.

A third experiment was conducted by Overman et al. (2006) to control for generalized arousal with the use of the Wisconsin

Card Sorting task (WCST). The WCST utilizes four decks of stimulus cards: the first has one red triangle, the second has two green stars, the third has three yellow crosses, and the fourth has four blue circles. Participants are then presented with an additional stack of cards and instructed to match those cards to one of the four stimulus cards. Participants are not instructed on how to sort the cards; however, the experimenter informs them whether they are right or wrong. During performance of the WCST, significant activation is seen in the DLPFC (Berman, K. F., Ostream, J. L., Randolph, C., Gold, J., Goldberg, T. E., Coppola, R. et al., 1995). In this experiment, subjects were asked to complete the WCST prior to completion of the IGT. The results of that experiment suggested that generalized arousal of the prefrontal cortex was not the cause for increased performance and that the change was a result of activation shifting to the dorsal lateral prefrontal cortex.

Possible Neuroanatomical Basis for Gender Differences

A significant gender difference in brain activation has been demonstrated during IGT performance in normal populations. The underlying cause of the gender difference may be related to the fact that males and females use somewhat different cortical areas during the IGT. Using positron emission tomography (PET) study, Bolla et al. (2004) revealed that during performance of the IGT, males had increased levels of activity in the right

DLPFC (BAs 9 and 10), large regions of right lateral OPFC (BA 47), and right parietal lobe (BA 40). In contrast, females showed increased levels of activation in the left medial OPFC (BA 11). Further analysis revealed that males showed significantly more activation in the right lateral OPFC (BAs 47, 10), whereas, women showed significantly more activation in the left DLPFC (BA 9). Bolla et al. (2004) further noted that the lateral OPFC (BA 47) may be more sensitive to punishment, whereas, the medial OPFC (BA 11) may be involved in reward. Thus, this may be related to female’s attraction to the +$100 yellow disadvantageous card and male’s avoidance of this card. This suggestion was based on the research of O’Doherty, Kringelback, Rolls, Hornak, and Andrews (2001) who investigated the reward/punishment dissociation in the OPFC. In his study, O’Doherty et al. (2001) utilized an fMRI during the performance of a task where symbolic monetary gains and losses were used as rewards and punishments. The results of this study paralleled Bolla et al.’s (2004) study, showing that the lateral OPFC (BA 47) is activated following a punishing outcome and the medial OPFC (BA 11) is activated following a reward outcome.

<u>Contemplation of Dilemmas also Activate PFC</u>

Greene et al. (2001) has defined three types of dilemmas that when contemplated, increase activity in different brain regions. “Personal moral dilemmas” (PM) must meet three criteria: a) they are likely to cause serious bodily harm, b) to a particular person, c) in such a way that they harm does not result from the deflection of an existing threat onto a different party. See example below:

> 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 given 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?

The “impersonal moral dilemmas” (IPM) is similar to the personal moral dilemmas, however, it involves the deflection of an existing threat. See example below:

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

The “non-moral dilemma” (NM) does not include any ethical/moral decisions. See example below:

> 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?

Greene et al. (2001) reported that deliberation of PM dilemmas increased activation in medial portions of the prefrontal cortex (BAs 11), whereas, deliberation of IMP increased activation in the dorsal lateral prefrontal cortex (BA 9, 10). More recent research, (Greene, Nystrom, Engell, Darley & Cohen, 2004) found that deliberation of difficult PM dilemmas (defined by long response times) increased activation in the dorsal lateral prefrontal cortex (BA 9, 10). Further analysis found that when the difficult PM dilemmas were answered with a utilitarian response (for the greater good), increased activation in the dorsal lateral prefrontal cortex also occurred. Gender differences could not be determined from this study because the data was combined from both sexes.

<u>Deliberation of Dilemmas Enhances IGT Performance</u>

In his study, Overman et al. (2006) had subjects silently read and deliberate one PM, MI, or NM dilemmas every 10 trials of the IGT (note: each participant read dilemmas from only 1 of the three conditions). Participants were also asked to indicate whether they felt the action described in the dilemma was “appropriate” or “inappropriate”. The results of this study showed that gender differences were eliminated in the PM condition only. Females continued to show a preference for the +$100 yellow disadvantageous card across the other two conditions (MI, NM), but not in the PM condition where their performance was elevated to that of males.

Overman et al. (2006) speculated that these findings of normal female’s preferential selection of the +$100 yellow disadvantageous card to Bolla et al.’s (2004) study that suggested females are attracted to the high-reward values of the +$100 yellow disadvantageous card due to activation of the orbital prefrontal cortex (BA 11). The increase in performance, when personal moral dilemmas were read) was attributed to activation of the DLPFC. Overman et al. (2006) speculated that these dilemmas shifted females performance equal to that of males, by shift activation to the brain areas utilized by males, DLPFC (Bolla et al., 2004).

In an effort to see if deliberating moral dilemmas could lead to a *persistent* effect throughout the IGT, Boettcher (2007) provided a systematic replication of Overman's (2006) study. In this study, participants were asked to silently read twenty PM, MI, or NM dilemmas *before* beginning the IGT. Results of this study indicated an enhancement effect (for females) in the all *three* conditions. More specifically, female's performance was enhanced to those of their male counterparts. These mixed results suggest a potential alternative cause for the increase in performance. In theory, this increase in performance is due to a shift from activation in the OPFC to the DLPFC.

<u>The OPFC and the Effects of Aromas on IGT Performance</u>

One way to indirectly test our hypothesis for a shift away from engagement of OPFC to engagement of DLPFC in females is to look for the opposite shift (from RDLPFC to LOPFC in males) and subsequent performance *decline*. In this experiment we predicted a decline in IGT performance in males because of olfactory stimulation during the IGT. The logic is as follows:

Orbital prefrontal cortex receives input from sensory systems including olfactory, gustatory, visceral, somatic sensory and visual (for review see Ongur & Price, 2000; Price, 2006; Rolls, 2004). This constellation of inputs, along with intimate limbic relationships, functions as a system for integration of sensory information, especially for the assessment of food choices, and for other emotionally-related decisional behaviors (Zald and Rauch, 2006).

Situated immediately caudal to ORB is primary olfactory cortex. This defined as all brain regions receiving direct inputs from the olfactory bulb (Price, 1990). Primary olfactory cortex consists of piriform cortex, entorhinal cortex, periamygdaloid cortex, olfactory tuberical, the tenia tecta and anterior nucleus (Carmichael, Clugnet and Price, 1994). Of particular note for the current paper is that the piriform cortex, the largest recipient of bulbar input, has *direct* connections with orbital prefrontal cortex. [Although, there is a small olfactory input to ORB via the mediodorsal nucleus of the thalamus (Price, 2006).] Specifically, piriform cortex projects to posterior orbitofrontal cortex (BA 13a, 13m) which in turn projects to other orbital areas including BA 11l (Price, 2006).

Based on the anatomical nature of the olfactory system and its rather direct connection to the orbital prefrontal cortex via the piriform cortex (primary olfactory center) Overman (in process) hypothesized that having participants smell odorants (essential oils) would shift male's performance from the dorsal lateral prefrontal cortex to the orbital prefrontal cortex (resulting in a decline in performance among males).

More specifically, participants were asked to smell an aroma in the right or left nostril for three seconds, prior to completing every 10 trials of the IGT. The results of this study confirmed Overman's hypothesis. Males in the experimental condition (aroma) (*M* = 61.29) chose significantly fewer advantageous cards than males in a previous studies non-aroma control condition (*M* = 64.18). In addition, Overman also discovered that males (*M* = 23.62) in the experimental condition showed the same yellow card preference originally demonstrated in females (*M* = 25.67).

<u>Interim Summary</u>

In summary, in a normal population, males perform significantly better than females on the IGT. Contemplating PM dilemmas significantly improves females performance to that of normal males, whereas, smelling odorants significantly decreases males performance to that of normal females. Thus, we have a strong double dissociation that fits the hypothesis that IGT performance can be shifted by various stimuli. However, one could argue that the female dilemma enhancement effect and the male aroma reduction in IGT performance might be due to positive and negative emotions elicited by the stimuli. Thus, a general discussion of emotion, the PFC, and it's effects on IGT performance is needed at this point.

The Role of Emotion in IGT Performance

Research on affective style and the prefrontal cortex (PFC) (Davidson, 2002), states that the two components of emotion circuitry are the prefrontal cortex and the amygdala. The prefrontal cortex is further subdivided into three general sections: dorsal lateral PFC, ventromedial PFC, and the orbitofrontal PFC. (Note: this stated division of the prefrontal cortex into these three areas is overly simplistic and we acknowledge that the PFC is very complex).

In their 1990 study, Davidson, Eckman, Saron, Senulis, & Friesen reported that during the production of negative and positive affective states, asymmetrical cortical activation occurred. With the use of brief film clips (i.e. nurse instructional video) Davidson et al. (1990) induced negative and positive affective states. The results of this study found that negative affect elicits right-sided prefrontal and anterior temporal activation, whereas, positive affect elicits an opposite pattern (i.e. left-sided prefrontal activation). Davidson et al. (1990) does not provide specific information regarding brain areas.

Northoff (2000) utilized fMRI/MEG techniques to assess prefrontal activation associated with the presentation of negative and positive pictures (adapted from the International Affective Picture System-IAPS). Participants were presented with blocks of negative, positive, neutral and gray pictures. The gray pictures did not have any contours, patterns, or content and consisted simply of a homogenous gray color. These pictures were used to control for arousal effects that may be elicited from the presences of any visual content. Participants were presented pictures for six seconds each. When a new picture appeared on the screen, participants were instructed to press a switch with their right index finger. The results showed that contrast-comparisons using negative emotional pictures (negative-gray, negative-neutral, negative-positive) showed strong activation clusters in the medial orbitofrontal cortex (BA 11). Positive contrast (positive-gray, positive-neutral, positive-negative) showed strong activation clusters in the lateral prefrontal cortex (BA 9, 46, 47). Northoff et al. (2004) also noted that while negative emotional pictures activated the medial orbitofrontal cortex, they were also marked with negatively correlated activity in the lateral prefrontal cortex. Positive emotional pictures also showed the negative correlated activity with regards to the orbitofrontal cortex. In addition, no significant differences existed across the conditions with regard to participants reaction time between the four conditions.

Bechara, Damasio, and Damasio (2000a) suggested that emotion rather than or, in addition to, pure cognition provides the information necessary to make advantageous decisions. According to the somatic marker hypothesis, deficits in emotions and feelings play significant roles in impaired decision making. Furthermore, Bechara et al. (2000) suggest that the ventromedial prefrontal cortex, due to its sensory and limbic input, is the biological mechanism that links the disposition of a situation and the disposition for the type of emotion previously associated with that type of situation.

In his (1999) study, Bechara et al. assessed the influence of ventromedial prefrontal cortex and amygdala on decision making. With the use of skin conductance response (SCRs) as a measure of somatic state activation, they hypothesized that patients with amgydala damage would perform poorly on the IGT and would fail to develop anticipatory SCRs (generated prior to turning any card over) before selecting a disadvantageous card. They further suggested that this decision making impairment was an indirect result of patient's inability to produce emotions associated with winning or losing money. This is significant because it suggested that patients are unable to anticipate future consequences or monitor their emotional states. Bechara et al. (1999) also hypothesized that patients with ventromedial damage would continue to generate post stimulus SCR’s because activation in the ventromedial cortex preceded activation of the amygdale (i.e post-stimulus emotion, but not anticipatory emotion).

With the use of the IGT, Bechara et al. (1999) tested his hypotheses on five amygdala and five ventromedial patients. Three types of SCRs were measured: 1) *reward*, which were generated after turning the card over for which there was a reward and no punishment; 2) *punishment*, generated after turning the card over for which there is a reward and an immediate penalty; and 3) *anticipatory*, generated before turning a card over from any deck. The results of this study showed that both amygdala and ventromedial patients failed to shift their performance (i.e. selecting more cards from the advantageous decks). Ventromedial and amygdala patients also showed significantly lower anticipatory SCRs when compared to the control group. This difference was not demonstrated when ventromedial and amygdala patients were compared. Amygdala patients showed severe impairment during the generation of reward and punishment induced SCRs, whereas, ventromedial patients did not show any impairment.

Tomb, Hauser, Deldin, and Caramazza, (2002) refuted Bechara et al.’s (1999) study. Utilizing Bechara’s (1999) version of the

IGT and a new version (good decks were now associated with a higher magnitude of reward and punishment versus the bad decks) of the IGT. Results showed that participants picked more cards from the good decks, which was accompanied by higher anticipatory SCR’s for the good decks than the bad decks. Tomb et al. (2002) further concluded that anticipatory SCR’s are driven by the immediate act to be performed rather than long-term negative and positive consequences. Thus, the opposite pattern of SCR’s do not provide evidence that somatic markers aid in decision making.

In his reply to Tomb et al. (2002), Damasio, Bechara, and Damasio (2002) addressed the aforementioned concerns. Damasio et al. argued that somatic makers are not only negative and can precede positive outcomes. The authors further suggested that the high anticipatory SCR’s in Tomb et al.’s (2002) study may reflect a positive state that encourages approach to the good decks rather than avoidance. In a similar modified task to Tomb et al.’s (2002), Damasio et al. demonstrated that patients with ventromedial damage (whom failed to develop anticipatory SCR’s) performed disadvantageously, providing additional support for the need of somatic markers.

De Vries, Holland, and Witteman (2008) address the influence of mood on IGT performance. The purpose of this study was to test whether mood moderated the tendency to choose +$50 advantageous cards during the early stages of the IGT. In the first experiment, participants received a brief mood inventory (three item scale to measure non-induced positive affect) and a brief filler task (asked to draw map of university). Participants then completed the IGT. The results of this study showed that non-induced mood was significantly positively correlated with performance in block 2 (cards selections 21-40). Individuals that demonstrated a more positive mood performed chose significantly more advantageous cards. In the second experiment, participants watched two 2.5 min film clips (either positive: a humorous clip from the Muppet Show or negative: a sad clip from Schindler's List) followed by the mood inventory. A filler task (drawing a map of the university)was completed, followed by the IGT. Similar to the first experiment, the results of this experiment also showed that individuals in the positive condition outperformed those in the negative condition only but only in block 2. A third experiment was conducted utilizing a computerized version of the IGT to control for possible experimenter effects in the second experiment. The results showed the same findings in block 2, however, showed that individuals in the negative condition significantly outperformed those in the positive condition in block 5 (card selections: 81-100). Although the authors caution interpretations, due to the findings in experiment 3, they emphasize that individuals in a positive mood are more likely to rely on somatic markers (or affective signals), therefore allowing their “gut” feelings to guide their decisions. This is turn, leads to more advantageous performance.

Northoff, Grimm, Boeker, Schmidt, Bermpohl, Heinzel, et al. (2006) addressed the effects of affective *judgments* on IGT performance. In his study, Northoff et al. (2006) utilized positive and negative pictures from the IAPS. Two experimental conditions, utilizing both positive and negative pictures in each, were created where subjects were asked to view a series of pictures. In the expected judgment condition, a cue slide was presented prior to picture presentation with the letter “J” at the corner of the screen. In the unexpected judgment condition, the same cue slide was presented with the judgment indicator (the letter “J”). Two control conditions, a passive picture viewing condition and a condition that required participants to press a key upon viewing the picture (without a judgment requirement), were created. FMRI imaging data collected during these conditions were compared to imaging data collected during performance of the IGT.

The results of this study, (Northoff et al., 2006) showed increases in activity in the right VMPFC in the unexpected judgment condition vs. baseline. This increase in activity was positively correlated with global performance on the IGT (i.e.

the stronger the activation signals, the better participants performed). In the expected judgment condition (vs. baseline), activity was marked by decreased signals in the right VMPFC, which in turn, correlated with worse performance on the IGT. Signal decreases in the right DMPFC were also observed in this condition, again, correlated with poor IGT performance. An increase in activation in the right LPFC was also noted. This increase in activation was positively correlated with IGT performance.

Northoff et al. (2006) further analyzed IGT performance by breaking down the IGT results into two groups: high and low global IGT performers. The results showed that high-IGT performers showed significantly more signal increases in the right VMPFC during the expected judgment condition than low-IGT performers. High-IGT performers also showed significantly more signal increases in the right LPFC during the expected judgment condition than low IGT-performers. Low-IGT performers showed significantly more signal decreases in the right VMPFC and posterior cingulated in the expected judgment condition than high-IGT performers (Northoff et al., 2006).

The Current Study

There is a possibility that the results of Overman’s (2006) dilemma enhancement and aroma reduction study, along with current research regarding emotion and the IGT performance changes seen in previous studies may be results of emotional induction effects. The goal of this study was to determine the effects of positive and negative affect on IGT performance. Stimuli dimensionality was addressed and the cognitive aspects (deliberation of dilemmas) found in earlier studies were eliminated. Images from the International Affective Picture System (IAPS) was used to induce affect *during* Iowa Gambling Task (IGT). To the extent that “emotions” affect IGT performance, we hypothesize that presenting positive, negative, and neutral emotions would alter performance from that seen in normative populations and perhaps shift it from baseline performance.

Method

Pilot Data

Three pilot studies were conducted to ensure that the stimuli selected for the current study would induce emotion from a baseline state. Based on Boettcher (2007) experimental paradigm (i.e. presenting all the dilemmas prior to completing the IGT), the initial pilot experiment was designed to test if presenting all the emotional stimuli would lead to a shift in emotion from baseline for a sustained amount of time (10 min). For the purpose of this research, 60 pictures from the International Affective Picture System (20 positive, 20 negative, and 20 neutral) were utilized (see Appendices A through C for list of stimuli). The state version of the Multiple Affect Adjective Check List was used as a method of measurement for participant’s emotional states (See Appendix E) In addition, pilot studies were conducted to see how long the emotion induction would last after viewing the selected stimuli.

Pilot Experiment 1

Experiment 1 was conducted to measure the emotion induction effects created by presenting all 20 pictures of one condition (i.e. positive affect) followed by a 10 min delay period. Mood assessments were made prior to picture presentation, immediately after picture presentation, and immediately after the 10 min delay.

Participants

Sixty-nine (24 males and 45 females) undergraduate psychology students at the University of North Carolina-Wilmington participated per class requirements.

Materials

Sixty pictures from the International Affective Picture System (IAPS) (Lang, P. J., Bradley, M. M., & Cuthbert, B. N., 1997) were used to construct three affective conditions (positive, negative, and neutral; see Appendices A through C). IAPS pictures were selected based on valence ratings of 100 subjects utilizing the Self-Assessment Manikin (SAM). This 1-9 scale consisted of a set of pictures expressing facial features based on two anchors: very unpleasant (1) to very pleasant (9). Twenty pictures were selected for each condition: 20 positive pictures (ranging in ratings from 6.5-9), 20 negative pictures (ratings 1-3.5), and 20 neutral pictures (ratings 4.5-5.5). The images were presented pseudorandomly, so that no three images with the same rating were presented sequentially. Microsoft Powerpoint 2007 and an Apple Desktop was utilized to present the pictures. This allowed for specific time constraints (i.e. 7 sec) to be easily controlled.

The state-version of the Multiple Affect Adjective Check List (MAACL) was used to assess current emotional states (Lubin, Zuckerman, Rinck, & Seever, 1986; see Appendix E). The checklist consists of 132 words that relate to 1 of 5 subscales (sensation seeking, anxiety, depression, hostility, and positive affect). For the purpose of this study, only anxiety, depression, and positive affect were used. These subscales were representative of our goal to measure positive and negative affect. The Purdue Pegboard Task was used as a distracter task. The Purdue Pegboard Task test motor coordination, and requires participants to insert as many pegs as possible before experimenters tell them to stop. Basic stopwatches were used to measure time intervals between MAACL administrations.

Procedures

Participants were assigned to one of three affective conditions (positive, negative, or neutral). Experiments prepared testing packets in a pseudorandom fashion by placing then in an alternating pattern prior to the beginning of the study. The order of the participant packets determined what condition an individual was placed in. Participants were tested one at a time. Upon entering the testing area, participants signed an IRB approved informed consent (see Appendix D). After signing the consent, participants were presented with the state-version of the MAACL to provide a baseline measure of their emotional state. Participants were instructed, “Please circle all that apply to how you are currently feeling at the moment.” Upon completion of the first MAACL (M-1), participants were asked to focus their attention onto a 15 in Apple Monitor. Participants were told the following “You will be presented with a series of pictures. It is important that you pay close attention to these pictures, because you may be asked to rate how they made you feel later. Do you have any questions?” The experimenter then cued the slide show. Pictures were presented for a duration of 7 sec each. After viewing all 20 pictures, participants were presented with the second MAACL (M-2) to measure the emotional induction effects produced immediately after viewing the pictures. Experimenter’s provided the same instructions used during the administration of the first MAACL. Upon completion of the second MAACL, participants were presented with either the Purdue Pegboard Task (half of participants) or the basic number search puzzle (half of participants). Experimenters started the stopwatch immediately upon the cessation of the picture slide show. After 10 min, the experimenters said “Stop!” Participants were provided with the third MAACL (M-3) and instructed “Please circle all that apply to how you are currently feeling at the moment.” The third MAACL established the emotional induction effects after a 10 min delay. When participants completed the third MAACL, they were thanked for their participation and assigned an experimental credit per university policy (see Figure 1).

Figure 1: Experimental steps for Pilot Study 1.

Data Analysis

A repeated-measures one-way ANOVA was used to investigate significant differences between the MAACL’s within each condition (positive, negative, and neutral). For example, in the positive affect condition, analyses were conducted to determine if any significant differences existed between the first, second, and third MAACL on the positive affect subscale. The same analyses were also utilized for the anxiety subscale and depression subscale. Again, these analyses were conducted in each condition.

Results

Positive Affect Condition

In the positive affect condition, differences between the positive affect subscales in the M-1, M-2, and the M-3 approached a significant difference, $F(2, 44) = 2.69$, $p = 0.078$. The anxiety subscale showed an overall significant difference, $F(2, 44) = 8.46$, $p < 0.01$. Post-hoc comparisons between M-1, M-2, and M-3 yielded significant results only between M-2 vs. M-3, $p < 0.01$. The depression subscale also showed an overall significant difference, $F(2, 44) = 4.14$, $p < 0.05$. Post-hoc comparisons yielded significant results between M-1 vs. M-3, as well as, M-2 vs. M-3, $p < 0.05$ (see Table 1).

Negative Affect Condition

In the negative affect condition, the positive affect subscales showed an overall significant difference, $F(2, 44) = 21.33$, $p < 0.0001$. Post-hoc analysis revealed significant differences at the 0.05 level between M-1 vs. M-2, M-1 vs. M-3, and M-2 vs. M-3. The anxiety subscale showed an overall significant difference, $F(2, 44) = 6.86$, $p < 0.01$. More specifically, post-hoc comparisons yielded significant results

Table 1

MAACL Scores by Condition and Administration (Pilot Study 1)

	Positive Affect Condition		
MAACL Subscales	M-1	M-2	M-3
Positive Affect	55.70	58.57	54.00
Anxiety	50.39	44.74	57.09**$_{c}$
Depression	49.22	40.09	51.13*$_{b}$,*$_{c}$
	Negative Affect Condition		
MAACL Subscales	M-1	M-2	M-3
Positive Affect	55.39	44.30*$_{a}$	48.83*$_{b}$,*$_{c}$
Anxiety	49.70	62.00**$_{a}$	57.17
Depression	48.30	77.70**$_{a}$	57.74**$_{b}$
	Neutral Affect Condition		
MAACL Subscales	M-1	M-2	M-3
Positive Affect	53.26	53.09	49.04*$_{b}$,*$_{c}$
Anxiety	52.39	51.26	55.22
Depression	51.57	55.35	51.35

*Note: *p < 0.05., **p < 0.01. Post-hoc comparisons (Tukeys HSD) indicated by the following: a)M-1 vs. M-2, b)M-1 vs. M-3, c)M-2 vs. M-3.*

only between M-1 vs. M-2, $p < 0.01$. The depression subscale also showed an overall significant difference, $F(2, 44) = 19.27$, $p < 0.0001$. Post-hoc comparisons yielded significant results between M-1 vs. M-2, as well as, M-2 vs. M-3, $p < 0.01$ (see Table 1).

Neutral Affect Condition

In the neutral affect condition, overall significant differences were only seen in the positive affect condition, $F(2, 44) = 5.69$, $p < 0.01$. Post-hoc comparisons yielded significant results between M-1 vs. M-3, as well as, M-2 vs. M-3, $p < 0.05$. The anxiety and depression subscales did not yield any significant findings, $F(2, 44) = .078$, $p = 0.93$, $F(2, 44) = 0.65$, $p = 0.53$, respectively (see Table 1).

Discussion

If the emotional effect persisted for 10 min, there should have been significant differences between M-1 vs. M-3. This occurred in only three of nine possible instances. Although the desired effect did not last 10 minutes, there were significant differences immediately after viewing the pictures. More specifically, in the positive affect condition we found decreases in positive affect after the 10-min delay. In addition, significant increases in anxiety and depression after the 10-min delay were also found in the positive affect condition. These changes suggested that the delay and the distracter task led to these unwanted changes. Given these unwanted effects, rather than presenting all the pictures prior to completion of the IGT, we decided to provide an emotional induction after every 10 trials of the IGT.

Pilot Experiment 2

As a result, the current study became a replication of an earlier study, Overman (2006), which presented moral dilemmas after every 10 trials of the IGT. Based on the results of pilot experiment 1, we knew an emotion induction effect occurred immediately after viewing 20 pictures; however, this study aimed to see if that same emotion induction effect would occur after seeing only 5 pictures. A 7 sec viewing period was selected because the total presentation time for 5 pictures (approximately 35 sec) was the approximate time it took subjects to read and respond to the moral dilemmas.

Participants

Ninety-six (17 males and 79 females) undergraduate psychology students at the University of North Carolina-Wilmington participated in this study per class requirements.

Materials

Sixty pictures from the International Affective Picture System (Lang et al., 1997) were used to construct three affective conditions (positive, negative, and neutral). Ten pictures were selected for each condition: 10 positive pictures

(ranging in ratings from 6.5-9), 10 negative pictures (ratings 1-3.5), and 10 neutral pictures (ratings 4.5-5.5). Participants were presented with only 5 pictures, however, experimenters utilized two sets of affective pictures per condition as a control for picture type. The images were presented pseudorandomly, so that no three images with the same rating were presented sequentially. Microsoft Powerpoint 2007 and a projector were utilized to present the pictures. This allowed for specific time constraints (i.e. 7 sec viewing period).
The state-version of the Multiple Affect Adjective Check List (MAACL) (Lubin et al., 1986). was used to assess current emotional states. As before, for the purpose of this study, only anxiety, depression, and positive affect were used.

Procedure

Participants were randomly assigned to one of three affective conditions (positive, negative, or neutral). Participants were tested in group sessions in a university classroom. Upon entering the testing area, participants signed an IRB approved informed consent. After signing the consent, participants were presented with the state-version of the MAACL to provide a baseline measure of their emotional state. Participants were instructed, “Please circle all that apply to how you are currently feeling at the moment.” Upon completion of the first MAACL (M-1), participants were asked to focus their attention onto the projection screen in front of them. Participants were told the following “You will be presented with a series of pictures. It is important that you pay close attention to these pictures, because you may be asked to rate how they made you feel later. Do you have any questions?” The experimenter then cued the slide show. Five pictures were presented for a duration of 7 sec. After viewing all 5 pictures, participants were presented with the second MAACL (M-2). Experimenter’s provided the same instructions used during the administration of the first MAACL. When participants completed the second MAACL (M-2), they were thanked for their participation and assigned an experimental credit per university policy (see Figure 2).

Figure 2: Experimental steps for Pilot Study 2.

Data Analysis

A series of correlated t-test were conducted within each of the three conditions (positive, negative, neutral). These analyses were used to determine significant differences between the subscales (ex. positive affect) between M-1 and M-2.

Table 2

MAACL Scores by Condition and Administration (Pilot Study 2)

MAACL Subscales	Positive		Negative		Neutral	
	M-1	M-2	M-1	M-2	M-1	M-2
Positive	54.53	63.33*	51.04	43.57*	53.03	54.88
Anxiety	50.63	44.45*	52.03	69.71*	51.16	46.03
Depression	48.13	47.48	53.09	102.03*	49.94	48.37

Note: $^{*}p < .05$. $^{**}p < .01$.

Results

Positive Affect Condition

In the positive affect condition, significant differences were revealed between M-1 vs. M-2 in the positive affect and anxiety subscales, $t(39) = -5.02$, $p < 0.0001$, $t(39) = 3.37$, $p < 0.01$, respectively. Significant differences were not seen in the depression subscale, $t(39) = 0.52$, $p = 0.60$ (see Table 2).

Negative Affect Condition

In the negative affect condition, significant differences were revealed between M-1 and M-2 in the positive affect, anxiety, and depression subscales, $t(33) = 6.66$, $p < 0.0001$, $t(33) = -6.39$, $p < 0.001$, $t(33) = -8.49$, $p < 0.0001$, respectively (see Table 2).

Neutral Condition

In the neutral condition, no significant differences were revealed between M-1 and M-2 in any of the subscales, $t(21) = -0.12$, $p = 0.9$, $t(21) = 0.7$, $p = 0.49$, $t(21) = 1.73$, $p = 0.09$, respectively (see Table 2).

Discussion

The second pilot study showed that 5 pictures were sufficient for the induction of a short-lived emotional state. The next step was to determine if 5 pictures would lead to emotional changes after a 2 min delay period, which is the approximate time required to perform 10 trials of the IGT.

Pilot Experiment 3

The results of Experiment 2 led to the development of Experiment 3. Because 10 trials of the IGT last approximately 1-2 min, Experiment 3 investigated whether this induction effect would last for 2 min. Again, this study would allow us to conclude that the emotion induction was continuing throughout the 10 trials of the IGT.

Participants

Forty-one (15 males and 26 females) undergraduate psychology students at the University of North Carolina-Wilmington participated in this study per class requirements.

Materials

Ten pictures from the International Affective Picture System (Lang et al., 2005) were used to construct two affective conditions (positive and negative). Five pictures were selected for each condition: 5 positive pictures (ranging in ratings from 6.5-9), and 5 negative pictures (1-3.5). The images were presented pseudorandomly, so that no three images with the same rating were presented in order. Microsoft Powerpoint 2007 and a projector were utilized to present the pictures. This allows for specific time constraints (i.e. 7 sec viewing period).

The state-version of the Multiple Affect Adjective Check List (MAACL) was used to assess current emotional states. The checklist consists of 132 words that relate to 1 of 6 subscales (sensation seeking, anxiety, depression, hostility, and positive affect). Only anxiety, depression, and positive affect were used.

A distracter task requiring participants to circle all of the D’s in a page of alphabet letters was used during the 2 min delay period. Stopwatches were used to measure time intervals between MAACL administrations.

Procedures

Participants were randomly assigned to one of two affective conditions (positive or negative). Participants were tested in group sessions located in a university classroom. Upon entering the testing area, participants signed an IRB approved informed consent. After signing the consent, participants were presented with the state-version of the MAACL to provide a baseline measure of their emotional state. Participants were instructed, “Please circle all that apply to how you are currently feeling at the moment.” Upon completion of the first MAACL (M-1), participants were asked to focus their attention onto the projection screen in front of them. Participants were told the following “You will be presented with a series of pictures. It is important that you pay close attention to these pictures, because you may be asked to rate how they made you feel later. Do you have any questions?” The experimenter then cued the slide show. Five pictures were presented for a duration of 7 sec.

After viewing all 5 pictures, participants were presented the distracter task and instructed “Please circle all of the D’s on the sheet”. Experimenters started the stopwatch beginning a 2 min time interval between MAACL’s immediately upon cessation of the slideshow. When the 2 min time interval expired, experimenter’s provided the same instructions used during the administration of the first MAACL. When participants completed the second MAACL (M-2), they were thanked for their participation and assigned an experimental credit per university policy (see Figure 3).

Figure 3: Experimental steps for Pilot Study 3.

Data Analysis

A series of correlated t-test were conducted within each of the two conditions (positive and negative). These analyses were used to determine significant differences between the subscales (ex. positive affect) between M-1 and M-2.

Results

Positive Affect Condition

In the positive affect condition, significant differences were revealed between M-1 vs. M-2 in the positive affect and anxiety subscales, $t(21) = -4.5$, $p < 0.0001$ (Cohen’s $d = 0.96$),

Table 3

MAACL Scores by Condition and Administration (Pilot Study 3)

	Positive		Negative	
MAACL Subscales	M-1	M-2	M-1	M-2
Positive	52.68	63.23**	51.24	41.90**
Anxiety	49.91	46.91*	47.19	64.78**
Depression	46.41	46.68	45.55	97.22**

Note: *$p < .05$. **$p < .01$.

$t(21) = +1.83$, $p < 0.05$ (Cohen's $d = 0.37$), respectively. Significant differences were not seen in the depression subscale, $t(21) = -1$, $p > 0.05$ (see Table 3). In addition, males and females did not significantly differ on their MAACL ratings across the three subscales in the baseline MAACL or second MAACL, all *p*'s > 0.05.

Negative Affect Condition

In the negative affect condition, significant differences were revealed between M-1 vs. M-2 in the positive affect, anxiety, and depression subscales, $t(18) = 4.37$, $p < 0.001$ (Cohen's d = 0.94), $t(18) = -4.78$, $p < 0.001$ (Cohen's $d = 1.08$), $t(18) = -7.28$, $p < 0.0001$ (Cohen's $d = 1.80$), respectively (see Table 3). In addition, males and females did not significantly differ on their MAACL ratings across the three subscales in the baseline MAACL or the second MAACL, all *p*'s > 0.05.

Discussion

The results of pilot study 3 confirmed the 2-min emotional induction effect. In addition, this study led to the development of the current study. In the current study, the pictures established to have an emotional induction effect were utilized throughout the IGT. Also, the MAACL was utilized as the dependent measure of affective change.

Current Study

Methods

Participants

One hundred ninety four (93 males and 101 females) undergraduate psychology students at the University of North Carolina – Wilmington participated in this study per class requirements.

Materials

Three hundred pictures from the IAPS (Lang et al., 1997) were used to construct three affective conditions (positive, negative, and neutral). One hundred pictures were selected for each condition: 100 positive pictures (ranging in ratings from 6.5-9), 100 negative pictures (ratings 1-3.5) and 100 neutral pictures (4.5-5.5). Two slide shows of IAPS pictures were created to counterbalance picture order for each condition. The pictures were presented in a pseudorandom order, so that no three images with the same rating were presented sequentially. Microsoft Powerpoint and a Dell Desktop computer were utilized to present the pictures. Again, this allowed for specific time constraints (i.e. 7 sec viewing period) to be easily controlled. The state version of the MAACL (i.e. the exact one used in earlier pilot research) was also utilized in this study (Lubin et al., 1986). This study utilized the same subscales (positive affect, anxiety, and depression). As previously described

(Overman et al., 2006) The Iowa Gambling Task (IGT) was used to assess decision-making.

Procedures

Participants were randomly assigned to one of three affective conditions: positive affect group (N= 65; 31 males, 34 females), negative affect group (N = 64; 31 males, 33 females), and the neutral affect group (N = 65; 31 males, 34 females). Upon entering the testing area, participants signed an IRB approved informed consent. After signing the IRB approved informed consent, participants were presented with the first state-version of the MAACL (M-1) to provide baseline measures of emotional states. Participants were instructed, “Please circle all that apply to how you are current feeling at the moment.” Upon completion of the first MAACL (M-1), participants were told the following, “You will now be participating in a computer card game. During this game, you will view a series of pictures after a preset number of trials. It is important that you pay close attention to these pictures, because you may be asked to rate how they made you feel later. Do you have any questions?” Participants were than instructed, “Now, I will instruct you on how to complete the computer task.” Participants were then provided the IGT instructions (see Appendix F). Experimenters clarified all questions prior to continuing the experiment.

The experimenter then asked the subject to focus their attention on the desktop monitor in front of them. The experiment then cued the slide show. Five pictures were presented for 7 sec each. A cue slide, with a number 1…2…3 utilized as a fixation point) followed the last picture slide. Upon reaching the cue slide, experimenters asked participants to focus their attention back on the adjacent computer card task. Participants selected cards from the four decks placed in front of them. Each participant started with +$2000 (not real money). After each card selection, the experimenter verbally announced the participants running total. The computer program stopped the task after the participant completed 10 trials, whereupon the experimenter asked the participant “which two decks do you think are the good decks?” Participant responses were recorded on an IGT score sheet (see Appendix F).After recording the participant’s response, the experimenter asked the participant to return their attention to the desktop monitor beside the Apple monitor (which presented the card task). Note: the monitors side by side, with an approximate 5 mm gap between screens. The experimenter cued the slide show, which presented another 5 pictures at a 7 sec rate. This process continued until the participant complete 200 trials of the IGT. In addition, a final cue slide indicating a new set of pictures would be viewed ended the IAPS slideshow so participants would not be aware of the task ending. Participants then completed the second MAACL (M-2). After completed the M-2, participants were thanked for the participation and assigned an experimental credit per university policy.

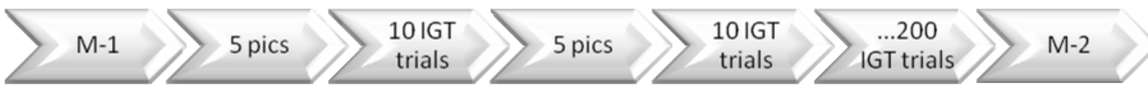

Figure 4. Experimental steps for the final study.

Results

<u>IGT</u>

Figure 5 illustrates the percentage of +$50 advantageous (+$50 red & green) cards selected by males and females in each of the three emotional conditions across the 200 trials of the IGT. The percentage of advantageous (+$50 red & green) cards and conditions (positive/negative/neutral) were entered into a 2 (Gender) x 3 (Emotion) analysis of variance (ANOVA). The results revealed a significant main effect for gender with males (M = 67.43) selecting more +$50 advantageous cards than females (M = 63.07), $F(2, 188) = 5.49$, $p = 0.02$). There was no significant main effect for condition, $F(2, 188) = 0.016$, $p = 0.984$. In addition, the analysis did not reveal a significant interaction, $F(2, 188) = 1.746$, $p = 0.177$.

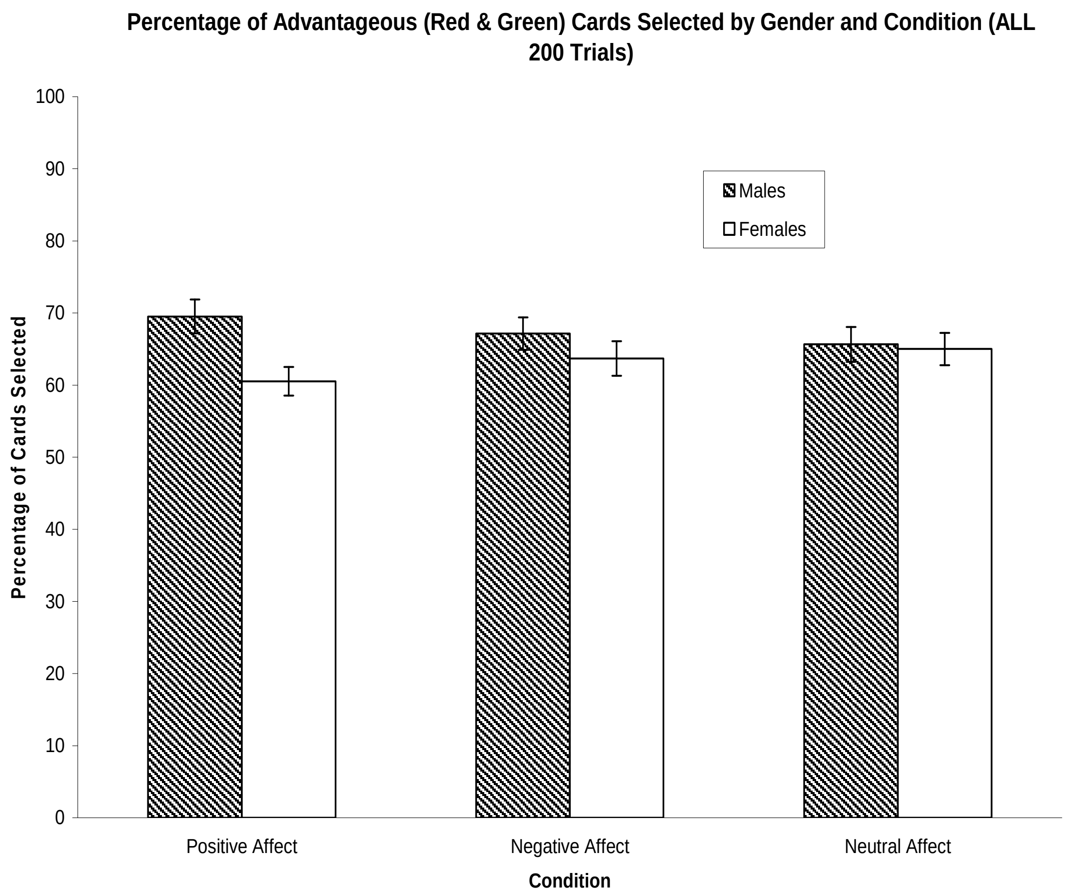

Figure 5: Percentage of +$50 advantageous (red & green) cards selected as a function of affective condition and gender across the 200 trials of the IGT. Error bars represent SEM.

Consequently, IGT data were collapsed across emotional conditions and gender and block effects were analyzed by a 2 (Gender: male/female) x 4 (1^{st}, 2^{nd}, 3^{rd}, and 4^{th} block) mixed ANOVA for selection of advantageous cards. Results revealed a significant main effect for both gender and block, $F(1, 582) = 5.39$, $p = 0.021$, $F(3, 582) = 83.29$, $p < 0.0001$, respectively. Results did not reveal a significant interaction, $F(1, 582) = 2.26$, $p = 0.08$. In other words males (Block 1 $M = 52.19$, Block 2 $M = 68.80$, Block 3 $M = 72.37$, and Block 4 $M = 75.13$) chose more +$50 red and green advantageous cards than females (Block 1 $M = 52.06$, Block 2 $M = 62.44$, Block 3 $M = 65.90$, and Block 4 $M = 70.63$) across the four blocks of the IGT. However, both males and females learned to choose advantageously as the task progressed (see Figure 6).

An analysis of the +$50 green deck revealed a significant main effect for gender and block, $F(1, 582) = 8.24$, $p = 0.005$, $F(3, 582) = 30.6$, $p < 0.0001$, respectively. Results did not reveal a significant interaction, $F(3, 582) = 2.05$, p = 0.062. This means that males (Block 1 $M = 21.23$, Block 2 $M = 32.17$, Block 3 $M = 34.28$, and Block 4 $M = 36.37$), on average, chose significantly more advantageous green cards than females (Block 1 $M = 20.67$, Block 2 $M = 25.23$, Block 3 $M = 26.79$, and Block 4 $M = 29.96$) across the four blocks of the IGT. Although males continued to select advantageous green cards at a higher rate

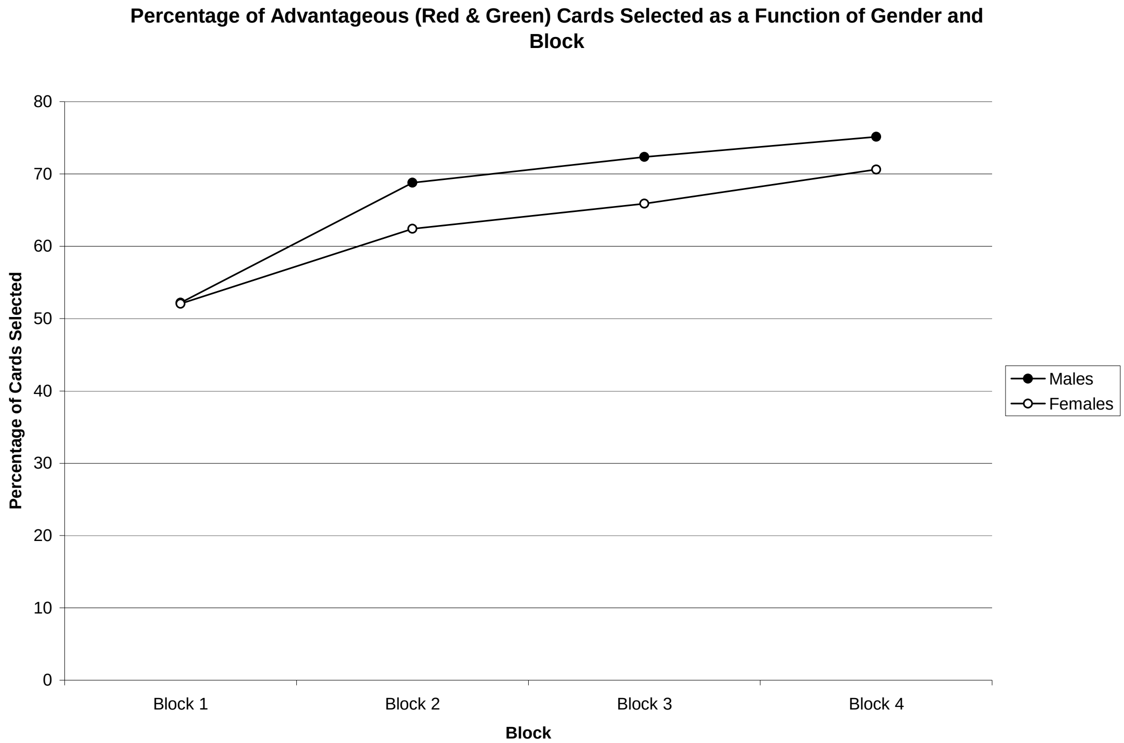

Figure 6: Percentage of +$50 advantageous (red & green) cards selected across blocks as a function of gender.

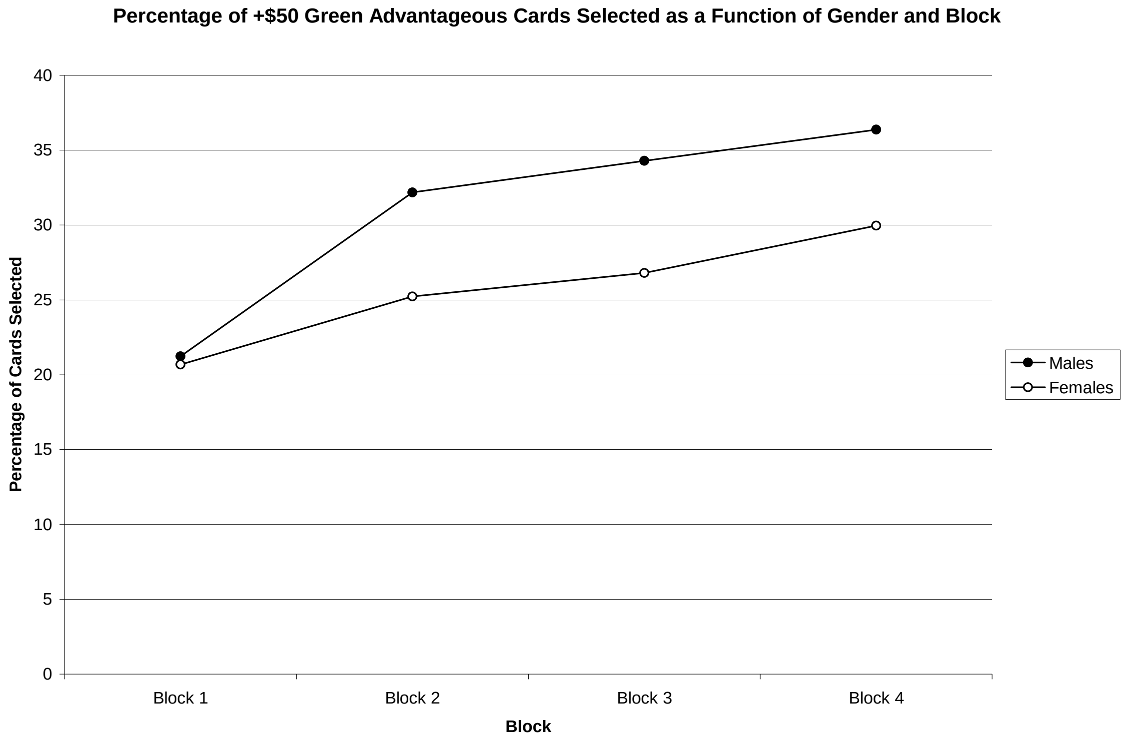

Figure 7: Percentage of +$50 green advantageous cards selected across blocks as a function of gender.

than females, both groups still showed a constant increase in the percentage of advantageous green cards as the task progressed (see Figure 7).

An analysis of the +$100 yellow disadvantageous deck revealed a significant main effect for gender and block, $F(1,582) = 11.79$, $p = 0.0007$, $F(3, 582) = 43.55$, $p < 0.0001$, respectively. Results did not reveal a significant interaction, $F(3, 582) = 0.88$, $p = 0.45$. This means that males (Block 1 M = 28.80, Block 2 M = 18.32, Block 3 M = 16.6, and Block 4 M = 14.22) chose significantly fewer disadvantageous yellow cards than females (Block 1 M = 31.56, Block 2 M = 24.53, Block 3 M = 22.86, and Block 4 M = 19.39) across the four blocks of the IGT. Although females continued to select disadvantageous yellow cards at a higher rate than males, both groups still showed a constant decrease in the percentage of disadvantageous yellow cards selected as the task progressed (see Figure 8).

An analysis of the +$100 blue disadvantageous deck did not reveal a significant main effect for gender; however, revealed a significant main effect for block, $F(1, 582) = 0.53$, $p = 0.47$, $F(3, 582) = 40.16$, $p < 0.0001$, respectively. Results did not reveal a significant interaction, $F(3, 582) = 0.46$, p = 0.71 This means that males (Block 1 M = 18.94, Block 2 M = 13.20, Block 3 M = 11.25, and Block 4 M = 10.41) and females (Block 1 M = 17.27, Block 2 M = 13.09, Block 3 M = 11.19, and Block 4 M =

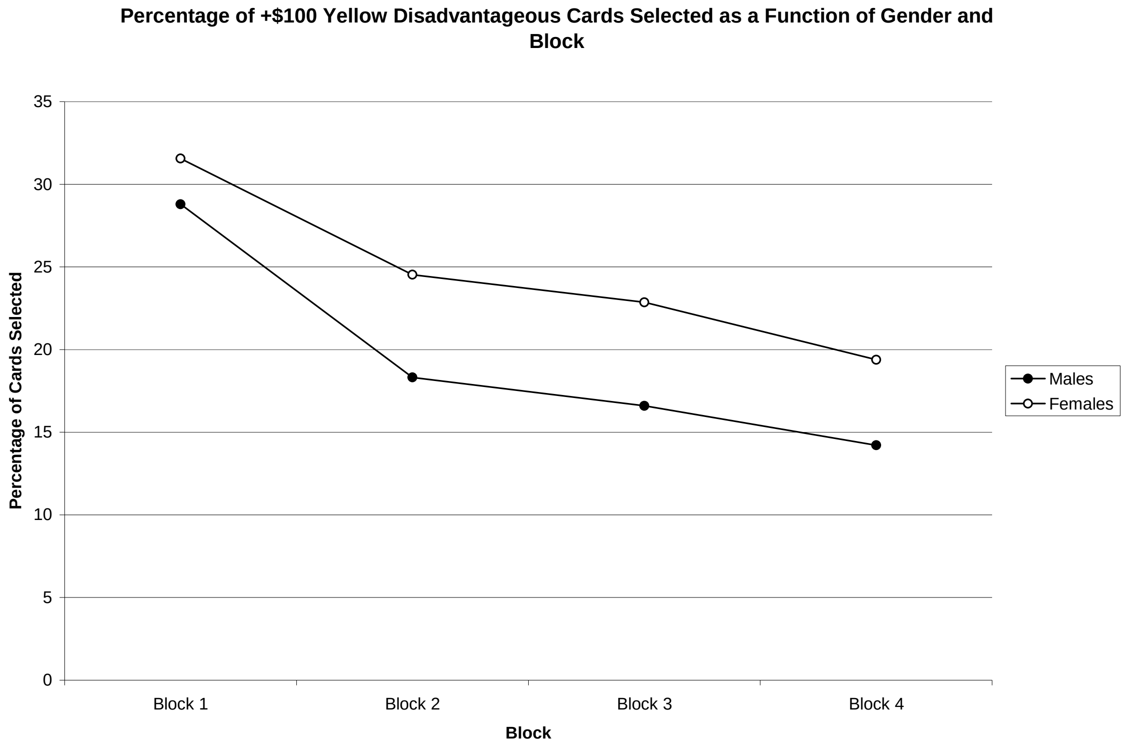

Figure 8: Percentage of +$100 yellow disadvantageous cards selected across blocks as a function of gender.

9.41) learned to select fewer disadvantageous blue cards as the task progressed.

An analysis of the +$50 red deck did not reveal a significant main effect for gender, however, revealed a significant main effect for block, $F(1, 582) = 0.85$, $p = 0.36$, $F(3, 582) = 11.54$, $p < 0.0001$, respectively. Results did not reveal a significant interaction, $F(3, 582) = 0.54$, $p = 0.66$. This means that males (Block 1 $M = 31.09$, Block 2 $M = 36.56$, Block 3 $M = 38.84$, and Block 4 $M = 39.4$) and females (Block 1 $M = 31.09$, Block 2 $M = 37.12$, Block 3 $M = 42.66$, and Block 4 $M = 41.37$) learn to select more advantageous red cards as the task progressed.

MAACL Results

A series of correlated-samples t-test were conducted on MAACL subscale scores (positive affect, anxiety, and depression) for males and females across the three conditions (positive/negative/neutral).

Positive Pictures. There were no significant differences between M-1 vs. M-2 for either males or females on any of the MAACL subscales, all p's > 0.05.

Negative Pictures. For males in the negative affect condition, significant differences were revealed between M-1 vs. M-2: a decrease in the positive affect subscale (M-1 = 53.81 vs. M-2 = 48.39), an increase in the anxiety subscale (M-1 = 47.49

vs. M-2 = 52.39), and an increase in the depression subscale (M-1 = 49.29 vs. M-2 = 56.94), $t(30) = 4.86$, $p < 0.0001$, $t(30) = -2.46$, $p = 0.01$, and $t(30) = -2.62$, $p = 0.007$, respectively. For females in the negative affect condition, significant differences were revealed between M-1 vs. M-2: a decrease in the positive affect subscale (M-1 = 55.58 vs. M-2 = 47), and an increase in the anxiety subscale (M-1 = 46.88 vs. M-2 = 53.58), and an increase in the depression subscale (M-1 = 47.97 vs. M-2 = 54.88), $t(33) = 5.62$, $p < 0.0001$, $t(33) = -3.22$, $p = 0.001$, and $t(33) = -2.49$, $p = .009$, respectively.

Neutral Pictures. For males in the neutral affect condition, there were no significant differences between M-1 vs. M-2 across the positive affect subscale, p's > 0.05. However, a significant increase was revealed in the depression subscale (M-1 = 47.39 vs. M-2 = 50.84), $t(30) = -1.86$, $p = 0.04$. For females in the neutral affect condition, there were no significant differences between M-1 vs. M-2 across the positive affect, anxiety, or the depression subscale, p's > .05.

These overall findings of this study were similar to those found in Graham's (2006) neutral condition (collapsed impersonal moral and non-moral conditions). After collapsing across all emotional conditions, an independent samples t-test analyzing the percentage of advantageous cards chosen over the 200 trials of the IGT found no significant differences between males in the

Table 4
MAACL Scores for Males and Females by Condition and Administration

Males						
	Positive		Negative		Neutral	
MAACL Subscale	M-1	M-2	M-1	M-2	M-1	M-2
Positive	51.03	51.65	53.81	48.39**	51.19	50.03
Anxiety	47.84	50.94	47.45	52.39**	49.84	51.19
Depression	51.94	53.39	49.29	56.94**	47.39	50.84*

Females						
	Positive		Negative		Neutral	
MAACL Subscale	M-1	M-2	M-1	M-2	M-1	M-2
Positive	55.76	54.91	55.58	47.00**	55.76	53.94
Anxiety	47.50	50.21	46.88	53.58**	47.38	49.00
Depression	48.06	48.76	47.97	54.88**	49.76	49.85

Note: *p < 0.05., **p < 0.01.

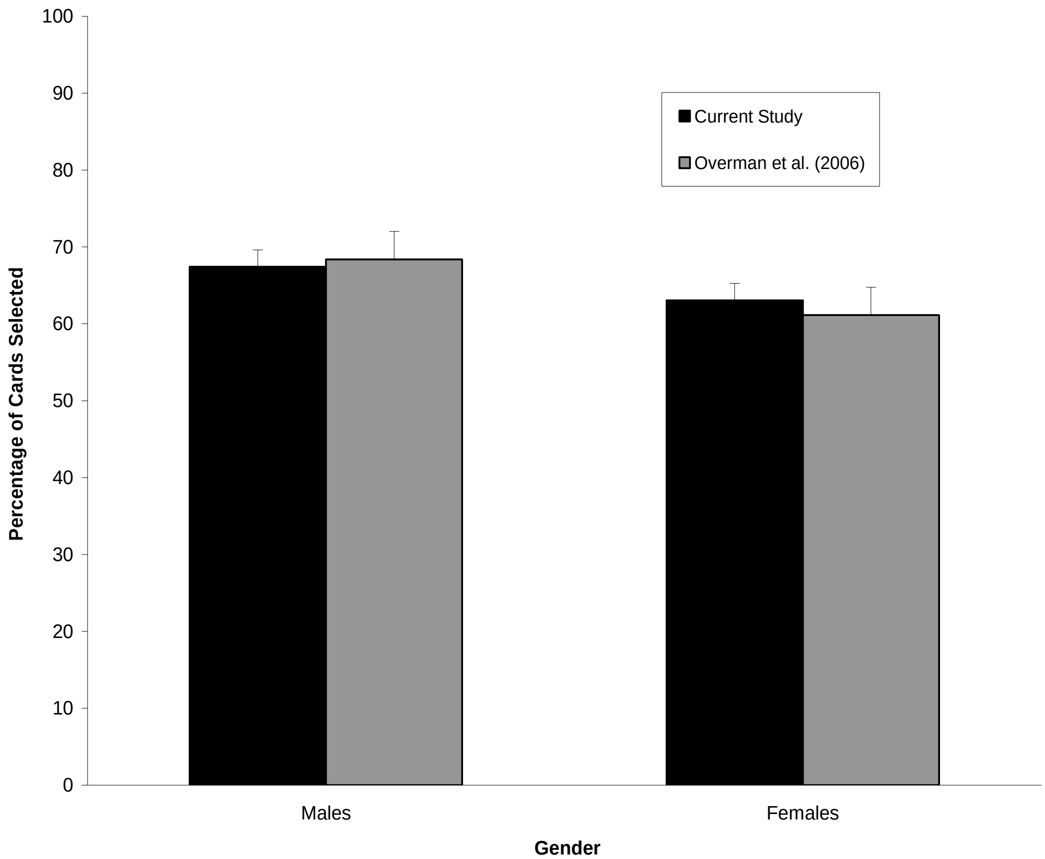

Figure 9: Percentage of +$50 advantageous (red & green) cards selected for the current study and Overman et al., (2006). Error bars represent SEM.

current study (*M* = 67.43) and males in Overman et al.’s (2006) study (*M* = 68.39), *t*(157) = -.42, *p* = .68. In addition, further analysis revealed that females in the current study (*M* = 63.07) did not shown any significant differences from females in Overman et al.’s (2006) study (*M* = 61.13) with regards to choosing advantageously, *t*(168) = .88, *p* = .38, see Figure 9).

Discussion

Recent research has presented mixed results on the role of the amygdala and orbital prefrontal cortex (OPFC) on decision-making (Davidson & Irwin, 1999; Frey & Petrides, 2000). Some research suggests that the orbital frontal cortex (BA’s 47 and 11) is involved in controlling social and emotional behaviors, (Ongur & Price, 2000). However, other research has implicated the ventromedial prefrontal cortex (VMPFC) (BA 12) and the dorsal lateral prefrontal cortex (BA’s 9 and 10) as the primary agents responsible for controlling these behaviors (Ueda, Okamoto, Okada, Yamashita, Hori & Yamawaki, 2003; Greene, Sommerville, Nystrom, Darley & Cohen, 2001). All of these areas of the brain are interconnected with the limbic system circuitry, suggesting that any emotional stimulus would affect the decision-making process.

The goal of the current study was to provide a control for the possible emotional factors of moral dilemmas in Overman (2006) and the possible emotions elicited during Walsh’s (2007) aroma study. In Overman et al.’s (2006) study, results showed an enhancement effect for females in the personal moral condition equal to that of their male counterparts. In addition, Walsh’s (2005) study showed that smelling odorants lead to a significant decrease in males IGT performance equal to that of their female counterparts.

Analyses revealed no significant effect for emotional condition, therefore, providing further evidence for the role of cognitive deliberation in enhanced decision-making. Males continued to significantly outperform women across all conditions. In addition, females continued to show a yellow card preference exhibited in block analyses. Compared to earlier research, Overman et al. (2006), men and women performed very similar to that seen in a normative population.

The findings of this study could be interpreted in a number of ways. Although, emotion is hard to measure and may be defined by the tools we use to measure it, we face an ethical dilemma. “Emotions” fall along a continuum that is not necessarily easy to partition. At one end, we have strong emotional events, such as the death of a family member. At the other end of our continuum, we have weak emotional events.

In addition, we also face individual differences and the ability for people to cope with emotions. Although we acknowledge this potential weakness, this study utilized pilot research to control for emotional-state conditions (i.e. baseline MAACLS) along with the relative changes after viewing the emotional stimuli. As reported earlier, pilot research did not reveal any gender differences in baseline MAACLS or the second MAACLS. Essentially, males and females began with the same emotional states and showed the same emotional changes. It is possible that the ability of emotions to influence our decision-making processes follows along a similar function as that seen in Yerkes-Dodson Law. Too much emotion may be detrimental, whereas, too little emotion may simply distract. Only future research can address this question.

The overall findings of Northoff et al. (2006) suggest that an affective component (characterized by an emotional reaction) in the unexpected judgment condition vs. cognitive component (rational categorization) in the expected judgment condition leads to more advantageous decision making. Again, this is marked by a significant positive correlation with IGT performance. Although this study is vital to our understanding of decision making, it fails to provide a control for emotion (i.e. the presence of a neutral condition). Because participants were exposed to negative and positive pictures, it is hard to isolate the effects of those separate emotions. In addition, these findings are only correlative, providing little evidence in a cause and effect relationship in affect and IGT performance. Based on the findings of the current study, our results would suggest that emotion, or the emotional induction in this specific paradigm, does not significantly influence decision making.

Also, in both Northoff et al.'s (2006) experimental conditions, a "judgment" was required; rather it was expected or unexpected. Although Northoff et al. (2006) argue that the unexpected condition relied more an automatic/affective processing (i.e. reacting to emotional stimuli), it could be argued that deliberation, similar to that seen when participants are asked to read moral dilemmas, is the true influential mechanism. Nevertheless, the passive task of smelling odorants in Walsh (2007), led to significant decreases in male's performance without any judgment requirements.

In comparison to DeVries et al. (2008) study, the current study revealed that positive affect does not significantly influence performance. In addition, DeVries et al. (2008) reported that the shift only occurred in block 2. Although males and females both showed significant block effects (i.e. chose more $+50 advantageous cards) as the task progressed, it is important to note that this shift was seen across all of the emotional conditions. If a positive mood is key to relying more heavily on somatic markers (i.e. "gut feelings"), the current study must contend with the failure to find an effect. Unlike

DeVries et al. (2008) study, the current study utilized a different version of the IGT (200 trials vs. 100 trials). In this version, the second block is characterized by card selections 51-100, rather than 21-40. A more thorough analysis of the current study's raw data could potentially yield similar findings. It is important to note that males and females showed similar baseline MAACL scores. Thus, this lack of difference in baseline MAACL's would suggest that all participants entered with the same emotional state. It is possible that the first 5 pictures, prior to the first 10 trials of the IGT, was not sufficient enough to induce a positive or negative mood. However, the large effect sizes seen in our pilot research would counter that assumption. Again, further analysis is needed. It is also noteworthy to mention the possibility that participants in a positive mood may be more likely to pay attention and engage in the experimental task, whereas, participants in a negative mood.

Bechara et al.'s (1999) work has been the major contributing factors to the somatic marker hypothesis and IGT performance. Bechara at al. (2000) contends that emotion, rather than (or in addition to) cognitive processes guides advantageous decision-making. The results of the current study would suggest that emotion alone is not sufficient enough to influence decision making processes and the involvement of a "cognitive" mechanism, such as the DLPFC is needed. Overman et al. (2006) and Walsh (2007) evidence in “shifting activation” further support this hypothesis. Bolla et al. (2004) also provides further neuroanatomical evidence implicating the significant role of the DLPFC, as seen in male’s significantly higher IGT performance.

Although the role of the VMPC in decision making is apparent, it may be possible that damage to this area affects the first step in advantageous decision making. The inability to assign emotions to winning or losing money (Bechara et al., 1999), should certainly inhibit the ability to choose advantageously, however, it should not lead to the conclusion that other prefrontal areas are also not involved in the decision making process as exhibited by other research. Fellows and Farah (2005) note that damage to the DLPFC leads to impaired IGT performance, however, contends that this impairment is likely attributed to a deficit in working memory. Also, damage to the orbitofrontal cortex (Bechara et al., 1994) leads to impaired IGT performance, as evidenced by participant’s inability to reverse previously learned stimulus-reward associations (Fellows and Farah, 2005).

The cautious interpretations of this study’s failure to find an effect, suggest that emotion (positive or negative) does not influence decision making. It is likely that emotion is only one component in a group of complex processes. Similar to Gestalt theories, “the whole is greater than the sum of any of it’s parts.” Greene et al., (2001) further supports this theory and suggest that decisions are made as the result of a "tug of war" between the (logical) lateral sectors of the PFC and the (emotional / affective) medial centers. The resulting behavioral choice depends on which of these areas activation is the strongest. Thus, optimal efficient decision making requires the full capacity of both logical and emotional systems.

References

Bechara, A., Damasio, A.R., Damasio, H., & Anderson, H. W. (1994). Insensitivity to future consequences following damage to the human prefrontal cortex. *Cognition*, *50*, 7-15.

Bechara, A., Damasio, H., Tranel, D., & Damasio A. R. (1997). Deciding advantageously before knowing the advantageous strategy. *Science, 275*, 215-225.

Bechara, A., Damasio, H., Tranel, D., & Anderson, S. W. (1998). Dissociation of working memory from decision making with the human prefrontal cortex. *The Journal of Neuroscience, 18* (1), 428-437.

Bechara, A., Damasio, H., Damasio, A. R., & Lee, G. P. (1999). Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. *The Journal of Neuroscience, 19*(13), 5473-5481.

Bechara, A., Damasio, H., Damasio., A. R. (2000a). Emotion, decision making and the orbitofrontal cortex. *Cerebral Cortex, 10,* 295-307.

Bechara, A., Tranel, D., & Damasio., H. (2000b). Characterization of the decision-making deficit of patients with ventromedial prefrontal cortex lesions. *Brain, 123,* 2189-2202.

Boettcher, L. (2007). *The effect of deliberating dilemmas on decision making as measured by the Iowa Gambling Task*. Unpublished master's thesis, University of North Carolina Wilmington, Wilmington, North Carolina, United States.

Bolla, K. I., Eldreth, D. A., Matochik, J. A., & Cadet, J. L. (2004). Sex-related differences in a gambling task and its neurological correlates. *Cerebral Cortex, 14,* 1226-1232.

Cavedini, P., Riboldi, G., Keller, R., D'Annucci, A., & Bellodi, L. (2002). Frontal lobe dysfunction in pathological gamblers. *Biological Psychiatry, 51,* 434-441.

Carmichael, S. T., Clugnet, M.C., & Price., J.L., (1994)Central olfactory connections in the macaque monkey. *Journal of Comparative Neurology,* 346, 403-34.

Clark, A. S., & Goldman-Rakic, P. (1989). Gonadal hormones influences the emergence of cortical function in nonhuman primates. *Behavioral Neuroscience, 103,* 1287-1295.

Clark, L., Manes, F., Antoun, N., Sahakian, B. J., & Robins, T. W. (2003). The contributions of lesion laterality and lesion volume to decision-making impairment following frontal lobe damage. *Neuropsychologica, 41,* 1474-1483.

Damasio, H., Bechara, A., & Damasio, A. (2002). RE: Do somatic markers mediate decisions on the gambling task? *Nature Neuroscience, 5*(11), 1104.

Davidson, R., Ekman, P., Saron, C., Senulis, J., & Friesen W. V. (1990). Approach/withdrawal and cerebral asymmetry: emotional expression and brain physiology. *Journal of Personality and Social Psychology, 58,* 330-341.

Davidson, R., & Irwin, W. (1999). The functional neuroanatomy of emotion and affective style. *Trends in Cognitive Sciene, 13*(1), 11-21.

Davidson, R. (2002). Anxiety and affective style: role of prefrontal cortex and amygdala. *Biological Psychiatry, 51,* 68-80.

Fellows, L. K., & Farah, M. (2005). Different underlying impairments in decision-making following ventromedial and dorsolateral frontal lobe damage in humans. *Cerebral Cortex, 15,* 58-63.

Fishbein, E. (2000). Neuropsychology function, drug use, and violence: a conceptual framework. *Criminal Justice and Behavior, 27,* 39-159.

Frey, S., & Petrides, M. (2000). Orbitofrontal cortex: a key prefrontal region for encoding information. *Proceedings of the National Academy of Sciences of the United States of America, 97*(15), 8723-8727.

Grant, S., Contoreggi, C., & London, E. D. (2000). Drug abusers show impaired performance in a laboratory test of decision-making. *Neuropsychologica, 38,* 1180-1187.

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

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

Hedges, L. V., & Nowell, A. (1995). Sex differences in mental test scores, variability, and numbers of high-scoring individuals. *Science, 269,* 41-45.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). International Affective Picture System (IAPS): Technical Manual and Affective Ratings. *NIMH Study for Emotion and Attention*. 1-5.

Lubin, B., Zuckerman, M., Hanson, P. G., Armstrong, T., Rinck, C. M., & Seever, M. (1986). Reliability and Validity of the Multiple Affect Adjective Check List- Revised. *Journal of Psychopathology and Behavioral Assessment*, *8*(2), 1573-1305.

Manes, F., Sahakian, B., Clark, L., Rogers, R., Antoun, N., Aitken, M., & Robins, T. (2002). Decision-making processes following damage to the prefrontal cortex. *Brain, 125,* 624-639.

Northoff, G., Richter, A., Gessner, M., Schlagenhauf, F., Fell, J., Baumgart, F. et al. (2000). Function dissociation between medial and lateral prefrontal cortical spatiotemporal activation in negative and positive emotions: a combine fMRI/MEG study. *Cerebral Cortex, 10,* 93-107.

Northoff, G., Grimm, S., Boeker, H., Schmidt, C., Heinzel, A., Hell, D. et al. (2006). Affective judgment and beneficial decision making: ventromedial prefrontal activity correlates with performance in the Iowa Gambling Task. *Human Brain Mapping, 27*, 572-587.

O'Doherty, J., Kringelbach, M. L., Rolls, E. T., Hornak, J., & Andrews, C. (2001). Abstract reward and punishment representations in the human orbitofrontal cortex. *Nature Neuroscience, 4*(1), 95-102.

Ongur, D., & Price, J. L. (2000). The organization of networks with the orbital and medial prefrontal cortex of rats, monkeys and humans. *Cerebral Cortex, 10*(3), 206-219.

Overman, W. H. (2004). Sex differences in early childhood, adolescents and adulthood on cognitive tasks that rely on orbital prefrontal cortex. *Brain and Cognition, 55,* 133-146.

Overman, W. H., Frassrand, K., Ansel, S., Trawalter, S., Bies, B., & Redmond, A. (2004). Performance on the Iowa card task by adolescents and adults. *Neuropsychologica, 42,* 1838-1581.

Overman, W. H., Graham, L., Redmond, A., Eubank, R., Boettcher, L., Samplawksi, O., & Walsh, K. (2006). Contemplation of moral dilemmas eliminates sex differences on the Iowa Gambling task. *Behavioral Neuroscience, 120*(4), 817-825.

Overman, W. H., Bachevalier, J., Schumann, E., & Ryan, P. (1996). Cognitive gender differences in very young children parallel biologically based cognitive differences in monkeys. *Behavioral Neuroscience, 110,* 673-684.

Price, J. L. Olfactory system in the human nervous system. (ed. Paxinos, G.) 979-1001 (Academic, San Diego, 1990)

Price, J.L. (2006). Connections of orbital cortex. In D.H. Zald & S.L.Rauch (Eds). The Orbitofrontal Cortex (pp. 39-550). New York: Oxford University Press.

Reavis, R., & Overman, W. H. (2001). Adult sex differences on a decision making previously shown to depend on the orbital prefrontal cortex. *Behavior Neuroscience, 115,* 196-206.

Rolls, E. (2000). The orbitofrontal cortex and reward. *Cerebral Cortex, 10*, 284-294.

Rolls, E. (2004). The functions of the orbitofrontal cortex. *Brain and Cognition*, 55, 1-29.

Tomb, I., Hauser, M., Deldin, P., & Caramazza, A. (2002). Do somatic markers mediate decisions on the gambling task? *Nature Neuroscience, 5*(11), 3-4.

Tranel, D., Bechara, A., & Denenberg, N. L. (2002). Asymmetric functional roles of right and left ventromedial prefrontal cortices in social conduct, decision-making, and emotional processing. *Cortex, 38,* 589-612.

Ueda, K., Okamoto, Y., Okada, G., Yamashita, H., Hori, T., & Yamawaki, S. (2003). Brain activity during expectancy of emotional stimuli: an fMRI study. *Neuroreport, 14*(1), 51-55.

de Vries, M., Holland, R. W., & Witteman, C. L. M. (2008). In the winning mood: affect in the Iowa Gambling Task. *Judgment and Decision Making, 3*(1), 42-50.

Walsh, K. (2007). *Olfactory stimulation eliminates sex differences on the Iowa Gambling Task.* Unpublished Master’s Thesis. University of North Carolina Wilmington, Wilmington, North Carolina, United States.

Zald, D. H. & Rauch, S.L. (Eds). (2006). The orbitofrontal cortex. New York: Oxford University Press.

Appendices

Appendix A: IAPS Positive Affect Image Identification Codes

5600	2208	2398	2091
2341	8490	5201	5631
5779	2345	5628	2070
5764	4599	2311	2598
2058	7200	1441	2306
1500	4606	4626	7230
7270	2360	5270	5220
2153	1510	2030	5300
4623	5833	2791	2540
1999	2209	1340	2222
5480	2388	2530	5030
2650	2332	5660	5010
4622	2224	1419	5891
2395	2391	8496	2057
4601	2152	5450	5760
5611	5260	5836	7502
2340	2660	4610	2387
2304	4608	8501	5594
2299	5982	5750	7260
5001	2550	2040	5711
2370	1460	5200	2331
4614	2050	5551	2216
2160	2154	1463	5000
4603	5910	1440	5830
5831	2346	7280	2260

Appendix B: IAPS Negative Affect Image Identification Codes

3220	2799	6560	2590
5971	9102	2710	3350
6250	8495	9620	2683
9280	3216	9600	6316
9925	7359	2095	2717
6540	9140	9300	6243
2120	6213	9452	6550
6021	6555	9471	2688
6022	2490	9007	6311
9424	2691	1274	6241
2900	9830	2700	6350
2730	1525	6300	9560
2753	6230	2692	2141
3191	7361	9000	6212
3230	4621	6831	9921
6242	6360	9290	2811
6571	1380	9180	6260
2703	6370	2715	1275
2276	3350	2455	6821
2751	2750	9181	6315
9320	6200	9301	6244
9220	2205	9120	2800
9330	6838	9470	9495
2278	9342	9001	6020
2053	6312	6210	9341

Appendix C: IAPS Neutral Affect Image Identification Codes

7004	7043	4613	5396
7040	7010	1390	2385
2495	7036	2410	2102
5531	7058	7031	1230
9070	2890	5731	2493
2514	2372	7055	1945
5471	2440	2575	1675
5740	7035	2393	5500
2480	7034	2038	7037
7020	2870	2595	2880
2190	5920	8475	1726
7044	7041	2351	1310
2512	2215	2780	4631
7050	9411	2499	2702
8232	7009	8060	2357
1112	7052	2749	7056
2230	2381	7025	7006
2830	6150	7038	5535
2720	2305	7030	1616
2214	2272	7053	7059
2570	2516	1935	2487
2441	1303	2200	2635
2445	2840	2396	2210
7000	8160	2850	2191
2383	2446	2397	7002

Appendix D: Informed Consent

INFORMED CONSENT

You are invited to participate in this research project. Your participation is voluntary and you may stop at any time without penalty.

If you decide to participate, you will be asked to play a computer decision-making card game. During the game, you will be asked to view a series of pictures. Some of the pictures may be disturbing such as those one might see on a TV crime or hospital show. This session will take approximately 50 minutes.

Your name will not be associated with the project in any manner. Only code numbers will be used. We are not interested in performance of individuals, but only groups of people. There are no risks involved in this experiment outside those carried in everyday life.

Your participation may provide no immediate benefits to you as an individual; however, the results of the project may provide us with valuable knowledge about the process of decision-making.

If you have questions, please contact Dr. William Overman who is director of this project at 962-3379 or Dr. Candace Gauthier, who is chair of the UNCW Institutional Review Board at 962-3558.

I have read and understood this consent form to participate. If you do not comply with instructions or if the experimenter feels that you are not trying, you WILL NOT GET CREDIT for participation. I have been given a copy of this for my records (*please request copy from experimenter if you would like one*).

______________________	______________________	__________
Printed name of Participant	Signature	Date

______________________	______________________	__________
Printed name of Witness	Signature	Date

Appendix E: MAACL

1. active
2. adventurous
3. affectionate
4. afraid
5. agitated
6. agreeable
7. aggressive
8. alive
9. alone
10. amiable
11. amused
12. angry
13. annoyed
14. awful
15. bashful
16. bitter
17. blue
18. bored
19. calm
20. cautious
21. cheerful
22. clean
23. complaining
24. contented
25. contrary
26. cool
27. cooperative
28. critical
29. cross
30. cruel
31. daring
32. desperate
33. destroyed
34. devoted
35. disagreeable
36. discontented
37. discouraged
38. disgusted
39. displeased
40. energetic
41. enraged
42. enthusiastic
43. fearful
44. fine
45. fit
46. forlorn
47. frank
48. free
49. friendly
50. frightened
51. furious
52. lively
53. gentle
54. glad
55. gloomy
56. good
57. good-natured
58. grim
59. happy
60. healthy
61. hopeless
62. hostile
63. impatient
64. incensed
65. indignant
66. inspired
67. interested
68. irritated
69. jealous
70. joyful
71. kindly
72. lonely
73. lost
74. loving
75. low
76. lucky
77. mad
78. mean
79. meek
80. merry
81. mild
82. miserable
83. nervous
84. obliging
85. offended
86. outraged
87. panicky
88. patient
89. peaceful
90. pleased
91. pleasant
92. polite
93. powerful
94. reckless
95. quite
96. rejected
97. rough
98. sad
99. safe
100. satisfied
101. secure
102. shaky
103. shy
104. soothed
105. steady
106. stubborn
107. stormy
108. strong
109. suffering
110. sullen
111. sunk
112. sympathetic
113. tame
114. tender
115. tense
116. terrible
117. terrified
118. thoughtful
119. timid
120. tormented
121. understanding
122. unhappy
123. unsociable
124. upset
125. vexed
126. warm
127. whole
128. wild
129. willful
130. wilted
131. worrying
132. young

Appendix F: Iowa Gambling Task Instructions

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 will keep 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 the 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 G: IGT Score Sheet

IGT Score Sheet

Trial	Money Earned	Good Deck Guess
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Appendix H: MAACL Score Sheet

MAACL Score Sheet

Positive Affect
Give a point if any of the adjectives below are checked:

Affectionate	Joyful	Steady
Free	Loving	Tender
Friendly	Peaceful	Understanding
Glad	Pleased Warm	
Good	Pleasant	Whole
Good-natured	Polite	
Happy	Satisfied	
Interested	Secure	

Total Number of Points (raw score): ______________
Number of Checks *(# of checks on subscale + # of checks on entire sheet)*: ________
Gender: _________
Standard Score: _________

Negative Affect (*using depression & anxiety)*
Anxiety
Give a point if any of the adjectives below are checked:
Afraid
Fearful
Frightened
Impatient
Nervous
Panicky
Shaky
Tense
Timid
Worrying

Total Number of Points (raw score): ______________
Number of Checks *(# of checks on subscale + # of checks on entire sheet)*: ________
Gender: _________
Standard Score: _________

Depression
Give a point if any of the adjectives below are checked:

Alone		Lost	Sunk
Destroyed		Miserable	Tormented
Discouraged		Rejected	
Forlorn	Sad		
Lonely		Suffering	

Total Number of Points (raw score): ______________
Number of Checks *(# of checks on subscale + # of checks on entire sheet)*: ________
Gender: _________
Standard Score: _________