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Defining a Role for Affect in Decision-Making

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Recent theories of decision-making have hinted that affect might be useful during some decision-making processes. I propose a model, the affective evaluation model, which defines the role of affect in decision-making as helpful when affect is decision-relevant and unhelpful when it is not. In three studies, I manipulate the decision-relevance of affect to test this central component of the affective evaluation model. Study 1 demonstrates that emphasizing decision-relevant affective signals facilitates optimal decision-making as compared to emphasizing purely cognitive evaluations. Study 2 tests the hypothesis that creating the expectation that affect is useful can facilitate decision-making. Finally, Study 3 tests the hypothesis that creating the expectation that affect is useful during decision-making can selectively improve decision making when affect is decision-relevant but not when it is decision-irrelevant, and demonstrates that instructing individuals to rely purely on cognitive evaluations can increase risk aversion. Together these studies find moderate support for a central tenet of the affective evaluation model that it is decision-relevance that determines whether affect is helpful or hurtful during decision-making and examines ways in which training or framing can optimize the decision-making process.

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Chapter One: Introduction

Affect and reason have often been characterized as opposing forces in the battle over human behavior. In fact, this rivalry is so deeply rooted in my conceptualization of these entities that lay opinion and scientific inquiry have often considered them mostly separately, or examined instances in which one "wins" over the other. This struggle is especially pronounced in the field of decision science, in which classical models regarded affect as a source of noise, not information (Edwards, 1954; Neumann & Morgenstern, 1947). This characterization came at a cost. Specifically, models that disregard affective responses were consistently shown to be far less predictive of human behavior than models that incorporate them (Kahneman & Tversky, 1979). Subsequent models of decision-making have embraced affect as an integral component of the process, and even posited that it may be a necessary component for adaptive decision-making. The present research details such models, examines the circumstances under which affective signals lead to sub-optimal and optimal decision-making, and proposes a model for the adaptive role of affect in complex decision-making. Finally, I present the results from three studies that begin to test conditions under which affect may consistently contribute to optimal choice.

Models of Affect and Decision-making

Affect has been integrated into decision-making theories under the umbrella of dual-process models (Brocas & Carrillo, 2014). For the purposes of this research I define affect as rapid, valenced responses to stimuli that are often conveyed through bodily signals and may or may not be accompanied by an explicit cognitive inference/subjective feeling. The central premise of such models is that individuals rely on both deliberative (i.e., cognitive-appraisal based judgments often characterized by slower, rule-based processing, often occurring in conscious awareness) and intuitive processes (i.e., affective-evaluation based judgments often characterized by faster, holistic processing, that may or may not be conscious) to make their decision. The nuances of each model distinguish ways in which these two processes interact, the circumstances in which individuals rely on one more than another, and the circumstances under which one leads to more optimal decisions than another (for reviews see, Evans & Olson, 2007; Weber & Johnson, 2009). Reviewed below is a selection of dual-process models that highlight affect as a key component of the model and characterize how affective signals can negatively or positively influence decision-making.

Considering Affect in Decision-making

Prospect theory. A seminal theory in decision-science, prospect theory revolutionized economics by demonstrating that affective responses to choices can cause systematic biases in decision-making. These biases may lead individuals to make decisions that may not be in their best interest (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991; Tversky & Kahneman, 1992). One foundational concept of prospect

theory is loss aversion. Loss aversion refers to people's tendency to overweight a loss as compared to the same monetary gain; loss aversion produces a pattern of decision-making that suggests individuals do not simply assess the overall objective value of each option but also the affective value, or a summary value based on how one feels towards the option. Loss aversion leads to risk aversion, where risk is defined as a choice with a less than 100% probability of a particular outcome but where that probability is known (versus uncertainty in which the probability is unknown; Tversky & Fox, 1995). Risk aversion results in the phenomenon that individuals overvalue certain outcomes even if the riskier choice would lead to a greater gain. Finally, what is even more striking is that these effects are evident when the difference is merely in the presentation, or framing of the choices (Benjamin & Robbins, 2007; Kühberger, 1998; Levin, Schneider & Gaeth, 1998; Rabin, 2000).

Subsequent research has extended these seminal findings demonstrating that affective influences in decision-making—specifically economic decision-making—often lead to sub-optimal choices as measured by the amount of financial gain. Namely, in investment paradigms in which participants are asked to make an investment under a certain amount of risk, participants often under-invest even though investing regardless of the risk would ultimately leave them with the most amount of money (Shiv, Loewenstein, Bechara, Damasio & Damasio, 2005). In these tasks, affective biasing (i.e., an affective influence on decision-making) is thought to prevent risk taking even when that risk would lead to better outcomes. For example, in one paradigm (Shiv et al., 2005), participants are given a dollar and told that they may invest or keep their dollar.

Importantly, task contingencies are set up to insure that always investing will lead to the most profitable outcome. Healthy participants and patients with cognitive deficits (but not affective deficits) did not make the most optimal choice (i.e., always investing), though patients with affective deficits consistently chose to invest, leading to more optimal decision-making. This pattern indicates that ability to 'rationally' choose the riskier option is improved by a lack of affect, suggesting that affective responding leads to loss (and risk) aversion. These results provide neurologically-informed evidence consistent with the central tenet of prospect theory, namely that affective biases move individuals away from "optimal" choice (Shiv et al., 2005).

Although prospect theory highlighted the importance of affective evaluations, it did not attribute the biases solely to differences in affective evaluation, but also other cognitive heuristics that might bias decision-making. Most importantly, it limited the examination of how affective evaluations might hinder decision-making as a supplementary form of information, rather than examining how affect might be necessary to the decision-making process. Subsequent research has begun to examine these questions and build upon the substantial foundation of prospect theory.

Risk as feeling. The risk-as-feeling hypothesis extends prospect theory, which viewed biases as primarily detrimental and tangential to decision-making, by stating that feelings are a source of information as central to decision-making as other cognition. In fact, when affective responses and other cognitions diverge, feelings often dictate behavioral outcomes (Loewenstein, Weber, Hsee & Welch, 2001). In a novel stance, the authors highlight the independent influence of affective information, especially in the

domain of decision-making under risk. The risk-as-feeling model posits that responses to risky situations are a composite of both direct affective influences and cognitive evaluations. The theory states that direct—or anticipatory—affect is generated from the stimulus itself, a direct reaction to a feature of your decision (e.g., a reaction to the color, price, or size of something) and is independent of cognitive evaluations (Floresco & Ghods-Sharifi, 2007; Slovic, Finucane, Peters & MacGregor, 2004; Slovic & Peters, 2006; Song & Schwarz, 2009).

According to this theory, anticipatory affect in response to choice options is therefore relatively uninfluenced by subsequent reframing or other cognitive influences. This independence can lead to divergent behavioral outcomes, one dictated by cognitive evaluations and one by affective responses. When such a divergence occurs, the model predicts that affective responses will determine behavioral outcomes. For example, individuals are much more fearful of airplane than car crashes, even though car crashes are much more likely. Their fear dictates their decision not to fly and the statistics of car crashes does nothing to deter participation in rush hour traffic (Loewenstein, Weber, Hsee & Welch, 2001). The cognitive evaluation of such outcomes should take these probabilities into account but in this example, cognitive and affective responses diverge and affect ultimately dictates decision behavior.

A critical prediction of the risk-as-feeling hypothesis is that anticipatory affect can independently influence decision-making, even flying under the radar of conscious awareness. Building on the work of Zajonc (1984), this assertion that affective reactions to risky stimuli need no inferences promotes affect from a supporting to leading role in

the decision-making story. Removing the need for a cognitive interpretation of affective reactions allows affect to stand alone, influencing decision-making separately from other cognitive processes. Furthermore, subsequent research reveals that direct neural projections from sensory regions can bypass cognitive regions to directly influence behavior (Öngür & Price, 2000; Zald, 2003). Demonstrating that affective responses can bypass systems that generate inferences but still can have an impact on behavior makes affective responding a central influence in the decision-making process, rather than a supplemental influence to cognitive inferences.

By theorizing that affective evaluations have as much (or perhaps more) influence over decisions under risk as cognitive evaluations, the risk-as-feeling model extends traditional consequentialist models of decision-making into a domain that factors in affective responding as much as cognitive evaluations. To argue for its distinct influence, the model thoroughly explores instances in which affective evaluations diverge from cognitive evaluations, demonstrating that in these cases affective evaluations often predict behavior. Although this model demonstrates the independent influence of affective information from cognitive evaluations in risky decision-making, like prospect theory, it also does not view affective influences as adaptive in decision-making. Subsequent models have begun to propose an adaptive role for affective information in decision-making.

An *Informative* Role for Affect in Decision-making

Affect-as-information hypothesis. The affect-as-information hypothesis (Schwarz & Clore, 1983) states that individuals use the affect experienced at the moment

of the decision, as a reaction to what is being judged, to guide behavior. This phenomenon has been illustrated in a myriad of domains as disparate as consumer products (Adaval, 2013) to life satisfaction (Schwarz & Clore, 1983). In the latter example, participants reported greater life satisfaction on sunny days compared to rainy, demonstrating that they inferred that their 'sunny' disposition (that was actually due to the weather) was in fact due to their overall satisfaction with their life (Schwarz & Clore, 1983). The affect-as-information hypothesis explains such patterns of behavior as the result of individuals using their affective states at the time of decision-making as an indication of the value of the target of their choice. This example demonstrates the influence of incidental affective evaluations on subsequent judgment. The affect-as-information hypothesis further posits that in addition to incidental affective evaluations, affective evaluations can also be caused by the decision options. Importantly, these evaluations are adaptive and often provide critical decision-relevant information about possible outcomes. These decision-relevant, affective evaluations can be generated in response to any sort of option or option feature, whether they are similar (e.g., the price of each option) or dissimilar (e.g., the style of option 1 and the status of option 2). Affect therefore may serve as a common currency through which individuals can compare distinct options that may not have many features that are comparable through cognitive evaluation alone (Clore & Huntsinger, 2007).

By elevating affect from an oppositional to complementary role in relation to cognitive evaluations, the affect-as-information hypothesis provides a theoretical framework through which subsequent research can examine how these two sources of

information influence decision-making in the presence of one another. This model solidifies that affect plays a critical role in decision-making, and proposes (at least theoretically) that this role is a helpful one. However, because of the potentially incidental nature of affective evaluations as described in the affect-as-information hypothesis, it remains unclear when individuals should ignore their affective evaluations and when they should rely on them as a source of decision-bound information.

Somatic marker hypothesis. Based on previous research and foundational, theoretical frameworks that help describe a myriad of decision-making scenarios, it is clear that affective signals play a role in decision-making. Defining exactly what that role is and how it influences decision-making is the primary aim of the somatic marker hypothesis. The central premise of the somatic-marker hypothesis is that affective signals conveyed through bio-regulatory mechanisms (e.g., changes in bodily state such as electro-dermal activity, endocrine release, heart rate, smooth muscle contraction, posture, facial expression, etc.) are necessary for adaptive decision-making (Bechara & Damasio, 2005; Dunn, Dalgleish & Lawrence, 2006; Reimann & Bechara, 2010). Thus, the hypothesis makes two important assertions: 1) That bio-regulatory mechanisms convey affective information that is related to the decision at hand, and 2) that use of this affective information during decision-making is in fact adaptive. These are significant additions to previous theories that acknowledged the benefit of affective evolutions in decision-making but did not claim that they were essential to adaptive choice (Schwarz & Clore, 1983; Clore & Huntsinger, 2007; Loewenstein et al., 2001; Khaneman & Tversky, 1979).

The most frequent empirical tests of the somatic marker hypothesis come from the Iowa Gambling Task. In the task, participants are presented with four decks of cards, two of which will yield a greater net reward and two of which will yield a greater net loss. The task contingencies are not explained to the participant. Instead, participants are told that they will receive money according to the cards they select. Healthy participants generate skin conductance responses in response to risky decisions and through experience. Then, healthy participants begin to select solely from the advantageous deck, demonstrating that they have learned which deck leads to better outcomes, (Bechara & Damasio, 2005; Gilbert & Wilson, 2007). These skin conductance responses (or somatic markers) have been interpreted as signal, cautioning the participant about a disadvantageous decision or driving them towards the advantageous one. Participants with damage to areas of the brain that interpret affective signals did not produce appropriate skin conductance signals and therefore did not learn to discriminate between the advantageous and disadvantageous deck (Bechara & Damasio, 2005). These findings were taken as evidence for the somatic marker hypothesis and the critical role that affective signals play in adaptive decision-making.

The somatic marker hypothesis extends the role of affect from complimentary to necessary in the decision-making process. Not only are somatic markers generated by affective responses essential to the decision-making process, but cognitive evaluation may even be superfluous as participants began to choose from the advantageous deck before they could report why they were doing so (Bechara & Damasio, 2005; Bechara, Damasio, Tranel & Damasio, 2005; Dunn et al., 2006). However, determining that

affective evaluations are adaptive during decision-making does not address if they are always necessary but supplemental additions to cognitive evaluations of decision-options, or, if there are some circumstances under which affective evaluations can independently lead to adaptive decision-making. Subsequent research aims to fill this gap and provides a hypothesis for more ecologically valid circumstances under which affective evaluations are not only necessary to decision-making, but can even outperform their cognitive counterparts.

Unconscious Thought Theory

The somatic marker hypothesis made the important contribution of highlighting how essential affect is to decision-making. However, it considered the role of affect in largely associative decision-making paradigms in which choices unfolded over time, often specific to risk and money, and each option often had a single attribute on which to be judged. The decisions examined in the somatic marker hypothesis are undoubtedly relevant to every-day life; however, these relatively simple choices do not characterize all of the choices I make in daily life. Under the framework of unconscious thought theory, another field of research has begun to examine more complex decisions in which each option has multiple attributes and comparison across options.

In the paradigm most associated with this theory, participants are presented with four options, each with a number of attributes, with one option being the objectively best choice (75% positive attributes), one being the objectively worst choice (25% positive attributes) and two neutral options (50% positive attributes). Participants assigned to the simple condition are presented with four options each with four attributes, and asked to

select one. Participants assigned to the complex condition are presented with four options each with twelve attributes, and asked to select one. Participants read the attributes and are then instructed to either deliberate about their options for three minutes (Deliberation condition) or complete anagrams for three minutes (Distraction condition). The typical pattern of results reveal that those in the Distraction condition chose the objectively best car approximately 50-60% of the time regardless of complexity, while those in the Deliberation condition chose the objectively best car 60% of the time in the simple condition, but only 20% of the time in the complex condition (Dijksterhuis et al., 2006). Importantly, these results reveal a counterintuitive characteristic of decision-making that suggests that there are some circumstances in which careful, conscious, and systematic thought might lead to worse decisions than relatively effortless intuition.

The theoretical framework used to explain these results has largely focused on the cognitive biases (e.g., availability heuristic; Tversky & Kahneman, 1973) and limited capacity of attention (e.g., processing information serially and only up to a certain amount; Miller, 1956) that are characteristic of the Deliberation condition, forcing participants to process each piece of information separately, thus preventing integration of large amounts of information (Dijksterhuis, 2004; Strick et al., 2011). On the other hand, the Distraction condition is not constrained by the limits of attention because in this condition the information is processed outside of direct conscious awareness, providing a more integrated impression of the options. Relatively little has been theorized about if and how information is actually being integrated during the Distraction condition, and what that "information" is made of. Previous research and dual-process models of

decision-making suggest that affect might be one option. The current model expands on this suggestion by asserting that it is not necessarily a deficit of conscious thought that leads to poorer decision-making in the Deliberation condition but an over-reliance on cognitive evaluations in the decision-making process.

Chapter Two: Affective Evaluation Model

As reviewed above, affect informs decision-making in a myriad of contexts, and many modern models of decision-making highlight affect as an integral part of the decision-making process (Loewenstein et al., 2001; Schwarz & Clore, 1983; Damasio, 1994). The present model extends such models by proposing that decision-relevant affect plays a central, and critical role in adaptive decision-making. According to this model, when making a decision (e.g., deciding between two cars) one first generates affective evaluations of the option attributes, which are then summarized into an "affective value," and reliance on this affective value will lead to more optimal decision-making.

I define affective evaluations as rapid, central and peripheral physiological responses resulting from processing a specific stimulus (e.g., an attribute) that generate an approach or avoidance signal (depending on the valence generated by the stimuli), and may or may not be consciously processed as valenced, feeling states. Importantly, affective evaluations are decision-relevant affective responses. The model does not posit that general affective responses during decision-making are universally helpful; therefore, decision-relevant affective evaluations refer only to those affective responses that are generated in response to the evaluation of the decision objects. I characterize "affective

value" as the weighted summary of these affective evaluations, leading to a single value for each option.

The affective evaluation model proposes that when participants are presented with an option and its attributes, autonomic responses similar to those described in the somatic marker hypothesis are generated (Damasio, 1994) and translated into affective evaluations (that may or may not be conscious) for each attribute. These signals or evaluations are then synthesized, forming a weighted summary, creating a singular affective value for each option, which is then conveyed as a feeling of preference for each option. The emphasis on affect in the affective evaluation model should not be interpreted as a denouncement of the importance of cognitive evaluations. Decision-relevant cognitive evaluations can be helpful in complex decision-making so long as they are unbiased, and translated with fidelity into the common currency of affective evaluations. As stated previously, affective responses are not universally adaptive, as decision-irrelevant affective information adds error when summarizing the affective evaluations to generate the affective value. The affective evaluation model proposes that affect will be helpful during decision-making when it is decision-relevant and when it can be applied to the decision at hand before the intrusion of decision-irrelevant cognition or affect. The key additions of the affective evaluation model are 1) a proposed process through which affect facilitates optimal decision-making, and 2) a theory that might shed some light on the mixed findings concerning the role of affect in decision-making described above.

The Present Research

The present research aimed to examine the central tenet of the affective evaluation model: Decision-relevant, affective evaluations facilitate optimal decision-making. Studies 1 and 2 used the complex decision-making task commonly used to examine unconscious thought theory (Dijksterhuis et al., 2006). Using affective and neutral instruction conditions, these studies aimed to determine if optimal decision-making could be facilitated or disrupted by varying levels of, and the use of decision-relevant affective information. In previous work the benefits of the Distraction condition, as exemplified by optimal choice and post-choice satisfaction, have been attributed to the presence of unconscious thought (Dijksterhuis et al., 2006). The current model proposes that the benefits of the Distraction condition are in fact due to the affective evaluations of the option attributes, their subsequent uninterrupted synthesis into an affective value, and the reliance on this affective value to make the decision**.** In contrast, previous work blames the poor performance of the Deliberation condition on the capacity limits of conscious thought and the disruptive nature of cognitive biases. The current model proposes that the costs of the Deliberation condition may result not from all types of deliberation, but from an over-reliance on biased cognitive evaluations, neglecting decision-relevant affective evaluations all together, thus preventing any accurate summary of such evaluations or the generation of a single affective value on which to base a decision.

Using the complex decision making task (Dijksterhuis et al., 2006), Study 1 tested the following hypotheses: 1) If the use of task relevant, affective evaluations contribute to optimal decision-making, then instructing individuals to deliberately reflect on their

feelings after learning of their options should increase optimal decision-making and 2) If the use of decision-relevant, affective evaluations contributes to optimal decision-making, then the introduction of decision-irrelevant, affective information should decrease optimal decision-making. The primary goal of this study was to examine the central tenant of the affective evaluation model and lay the groundwork for future examination of this phenomenon.

Study 2 also used the complex decision making task to examine the importance of affective evaluations in decision-making, by manipulating the expectations individuals have about the helpfulness of affective signals. By informing participants that affective evaluations are helpful during decision-making, participants may rely on such evaluations to a greater extent, ostensibly increasing their reliance on decision-relevant signals. To see if expectations can be manipulated to discourage the use of affective evaluations, participants were informed that only cognition is helpful during decision-making, ostensibly decreasing their reliance on decision-relevant affective signals. Therefore, Study 2 tested the following hypotheses: 1) If affective evaluations are helpful during decision making, then increasing the expectation that they will be helpful should increase optimal decision-making, and 2) If affective evaluations are helpful during decision making, then increasing the expectation that cognition alone is helpful should decrease optimal decision-making.

Finally, Study 3 continued to examine the central tenet of the affective evaluation model by asking if manipulating expectations about the usefulness of affect will selectively improve choice under conditions when affect is decision-relevant or decision-

irrelevant. This study used a decision-making under risk paradigm that asks participants to decide between two options, one more certain than another (Slot Machine Game; Martin, Herrera & Delgado, 2014). Importantly, the options with the greatest expected value (i.e., the option that leads to the greatest amount of monetary gain on average) were sometimes the 'safer' option, or the 'riskier' option. Thus affective reactions to risk are decision-irrelevant, as they cannot consistently predict optimal outcomes. This paradigm therefore instantiates both decision-irrelevant, affective responses (i.e., responses to risk), and decision-relevant affective evaluations (i.e., response to the higher expected value outcome) allowing for a critical test: If increasing individuals' expectations that affect is helpful during decision-making simply increases awareness of all affective responding, then participants should make more risk-adverse decisions regardless of the expected value of the choice. However, if increasing individuals' expectations that affect is helpful during decision-making increases the reliance upon decision-relevant affective evaluations, then participants should choose the option with the greater expected value even when that choice is riskier. These competing hypotheses allow for the examination of both the affective evaluation component of the present model, and to determine whether instructing individuals to reflect on their emotions is an effective way to increase optimal decision-making.

Chapter Three: Study 1

Study 1 assessed whether attending to decision-relevant affective evaluations could facilitate decision-making and whether introducing decision-irrelevant affective information could interfere with decision-making. Using the complex decision-making paradigm (Dijksterhuis et al., 2006), Study 1 compared the traditional Neutral Deliberation and Neutral Distraction conditions to modified Affective Deliberation and Affective Distraction conditions. Study 1 also included an Immediate condition as a baseline for decision-making. The Affective Deliberation condition asked participants to consider their feelings towards the stimuli, theoretically increasing the impact of decision-relevant affective evaluations and potentially increasing the proportion of optimal choice occurring in this condition as compared to the Neutral Deliberation condition. The Affective Distraction condition asked participants to solve anagrams of emotionally evocative words as opposed to neutral words, thus introducing decision-irrelevant affective information and potentially decreasing the amount of optimal choice occurring in this condition as compared to the Neutral Distraction condition. Thus, Study 1 tests whether decision-relevance can distinguish helpful affective evaluations from affective responses that hinder decision-making.

Participants

Participants were recruited from the University of Denver and the surrounding community (M = 19.91 years, SD = 2.81; 70% female). Participants were randomly assigned to one of five conditions: 45 in Neutral Deliberation, 47 in Neutral Distraction, 44 in Affective Deliberation, 46 in Affective Distraction, and 46 in the Immediate condition. Participants were required to be at least 18 years of age, and be fluent in English.

Procedure

Participants were recruited to participate in an hour-long, computer-based task, using community flyers, online advertisements and classroom announcements. The study was conducted in a specialized room equipped to measure psychophysiology. Participants were given a consent form and the opportunity to ask any questions about the study procedure. After consent, participants were connected to electrodermal activity (EDA) sensors; they were then instructed to begin the task[1].

The basic task design was closely modeled after the complex decision-making task used in studies examining unconscious thought theory (Dijksterhuis, 2004; Strick, Dijksterhuis, Bos, Sjoerdsma & van Baaren, 2011). Participants were told that they would be presented with information about four cars and asked to choose one of those cars at a later stage. Each car was comprised of 12 clearly positive (e.g., the Hatsdun has good

[1] Skin conductance data were unusable. Due to a lab-wide error, for a brief period of time I used skin conductance electrodes with a solution that was not designed for skin conductance data collection. Unfortunately, this means that those data were not interpretable. Therefore, I have decided not to use any of the skin conductance data collected now or in the future.

mileage) or negative (e.g., the Hatsdun has bad service) attributes. One car was the objectively best car with 75% positive attributes, two cars were neutral with 50% positive attributes, and one car was the worst car with 25% positive attributes. Stimuli were presented using E-prime stimulus presentation software and proceeded as follows: All 12 attributes of the first car were presented at once and participants had 12 seconds to read this information. The attributes of the first car stayed on the screen while the 12 attributes of the second car appeared. This continued until the attributes of all four cars appeared on the screen together. Participants then had an additional 12 seconds to read information about all of the cars. After all information about each car was presented, participants were asked to either deliberate for four minutes and then choose one car, solve anagrams for four minutes and then choose one car, or to immediately choose one car. For 62% of participants, additional attitude ratings were collected after car selection. Positive and negative attitudes towards each car were collected on a four-point scale (e.g., 0 being not positive/negative at all, 2 being somewhat positive/negative, 3 being positive/negative, 4 being very positive/negative). Participants then completed a funneled debriefing form (Chartrand & Bargh, 1996) to assess their knowledge of task contingencies and hypotheses, no participants were excluded based on the debriefing.

After funneled debriefing, participants were disconnected from the psychophysiological equipment, given a break and asked to complete several questionnaires to assess demographics, individual differences, and task compliance. Only task compliance data will be discussed for the purposes of this dissertation. Finally,

participants were fully debriefed, compensated with cash or course credit, and thanked for their participation.

The procedure above was consistent across all conditions. The key difference occurred after all the information about each car had been presented. This was a between-subjects design in which participants were assigned to one of the following five conditions:

Neutral Deliberation: In this condition participants were asked to "think very carefully about *what you think of* each of the four cars" (emphasis added) for four minutes before they were asked to choose which car was best. This condition was designed to replicate previous effects and to provide a comparison for the Affective Deliberation condition.

Affective Deliberation: In this condition participants were asked to "think very carefully about *how you feel about* each of the four cars" (emphasis added) for four minutes before they were asked to choose which car was best. The affective emphasis in the instructions for this condition were designed to increase the participants' awareness of their own affective responses towards the car choices, potentially attenuating some of the detrimental effects typically seen in the Neutral Deliberation condition.

Neutral Distraction: In this condition participants were asked to solve anagrams of affectively neutral words before they were asked to choose which car was best. This condition was also designed to replicate previous effects and provides a comparison for the Affective Deliberation condition.

Affective Distraction: In this condition participants were asked to solve anagrams of highly arousing, affectively positive and negative words before they were asked to

choose which car was best. The affective responses evoked by the positively and negatively valenced anagrams were intended to introduce affective signals during the distraction period that were not related to the car options.

Immediate: In this condition participants were asked to make their decision immediately after all of the option attributes were been presented. This condition served as a no-instruction comparison for all above manipulations.

Data Analytic Strategy

Based on previous studies, my primary measures of interest were 1) the number of participants who selected the objectively best car and 2) the attitude ratings towards each car. The numbers of participants who selected the best car in each condition were compared in a series of chi-squared tests of independence. First, an omnibus chi squared test of independence comparing the number of participants who selected the best car across all five conditions was conducted. Second, as a replication of previous results, the prediction that more participants in the Neutral Distraction condition would choose the objectively best car as compared to participants in the Neutral Deliberation condition was tested. Third, to test the first hypothesis that instructing individuals to deliberately reflect on their feelings should increase optimal decision-making, the prediction that more participants in the Affective Deliberation condition would choose the objectively best car as compared to those in the Neutral Deliberation condition was tested. Finally, to test the second hypothesis that introducing decision-irrelevant affective information should decrease optimal decision-making, the prediction that participants in the Neutral Distraction condition would choose the objectively best car compared to those in the

Affective Distraction condition was tested. When chi-squared tests of independence were significant, odds-ratios were computed by first dividing the number of participants that selected the best car by those that did not select the best car in each condition, and then dividing the larger resulting ratio by the smaller resulting ratio. All chi-squared independence tests met the expected count assumption with all counts for each 2x2 test greater than 5.

To mimic the choice behavior analyses, means of the positive and negative attitude ratings only towards the objectively best car were analyzed using a one-way ANOVA. First, an omnibus one-way ANOVA was conducted with all five conditions predicting attitude ratings towards the objectively best car. Due to strong a priori predictions, follow-up independent samples t-tests were conducted with the predictions that participants in the Neutral Distraction condition would rate the objectively best car more appropriately (i.e., more positively and less negatively) than those in the Neutral Deliberation condition, that those in the Affective Deliberation condition would rate the objectively best car more appropriately than those in the Neutral Deliberation condition, and finally that those in the Neutral Distraction condition would rate the objectively best car more appropriately than those in the Affective Distraction condition.

Results

Choice behavior. The number of participants that selected the objectively best car in each condition was submitted to a chi-squared test of independence. The overall chi-square with all five conditions (i.e., Neutral Deliberation, Neutral Distraction, Affective Deliberation, Affective Distraction, and Immediate) indicated that condition

had a trend-level effect on whether or not the best car was selected, $\chi^2(4) = 8.63$, $p = .07$ (see Appendix A for the percent of participants within each condition who selected the best car).

Pairwise comparisons indicated that the original effect (Dijksterhuis et al., 2006) was replicated such that, of the participants who selected the objectively best car, a greater percentage were in the Neutral Distraction condition (60.4%) than the Neutral Deliberation condition (39.6%), $\chi^2(1) = 4.32$, $p = .04$. Participants in the Neutral Distraction condition were 2.44 times more likely to select the best car than participants in the Neutral Deliberation condition.

The hypothesis that instructing individuals to deliberately reflect on their feelings should increase optimal decision-making was also supported, given that of the participants who selected the objectively best car a greater percentage were in the Affective Deliberation condition (58.8%) than in the Neutral Deliberation condition (41.2%), $\chi^2(1) = 4.21$, $p = .04$, such that participants in the Affective Deliberation condition were 2.45 times more likely to choose the best car than participants in the Neutral Deliberation condition. The second hypothesis that introducing decision-irrelevant affective information should decrease optimal decision-making was not supported by the data, as there was no significant association between the Neutral Distraction (52.5%) versus Affective Distraction (47.5) and whether or not participants selected the best car, $\chi^2(1) = 0.26$, $p = .61$.

Finally, exploratory analyses comparing each condition to the Immediate condition investigated whether a decision without any delay period resulted in better or

worse decisions as compared to each of the other four conditions. Of the participants who selected the objectively best car, a greater percentage of participants were in the Neutral Distraction condition (59.3%) compared to the Immediate condition (40.7%), $\chi^2(1) = 3.92$, $p = .05$, such that participants in the Neutral Distraction condition were 2.33 times more likely to select the best car than participants in the Immediate condition. Of the participants who selected the objectively best car, a greater percentage of participants were in the Affective Deliberation condition (57.7%) compared to the Immediate condition (42.3%), $\chi^2(1) = 3.82$, $p = .05$, such that participants in the Affective Deliberation condition were 2.34 times more likely to select the best car than participants in the Immediate condition. There was no significant association between the Immediate, Neutral Deliberation, or Affective Distraction conditions and whether or not participants selected the best car (all ps > .14).

Attitude ratings. To most informatively supplement the choice data analyses, which focused on the objectively best car, attitude analyses also focused on the attitudes towards the best car. First, for the positive attitude scale with higher numbers indicating a more positive attitude, a one-way ANOVA with all five conditions was conducted revealing no effect of condition, $F(4, 136) = 0.86$, $p = .86$, $\eta^2 = .01$. However, because of my a priori predictions I conducted independent samples t-tests that mirrored my analyses of choice behavior. Unlike in choice behavior, I did not see a difference between Neutral Deliberation and Neutral Distraction, between Neutral Deliberation and Affective Deliberation, nor a difference between the Immediate condition and each of the other four conditions in how positively participants in each condition rated the objectively best car

(all *p*s > .46). As in choice behavior, I did not see a difference between Neutral Distraction and Affective Distraction in how positively participants in each condition rated the objectively best car, $p = .98$ (see Appendix B for figure of positive affect ratings).

Next, for the negative attitude scale with higher numbers indicating a more negative attitude, a one-way ANOVA with all five conditions was conducted revealing no effect of condition, $F(4, 136) = 1.93$, $p = .11$, $\eta^2 = .05$. As with the positive ratings I did not see a difference between Neutral Deliberation and Neutral Distraction nor a difference between Neutral Deliberation and Affective Deliberation in how negatively participants in each condition rated the objectively best car (all *p*s > .15). However, contrary to hypotheses, I did see a difference between Neutral Distraction and Affective Distraction in how negatively participants in each condition rated the objectively best car, $t(55) = 2.19$, $p = .03$, such that participants in the Neutral Distraction condition rated the best car more negatively (less appropriately), $M = 1.28$, $SD = 0.88$, than participants in the Affective Distraction condition, $M = 0.82$, $SD = 0.67$ (see Appendix C for figure of negative affect ratings). Finally, results indicated a significant difference between the Immediate and Neutral Distraction condition, $t(56) = 2.22$, $p = .03$, such that participants in the Neutral Distraction condition rated the best car more negatively, $M = 1.28$, $SD = 0.88$, than participants in the Immediate condition, $M = 0.79$, $SD = 0.77$.

Discussion

The results of Study 1 provide insight into the role of affect in complex decision-making. By manipulating whether participants attend to their affective evaluations or

more cognitive evaluations in the Deliberation condition, the present study asks whether deliberation of all kinds has similar effects on optimal decisions, or whether certain kinds of deliberation are more or less helpful. The results suggest that reflecting on affective evaluations during deliberation facilitates optimal choice providing some support for the first tenet of the affective evaluation model: that using decision-relevant affect to make a decision can help facilitate optimal decision-making.

These results also shed light on the utility of deliberation frames in shaping subsequent decisions, and suggest that affective evaluations can be consciously attended to such that optimal decision-making is increased. Unconscious thought theorists would likely argue that drawing attention to these affective signals would disrupt unconscious thought and thus decrease optimal choice (Dijksterhuis, 2004). If this is in fact the case, then the results would show no difference between the quality of decisions in the Affective Deliberation condition as compared to the Neutral Deliberation condition. However, if it is decision-relevant affect that is necessary for optimal decision-making and if affective evaluations are consciously accessible, than, as observed, the Affective Deliberation condition should produce more optimal decisions than the Neutral condition.

Secondly, by introducing task irrelevant affective information in the Affective Distraction condition, Study 1 continued to test the affective evaluation model's proposal that decision-relevant affective information is the key ingredient in optimal decision-making. This manipulation homed in on decision-relevance by comparing Affective Distraction to Neutral Distraction and predicted that decision-irrelevant information presented in the Affective Distraction condition would reduce the effectiveness of

decision-relevant affective evaluations generated from the car attributes, thus reducing the number of optimal decisions as compared to the Neutral Distraction condition. While the negative attitude ratings indicated a pattern in the opposite of the predicted direction, with participants in the Affective Distraction condition ratings the best car less negatively (or more appropriately), than those in the Neutral Distraction condition, I did not observe a difference between these two conditions in choice behavior.

Together these results suggest that instructing individuals to introspect about decision-relevant affect may facilitate decision-making and that perhaps a stronger source of interfering affect is needed to disrupt the influence of decision-relevant affect on choice behavior.

Chapter Four: Study 2

Study 1 demonstrated that instructing individuals to introspect about decision-relevant affective evaluations could increase optimal choice compared to introspecting in a way that did not emphasize affect as a source of information. Study 2 extended these findings by asking if instructing individuals to utilize affective evaluations could improve decision-making compared to instructing individuals to utilize only cognitive evaluations. Study 2 achieved this goal by manipulating participants' expectations of the helpfulness of affective evaluations. By shifting participants' expectations of affective evaluations, or as lay people might call them "gut feelings", Study 2 encouraged or discouraged individuals to rely on affective evaluations during decision-making. If affective evaluations are helpful, creating the expectation that they are helpful should increase the amount of optimal choice. However, if affective evaluations are helpful, creating the expectation that cognitive evaluations are helpful should decrease the amount of optimal choice.

Participants

Participants included 261 MTurk workers (M = 32.58, SD = 8.84; 44% female). MTurk workers were required to be 18 years of age or older, to have an approval rate of

at least 95% (i.e., 95% or more of that participant's previous submissions were approved by requesters), completed at least 50 tasks, and were located in the United States. These restrictions were to ensure comparability across my three studies, and followed guidelines suggested by prior research using MTurk participants (Goodman, Cryder & Cheema, 2013). Participants were randomly assigned to one of five conditions, 52 in Neutral Deliberation, 51 in Neutral Distraction, 53 in Cognition-Helpful, 53 in Affect-Helpful, and 52 in the Immediate condition.

Procedure

Study 2 procedures closely followed Study 1 with a few exceptions. First, the task was completed online so no physiology measures will be collected. Second, during the delay period of each Deliberation condition participants were asked to continuously type any thoughts that come to mind during the delay. This was to ensure that participants remained on task even during the delay. Third, the delay was reduced to 3 minutes as previous studies have shown that this duration is just as effective in producing the typical complex decision making task effect as a longer delay (Strick et al., 2011). Finally, the Affective Deliberation and Affective Distraction conditions were replaced with Affect-Helpful and Cognition-Helpful, two conditions that manipulated participants' expectations of the helpfulness of affective evaluations. As in Study 1, the key difference occurred after all the information about each car has been presented. This was a between-subjects design in which participants were assigned to one of the following five conditions:

Neutral Deliberation: In this condition participants were asked to "think very carefully about *what you think of* each of the four cars" for three minutes before they were asked to choose which car is best.

Neutral Distraction: In this condition participants were asked to solve anagrams of affectively neutral words before they were asked to choose which car is best.

Immediate: In this condition participants were asked to make their decision immediately after all of the option attributes were presented. This condition served as a comparison for all other conditions.

Affect-Helpful: In this condition participants saw the following after attribute presentation: "*Research shows that using your gut, or intuition, is often helpful when making a decision*. Please try to use your gut or intuition to help you make your decision. Please write any thoughts you have about each of the four cars into the box below." The instructions were designed to create the expectation that affective-evaluations are helpful in decision-making and increase the reliance of participants on such evaluations, therefore increasing the amount of optimal decisions as compared to the Neutral Deliberation condition.

Cognition-Helpful: In this condition participants saw the following after attribute presentation: "*Research shows that using your head, or logic, is often helpful when making a decision*. Please use your head or logic to help you make your decision. Please write any thoughts you have about each of the four cars into the box below." The instructions were designed to create the expectation that cognitive, deliberative evaluations are helpful in decision-making and increase the reliance of participants on

such evaluations, therefore decreasing the amount of optimal decisions as compared to the Neutral Deliberation condition.

Data Analytic Strategy

The data analysis strategy for Study 2 was similar to Study 1 with the following exceptions. First, to test the hypothesis that increasing the expectations that affective evaluations are helpful, should increase the reliance on affective evaluations, and therefore increase the amount of optimal choice, the Neutral Deliberation was compared to the Affect-Helpful condition with the prediction that more participants in the Affect-Helpful condition would choose the objectively best car as compared to those in the Neutral Deliberation condition. This comparison was also made for attitude ratings such that participants in the Affect-Helpful condition would more appropriately rate the objectively best car than those in the Neutral Deliberation condition.

To test the second hypothesis that increasing the expectations that cognition alone is helpful should decrease the reliance on affective evaluations, and therefore decrease the amount of optimal choice, the Neutral Deliberation was compared to the Cognition-Helpful condition with the prediction that more participants in the Neutral Deliberation condition would choose the objectively best car compared to those in the Cognition-Helpful condition. Once again this comparison was also made for attitude ratings such that participants in the Neutral Deliberation condition would more appropriately rate the objectively best car than those in the Cognition-Helpful condition.

Results

Choice behavior. As in Study 1, the number of participants that selected the objectively best car in each condition was submitted to a chi-squared test of independence. Unlike Study 1, the overall chi-square with all five conditions (i.e., Neutral Deliberation, Neutral Distraction, Immediate, Affect-Helpful, and Cognition-Helpful) did not show that condition had an impact on whether or not the best car was selected, $\chi^2(4) = 6.30$, $p = .18$ (see Appendix D for a figure depicting the percent of participants that chose the objectively best car in each condition). The original effect (Dijksterhuis et al., 2006) was not replicated with no difference between the number of participants in the Neutral Distraction condition selecting the objectively best choice compared to those in the Neutral Deliberation condition ($p = .78$). Unlike in Study 1, no support was found for the first hypothesis that increasing the expectations that affective evaluations are helpful would increase the amount of optimal choice, as there was no significant association between the Neutral Deliberation compared to the Affect-Helpful condition and whether or not participants selected the best car ($p > .18$). Contrary to the predictions of the second hypothesis, the results indicated that of the participants who selected the objectively best car, a somewhat higher percentage were in the Cognition-Helpful condition than in the Neutral Deliberation condition, $\chi^2(1) = 3.20$, $p = .07$. The 2x2 chi-squared test of independence indicated no significant association between the Immediate condition and any other condition, and whether or not participants selected the best car (all ps $> .19$).

Attitude ratings. As in Study 1, to most informatively supplement the choice data analyses, which focused on the objectively best car, attitude analyses also focused on the attitudes towards the best car. Neither the results of the one-way ANOVA for positive (see Appendix E), nor negative ratings (see Appendix F) showed a main effect of condition (all *p*s > .42). Follow-up, independent samples t-tests indicated no differences between Neutral Deliberation compared to, Neutral Distraction, Cognition-Helpful, or Affect-Helpful, for positive or negative ratings (all *p*s > .13). Comparisons of each condition with the Immediate condition did not indicate any differences for positive or negative ratings (all *p*s > .36).

Discussion

Study 2 examined the effect of expectations of the helpfulness of affective evaluations on decision-making. The results did not support the hypothesis that increasing expectations that affective evaluations are helpful in decision-making leads to more optimal decision making as compared to no manipulation of expectations. The results of Study 2 somewhat contradict Study 1 in which I did see evidence that instructing participants to introspect about decision-relevant affect information improved the quality of their decision-making. There are several reasons why Study 2 may differ from Study 1. First, by instructing participants to write down their thoughts during the delay period I may have encouraged individuals to make a more immediate choice, or ruminate on a single option, rather than considering all choices. In fact, coding and analysis of the written response data indicated that 41.14% of participants mentioned only one or fewer cars in their free responses. This shift may have made the Neutral

Deliberation, Cognition-Helpful and Affect-Helpful conditions more similar to the Immediate condition during which participants made the choice immediately after the car attributes were presented. Having participants write down their thoughts may have also increased confabulation (or the tendency to make up or distort memories without the intent to deceive) of the reasons behind their decision-making. Prior research has demonstrated that even when individuals are trying to express the reasons behind their decisions (Harte, Westenberg, & van Someren, 1994) they are often not privy to the real reasons behind their choices (Nisbett & Wilson, 1977). Given that such confabulation might favor cognitive reasons over affective ones (i.e., if one is trying to think of why they chose something they might be more likely to list a fact rather than a feeling), having participants in the Affect-Helpful condition write down their reasons may have reduced the influence of the belief manipulation. In fact, only 15.38% participants in the Neutral Deliberation, 7.55% in the Cognition-Helpful and 18.87% in the Affect-Helpful condition used 'feeling' words in their written responses. Despite the changes instructing participants to record their thoughts during the delay might have had on the Deliberation conditions, I felt it necessary to ensure participants remained on task while participating in an online study with such a long delay period. Furthermore, the information collected in the responses shed some light on how participants reasoned through their decisions, an insight that would not be accessible had participants not recorded their thoughts during the delay.

Chapter Five: Study 3

Studies 1 and 2 aimed to provide important information about the malleability of decision-making behavior, and usefulness of attending to affective evaluations during decision-making, but only did so in the context of a fairly specialized, complex decision-making task. While this task did provide important insight into some of the complex decisions we make throughout our lives, it did not incorporate one heavily explored facet of decision-making: risk. Previous models that consider affect's role in decision-making have often examined risky decisions and have concluded that during such decisions, affective responses typically lead individuals to make sub-optimal choices (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991; Tversky & Kahneman, 1992). Through the lens of the affective evaluation model, these results are explained in terms of the decision-relevance of affective responses. If such responses are generated towards the risk and not the overall value of the object, then the affective evaluation model would not consider affective responses to risk decision-relevant affective evaluations, and therefore detrimental to the decision-making process. Study 3 examined if increasing the expectation that affect is helpful during decision-making could selectively increase the use of decision-relevant affective evaluations—and not simply all affective responding

towards risk—using a modified version of a decision-making under risk paradigm called the Slot Machine Game (Martin et al., 2014).

Participants

Participants included 159 MTurk workers (M = 34.18, SD = 9.72; 43% female). MTurk workers were required to be 18 years of age or older, to have an approval rate of at least 95% (i.e., 95% or more of that participant's previous submissions were approved by requesters), completed at least 50 tasks, and were located in the United States. These restrictions were to ensure comparability across my three studies, and followed guidelines suggested by prior research using MTurk participants (Goodman, Cryder & Cheema, 2013). Participants were randomly assigned to one of three conditions with 53 in Cognition-Helpful, 53 in Affect-Helpful, and 53 in the Look condition.

Procedure

Consent, questionnaire, and debriefing procedures were the same as Study 2 and took place entirely online. The Slot Machine Game (SMG) closely mirrored that performed in Martin et al. (2014). Before beginning the game participants were given affect-expectation instructions. Participants were divided into three groups and were given one of the following sets of instructions:

Affect-Helpful: Recent research has shown that when you're making any sort of decision using your gut feelings or intuitions concerning the choices is very helpful. The task you will complete today is designed so that gut feelings or intuition will help you make your decision. Please rely on your feelings about the decision at hand as much as possible.

Before each trial you will see the words "consider your feelings", to remind you to rely on your feelings. (Emphasis appeared to participants).

Cognition-Helpful: Recent research has shown that when you're making any sort of decision using your head or logic concerning the choices is very helpful. The task you will complete today is designed so that your head or logic will help you make your decision. Please rely on the facts about the decision at hand as much as possible. Before each trial you will see the words "consider your facts", to remind you to rely on the facts. (Emphasis appeared to participants).

Look: In this condition participants were told about the task instructions but no affect-expectation instructions were presented.

After the expectation instructions participants were told how to complete the task. Before each block of trials participants were reminded of the condition phrase (i.e., either "consider your feelings", "consider the facts" or "look" depending on condition). Each trial of the SMG consisted of the decision screen (two monetary values with differing risks; 4s) and an inter-trial interval (4 or 6 s). Inter-trial intervals were varied to increase focus on the decision-screen, as participants did not know exactly when the decision screen would appear.

Decisions were between two monetary options: one risky (e.g., 50% chance of winning $8.41) one safe (e.g., 100% chance of winning $4.20). Importantly, the risky and safe option varied with respect to which option has the higher expected value. Expected value (Rabin, 2000) is defined as the amount of reward (i.e., the monetary amount) multiplied by the amount of risk (i.e., 50% or 100%). For example, if a decision for a

given trial is "50% chance of winning $8.41 OR $100 chance of winning $4.20" then the expected value of option 1 is $8.41 multiplied by .5 which equals $4.20. The expected value of option 2 is $4.20 multiplied by 1, which equals $4.20. Risky options varied in extent of risk (i.e., 35%, 50% or 65%) but were always compared to a certain option (i.e., 100%). Three distinct trial types were generated using the discrepancy between expected value and risk:

Risky-Advantageous: A trial in which the expected value was greater for the risky option.

Equal: A trial in which the expected value was equal for both the risky and safe option.

Risky-Disadvantageous: A trial in which the expected value was greater for the safe option.

These trial types (12 of each type) allowed the assessment of decision-relevance, as affective responses to the expected value of choice options were defined as decision-relevant affect because they provided valuable information about the monetary value of choice options, while affective responses to the overall risk of choice options were defined as decision-irrelevant affect because they did not consistently indicate which choice option had the greater monetary value. Trial type and the extent of risk were counterbalanced across trails. To ensure that participants were aware that each trial was independent and important, they were also told at the beginning of the study that they would receive the amount of money they won on a randomly selected trial. MTurk workers were granted a bonus based on their task performance in addition to their standard compensation rate.

Data analytic strategy

The SMG task consisted of a 3x3 mixed design: Expectation (between subjects; Affect-Helpful, Cognition-Helpful, Look) and Decision Type (within subjects; Risky-Advantageous, Equal, Risky-Disadvantageous). For each unique condition, participants' choices were quantified as the average number of times that the risky option is selected. A risky decision was defined as any time a participant selected the uncertain (i.e., not 100%) option. A mixed-model ANOVA was used to test two competing hypotheses: 1) Participants in the Affect-Helpful condition would avoid the risker option more often than those in the Cognition Helpful condition, regardless of Decision Type or that 2) Participants in the Affect-Helpful condition would avoid the riskier option during Risky-Disadvantageous trials, but select the riskier option during Risky-Advantageous trials.

First a mixed-model ANOVA of Expectation (Affect-Helpful, Cognition-Helpful, Look) and Decision Type (Risky-Advantageous, Risky-Disadvantageous, Equal) was conducted for the number of risky decisions in each condition. A main effect of the Decision Type was predicted, such that all participants would make a greater number of risky decisions Risky-Advantageous trials as compared to the Equal or the Risky-Disadvantageous trials. No main effect of condition in overall risk taking was predicted (i.e., no support for hypothesis 1). In agreement with hypothesis 2, an interaction of Expectation and Decision Type was predicted, such that participants in the Affect-Helpful condition would make a greater number of risky decisions in the Risky-Advantageous condition compared to the Risky-Disadvantageous condition than participants in the Cognition-Helpful or Look conditions. Participants in the Look and the

Cognition-Helpful conditions were predicted to make comparable risky decisions during the Risky-Advantageous decision-type as compared to the Equal or Risky-Disadvantageous decision-type. Planned comparisons (independent samples t-tests) of each decision type were conducted to further probe each of the above hypotheses.

Results

The results of the 3x3 mixed-model ANOVA described above indicated a main effect of Decision-Type, $F(2, 312) = 149.85$, $p < .001$, $\eta^2 = .49$ (see Appendix G for a graph of the proportion of participants who selected the risky option in each condition), such that participants selected the risky option a greater proportion of the time during the Risky-Advantageous trials ($M = .45$, $SD = .03$), compared to Neutral ($M = .16$, $SD = .02$), or Risky-Disadvantageous trials ($M = .08$, $SD = .01$). These results replicated the manipulation effect found in Martin et al. (2014) and served as a manipulation check for the current, online version of the task. The results did not provide any support for the hypothesis that increasing belief that affect is useful during decision-making would selectively increase attention to decision-relevant affective evaluations, with no main effect of Expectation, $F(2, 156) = 1.99$, $p = .14$, $\eta^2 = .03$, nor an Expectation by Decision-Type interaction, $F(4, 312) = 1.61$, $p = .17$, $\eta^2 = .02$. Planned comparisons using Tukey's HSD correction, did not reveal any differences between Expectation levels (i.e., Affect-Helpful, Cognition-Helpful, or Look) for any Decision-Type (i.e., Risky-Advantageous, Neutral, or Risky-Disadvantageous), all ps $> .12$.

Although no differences emerged in average risk taking between Expectation levels, exploratory chi-square analyses indicated differences between conditions for the

number of participants who invariably selected certain (100%) options. In other words, these participants exhibited especially risk-averse behavior, as they *never* selected the riskier option even when it was advantageous to do so (e.g., in the Risky-Advantageous condition). First, the overall chi-square test for independence comparing the number of participants who always selected the certain option (i.e., were especially risk-averse) across Affect-Helpful, Cognition-Helpful, and Look, was significant, $\chi^2(2) = 9.20$, $p = .01$(see Appendix H). A pair-wise comparison of conditions indicated a trend when comparing the number of participants who always selected the certain option (100% probability of winning) in the Cognition-Helpful compared to the Affect-Helpful condition, $\chi^2(1) = 3.69$, $p = .06$, and a significant difference between the Cognition-Helpful and Look condition, $\chi^2(1) = 8.40$, $p < .01$, such that more participants always selected the certain option in the Cognition-Helpful condition. There was no difference between the number of participants who always selected the certain option in the Affect-Helpful compared to the Look condition, $\chi^2(1) = 1.07$, $p = .30$.

Discussion

Study 3 aimed to extend the examination of the affective evaluation model by asking if increasing the belief that affect is helpful during decision-making can selectively increase the influence of decision-relevant affective signals. This design aimed to help answer this question by independently manipulating the influence of decision-relevant (the affective evaluation associated with the expected value of an option) and decision-irrelevant affective information (the affective response associated with the amount of risk alone), and instructing some participants that affect is helpful

during decision making and others that cognition is helpful. The results did not demonstrate that the Affective-Helpful manipulation caused participants to make a greater number of risky decisions during the Risky-Advantageous as compared to the Risky-Disadvantageous decision types. Nor did the results provide support for the alternative hypothesis that instructing individuals to utilize affective evaluations would increase risk-taking in general (i.e., risk taking was not greater for participants in the affect-helpful condition compared to cognition-helpful or look, regardless of Decision-Type). However, exploratory analyses suggest that participants in the Cognition-Helpful condition were more likely to always select the certain option, regardless of Decision-Type, as compared to those in the Affect-Helpful or Look conditions. This type of blanket risk aversion, that is insensitive to context and the specific attributes of each decision option (e.g. that the risky option in the Risky-Advantageous condition had a greater expected value than the certain option), may lead to less nuanced and flexible decision-making that could result in poorer outcomes over time.

Chapter Six: General Discussion

Decision-making plays a role in many facets of life and has implications for fields as varied as consumer-research to international relations (Adaval, 2013; Levy, 1992). While it is clear that affect influences decision-making (Bechara & Damasio, 2005; Clore & Huntsinger, 2007; Khaneman & Tversky, 1979; Loewenstein et al., 2001), how this influence occurs and when it is helpful has been hard to determine. The affective evaluation model attempts to describe one way in which affect might influence decision-making and uses this model to determine conditions under which affect is helpful and harmful to the decision-making process. The central tenet of the model is that decision-relevant affective evaluations are helpful to decision-making but decision-irrelevant affective signals are harmful. The proposed studies aimed to test this central premise with conditions that were designed to emphasize or deemphasize the use of task-related affective evaluations thus examining if decision-relevance is a key ingredient in allowing affect to facilitate optimal choice. Study 1 demonstrated that instructing individuals to rely on affect during complex decision-making can lead to more optimal decision-making. Study 2 aimed to extend Study 1 by manipulating expectations of the helpfulness of affective evaluations, but did not support this hypothesis. Finally, Study 3 applied the expectation manipulation of Study 2 to an economic decision-making task, demonstrating

that participants who were told that cognition is useful tended to be more risk averse than those who were told that affect is useful. Together these studies provide some support for the affective evaluation model, as emphasizing affective evaluations (vs. cognitive evaluations) often resulted in more optimal decision-making.

Study 1 manipulated whether participants attended to their affective or cognitive evaluations during a complex decision-making task, and asked whether deliberation of all kinds had a similar effect on decision-making. This is similar to the framing effects literature that demonstrates that how a decision is presented significantly changes the subsequent choices (Levin, Schneider & Gaeth, 1998; Tversky & Kahneman, 1981). However, rather than manipulating how options are presented, Study 1 asked if the decision-maker's own frame or strategy, manipulated after all relevant information was presented, can significantly influence their choices. Results indicated that asking participants to deliberate using their affective evaluations leads to more optimal decision-making. These results are especially surprising given that the only difference between the Neutral and Affective Deliberation conditions was a single word in the instructions: "think" vs. "feel". What is even more compelling is that this subtle manipulation was between subjects, so participants were not able to compare the Neutral and Affective Deliberation instructions to assist them in understanding the contrast between the two. Simply by using the word "feel" in the instructions, participants in the Affect-Deliberation condition were able to make more optimal decisions.

While these results provide some support for one tenet of the affective evaluation model, what is still uncertain is whether individuals can selectively utilize decision-

relevant, affective evaluations. All affective evaluations in the Deliberation conditions of Study 1 were ostensibly decision-relevant, therefore providing no opportunity to determine if individuals could parse apart decision-relevant and irrelevant affective evaluations. This limitation was considered and accepted as a necessary stepping-stone to understand how affective evaluations function during complex decision-making. Study 1 did provide evidence that a very subtle decision-frame that encouraged the use of affect during decision-making, could lead to more optimal choices. This result changes the most common interpretation of previous studies: that conscious thought (as in the deliberation condition) necessarily leads to fewer optimal choices because of the attentional limitations and biasing heuristics that characterize such thinking (Dijksterhuis et al., 2006). The affective evaluation model would reconcile these two findings as examples of instances in which decision-relevant affect was emphasized as a tool during deliberation (Study 1) and instances in which no such tool was provided. Deliberation with no affective emphasis may result in conscious deliberation that falls victim to the limited attentional resources, heuristics, and biases that have been shown to plague conscious, effortful, deliberation and that can often lead an individual away from an optimal choice (Study 1 Neutral Deliberation condition; Dijksterhuis et al., 2006; Tversky & Khaneman, 1974). In fact, research examining the difference between intuitive and deliberative judgments in perceptual decision-making mirrors this finding by demonstrating that it is the content of deliberative thoughts that positively predict decision-making quality (Leisti & Hakkinen, 2016).

While Study 1 demonstrated that deliberating on affective evaluations during complex decision-making could lead to more optimal choices, Study 2 failed to support this hypothesis. It may be the case that manipulating beliefs about the usefulness of affect does not have the same impact as a more subtle manipulation instructing participants to reflect on thoughts or feelings during the decision-making process. While it is has been demonstrated that more subtle goal-priming manipulations often have an effect (Chartrand & Bargh, 1996), the belief manipulation in Study 2 was intended less as a prime and more as an explicit tool to aid participants in their decision-making. Previous studies that instruct individuals to utilize certain strategies to influence their thought processes have been shown to be effective (Martin et al., 2014; Sokol-Hessner et al., 2009), but the effectiveness of such strategies do interact with a participants' ability to implement them (Buhle et al., 2014). Therefore it is possible that the beliefs manipulation of Study 2 was less effective than the general strategy of Study 2 because participants were less able to explicitly implement the affect-focused or cognition-focused tool. Future research could test this hypothesis by pitting the Study 2 instructions against a more, and less subtle instruction. By determining how much instruction is needed to positively impact the use of decision-relevant affective signals during decision-making, future research could inform interventions to aid in everyday choices.

Study 2 was conducted completely online and, as discussed in the discussion section for Study 2, this may have fundamentally changed the design of this task. Having participants write down their thoughts during the delay period after reading about their options, may have led to confabulation of fact-based reasons behind their decision-

making (Leisti & Hakkinen, 2016; Nisbett & Wilson, 1977) leading participants away from the use of affective evaluations. Analysis of the free response data collected from each participant during the delay supports this hypothesis (see Study 2 discussion). In accordance with this idea, the overall act of trying to explain one's reasoning might be more useful when the decision options have fewer attributes or attributes that are easily quantifiable and comparable (Dijksterhuis, 2004; Dijksterhuis et al., 2006; Leisti & Hakkinen, 2016). When choices have fewer attributes for example, it might be easier to keep in mind the attributes you most value, and to efficiently compare each attribute to the others without succumbing to such biases as the availability heuristic (Tversky & Khaneman, 1973). When choice attributes are easily quantifiable and comparable, like in many risky economic decision-making tasks in which two monetary values are presented to a decision-maker (see Kuhberger, 1998 for review), writing out one's thought process might be beneficial as it is clear that the factor that makes one option better than the other is the monetary value. In complex decision-making tasks in which each option has multiple attributes and these attributes are not easily comparable (e.g., a dollar amount to a dollar amount is more comparable than a location to square footage), writing out one's thought process might not be as helpful because one is often not privy to the real reason for preferring one attribute over another (Nisbett & Wilson, 1977; e.g., you may think you care more about square footage but you really care a lot more about location). Future studies may test to see if instructing individuals to write down their thoughts during decision-making leads to more optimal decision-making when each choice has fewer attributes as compared to many attributes. Another important comparison would be

between more comparable and quantifiable attributes versus decision-problems with less comparable and quantifiable attributes. Perhaps writing during decision-making is only beneficial when the value of each attribute is easily quantifiable, and that quantity is comparable across attributes (e.g., monetary value).

To further probe the question of decision-relevance, Study 3 examined if framing affect as useful during decision-making could increase reliance on decision-relevant affective evaluations but not decision-irrelevant affective evaluations. Previous research has demonstrated that risk perception can powerfully influence decision-making, revealing that affect is central to decision-making but not always helpful (Levin, Schneider & Gaeth, 1998; Tversky & Kahneman, 1981). In such risky decision-making paradigms, affective responses to risk often lead participants away from the option that would make them the most amount of money. Making the risk an unhelpful source of information if the participant's goal is to find the option that leads to the most monetary gain. Tools such as "think like a trader" dampened affective responding throughout the entire task reducing the adverse effects of risk aversion (Sokol-Hessner et al., 2009). However such manipulations might have reduced the benefits of decision-relevant affective evaluations along with the costs of decision-irrelevant affective responses. Study 3 tested if it is possible to selectively promote responding to decision-relevant affective evaluations without amplifying responses to decision-irrelevant affective responses (e.g., responses to risk). Primary analyses from Study 3 did not provide support for this hypothesis. Participants in the Affect-Helpful condition did not differentiate between Risky-Advantageous and Risky-Disadvantageous trial types to a greater extent

than those in the Look, or Cognition-Helpful conditions. Instead, across all conditions, participants selected the risky options a greater percentage of the time during the Risky-Advantageous trials as compared to the Risky-Disadvantageous trials. This blanket preference for the Risky-Advantageous trials could be due to the salience of the expected value of each option. Although expected values in each trial type were intended to be subtly different, this difference may have become obvious to participants, making the choice between risky and certain options easy in either Risky-Advantageous or Risky-Disadvantageous trial types. It may also be the case that because this study took place online participants may have used a calculator or written down the calculations to compute the expected values of each option—something that was prevented in previous studies that employed this paradigm (Martin et al., 2014). This type of easy calculation that could occur in the slot machine game paradigm, speaks the point made earlier: that relying on affective evaluations during decision-making may be less beneficial when choice attributes are easily comparable, as they are in monetary decision-making tasks.

Future research may try to examine if decision-relevant affect can be selectively attended to, by designing a complex decision-making task with attributes that evoke specific affective responses in the decision-maker. Then, while deciding between the options, researchers could introduce a task-irrelevant affective signal (e.g., sad music). If participants who are trained to introspect about decision-relevant affect during decision-making are able to make decisions that are congruent with the task-relevant affective signal, then there is some evidence that this type of training can help facilitate decision-making.

Despite the lack of an overall condition interaction with trial type, exploratory analyses indicated that a greater number of participants in the Cognition-Helpful condition always selected the certain option as compared to those in the Look or Affect-Helpful conditions, regardless of the risky option's expected value. These results suggest that participants in the Cognition-Helpful condition were more likely to completely avoid any risk, whether financially advantageous or not. The Cognition-Helpful instruction echoed conventional wisdom that individuals should make decisions devoid of emotion, that this would lead to the most 'logical' choices. However, as many psychologists have demonstrated, affect is an undeniable (Loewenstein et al., 2001; Schwarz & Clore, 1983), and even critical (Damasio, 1994) component of decision-making. These preliminary results suggest that such denouncements of emotion in decision-making may be putting decision-makers at a great disadvantage. Instead of such a denouncement, with no consideration of nuance, future research might explore conditions under which relying on affective responses to decision-options does in fact facilitate choice, and when a decision-maker might be better off employing such a blanket emotion-avoidant strategy.

Limitations and Future directions

Studies 1 and 3 provided preliminary evidence that instructing individuals to rely on affective evaluations may facilitate optimal decision-making under certain circumstances. However, the generalizability of these studies is limited due to the nature of the tasks, and the affective belief manipulation. First, it is unclear if such belief manipulation would positively influence decision-making outside of a laboratory setting, in which many other task-irrelevant affective evaluations could be generated. The

complex decision-making task was carefully chosen in order to examine a context in which cognitive evaluations were demonstrated to be detrimental to decision-making (Dijksterhuis, 2004) to see if the introduction of an emphasis on affect into the deliberation condition would offset the demonstrated cost that the pure cognitive evaluations seemed to have in this decision-making context. This was especially important because the types of decisions made in the complex decision-making tasks are analogous to ones that every individual encounters and the consequences of these choices are great. However, unlike real-world decisions, this lab-based task did not include the meta-emotions that often accompany a complex life choice (e.g., anxiety about buying a new car, above and beyond affective evaluations about the car's features). Future studies could attempt to add this layer of decision-irrelevant affect to see if participants are able to distinguish between affective evaluations of the decision options, and their affective response to having to make a choice at all.

The slot machine game was chosen as a decision-under-risk task as it is poised to contribute to a vast literature concerning risky decisions and also exemplifies a type of decision commonly made in every day life (Bechara & Damasio, 2005; Sokol-Hessner et al., 2009; Tversky & Kahneman, 1992). Because one trial type rewarded the reliance on decision-relevant affect (i.e., Risky-Advantageous trials) and another trial type rewarded the reliance on decision-irrelevant affect (i.e., Risky-Disadvantageous trials), the slot machine game provided an opportunity to see if an instruction to emphasize affect during decision-making could selectively impact trials in which relying on affect would lead to greater financial gain. Despite this design, no interaction emerged between trial types and

belief manipulation. This may be due to the strength of the belief manipulation, which was intentionally subtle, or the nature of economic decision-making tasks. As stated above, in such tasks both options are relatively easy to compare: a dollar amount vs. a dollar amount. Unlike economic tasks, decisions such as where to move, or who to trust, often have less comparable attributes such as family proximity vs. good job prospects. Such attributes may be less obviously quantifiable and may therefore benefit more from reliance on affective evaluations that result from each option. These affective evaluations may serve as a common currency with which one can more easily compare the value of family proximity to the value of job prospects. Future research may explore this idea by asking participants to assign an explicit value to seemingly incomparable choice attributes, to add those values up, and finally to select the option with the largest sum. Participants could also be encouraged to rely on affect when assigning an explicit value or not. If those that rely on affect chose the more optimal option, there would be some support for the common currency hypothesis.

Implications

The present research has three main implications. First, there is some evidence that decision-relevance is an important determining factor in whether affect will facilitate or hinder optimal decision-making. Future studies examining decision-making processes should consider whether their design is biased towards decision-relevant or irrelevant affective evaluations and adjust their interpretations of results accordingly. For example, in classic risky, economic, decision-making paradigms (Kuhberger, 1998), researchers might consider comparing instances where risk aversion leads to the more optimal choice

with times in which it does not. As risk aversion has been hypothesized to be evolutionarily adaptive (Hintze, Olson, Adami, & Hertwig, 2015), it may be helpful to determine the circumstances under which our natural propensity towards certainty can lead to better decision-making.

Second, the present research provides preliminary evidence that instructing individuals to rely on affect during decision making can, under certain circumstances, leads to more optimal choices. While more research is needed to determine the size and consistency of the observed effects, it may be the case that a subtle instruction to rely on affect can improve decision-making outcomes, just as subtle instructions to take a long term perspective on investments can improve financial outcomes (Martin et al., 2014; Sokol-Hessner et al., 2009). Such instruction could even be conveyed in writing (as in the present research), needing no additional training, just the reminder to consider affective responses while making a decision. These reminders might be especially useful when individuals are attempting to make a rather complicated financial, health, or life decision (Lauver et al., 2002).

Finally, the present research suggests that how information is presented and consumed during the decision-making process can have important consequences for the role of affect in said process, and the quality of choice. Prior research has established that how a decision is framed can exacerbate the negative effects of affect on choice behavior (Tversky & Kahneman, 1981). The present research adds to this framework by suggesting that there may be ways to present and consume information that could capitalize on helpful, decision-relevant affective responding during decision-making. For

example, when making a complex decision the success of which will be measured by an individual's satisfaction with the choice (i.e., when making a big purchase, or move; Dijksterhuis, 2004), it may be beneficial to gather all of the relevant information, deliberate on the attributes of one option, then take some time to reflect on the feelings generated during that deliberation, before comparing it to the feelings generated by the other choice's attributes. This deliberate integration of affective signals during complex decision-making may provide a method through which individuals can avoid the pitfalls of affect during decision-making (Clore & Huntsinger, 2007), while capitalizing on the benefits (Bechara & Damasio, 2005; Loewenstein et al., 2001).

Conclusion

The present research aimed to understand the role of affect in decision-making and attempted to determine conditions under which affect may be consistently helpful. By comparing an affectively-focused deliberation strategy to a purely cognitive strategy, the present research demonstrated a cognitive-evaluation-only decision-making strategy can lead to less optimal decision-making than one that incorporates affective-evaluations. These results could help individuals' decision-making strategies. Instead of ignoring your 'heart' and going with your 'head'—as colloquial wisdom often recommends—incorporating your heart's desires during decision-making might actually lead to a choice the decision-maker would ultimately be happier with. In addition to influencing the decision-maker, this research may influence how decisions are presented. For example, health care decisions may be framed in a way that facilitates the use of decision-relevant affective evaluations thus allowing patients with cognitive deficits to make their own

decisions and remain autonomous for a longer portion of their lives. Decision-making is a constant and essential process and understanding how to make more optimal choices will improve a myriad of outcomes on both small and large scales.

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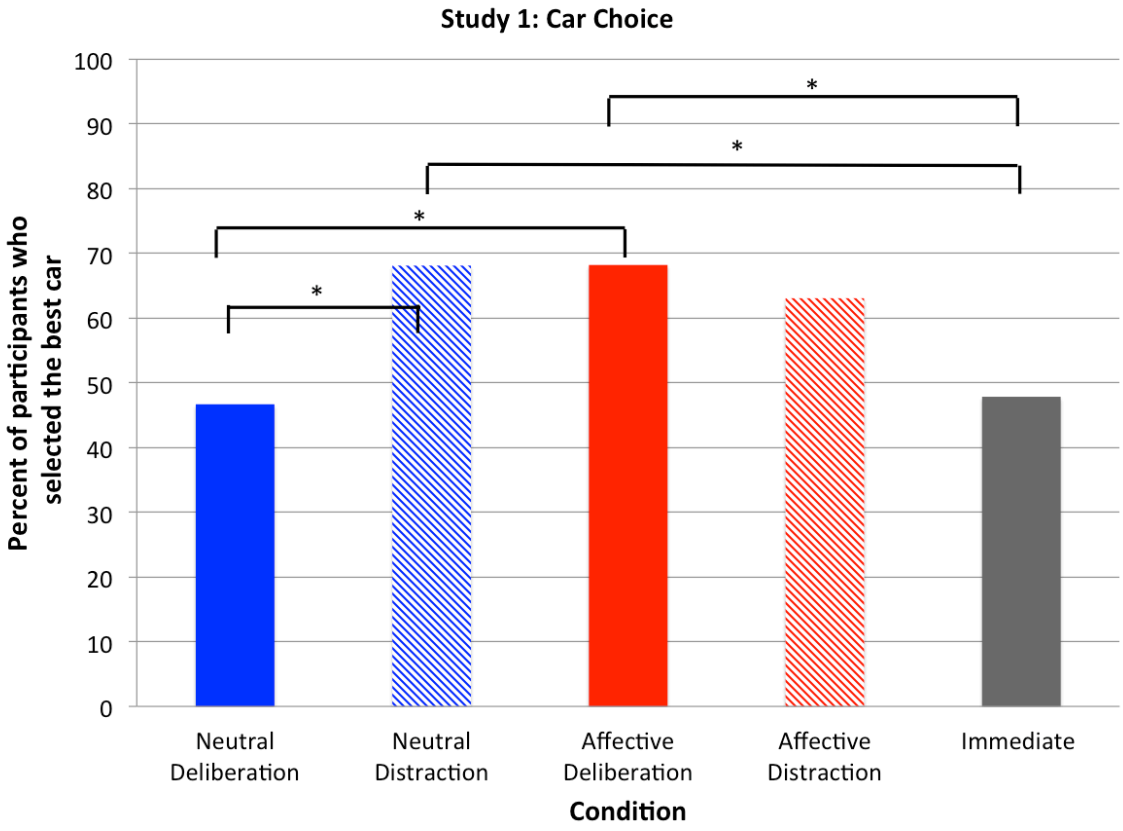
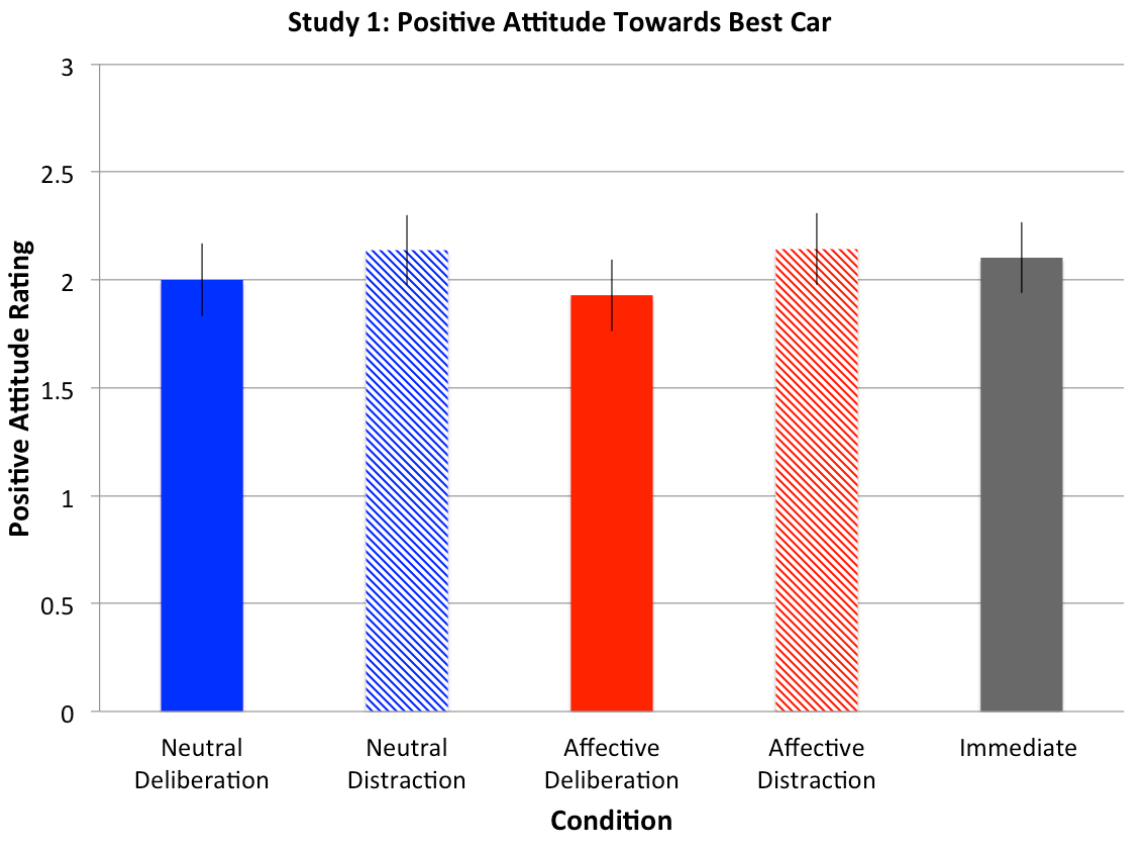
Appendix A

Figure 1. Percent of participants who selected the best car in each condition. Comparison bars indicate that a significantly greater number of participants selected the best car in the Neutral Distraction condition compared to the Neutral Deliberation condition, the Affective Deliberation compared to Neutral Deliberation, and the Neutral Distraction and Affective Deliberation compared to the Immediate Condition (all *p*s < .05).



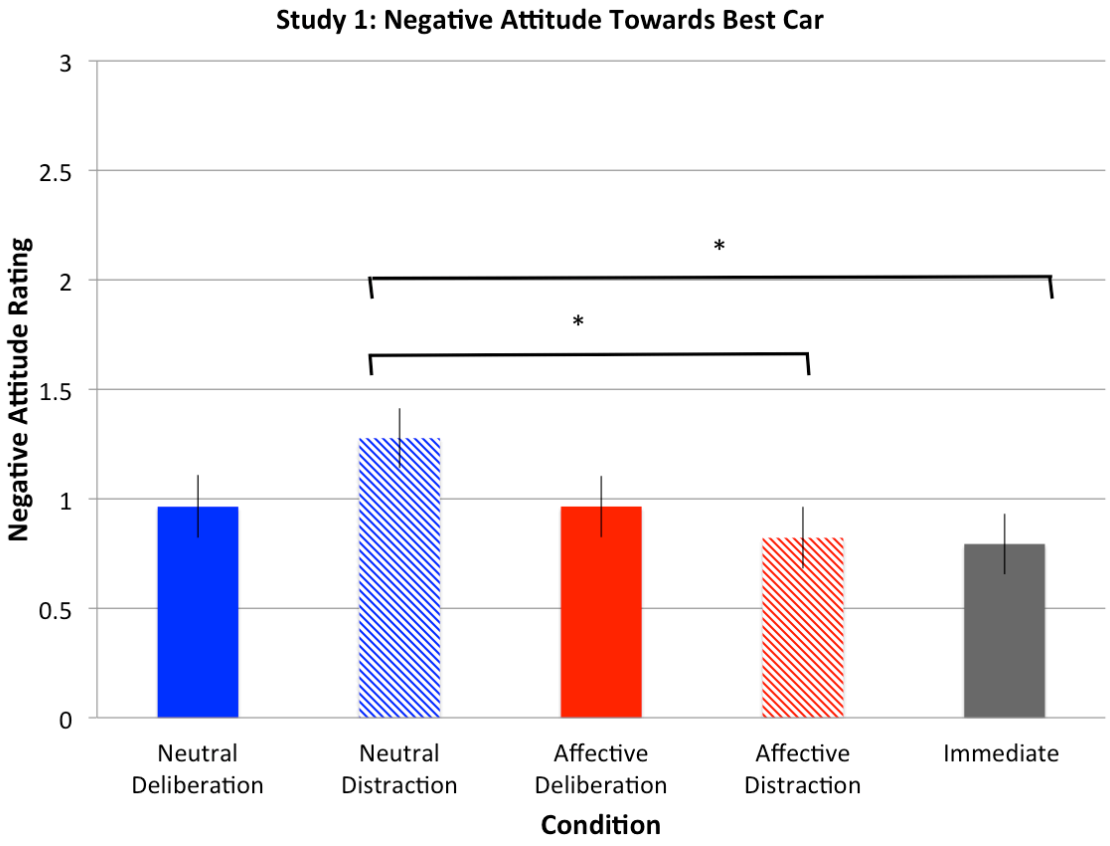
Appendix B

Figure 2. Positive attitude ratings towards the best car in each condition.



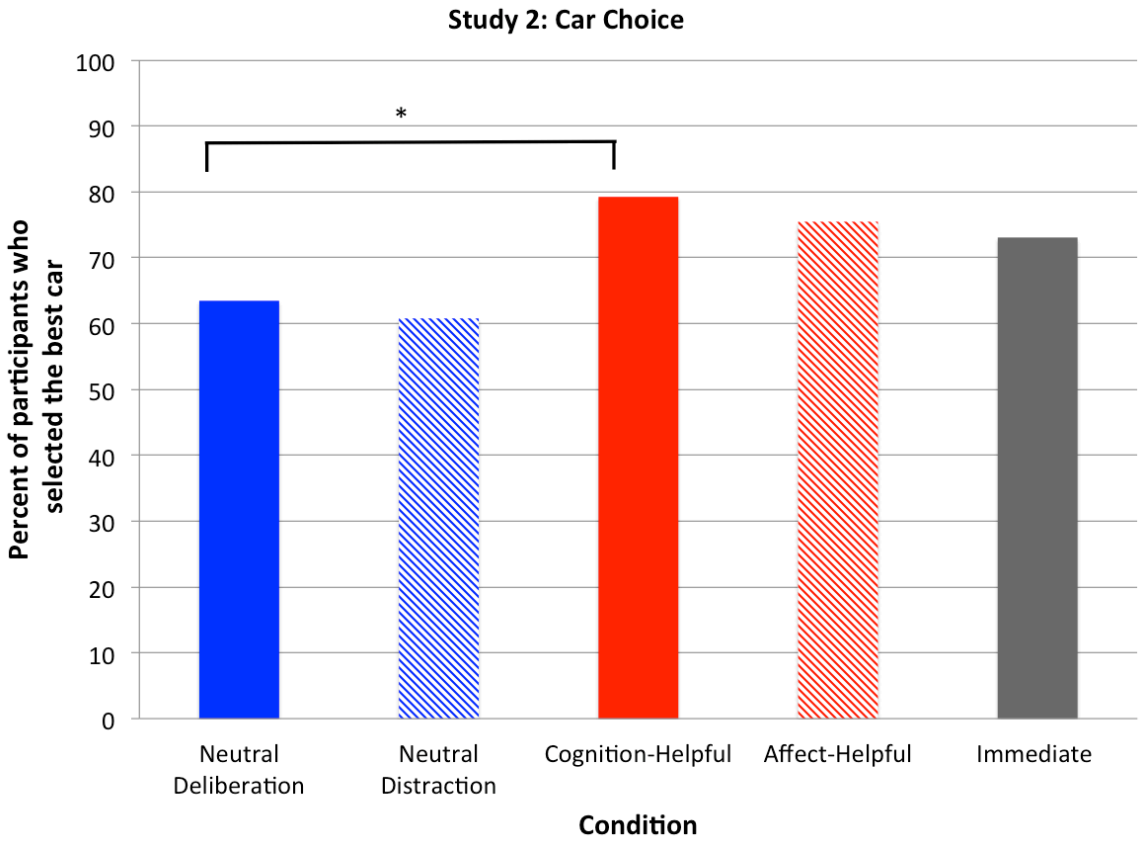
Appendix C

Figure 3. Negative attitude ratings towards the best car in each condition. The comparison bars indicate that participants in the Affective Distraction and Immediate conditions rated the best car more negatively (more appropriately), than participants in the Neutral Distraction condition ($p < .05$).



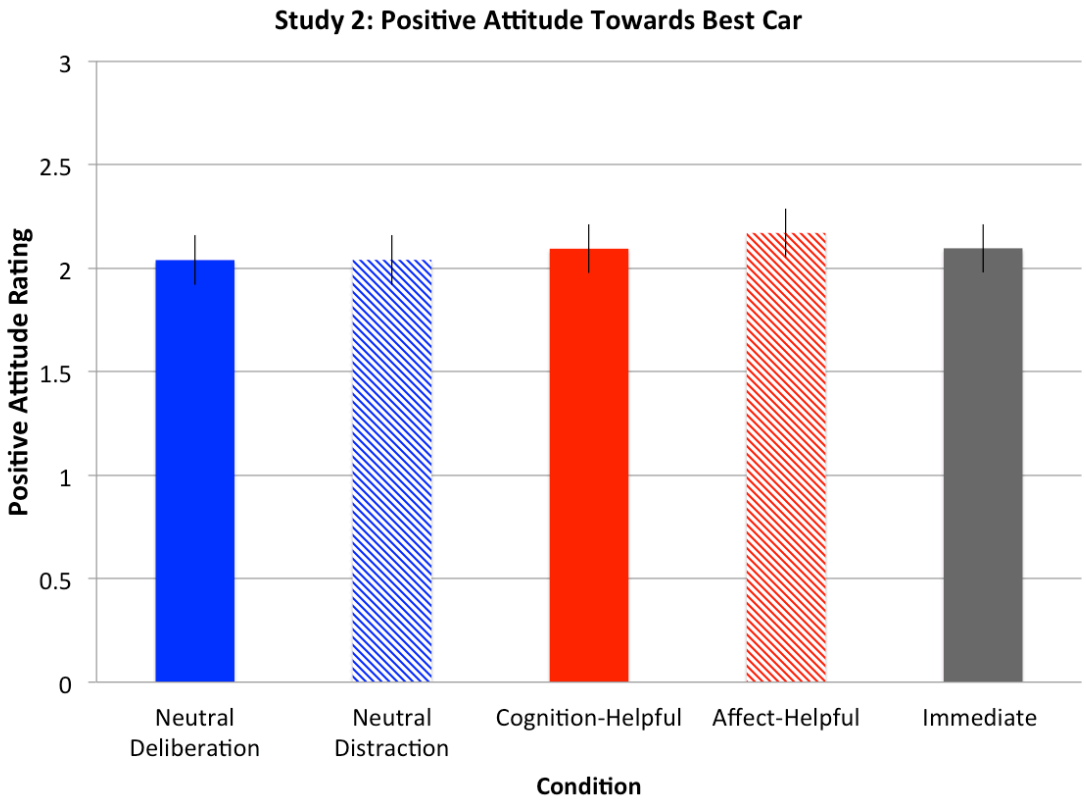
Appendix D

Figure 4. Percent of participants who selected the best car in each condition. Comparison bars denote a trend level difference (p =.07), indicating that a greater number of participants selected the best car in the Cognition Helpful condition compared to the Neutral Deliberation condition.



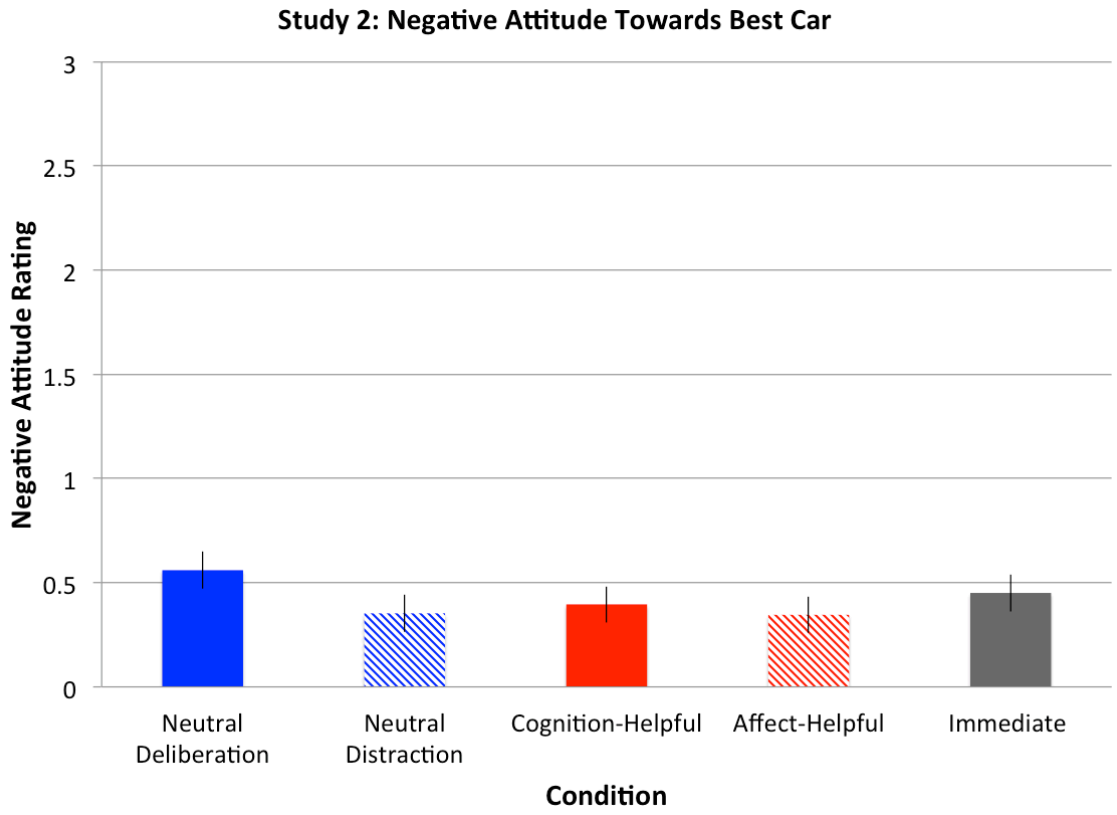
Appendix E

Figure 5. Positive attitude ratings towards the best car in each condition.



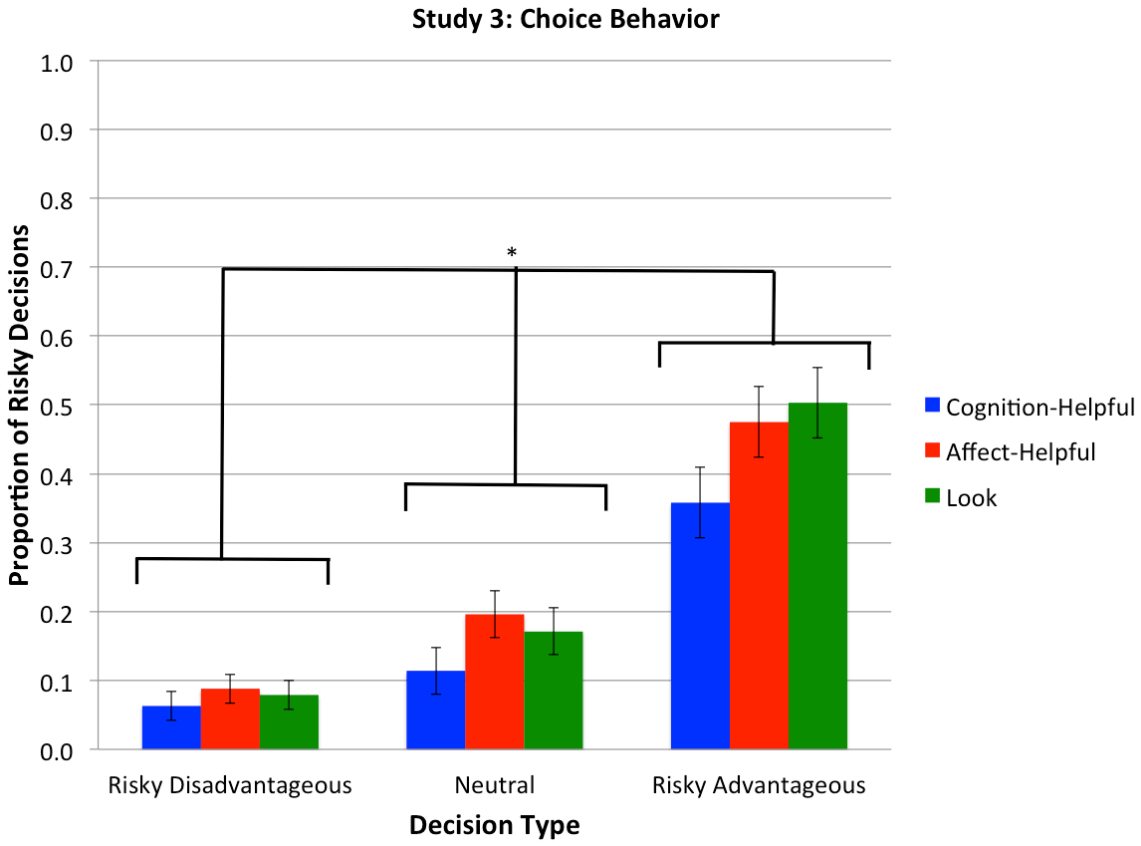
Appendix F

Figure 6. Negative attitude ratings towards the best car in each condition.



Appendix G

Figure 7. Proportion of trials in which the risky trials were selected. Comparison bars indicate a main effect of Decision Type.



Appendix H

Figure 8. Number of participants who always selected the certain option regardless of Decision Type (Risk-Averse) compared to participants who sometimes selected a risky option. Comparison bars indicate that a greater number of participants in the Cognition-Helpful condition always selected the certain option as compared to participants in the Affect-Helpful ($p = .06$) and Look conditions ($p < .01$).