FALSE MEMORIES FOR DISSONANCE INDUCING EVENTS

by

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Abstract

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Memories serve as a “database” of the self and people may produce distorted memories that support their self-concepts. Dissonance theory suggests self-consistency is a fundamental human motivation. Inconsistency between beliefs and actions leads people to adopt various strategies to effectively restore consonance. Because instances of dissonance are counter to most people’s self-concept, people may misremember past dissonance-inducing events in ways that promote their self-concept (i.e., consistency). Current models of memory and motivated cognition, specifically M. A. Conway’s (2005) self-memory system (SMS), can incorporate dissonance processes and account for false memories. In the current report, we describe the results of two experiments designed to establish the link between cognitive dissonance and false memories.

In Experiment 1 participants made either an easy or a difficult choice between two smart phones. Either immediately or two days later, participants reported their memories for their decision experience and phone specifications. Participants in the difficult choice conditions produced the expected spread of alternatives effect and were more likely than those in the easy conditions to misremember their initial decision as easier and more satisfactory than they had initially rated it. Delay did not influence participants’ memories.

In Experiment 2, participants either chose or were forced to write a counterattitudinal essay supporting a tuition increase and were afforded the opportunity to reduce dissonance via attitude shift or denial of responsibility by way of a question-order manipulation embedded in a questionnaire. They then reported their memories for the experimental instructions and their initial attitudes (assessed via online questionnaire two days prior to the laboratory session). Participants who chose to write the essay shifted their attitudes to be more favorable toward a tuition increase than those who were forced to write the essay. Additionally, they misremembered their initial attitudes as more favorable toward a tuition increase, and were more likely to misremember the experimental instruction. We did not replicate the denial of responsibility mode of dissonance reduction. Overall, the results from the present studies provide preliminary evidence that cognitive dissonance can yield memory distortion under certain circumstances. Theoretical implications and directions for future research are discussed.

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CHAPTER 1: INTRODUCTION

Paul Ingram was a deputy sheriff in Olympia, Washington, a father of five children, a central member of his church, and a model citizen. However, his life changed suddenly in 1988 when his two adult daughters accused him of sexual abuse, rape, and the satanic slaughter of 25 babies (Ofshe, 1992; Olio & Cornell, 1998). Although there was no physical evidence against him, Ingram was arrested and interrogated 23 times during the five months he spent in jail after his arrest (Wright, 1994). He was hypnotized and given graphic crime details reported by his daughters; he was told by a forensic psychologist that he may not remember perpetrating the crimes because sex offenders often repress memories of their offenses; and his pastor urged him to confess because the charges were "probably true." Although he initially denied any knowledge of the crimes, his answers began to change over the course of the interviews from adamant denials of committing any offense, to vivid accounts of his crimes and admissions of guilt. He eventually stated to police "I really believe that the allegations did occur and that I did violate them and abuse them, and probably for a long period of time. […] I know from what they're saying that the incidents had to occur, that I had to have done these things…my girls know me. They wouldn't lie about something like this" (Ofshe & Waters, 1994, p. 167). Some events Ingram recalled included watching robed people cutting out the beating heart from a live cat, and watching a fellow deputy have sexual intercourse with his daughter. Although many social scientists believed Ingram's reports were false and that he was, in fact, innocent (e.g., Ofshe, 1992), he eventually pleaded guilty to the charges and was sentenced to 20 years in prison.

Paul Ingram's case is bizarre, but unfortunately, the phenomenon of suspects providing false memorial reports in the interrogation room is not uncommon. There have been numerous high-profile cases in which innocent suspects have confabulated incriminating details of crimes

to reconcile conflicting information, such as evidence provided by an interrogator with their own recollections (e.g., Martin Tankleff: Innocence Project, 2006). Indeed, false confessions have been associated with 25% of cases of those wrongfully convicted and later exonerated by the Innocence Project (Innocence Project, 2011). Social psychologists have noted that the tremendous pressures of many popular interrogation tactics may elicit false confessions by simply wearing innocent suspects down to the point that they confess to escape the interrogation (Kassin & Gudjonsson, 2004). In these situations, the suspects do not believe they actually committed the crimes to which they are confessing. However, other suspects internalize these false confessions and develop vivid memories for crimes they did not commit. A synthesis of cognitive and social psychological research may elucidate some ways in which people can develop and believe false memories, generally. Moreover, it may provide a framework for empirically testing these mechanisms and, ultimately, may yield findings that could be applied to the interrogation room and internalized false confessions, specifically.

It is virtually axiomatic among cognitive researchers that "memory is not like a tape-recorder." Rather, it is a reconstructive process wherein information is pieced together to form an account of a past event (Johnson & Sherman, 1990; Roediger & Karpicke, 2005). Often, a person's beliefs, expectations, and schema concerning a target event guide the reconstruction of a memory for that event. That is, information is typically collated in a manner that is consistent with the person's pre-existing beliefs (Davis & Loftus, 2009). In the (likely) event of missing information within the memory, people may make inferences, which are also guided by expectations and beliefs, to "fill in the gaps." Thus, although memory is often conceived as a purely cognitive, information-driven process, social and motivational factors may influence its accuracy (e.g., Roediger, Meade, & Bergman, 2001). Cognitive dissonance is one mechanism

that has been proposed to account for distorted or false beliefs. Some have posited that it contributes to mundane memory errors (e.g., misremembering prior attitudes: Bem & McConnell, 1970) and others have suggested that it may account for more unusual and outlandish memories (e.g., false memories of abuse and alien abduction: de Rivera, 1997; Neuman & Baumeister, 1996). To our knowledge, however, there has been no empirical test of the relationship between the two phenomena, nor any major theoretical work done to integrate the two literatures. A review of the broader memory literature suggests that Conway's (2005) self-memory system (SMS) may be a useful framework for integrating these two domains. In this paper, we (1) briefly review the cognitive dissonance literature, (2) summarize the SMS, (3) demonstrate how the SMS can incorporate dissonance processes to account for memory distortions, and (4) report the results of two experiments designed to test the link between cognitive dissonance and false memories.

CHAPTER 2: COGNITIVE DISSONANCE

Dissonance Arousal

Leon Festinger formulated the theory of cognitive dissonance in the mid 1950s. In his first complete presentation of the theory, Festinger (1957) proposed that people strive for cognitive consistency. If, however, a person holds two or more elements of knowledge (or cognitions) that are relevant to each other but inconsistent with one another (e.g., an attitude and a counterattitudinal behavior), a state of "dissonance" is aroused[1]. This state of discomfort is particularly unpleasant when the inconsistent cognitions are related to a focal or generative cognition, one that the person considers central to his or her views of the self (Harmon-Jones & Harmon-Jones, 2007). As a result, the person becomes motivated to somehow reduce the inconsistency between or among the cognitions. Many experimental paradigms have been used to investigate cognitive dissonance; studies using these paradigms have revealed many distinct situations in which dissonance is aroused and different mechanisms by which people can choose to reduce their dissonance.

Dissonance Reduction

Adding consonant cognitions/rationalization. According to dissonance theory, after making a decision, all cognitions that favor the chosen alternative are considered "consonant" cognitions, whereas all those that favor the rejected alternative are considered "dissonant." The amount of dissonance aroused by the choice is dependent on the relative number and importance of dissonant cognitions to consonant cognitions, whereby more numerous and more important dissonant cognitions are likely to evoke greater dissonance. The dissonance caused by these

[1] Other psychologists have suggested different conditions for dissonance arousal. These include Aronson's (1968, 1999) self-consistency theory, Steele's (1988) self-affirmation theory, and Cooper and Fazio's (1984) new look at dissonance. However, these revisions to the original theory have received, at best, mixed support (see Harmon-Jones, Amodio, & Harmon-Jones, 2009 for a review).

post-decisional cognitions may be reduced by adding consonant cognitions regarding the chosen alternative (i.e., rationalization). Brehm (1956) examined these post-decisional processes in the first published experimental investigation of dissonance theory. He asked participants to evaluate decision options prior to, and after making either an easy or a difficult decision. The results showed that, after making a difficult decision, participants changed their attitudes to be more negative toward the rejected option, whereas participants who made an easy decision did not change their attitudes. Much research since has confirmed that, after making a difficult decision (i.e., one in which both options are equally "attractive"), one mode of dissonance reduction that people may employ is to convince themselves they made the correct decision by adding consonant cognitions, effectively exaggerating their attitudes toward both (all) options (e.g., Harmon-Jones & Harmon-Jones, 2007). That is, attitudes toward options that were favored (even if only slightly) become increasingly positive, whereas attitudes toward options that were not favored become increasingly negative. Research has also shown that this dissonance reduction strategy has implications for a person's behavior, such that adding consonant cognitions will likely lead a person to persist in the chosen course of action or to behave in a similar manner in the future (Harmon-Jones, 1999; 2000a).

Attitude change. Dissonance theory predicts that dissonance should be aroused when a person acts in a manner that is inconsistent with his or her attitudes. In their investigation of this prediction, Festinger and Carlsmith (1959) had participants complete a boring task, and then paid them either $1 or $20 to tell another participant that the task was interesting (a lie). Results of the experiment revealed that those who were paid $1 for lying changed their attitudes to be more positive toward the task (relative to the control group who rated their attitudes but did not lie), whereas those who were paid $20 did not. The authors concluded that those who were paid $20

did not experience dissonance because they had sufficient external justification for engaging in the counterattitudinal behavior. They violated their beliefs because $20 was a lot of money. However, those who received $1 did not have sufficient external justification; one dollar was not enough money to justify violating one's beliefs. Therefore, they attempted to reduce their dissonance by changing (reversing) their attitude toward the task. The results confirmed that changing one's attitude to match one's behavior is an effective dissonance reduction strategy.

Attitude change has also been investigated in situations with different circumstances. For example, cognitive dissonance may be aroused when a person engages in an unpleasant activity to obtain a desirable goal. That an activity is unpleasant generally indicates that one should not engage in that behavior. Therefore, the act of engaging in that behavior will likely evoke dissonance, and dissonance will likely increase as the unpleasantness of the activity increases. In order to reduce this dissonance, individuals may exaggerate the desirability of the goal of the unpleasant behavior (i.e., changing their attitudes toward the outcome). To examine this prediction, Aronson and Mills (1959) had women either undergo no, mild, or severe "initiation" to become members of a group. When accepted into the group, the women learned first-hand that the group was actually very dull and boring. Afterward, those in the severe initiation group evaluated the group significantly more favorably than those in the mild or control initiation groups. From these results, the authors concluded that those who experience dissonance as the result of having suffered without justification may attempt to reduce their dissonance by changing their attitude toward the outcome (i.e., exaggerating its desirability).

Trivialization. A third dissonance reduction strategy that Festinger (1957) posited was trivialization (or minimization). This strategy differs considerably from previous modes of dissonance reduction. Whereas the previous strategies are used as attempts to justify or

rationalize a choice or behavior to reduce dissonance, trivialization involves an attempt to reduce the *importance* of the dissonance rather than the dissonance itself. Although largely ignored for many decades, this mode of dissonance reduction was investigated several years ago in four experiments. Simon, Greenberg, and Brehm (1995) demonstrated that when a target attitude is made salient immediately before a person engages in a counterattitudinal behavior, the target attitude is made resistant to change; as a result, that person is more likely to engage in trivialization (rather than attitude change or adding consonant cognitions) to reduce the dissonance aroused by the counterattitudinal behavior. Recently, Joule & Martinie (2008) conceptually replicated Simon et al.'s findings, showing that when participants trivialized a counterattitudinal behavior, they did not exhibit attitude change, and vice versa. Consistent with previous research (e.g., Götz-Marchand, Götz, & Irle, 1974), Simon et al. also showed that, following the arousal of dissonance, people are likely to engage in the dissonance reduction strategy made available to them first, which may often be trivialization.

Self-affirmation. In a re-examination of classic dissonance theory, Steele (1988) proposed that people seek to maintain an overall self-image of competence and moral adequacy (rather than cognitive consistency, per se). Cognitive dissonance threatens this positive self-image. Steele argued that although people may change their attitudes to reduce dissonance, they may also choose to affirm an important value as an additional dissonance reduction strategy. Essentially, reminding oneself that one is a good person may reduce the unpleasantness associated with cognitive inconsistency. He provided empirical evidence that when participants were given an opportunity to affirm an important value, dissonance-related attitude change did

not occur (e.g., Steele & Liu, 1983; Steele, Spencer, & Lynch, 1993). Thus, he concluded that self-affirmation is an effective mode of dissonance reduction[2].

Denial of responsibility. One of the conditions Festinger (1957) proposed for the arousal of cognitive dissonance was a sense of personal responsibility regarding the inconsistent attitudes/behaviors. Indeed, without a sense of responsibility, dissonant elements are not psychologically pertinent to the individual (Wicklund & Brehm, 1976). However, little research attention has been paid toward denial of responsibility as a mode of dissonance reduction. In three of the only studies on the issue, Gosling, Denizeau, and Oberlé (2006) provided empirical evidence that the denial of personal responsibility is an effective dissonance reduction strategy, especially when feelings of guilt, shame, or disgust are aroused following a counterattitudinal behavior. Participants given the opportunity to deny responsibility for writing a counterattitudinal essay in an induced-compliance paradigm did not exhibit the usual dissonance-reducing attitude shift, suggesting that denial of responsibility sufficiently reduces dissonance, making dissonance reduction via attitude change unnecessary.

Recent Developments in Dissonance Research

Although Festinger (1957) proposed that cognitive inconsistency produces a motivation to achieve consonance, he did not opine as to exactly *why* this motivation is elicited. Recent work by E. Harmon-Jones and colleagues has been directed toward understanding why dissonance processes occur (e.g., Harmon-Jones et al., 2009; Harmon-Jones & Harmon-Jones, 2002). Drawing on the self-regulation literature (e.g., Gibson, 1979; Smith & Semin, 2004), the action-based model of cognitive dissonance suggests that perceptions and cognitions serve as

[2] However, Simon et al. (1995) argued that affirming an important value effectively decreases the perceived importance of the dissonance. They showed experimentally that previous results obtained using self-affirmation paradigms could be accounted for by conceiving of self-affirmation as trivialization (see Aronson, Cohen, & Nail, 1999, for review).

action tendencies. That is, they suggest appropriate courses of action a person can follow within a specific situation. Because dissonance, by definition, involves inconsistency between two or more cognitions, it also involves conflicting action tendencies. Conflicting cognitions thus interfere with effective behavior, resulting in the negative affect that characterizes dissonance (see Elliot & Devine, 1994). The modes of dissonance reduction that psychologists have observed for decades (e.g., rationalization, attitude change, trivialization) are attempts to bring cognitions and action tendencies in line with the behavioral commitments of a given situation to allow for effective action. At its heart, the model suggests that dissonance arousal and subsequent reduction are "adaptive regulatory processes that ultimately serve survival needs" (Harmon-Jones et al., 2009, p. 129); together they identify and resolve problems for effective behavior.

E. Harmon-Jones and colleagues have conducted numerous empirical examinations of their action-based model of dissonance. For example, Harmon-Jones and Harmon-Jones (2002) conducted two "spreading of alternatives" experiments modeled after Brehm's (1956) classic study, using different exercise regimens as the decision options. In these studies, they manipulated decision difficulty and action orientation (by having participants list either things they do in a typical day [control] or things they can do to improve their performance on their chosen exercise option [action-orientation]). In both studies, they obtained the interaction predicted by the action-based model: Participants in the action-orientation condition who made a difficult choice showed a greater spread in their evaluations of the two decision options than all other conditions. Similarly, Harmon-Jones, Harmon-Jones, Fearn, Sigleman, and Johnson (2008) and Harmon-Jones, Gerdjikov, and Harmon-Jones (2008) conceptually replicated these results using spread of alternatives and induced compliance paradigms, respectively. More recently, C.

Harmon-Jones, Schmeichel, Inzlicht, and Harmon-Jones (2011) investigated whether the motivation elicited by dissonance is associated with approach- (as predicted by the action-based model) or avoidance-orientation. Supporting the model, they found that state approach motivation was directly correlated with dissonance reduction as measured by spreading of alternatives (Study 1) and attitude change (Study 2).

The action-based model of dissonance is very similar to models of self-regulation currently being investigated in the field of cognitive neuroscience. Thus, recent investigations of the model have incorporated neuropsychological measures in an attempt to integrate cognitive dissonance within the broader context of motivated cognition and self-regulation (see Harmon-Jones et al., 2009). For example, Harmon-Jones (2004) predicted that dissonance arousal would be associated with activity in the anterior cingulate cortex, the area of the brain associated with conflict monitoring. Indeed, Amodio et al. (2004) found that low-prejudice participants who responded prejudicially to a test of automatic stereotype tendencies showed increased activity in the anterior cingulate cortex (as measured by "error-related negativity": van Veen & Carter, 2006) relative to trials that did not induce inconsistency. Van Veen, Krug, Schooler, and Carter, (2007) found similar results using an induced-compliance dissonance paradigm.

The prefrontal cortex governs controlled processes, including those that are often enacted following conflict detection by the anterior cingulate cortex (Miller & Cohen, 2001). Thus, whereas the anterior cingulate cortex should be associated with dissonance arousal, dissonance reduction should be associated with activity in the prefrontal cortex, specifically the left frontal region, which is associated with approach motivation (Amodio, Master, Yee, & Taylor, 2008). Many studies have confirmed that, indeed, the left region of the prefrontal cortex is associated with approach motivation (e.g., Amodio, Devine, & Harmon-Jones, 2007), but to date there has

been no published direct examination of left cortical brain activity in the context of dissonance paradigms. Although a complete discussion of these findings is beyond the scope of this paper, in general, results of these studies suggest that neural activity observed during dissonance paradigms corresponds meaningfully with activity observed in investigations of theoretically-related processes; thus, the action-based model appears to appropriately capture dissonance arousal and reduction processes, which are likely fundamental aspects of human functioning (Gawronski, 2012; Gawronski & Strack, 2012).

CHAPTER 3: THE SMS

Memory has been a topic of general philosophical interest for centuries, and of psychological interest for many decades. Investigations of its structure and function have transcended numerous areas of psychological inquiry, including personality (Strauman, 1996), developmental (Howe & Courage, 1997), and cognitive psychology (Conway, 1996), among others. Perhaps due to the increasing development and specialization of the field, findings in one area often fail to inform research in others (Conway & Pleydell-Pearce, 2000). Recent attempts have been made, however, to integrate what is known about memory into a unified framework that can be drawn upon across the various fields of psychology. One example is Conway's (2005; Conway & Pleydell-Pearce, 2000) SMS, a framework that attempts to illustrate the intimate relationship among autobiographical memory, working memory, and personal identity or sense of self. Research suggests that the SMS adequately synthesizes psychological knowledge concerning the structure and function of autobiographical memory and provides a framework that can be used to integrate seemingly disparate phenomena across the field, most notably for our purposes those of memory distortion and cognitive dissonance reduction (for extensive reviews, see Conway, 2009, 2005; Conway & Pleydell-Pearce, 2000).

Building Blocks of the SMS

According to the SMS, autobiographical memories (i.e., cognitive representations of personally-relevant events in the past) are the product of the interaction between two distinct components: the autobiographical memory knowledge base and the working self (Conway, 2005). Both components may operate independently from each other and may be involved in processes beyond simply those of memory (e.g., decision-making), but it is when they act in tandem that self-relevant autobiographical memories are constructed.

The autobiographical memory knowledge base. The autobiographical memory knowledge base refers to the cognitive representations of activities or events and corresponds to what has typically been regarded as memory (e.g., Tulving, 1983). In the SMS, autobiographical knowledge is organized hierarchically, and ranges from highly abstract and conceptual knowledge to event-specific knowledge (Burt, Kemp, & Conway, 2003). Specifically, from most to least abstract, these levels of knowledge include themes, lifetime periods, general events, and finally episodic memories, which arise from the integration of information concerning a specific event across all levels of the hierarchy. A complete discussion of the structure of this component of the SMS is beyond the scope of this paper; for fuller reviews, please see Conway (2009, 2005) and Conway and Pleydell-Pearce (2000).

The working self. The SMS regards memory as a motivated, goal-directed system. That is, memory functions as a system designed to organize a person's overarching goals (e.g., mastering a skill, graduating college) and record progress made toward achieving those goals. The working self refers to the particular goal (and hierarchy of associated subordinate goals) that is currently held in working memory (see Baddeley, 2000; Conway & Pleydell-Pearce, 2000). It serves as the "goal management center" of the memory system, by coordinating goal processing, maintaining goal compatibility, and prioritizing goals. Its main function is to "maintain coherence (between goals) and it does so, in part, by modulating the construction of specific memories, determining their accessibility and inaccessibility, and in the encoding and consolidation of memories" (Conway, 2005, p. 597). Analogous to working memory, the working self is the lens through which all new information is encoded and all pre-existing information is retrieved from long-term memory and combined to form memories. As such, the

working self plays a crucial role in decision-making and regulating behavior in accordance with the goal (or sub-goal) currently activated (see Carver & Scheier, 1998, for a fuller discussion).

Conway, Meares, and Standart (2004) proposed that the activated goal hierarchy of the working self also consists of non-temporal self-conceptual knowledge, called the "conceptual self." These structures include personal scripts (Demorest, 1995), relational schema (Baldwin, 1992), attitudes, values, and beliefs (Conway, 2005), which are both informed by, and guide a person's social interactions. The working self (informed by the conceptual self) thus acts as the control process for the encoding of information and subsequent construction into memories.

Constructing Memories

The construction of autobiographical memories involves the operation of both the autobiographical memory knowledge base and the working self. Relatively little empirical work has been conducted concerning the actual construction of memories in the SMS, but Conway (2005) does specify some predictions that the model makes. Cues from the environment activate the autobiographical memory knowledge base, which makes a certain set of knowledge available to the working self control processes (Conway, 2005). The working self then either terminates the search for information (direct retrieval), or initiates a new search using a cue produced from the previous search cycle, using an iterative search-evaluate-elaborate process (generative retrieval: Burgess & Shallice, 1996; Conway, 1996). Generative retrieval eventually ends with a direct retrieval (see Conway, 2005, for a fuller discussion).

In the SMS, retrieval is governed by a retrieval model (see Norman & Bobrow, 1979). Not much is currently known about retrieval models, but they are hypothesized to develop throughout childhood via socialization (Wang & Conway, 2004) and serve the main function of separating mental representations of memorial information from mental representations of

knowledge that was not actually experienced (Conway, 2005; cf. reality monitoring: Johnson, 1988). Engaging a retrieval model, and the subsequent construction of memory, necessarily involves a record of recollective experience, a direction of attention inwards toward memorial information, and the emergence of types of knowledge into consciousness. The retrieval models engaged and the conditions for the construction of a memory, however, will likely change according to the demands of the situation (e.g., individual vs. group memories).

Coherence vs. Correspondence

In the SMS, memory is affected by more than the personal goals discussed above. Evolutionary considerations also influence the motivated nature of the SMS. Specifically, it involves a trade-off between the often competing demands of *coherence* and *correspondence*, which correspond generally to consistency and accuracy, respectively. Coherence refers to a drive at encoding, remembering, or re-encoding that shapes the content and accessibility of one's memories to make them consistent with one's current goals, self-images, or self-beliefs (see Conway et al., 2004). Indeed, psychologists have observed this tendency for decades, noting that people often alter, distort, or even fabricate memories to support their notions of the self (e.g., Bartlett, 1932; Freud, 1899; James, 1890/1950; Loftus, 1993). Thus, in the SMS, memory functions as a database of the self, such that "memory and central aspects of the self form a coherent system in which […] beliefs about, and knowledge of, the self are confirmed and supported by memories of specific experiences" (Conway, 2005, p. 595). The drive for coherence has implications for emotional well-being and adaptive functioning. Specifically, an individual with an integrated and coherent sense of self is likely to have higher self-esteem, a stronger sense of well-being, and be better able to achieve goals through effective action than someone who does not have a coherent sense of self (Bluck, 2003; Bluck & Habermas, 2001).

Although the drive for a consistent self system is associated with many benefits, such a system must also be grounded in some accurate conception of reality for the person to be able to function effectively. After all, from an evolutionary perspective, an organism without a realistic view of its surroundings would not survive (Conway et al., 2004). Thus, the SMS also holds that memory is motivated by the need for correspondence between cognitive representations and actual experience. However, a system that maintains completely accurate representations of each and every experience would quickly encounter problems with storage and retrieval of memories (Conway, 2005). The system must then strike a balance between storing enough information so that one can function based on accurate memorial information, but not so much information that it prevents one from efficient decision-making and action. Additionally, it must satisfy the basic need of coherence. The demands of individual situations likely determine how much correspondence drives the memorial process (Brainerd & Reyna, 2001). For most experiences, it may be sufficient to only encode or recall the "gist," but for others, greater detail (and, consequently, correspondence between the cognitive representation and the actual event) may be required (Koriat, Goldsmith, & Pansky, 2000). Indeed, the SMS posits that these different types of information can be encoded, stored, and recombined to form memories. In summation, memory in the SMS is a function of the competing demands of coherence and correspondence.

Recent vs. Long-term Memory

In addition to being driven by the considerations addressed above, memories are encoded, stored, and retrieved according to their relevance to a person's individual, long-term goals (Conway & Pleydell-Pearce, 2000). Conway (2005) states that one problem facing any goal-based system is keeping track of progress toward attaining relevant goals. After all, if a person cannot remember the actions he or she took toward accomplishing a goal, he or she is likely to

repeat those actions unnecessarily and delay overall progress. Conscious holding of episodic memories uses relatively more cognitive resources than the storage of long-term representations. Because people cannot devote resources to holding these memories in consciousness indefinitely, the SMS holds that memories of recent actions only remain accessible temporarily and will eventually be forgotten unless they can be successfully integrated with other long-term goal representations. Conway (2005) argues that this is adaptive: Recent episodic memories that are associated with overarching goals (e.g., obtaining financial independence) can be effectively integrated into long-term storage, whereas recent episodic memories that are associated with short-term goals (e.g., getting dressed for work) only temporarily draw on cognitive resources when relevant, and are then forgotten.

Because recent and long-term episodic memories usually differ in their relation to overarching goals, Conway (2005) argues that they are differentially affected by the drives for coherence and correspondence. Specifically, recent episodic memories (which are likely to be unrelated to long-term goals) are biased toward correspondence over coherence: Cognitive resources are more likely to be devoted to creating accurate representations of these events than integrating them into long-term goal representations. Long-term episodic memories (which contain information that is integrated within the context of overarching goals), however, are biased toward coherence over correspondence: Cognitive resources are more likely to be devoted to integrating the meaning of the events into the context of long-term goal representation than recording detailed accounts of the events.

The SMS and Memory Distortion

Psychologists have long been aware of memory's susceptibility to distortion (e.g., James, 1890/1950). Experimental investigations show that people can develop a wide range of false

memories, from misremembering small details to developing rich false memories for entire events. Although a full review of the false memory literature is beyond the scope of this paper, it is noteworthy that several false memory phenomena can be accounted for using Conway's (2005) SMS. Roediger and McDermott (1995) demonstrated minute memory distortions using a word list paradigm developed by Deese (1959). They presented participants with words lists containing the associates (e.g., bed, awake) of a non-presented word (e.g., sleep). They found that participants frequently falsely recalled the non-presented words and, later, recognized these words with high confidence. Several hundred experiments have since replicated the effect, confirming that people can develop false memories for non-presented words (for a review, see Roediger & Gallo, 2005). Loftus, Miller, and Burns (1978) demonstrated that people can also develop false memories for aspects of witnessed events. In the first investigations of what is now known as the "misinformation effect," Loftus et al. showed participants slides of a car making a turn at either a stop sign or a yield sign and then asked them questions about the slides they saw. A critical question was either consistent with their experience (e.g., asking about a stop sign when a stop sign was presented) or misleading (e.g., asking about a yield sign when a stop sign was presented). Later, participants completed a forced-choice recognition task that included both critical slides (i.e., stop sign and yield sign). Participants who received misleading information performed significantly worse than chance on this task, suggesting that misinformation contaminated participants' memories for the original event.

Research has also shown that people can develop rich false memories. Psychologists have successfully implanted false memories for entire events, including being lost at a shopping mall as a child (Loftus, 1993), being the victim of an animal attack (Porter, Yuille, & Lehman, 1999), nearly drowning and being rescued by a lifeguard (Heaps & Nash, 2001), and meeting Bugs

Bunny at Disneyland (an impossible event: Braun, Ellis, & Loftus, 2002). Forensic psychologists have even demonstrated that people can develop false memories for crimes they did not commit (e.g., Kassin & Kiechel, 1996). Although the exact mechanisms for each of these types of distortion are not yet fully understood, the SMS can account for the phenomena at a theoretical level. Each type of distortion is formed by the same processes that form true memories – an interaction of the autobiographical knowledge base and the working self. In these examples, the working self attempts to reconcile current information (e.g., the presentation of a previously non-presented target word, accusations from an interrogator) with information from the autobiographical knowledge base (e.g., memories for associated words, memory of the purported crime circumstances). Memory distortion results from the working self's drive for coherence in the integration of new information into long-term storage (Conway, 2005).

CHAPTER 4: IMPLICATIONS FOR THE RELATIONSHIP BETWEEN COGNITIVE DISSONANCE AND MEMORY

One of the fundamental assumptions of the SMS is that memory is a motivated process. Consequently, in addition to elucidating the processes that make memory work and incorporating data regarding memory distortion, the SMS also suggests other systematic ways in which memory may fail. The working self—the lens through which all information is encoded into long-term storage and subsequently retrieved to construct memories—is not a wholly objective structure. It is colored by a drive for coherence among its components: goals, the autobiographical memory knowledge base, and the conceptual self. Goals, memories, beliefs (including beliefs about the self: Stone & Cooper, 2001), and actions all fall under the umbrella of "cognitions" in Festinger's (1957) theory of cognitive dissonance. Inconsistencies among the components of the SMS (e.g., a belief about oneself and a memory of failing to act according to that belief) would constitute conflicting cognitions and should then produce cognitive dissonance.

The notion that one is not "a person who says one thing and does another" is likely a core self-belief that we all share (Harmon-Jones et al., 2009), a universal component of our conceptual self. Indeed, Conway (2005) and Festinger (1957) both consider consistency of fundamental importance to their cognitive models of memory and behavior, respectively, and consequently, to organisms' effective behavior and, ultimately, survival. Overall, the drive for coherence that defines the SMS appears tantamount to the drive for cognitive consistency underlying the theory of cognitive dissonance. Because the working self is purported to be involved in both encoding and memory construction, the overlap in these two theoretical perspectives presents some interesting implications for the relationship among memories,

cognitive inconsistency, and behavior. The focus of the present research is to examine particular implications of these relationships that heretofore have been ignored.

Dissonance-Inducing Memories May Yield Dissonance-Reducing Behaviors

When cued, the working self (with guidance from self-conceptual knowledge and the salient goal hierarchy) retrieves information from the autobiographical memory knowledge base and synthesizes it to form memories (Conway, 2005). The resulting memory is used to guide subsequent behavior. Occasionally a person may recall a memory that is inconsistent with his or her current goals or self-concept. The constructed memory effects inconsistency: In the SMS, the memory constitutes a violation of coherence between memories and goals, whereas in cognitive dissonance theory the memory makes salient a clash between cognitions. An integration of the SMS and cognitive dissonance theory suggests that the behavior that results from the construction of this memory, then, will likely be guided by efforts to resolve or reduce the inconsistency.

Much evidence supporting this prediction already exists in the cognitive dissonance literature. Indeed, cognitive dissonance theory alone makes such a prediction without the introduction of components from the SMS (see Aronson, 1969). For example, Harmon-Jones, Peterson, and Vaughn (2003) predicted that memories of past failures to act in accordance with one's beliefs would lead participants to take dissonance-reducing action. Participants were induced to experience either high or low empathy toward an ill boy, and were then reminded of either neutral events or past failures to help similar others. All participants were offered an opportunity to donate money and/or volunteer their time to help the boy. As predicted, those in the high empathy/past failures group volunteered more time and donated more money than those in other conditions. Comparable results have been found using hypocrisy-induction methods

across a number of domains, including water conservation behavior (Dickerson, Thibodeau, Aronson, & Miller, 2006) and safe sex behavior (Stone, Aronson, Crain, Winslow, & Fried, 1994). These studies show that memories for inconsistencies between beliefs and action elicit dissonance, which in turn motivates behavior to reduce or eliminate the inconsistency.

Dissonance-Inducing Behaviors May Yield Corresponding False Memories

The overlap between the SMS and cognitive dissonance theory also has implications for effects in the opposite direction: Experiencing dissonance in a particular situation may influence (and even distort) the memory one constructs for those events. The SMS suggests two possible sequences by which dissonance-inducing events may yield distorted memories. The first possibility involves a distortion of memorial information during encoding. As discussed above, there are numerous situational conditions that may arouse dissonance, and many strategies one may employ to deal with the resulting discomfort (e.g., adding consonant cognitions, attitude change: Harmon-Jones & Harmon-Jones, 2007). After reducing dissonance via one of these mechanisms, this new, salient interpretation or evaluation of the dissonance-inducing event may be the one that is encoded into long-term storage. After all, the working self seeks to integrate knowledge with overarching goals and the conceptual self (which includes the notion that one is a consistent person). Encoding the original circumstances concerning the arousal of dissonance may essentially make the dissonance salient again, and require additional dissonance-reduction. Thus, the information that becomes integrated into long-term memory and is later available for retrieval may not be an accurate representation of actual events. Rather, the record of the dissonance-inducing event may be more consistent with the individual's mode of dissonance reduction than an accurate representation of the actual event (or the individual's actual, initial experiences of the event). When cued later, the working self will retrieve from the

autobiographical memory knowledge base memorial information that is already distorted, leading to the construction of a false memory for the original dissonance-inducing event.

However, the SMS also suggests that memories for dissonance-inducing events may not become distorted at encoding, but rather at retrieval. Although dissonance-reduction strategies may change a person's interpretation or evaluation of a dissonance-inducing event for the time being, the processing of memorial information for the event may be governed by a drive for correspondence, for an accurate representation of the event. Indeed, Conway (2005) states that "recent memory is biased towards correspondence at the expense of coherence" (p. 597). Dissonance-reduction strategies may alleviate a person's present discomfort, but the working self may seek to integrate an accurate cognitive representation of the event into long-term storage, nonetheless. Retrieval, however, "is biased towards issues of coherence over correspondence" (Conway, p. 597). Consequently, the working self may actively attempt to distort the memorial information at retrieval to preserve coherence among goals and self-knowledge, a possibility that researchers have long acknowledged and the SMS allows (Conway & Pleydell, Pearce, 2000).

Empirical research on memory errors in the SMS has been confined mostly to issues regarding memory accessibility and directed forgetting. Memory accessibility studies tend to show that memories that elicit positive emotion are associated with goal attainment (e.g., Sheldon & Elliot, 1999), whereas memories that elicit negative emotion are associated with failure to achieve goals (e.g., Singer & Salovey, 1993). Conway and Holmes (2004) found that, across the lifespan, memories of high relevance to the self remain more accessible than those that are less relevant. Although a complete discussion of the directed forgetting studies is not offered here, these studies indicate that, indeed, people are able to actively suppress the availability of a prescribed type of memory (see, e.g., Barnier et al., 2007; Barnier, Hung, & Conway, 2002;

Racsmány & Conway, 2006). Together, these types of studies provide empirical support for the SMS's contention that the working self can moderate the content and accessibility of memories in accordance with salient goal hierarchies and the conceptual self (i.e., increase the accessibility of memories that confirm or support important goals, and actively suppress those that do not).

Recently, there has been some research on the nature and content of confabulation using the SMS as an organizing framework. These studies have typically involved single- or small-*n* research designs with neurologically impaired patients (e.g., amnesics) as participants (e.g., Fotopoulou, Conway, Griffiths, Birchall, & Tyrer, 2007; Fotopoulou, Conway, & Solms, 2007; Fotopoulou et al., 2008). In these studies, the authors found that self-relevant confabulations were far more likely to be positively- than negatively-valenced. Although the results from these investigations shed some light on the motivated nature of the working self, they do not speak to the possibility of memory distortion and confabulation among unimpaired adults, nor do they offer any generalizable connections between false memories and cognitive dissonance. To date, there has been no empirical work aimed at integrating these two areas, so the discussion of the relationship between dissonance and memory distortion has been, necessarily, speculative.

Numerous studies have examined memory distortion as the product of theoretically related attitude-change mechanisms (e.g., persuasion: Lindsay & Read, 2006; McIntyre, Lord Lewis, & Frye, 2004; Frye & Lord, 2009). These studies typically show that people (mis)remember information that supports their current attitudes, even if their attitudes have been experimentally influenced (Lydon, Zanna, & Ross, 1988). For example, Ross, McFarland, and Fletcher (1981) used persuasive messages to manipulate participants' attitudes toward brushing their teeth, and then assessed participants' memories for the frequency with which they brushed their teeth. Participants who were persuaded to devalue tooth-brushing behavior remembered

brushing their teeth less frequently than participants who were persuaded to value tooth-brushing. Similar effects hold for attitudes across a wide range of topics, such as social issues (Marcus, 1986), romantic partners (McFarland & Ross, 1987), and person perception (Spiro, 1980), and for a variety of target memories (e.g., one's prior attitudes, as well as autobiographical events: Hyman & Loftus, 1988; Ross, 1989). Our discussion of dissonance theory and the SMS predicts similar effects on memory distortion, specifically, that dissonance-induced attitude change may yield corresponding distorted memories for prior attitudes and behavior. Results supporting our hypotheses would complement this area of research by elucidating another mechanism by which previously observed memory distortion may occur.

Overview of the Present Research

An integration of the SMS and dissonance theory provides a strong theoretical basis for the notion that dissonance may induce memory distortion. The primary goal of the present studies was to empirically establish this link. In two experiments, we appended a memory phase to a classic cognitive dissonance paradigm to assess participants' memories for relevant attitudes and details regarding their participation experience. Across the two experiments, we predicted two general effects. First, we expected to replicate classic dissonance effects (i.e., the "spread of alternatives" effect in Experiment 1, and the "attitude shift" and "denial of responsibility" effects in Experiment 2). Second, we predicted that those in dissonance conditions would misremember their initial attitudes and details of their experimental experience in accordance with the route by which they reduced dissonance, whereas participants who did not experience dissonance would not. In general, for both experiments, tests of hypotheses regarding the influence of dissonance on memory distortion were conducted using difference scores that assess the amount and direction of shift in attitudes and memory relative to initial target attitudes or target details. Path

analyses were then conducted to test whether dissonance indices mediated the effects of our experimental manipulations on memory distortion indices. We report herein all data exclusions, manipulations, and dependent measures for both experiments.

CHAPTER 5: EXPERIMENT 1

In Experiment 1, we examined the influence of post-decision dissonance reduction on memory accuracy for the characteristics of decision options and subjective experience of the decision itself. Specifically, we modified Brehm's (1956) classic "spread of alternatives" paradigm and added a memory test phase in a second session that was held either immediately or two days after the initial decision session. In a purported marketing research study, participants rated several items (in this case, cell phones) on a number of characteristics (e.g., desirability) and chose one from between a pair of them (either an easy or a difficult choice). Participants were purportedly entered into a lottery to receive the phone they had chosen. After reading some short reviews about some of the cell phones, they rated the qualities of the cell phones a second time. In the second session, which took place either immediately or two days later, participants completed a memory test for the characteristics of the cell phones (some of which were not included in the initial descriptions) and evaluated the decision they made in the previous session (e.g., how easy it was).

Hypotheses

Hypothesis 1. Consistent with previous research, we predicted that participants who made a difficult decision would attempt to reduce their dissonance via adding consonant cognitions (rationalization: Brehm, 1956). Specifically, after making their choice between the two cell phones, we predicted participants would rate the chosen cell phone more positively and/or rate the rejected cell phone more negatively. We also predicted the post-decision ratings of those who made an easy choice (i.e., did not experience dissonance) would be consistent with their pre-decision ratings.

Hypothesis 2. The drive for coherence in the SMS (Conway, 2005) and the need for cognitive consistency in dissonance theory (Festinger, 1957) suggest that dissonance-inducing events may yield distorted memories. We expected participants who made a difficult (vs. easy) decision to misremember the details surrounding the decision they made in accordance with the "adding consonant cognitions" mode of dissonance-reduction. This general hypothesis corresponds to 3 corollary hypotheses.

Hypothesis 2a. We predicted that, as a result of their motivation to be satisfied with their decision and reduce dissonance, those who made a difficult decision would misremember their decision more favorably (e.g., as being easier) than they initially reported; we predicted that participants who made an easy decision, however, would not misremember their decision.

Hypothesis 2b. We also predicted that those who made a difficult decision would misremember the qualities of their chosen and rejected cell phones in a manner that was consistent with their dissonance reduction. Specifically, we hypothesized that they would remember the specifications for their chosen phones more positively and the specifications for their rejected phones more negatively relative to the phones' true specifications.

Hypothesis 2c. Finally, we predicted that participants who made a difficult choice would be more likely than those who made an easy choice to mistakenly recall specifications of the cell phones that had not been initially presented to them in patterns that were consistent with their dissonance-reduction (i.e., rating the chosen cell phone higher than the rejected cell phone on the previously unseen specifications). That is, participants in difficult conditions will misremember the chosen options as possessing more favorable specifications relative to the rejected option than participants in easy conditions.

Exploratory hypothesis. For decades, psychologists have known that memory quality degrades as time between the target event and recall increases, with the most dramatic decrements in memory quality occurring shortly after encoding (Ebbinghaus, 1913). As Conway (2005) noted, memory construction is influenced not only by memorial information for previously experienced events, but also by motivational forces. As memorial information degrades, motivational forces may more effectively shape the constructed memory (cf., memory strength and reality monitoring judgments: Hoffman, 1997). The dissonance-induced memory distortion hypothesized here is one type of motivated memory construction. Thus, the degree to which dissonance reduction shapes memories may depend on the strength of the memorial record and, consequently, the delay between the dissonance-inducing event and memory construction. Specifically, dissonance-induced memory distortion may be greater after long delays (vs. short delays) due to the relatively weaker constraints of memory for details of the original event. Conversely, because the hypothesized effect of dissonance on memory distortion is a product of motivated cognition that affects human behavior and attitudes even immediately following the target event, the relative strength of the memorial record of the event may not influence the amount of memory distortion. To examine these possibilities, we manipulated the amount of delay between the first and second experimental sessions (either no delay or a 2-day delay). However, because both significant and null effects of this manipulation were theoretically plausible, we examined its effects in an exploratory fashion. Results in either direction would provide valuable information regarding the nature of the relationship between cognitive dissonance and memory construction.

Method

Participants. One hundred seventy-seven undergraduates from the introductory psychology participant pool at John Jay College of Criminal Justice were recruited to participate in Experiment 1 in exchange for partial course credit. Participants were assigned to one of four conditions in a 2 (Decision: difficult vs. easy) × 2 (Delay: none vs. 2 days)[3] between-subjects design using block-randomization. Forty-three participants in the 2-day delay conditions did not return for the second session and were removed from the data set. Eleven participants across the four conditions were eliminated because they rated all eight cell phone profiles similarly and at the extremes of the scales (e.g., they rated all phones as "1" on all four rating scales), preventing the experimenters from appropriately constructing the Choice manipulation. The final sample consisted of 123 participants[4] (73.2% female) who ranged from 18 to 56 years of age (M = 20.49, SD = 5.01) and self-reported as Latino (37.4%), White (21.1%), Black (17.9%), East Asian (10.6%), or another ethnicity (13%). The four cell sizes ranged from 30 to 32 participants. Participation took approximately 30 minutes, over either one (no delay conditions) or two experimental sessions (2-day delay conditions).

Materials.

***Product profiles*.** All participants read information sheets about eight types of cell phones (all "smart phones"). Each sheet contained a picture of a cell phone (labeled with a letter, brand names and identifying information removed) and a list of its specifications along with "typical ranges" for six specifications within which similar phones typically fall with respect to the

[3] Brehm (1956) included an additional no-choice control group to examine the possibility that mere ownership of chosen items could account for shifts in participants' desirability ratings. There was no evidence of an "ownership" effect, and these control groups have since been dropped in "spread of alternatives" studies.

[4] Harmon-Jones and Harmon-Jones (2002) reported effect sizes of d = 1.4 in conditions expected to maximize the spread-of-alternatives effect, and d = .4 in conditions expected to minimize this effect. A power analysis using G*Power (Faul, 2012) indicated that a sample of N = 120 would be sufficient to detect d = .52 effects with power = .80 and α = .05.

displayed specifications (i.e., megapixels for the main camera [Mpx], number of languages supported, number of minutes of battery life during regular use, number of songs that can be stored, number of apps that can be stored, and processor speed in gigahertz [GHz]). At the bottom of each sheet, participants completed four 9-pt. Likert-type items assessing the phone's desirability, value, quality, and attractiveness. Profiles were pilot-tested prior to the beginning of this study to ensure a wide range of desirability of cell phones. See Appendix A for an example. To provide peripheral cues supporting the legitimacy of the cover story, all materials included a logo for the fake sponsoring agency.

Cell phone use survey. Participants completed a filler survey concerning their cell phone ownership, use, and needs. This survey contained demographic items, and several checklists that functioned mainly to support the cover story of a cell phone marketing study and provide the experimenter with enough time to construct the experimental manipulation. See Appendix B for a copy of the survey.

Consumer reviews. Participants read purported consumer reviews of four cell phones. Each review was approximately the same length (about 100 words) and contained the same number of positive and negative statements about each phone. These reviews were created by adapting actual consumer reviews from various public websites (e.g., www.amazon.com). After each review, participants made note of characteristics that stuck out to them as being particularly good or bad about each. See Appendix C for a sample product review.

Post-review rating forms. Participants re-rated each phone for which they read a consumer review. These forms contained a picture of each phone at the top, and asked participants to provide their ratings on these cell phones (using the same rating scales as included on the product profiles). See Appendix D.

Memory forms. The memory forms asked participants to recall specifications for the chosen and rejected decision options using a fill-in-the-blank format (with a "Can't remember" option for each specification). As a reminder, each form contained a photo of the corresponding phone at the top. Five of the specifications on the form, however, were not presented to the participants initially (megapixels of front-facing camera, minutes of battery life when browsing the Internet, gigabytes [GB] of usable memory, download speed in kilobytes per second [Kbps], and SD card capacity in GB). Each item contained a range of values typically available in similar cell phones. For the previously-presented specifications, these were the same ranges presented initially. Some of these ranges were also used for previously un-presented specifications, where appropriate. For other specifications for which the previous ranges were not appropriate, new ranges were given. See Appendix E for a copy of a memory form.

Procedure. The experiment took place in two phases: a Decision phase and a Memory phase. The Decision phase was modeled after the procedure used by Brehm (1956). Participants came to the laboratory individually, ostensibly to participate in a marketing study (contracted by a fake marketing agency) examining the types of features young adults in the metropolitan area find desirable in a cell phone. Two researchers who were blind to the study's hypotheses conducted the experimental sessions. After granting consent, the experimenter gave all participants eight randomly-ordered[5] cell phone product profiles to read and complete.

After they completed the rating task, participants completed the cell phone use survey. While the participants completed this survey, the experimenter selected the phone options to present (i.e., the dissonance manipulation): In the difficult decision condition, the experimenter selected two phones the participant had rated as approximately 7 on the desirability scale,

[5] The order of phone presentation was determined randomly before data collection began, and all phones were presented in the same random order.

whereas in the easy decision condition, the experimenter selected one phone the participant rated as approximately 7, and one phone he or she rated as 3 or 4 (see Harmon-Jones & Harmon-Jones, 2002). After the participants finished the survey, the experimenter said,

> "As compensation for completing this study, the market research firm has given us a few of each type of the cell phones you are evaluating. To make sure that people have a relatively equal chance of winning a phone, we have randomly selected two phones for you to choose from. The phone you choose will be the one that you are entered into the lottery to receive."

The experimenter then introduced the dissonance manipulation. In the difficult decision condition, the participant chose between two moderately desirable cell phones; in the easy decision condition, the participant chose between one moderately desirable cell phone and one less desirable cell phone. The experimenter recorded the participant's choice on an experimenter recording form and then presented the participant with a fake compensation agreement, saying,

> "This is a compensation agreement so that you can be entered in the lottery for your chosen cell phone. It basically says that you agree to complete the study and that, in exchange, you'll be placed in a lottery for the phone you chose. We'll randomly select a winner and contact him or her to receive the phone. If you win the phone, it's free and you are not obligated to use any particular wireless provider or anything – you have no obligations to the research company at all. You're free to do what you want with it."

The experimenter filled in the participant's choice, asked the participant to sign the form, and then signed the form as the experimenter witness. The experimenter then asked participants to rate the ease of, confidence in, and satisfaction with their decisions on 10-pt scales (1 = not at all, 10 = very), and recorded their responses.

The experimenter then told the participants that the manufacturers were also interested in learning what strikes people as good and bad about certain cell phones, so they had an independent research organization collect consumer reviews of each cell phone. The experimenter explained that the current marketing agency was interested in how these types of consumer reports influence consumer appraisals of their cell phones. The experimenter presented to each participant consumer reviews of four of the cell phones, including the one the participant chose, the rejected option, one very desirable phone, and one undesirable phone. Participants read these reports, made note of characteristics that stuck out to them as being particularly good or bad about each[6], and provided their ratings on these cell phones again, using the same rating scales as earlier. Participants in the delay conditions were then reminded to return to the lab two days later at the same time to finish the study.

At the beginning of the Memory phase, the experimenter reminded the participants of the purpose of the study. The experimenter showed the participants the pictures of the two cell phones from which they were able to choose and asked them to remember which phone they had chosen. The experimenter then asked participants to think back to when they initially chose the phone for which they wanted to be placed in a lottery and rate how they felt about their decision at the time they made it, along the same three dimensions (i.e., ease, confidence, satisfaction). Experimenters recorded participants' responses and participants then completed the memory forms. After completing the memory task, the experimenter probed for suspicion; specifically, the experimenter asked participants if they were suspicious about any aspect of experiment, their compensation, or the true purpose of the experiment. No participants reported any suspicion.

[6] The purpose of this aspect of the procedure was to allow participants the opportunity to add consonant cognitions regarding their decision (i.e., focus on positive aspects of the chosen phone, and negative aspects of the rejection phone)

Finally, the experimenter fully debriefed the participants with a written report and dismissed them.

Results

Dissonance effects on memory for the decision. For Hypothesis 2a, we predicted that participants who experienced dissonance as the result of making a difficult decision would misremember their initial decision experience more favorably than those who made an easy decision (and did not experience dissonance). Additionally, we investigated the influence of delay on this memory distortion in an exploratory fashion. We computed a difference measure for each dimension (i.e., ease, confidence, and satisfaction) to assess the amount and direction of participants' memory distortion as a function of the manipulated variables. Specifically, we subtracted participants' initial decision ratings from their *memories* for the initial decision ratings on each of the three dimensions. Positive values indicate participants misremembered their decisions more favorably than they initially rated them; negative values indicate participants misremembered their decisions less favorably than they initially rated them.

We conducted a 2 (Decision) × 2 (Delay) multivariate analysis of variance (MANOVA) with the memory shift indices as dependent variables. The analysis revealed a significant multivariate effect of Decision on the memory shift indices, Wilks' $\lambda = .907$, F (3, 117) = 3.98, $p = .010$, $\eta^2 = .093$ [.006, .184][7]. Follow-up univariate analyses revealed significant effects of Decision on shift in participants' memories of the ease of the decision, F (1, 119) = 5.72, $p = .02$, $\eta^2 = .046$ [.001, .136], and satisfaction with their decision, F (1, 119) = 5.85, $p = .02$, $\eta^2 = .047$ [.001, .138], but not on shift in their memories for their confidence that they made the right decision, F (1, 119) = 1.17, $p = .28$, $\eta^2 = .009$ [.000, .071] . Participants who made difficult decisions were more likely to misremember the ease of ($M = .60$, $SD = 1.49$) and satisfaction

[7] Numbers is brackets represent the 95% confidence interval for the reported effect size.

with their decisions (M = .19, SD = .79) more favorably than those who made easy decisions (ease: M = -.08, SD = 1.64; satisfaction: M = -.21, SD = 1.05). Neither the multivariate main effect of Delay, Wilks' λ = .976, F (3, 117) = .95, p = .42, η^2 = .024 [.000, .007], nor the multivariate Decision × Delay interaction effect was significant, Wilks' λ = .984, F (3, 117) = .64, p = .59, η^2 = .016 [.000, .062].

It is possible that a ceiling effect may account for the main effect of Decision on memory distortion for the initial decision experience: Participants in the easy conditions may have initially rated the decision at the extreme positive end of the scales, and thus a shift in their ratings may not have been detectable by the test on the difference score. To examine this possibility, we conducted three independent-samples *t*-tests with Decision as the independent variable and participants' initial decision ratings as the dependent variables. These tests revealed that participants in difficult and easy conditions rated the initial decisions similarly on all three dimensions [ease: t (121) = 1.37, p = .17; confidence: t (121) = .84, p = .41; satisfaction: t (121) = .11, p = .91]. If the effect of decision difficulty on memory distortion was purely the result of a ceiling effect, it would have affected both easy and difficult decision groups equally. These results suggest, however, the distorting effect of dissonance on memory for the experience of the initial decision is not a statistical artifact.

Dissonance effects on memory for phone specifications. In Hypothesis 2b, we predicted that dissonance would distort participants' memories for the characteristics of their decision options. Specifically, we predicted that participants who experienced dissonance as the result of making a difficult decision would misremember the specifications of the chosen phone more positively and the specifications of the rejected phones more negatively relative to those who made an easy choice (and did not experience dissonance). Additionally, we investigated the

influence of delay on this memory distortion in an exploratory fashion. To test this hypothesis, we computed difference measures similar to those used in Hypothesis 2a. Specifically, for each of the six presented phone specifications (i.e., Mpx of main camera, number of languages supported, minutes of battery life during regular use, number of songs stored, number of apps stored, and processor speed in GHz), we computed a difference score by subtracting the *actual*, presented specifications from participants' recalled values. We computed specification differences score for both the chosen option and the rejected option. Then we subtracted the rejected difference score from the chosen difference score for each of these specifications to form measures of overall spread in memory distortion for each of the six phone specifications. Positive values indicate that participants misremembered the specifications of the chosen phone more favorably and the rejected phone less favorably relative to their true specifications; negative values indicate participants misremembered the rejected phone more favorably and the chosen phone less favorably.

We conducted a 2 (Decision) × 2 (Delay) MANOVA with the six spread of memory distortion measures as the dependent variables. The analysis revealed a significant multivariate effect of Decision, Wilks' $\lambda = .242$, $F\ (6, 9) = 4.71$, $p = .02$, $\eta^2 = .76$ [.001, .801]. Follow-up univariate analyses indicated this multivariate effect was driven entirely by the tendency of participants in difficult conditions to misremember the difference in the number of songs their decision options were capable of storing, $F\ (1, 14) = 6.17$, $p = .03$, $\eta^2 = .306$ [.001, .570]. Participants who made a difficult decision ($M = 1046.67$, $SD = 1518.42$) misremembered the difference in song capacity between the chosen and rejected phones more favorably than those who made an easy decision ($M = -1085.33$, $SD = 1312.50$). Neither the multivariate main effect of Delay, Wilks' $\lambda = .868$, $F\ (6, 9) = .23$, $p = .96$, $\eta^2 = .133$ [.000, .138], nor the multivariate

Decision × Delay interaction effect was significant, Wilks' $\lambda = .428$, $F\ (6, 9) = 2.01$, $p = .17$, $\eta^2 = .573$ [.000, .647].

In Hypothesis 2c, we predicted that participants in difficult conditions would misremember the chosen options as possessing more favorable specifications relative to the rejected option than participants in easy conditions. Additionally, we investigated the influence of delay on this memory distortion in an exploratory fashion. To examine this hypothesis, we computed a difference score for each of the five specifications that were not previously presented to participants. Specifically, we subtracted participants' recalled values for the rejected phone from their recalled values for the chosen phone to form a five "confabulation spread" measures. Positive values indicate more favorable false recall for the chosen phone, whereas negative values indicate more favorable false recall for the rejected phone.

We conducted a 2 (Decision) × 2 (Delay) MANOVA with the five confabulation spread measures as the dependent variables. This analysis, however, failed to yield any significant multivariate effects, Fs $(3, 5) < 1.7$, ps $> .35$. For each specification on the memory form, participants had a "Can't recall" option. The number of participants who provided all the information necessary to compute the measures for the tests of Hypotheses 2b and 2c was very small. This is a likely cause for the obtained null effects. Additionally, although the main effect of Decision on memory for song storage capacity is in the predicted direction, caution should be used in interpreting these results due to the small sample size.

Exploratory analyses. It is possible that dissonance may influence participants' metacognitive assessments regarding their own memory. To examine this possibility in a way that was not limited by small sample size, we coded whether participants attempted to recall each phone specification (yes or no, regardless of accuracy), and then computed a sum of each

participant's total attempts at recall. We conducted a 2 (Decision) × 2 (Delay) analysis of variance (ANOVA) with this measure as the dependent variable. This analysis yielded a significant main effect of Delay, F (1, 119) = 5.68, p = .02, η^2 = .046 [.001, .136]. Participants in the 2-day delay conditions (M = 12.11, SD = 5.86) attempted to recall more phone specifications than participants in the no-delay condition (M = 9.51, SD = 6.31). This main effect was qualified, however, by a marginally significant Decision × Delay interaction, F (1, 119) = 3.00, p = .08, η^2 = .027 [.001, .102]. Simple effects analyses revealed that, in the no-delay condition, participants who made a difficult decision (M = 9.00, SD = 6.74) attempted to recall the same number of phone specifications on average as participants who made an easy decision (M = 10.03, SD = 5.89), F (1, 119) = .45, p = .51, d = .17 [-1.40, 1.73]. However, in the 2-day delay condition, participants who made a difficult decision (M = 13.48, SD = 6.33) attempted to recall marginally more phone specifications on average as participants who made an easy decision (M = 10.74, SD = 5.07), F (1, 119) = 3.19, p = .07, d = .486 [-0.92, 1.89].

Mediation analyses. For Hypothesis 1, we sought to replicate the classic "spread of alternatives" effect of dissonance reduction. To examine this hypothesis we computed a new variable to serve as an index of the "spread of alternatives" for each characteristic (see Harmon-Jones & Harmon-Jones, 2002). Specifically, we took the differences between the predecision ratings of the chosen and rejected alternatives on each of the four dimensions (i.e., quality, value, attractiveness, and desirability) and subtracted them from the differences between the postdecision ratings of the chosen and rejected alternatives. A value of zero indicates no change in the differential evaluations of the decision options across the two ratings; positive values on these measures indicate an increase in the spread of alternatives (e.g., increase in the desirability of the chosen option, and decrease in the desirability of the rejected option relative to initial

ratings), whereas negative values indicate the opposite trend (e.g., increase in the desirability of the rejected option, and decrease in the desirability of the chosen option). We predicted participants who made a difficult decision would yield higher values on these indices relative to those who made an easy decision.

We conducted a series of hierarchical regression analyses to confirm the effectiveness of our dissonance manipulation (Hypothesis 1) and to examine whether dissonance-induced spread-of-alternatives mediated the effect of dissonance on memory distortion for the initial decision. First, the four spread indices from the test of Hypothesis 1 were regressed on the Decision manipulation (0 = easy, 1 = difficult)[8]. Then, in Block 1 of a separate set of regression analyses, the three memory distortion indices from the test of Hypothesis 2a were regressed on the Decision and Delay (0 = none, 1 = 2 days) manipulations, and their residualized interaction term (see Cohen, 1978; Lance, 1988). In Block 2, the four spread indices were added to the model as predictors. These analyses are summarized in Table 2, and Figure 1 displays a model containing all significant paths.

The Decision manipulation significantly predicted three spread-of-alternatives indices (quality, attractiveness, and desirability). As predicted, participants who made a difficult decision showed a greater spread of alternatives on these dimensions than those who made an easy decision. It is possible we did not observe a significant effect of Decision on the value index because, as in previous "spread of alternatives" studies, we did not provide participants with information regarding each phone's retail price, a piece of information that is likely used to determine a product's overall value (e.g., Petroshius & Monroe, 1987). Overall, the dissonance manipulation was successful.

[8] The main effect of Delay and the interaction term were not included in this analysis because Delay was manipulated after participants had completed the relevant spread of alternatives items.

Table 1

Hierarchical Regression Mediator Analyses for the Prediction of Distorted Memories for Initial Decision Experience (Experiment 1)

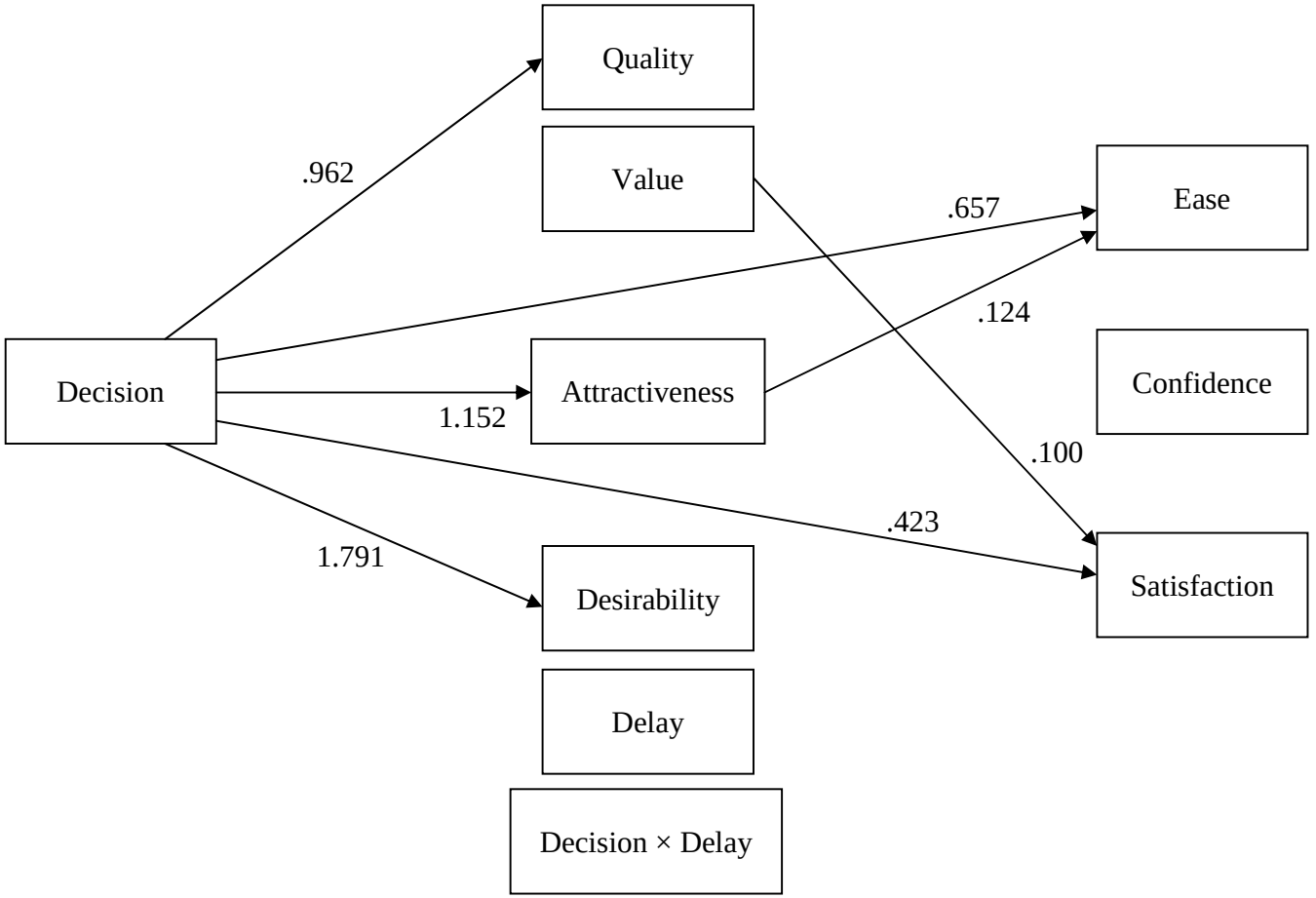
	Ease			Confidence			Satisfaction		
Predictor	Beta	*t*	*df*	Beta	*t*	*df*	Beta	*t*	*df*
Decision manipulation	.213	**2.40**	119	.097	1.07	119	.215	**2.42**	119
Delay manipulation	-.102	-1.45	119	-.001	-.01	119	-.110	-1.24	119
Decision × Delay	.072	.81	119	-.098	-1.08	119	.008	.09	119
(Block 1, R^2 change)	(.038*)			(.019)			(.059*)		
Decision manipulation	.207	**2.26**	115	.083	.87	115	.225	**2.42**	115
Delay manipulation	-.083	-.93	115	.003	.04	115	-.103	-1.14	115
Decision × Delay	.097	1.04	115	-.099	-1.02	115	.057	.60	115
Quality	-.047	-.30	115	.077	.47	115	-.138	-.86	115
Value	.159	1.01	115	-.037	-.22	115	.308	**1.93**	115
Attractiveness	.251	**1.99**	115	.161	1.23	115	-.040	-.31	115
Desirability	-.195	-1.29	115	-.083	-.53	115	-.080	-.52	115
(Block 2, R^2 change)	(.062)			(.019)			(.031)		

Note: All *t*s in bold are significant at $p < .05$.

*$p < .06$

Figure 1

Test of Spread-of-Alternatives Mediation Models (Experiment 1)



Note: Unstandardized coefficients. Paths shown are significant, $p < .06$.

Consistent with earlier analyses, Decision predicted participants' memory shift for the ease of, and satisfaction with their initial decisions. Further, the mediation analyses also revealed that the degree of spread in participants' attractiveness ratings predicted their memory shift for the ease of their decisions, and the degree of spread in participants' value ratings predicted their memory shift for their satisfaction with their decisions. However, adding these variables to the regression models did not significantly improve their explanatory power. In order to test whether the effect of the Decision manipulation on participants' memory shift for the ease of their decision was mediated by the attractiveness spread index, we used the procedure for estimating indirect effects in simple mediation models (Preacher & Haynes, 2004). The tests revealed that the indirect effect of Decision was not significant (b = .104, p = .18). It appears that dissonance-induced spread in attractiveness ratings did not mediate the influence of dissonance on participants' distorted memories for the ease of their decisions. Rather, the dissonance induction directly affected participants' memory distortion for the ease of their decision.

Discussion

Using a modification of Brehm's (1956) classic paradigm, we successfully replicated the "spread of alternatives" effect: Participants who made a difficult choice between two equally attractive options exaggerated their attitudes toward those options relative to those who made an easy choice between one attractive option and one less attractive option. That is, they rated their chosen options more favorably and their rejected options less favorably than they had initially. It is generally accepted that dissonance-reduction is the mechanism that drives this effect (see Harmon-Jones & Harmon-Jones, 2007). A difficult decision evokes dissonance by virtue of the fact that one may have made the wrong choice. Dissonance is reduced by exaggerating one's attitudes toward decision options, effectively rationalizing that one has made the correct choice.

The primary purpose of this study, however, was to demonstrate that dissonance reduction could also cause memory distortion. We found support for this possibility. We tested participants' memories for two general aspects of their experimental experience: their initial attitudes toward their decision, and specifications of the decision options from which they chose. We found support for the distorting influence of dissonance on participants' memories for their initial decision experience. As predicted, participants in difficult choice conditions (i.e., dissonance conditions) were more likely than participants in easy choice conditions to misremember their initial decision experience more favorably (i.e., easier, more satisfying) than they had initially rated it. These effects are consistent with memory distortion mechanisms implied by the concept of coherence in the SMS, whereby memories may become distorted via drive for consistency of the working self (e.g., relevant goals, the conceptual self). In the present study, remembering one's decision as more difficult and less satisfying would essentially "re-activate" one's experience of dissonance. Via the memory distortion observed here, this re-activation is averted. Interestingly, the effect of decision difficulty on memory distortion was not mediated by the spread of alternatives indices. Though interpreting null effects is difficult, it is possible that the spread indices were too dissimilar from those assessing memory distortion to detect a mediating relationship. Assessing dissonance-reduction and memory distortion along more closely related dimensions may reveal the predicted mediating relationship.

Memory for phone specifications was assessed via an open-ended questionnaire, to which participants could respond that they were unable to recall a given specification. Particularly given the difficulty of remembering such technical information (Alba, Hutchinson, & Lynch, 1991), we believed it was important to afford participants this option so that any detected effects were more likely to be the result of true memory distortion rather than a statistical artifact

resulting from a leading memory test. Unfortunately, however, the majority of participants indicated they could not recall their decision options' specifications. Our hypothesis tests on these items, as a result, were underpowered. Nevertheless, some results suggest that, with adequate power, the effect of dissonance on memory distortion for phone specifications may be detectable. First, we found a significant (though unstable) effect of dissonance on participants' distorted memories for the number of songs the chosen and rejected phones could store: As predicted, participants in difficult choice conditions misremembered a significantly larger and more favorable spread in the two options' capacity than those in easy choice conditions. Second, exploratory analyses showed that participants in difficult choice conditions were more likely to attempt to recall phone specifications after a delay than those in easy choice conditions. Although on their own these results provide weak support for the overarching hypothesis regarding the effect, together they suggest that dissonance may affect people's memory and metacognitive judgments beyond what we were able to detect with these measures.

Classic psychological research shows that memory weakens as time passes (e.g., Ebbinghaus, 1913). We manipulated the amount of delay between the dissonance reduction and the memory test to examine the extent to which memory strength for the initial decision may moderate the effect of dissonance on memory distortion (cf. Hoffman, 1997). We found no effects of delay on any of the primary decision-experience memory measures. This may reflect characteristic differences between memory for subjective experiences versus memory for facts or details (Kelley & Jacoby, 1990). Memory for facts may be much more strongly influenced by delay than memory for subjective experience. Indeed, participants in this study were much more likely to recall their decision experiences than the facts (i.e., phone specifications) they encountered during the experiment, and were less likely to attempt to recall the facts in the 2-day

delay (vs. immediate) condition. The lack of an interaction effect between delay and decision difficulty may also suggest that the distorting influence of dissonance on memory may not be constrained by memory strength. Like the dissonance effects typically observed, the effect of dissonance on memory distortion may be immediate. Additional research is needed, however, to examine this relationship.

Experiment 1 provided preliminary support for the hypothesis that dissonance reduction can yield memory distortion. However, additional research utilizing different methodology and measures is necessary to confirm that the effect is attributable to generalized dissonance reduction per se, and is not specific to the spread of alternatives paradigm (Meiser, 2011). Additionally, it is possible that the memory distortion we observed may simply reflect a general tendency to look back on one's experiences and decisions favorably, with "rose colored glasses." It is, therefore, necessary to include control memory items that are irrelevant to participants' experimental experiences of dissonance to rule out this possibility. Experiment 2 was designed to address these issues.

CHAPTER 6: EXPERIMENT 2

In Experiment 2, we aimed to replicate the effect of cognitive dissonance on memory distortion, and examine the locus of the effect. Specifically, we aimed to test the prediction that dissonance-induced false memories become distorted in accordance with the dissonance reduction strategy employed. We modeled a traditional induced-compliance paradigm after Gosling et al. (2006) and Harmon-Jones, Gerdjikov, & Harmon-Jones (2008), in which undergraduate participants either chose or were forced to write a counterattitudinal essay (i.e., supporting a tuition increase). Afterward, participants completed a survey that contained items assessing attitudes for the tuition increase and perceived responsibility for writing the counterattitudinal essay. The opportunity to reduce dissonance via attitude change or denial of responsibility was manipulated via a question-order manipulation embedded in a post-essay survey (i.e., attitude items first, or responsibility items first). We then tested participants' memories for their experimental instructions and their initial attitudes (which had been assessed by an online survey two days before the laboratory session).

Hypotheses

Hypothesis 3. The subjective experience of choice in one's actions is a necessary component for the arousal of dissonance (Festinger, 1957). Therefore, we predicted that participants in the High choice condition would experience cognitive dissonance from having chosen to engage in a counterattitudinal behavior (i.e., write an essay against what they believe), whereas those in the Low choice condition would not. People are likely to choose the first mode of dissonance reduction made available to them (Simon et al., 1995) and are unlikely to utilize more than one mode for a particular event (Götz-Marchand, Götz, & Irle, 1974). Thus, we

predicted that participants in the High choice conditions would use the first mode afforded to them.

Hypothesis 3a. Participants in the High choice/Attitude first condition will reduce dissonance via attitude change and will shift their attitudes to be more favorable toward the tuition increase than those in all other conditions (i.e., Choice × Order interactions on attitude-shift measures). Participants in the High choice/Responsibility first condition, however, will not reduce dissonance via attitude shift.

Hypothesis 3b. Participants in the High choice/Responsibility first condition will reduce dissonance via denial of responsibility: They will report less perceived personal responsibility for the counterattitudinal behavior than those in the High choice/Attitude first condition, and comparable perceived personal responsibility to those in the Low choice conditions (i.e., Choice × Order interactions on responsibility measures).

Hypothesis 4a. Participants' memories of their attitudes will be distorted in accordance with the mode of dissonance reduction they used initially (i.e., attitude change or denial of responsibility). Participants in the High choice/Attitude first condition (who will have reduced dissonance via attitude change) will misremember their initial attitudes toward the tuition increase as more favorable than those in all other conditions (i.e., Choice × Order interactions on memory-shift measures).

Hypothesis 4b. Participants in the High choice/Responsibility first condition (who will have reduced dissonance via denial of responsibility) will misremember being presented with the Low choice instructions and signing the Low choice statement more often than those in the High choice/Attitude first condition. Those in the Low choice conditions are not expected to misremember their instruction or the statement they signed.

Method

Participants. One hundred forty-four undergraduates in the introductory psychology participant pool at John Jay College of Criminal Justice were recruited to participate in the current study in exchange for partial course credit. Participants were assigned to one of four conditions in a 2 (Choice: low vs. high) × 2 (Order: Attitude first vs. Responsibility first) between-subjects design using block-randomization. Fifteen participants across the four conditions were eliminated from the dataset because they failed to appear for the laboratory session after completing the initial online attitude survey. Eight participants across the four conditions were eliminated because they refused to write the counterattitudinal essay (or stated that they had written the counterattitudinal essay, but actually did not). The final sample consisted of 121 participants[9] (77.7% female) who ranged from 18 to 57 years of age (M = 20.51, SD = 5.51) and self-reported as Latino (43%), White (15.7%), Black (17.4%), East Asian (6.6%), or another ethnicity (17.3%). The four cell sizes ranged from 27 to 33 participants. Participation took approximately 40 minutes, over an initial online survey and a laboratory session that took place two days later.

Materials.

Pre-study online questionnaire. All participants completed an online questionnaire (via www.psychsurveys.org) regarding their attitudes toward a number of school policies two days before participating in the experimental session. Embedded in this 14-item questionnaire were three target items assessing participants' attitudes toward a tuition increase (i.e., "Tuition should be raised by 10% for the upcoming school year" [Raise item], "A 10% increase in tuition would

[9] Harmon-Jones et al. (2008) reported an average attitude-shift effect of d = .47. Gosling et al. (2006) reported an attitude-shift effect of d = 1.61, and an average denial-of-responsibility effect of d = 2.15. A power analysis using G*Power (Faul, 2012) indicated that a sample of N = 120 would be sufficient to detect d = .45 effects with power = .80 and α = .05.

ultimately benefit me as a John Jay student" [Benefit item], and "A 10% increase in tuition places too much strain on me as a John Jay student" [Strain item]). Participants rated their agreement with each statement on 11-pt. Likert-type scales (1 = strongly disagree, 11 = strongly agree). This questionnaire also contained all demographic items (see Appendix F for the complete survey).

Experimental instructions and Choice manipulation. We modeled the instructions and Choice manipulation after those used by Gosling et al. (2006) and Harmon-Jones et al. (2008). During the laboratory session, the experimenter gave participants an instruction sheet regarding the essay-writing task. This sheet explained that a (fake) college committee sponsors research in the psychology department in exchange for occasional data collection on its behalf – data collection for this committee would comprise the next phase of their study. The instructions stated that the committee was considering a 10% increase in tuition for the next school year and was interested in students' opinions about the matter. Students' opinions were being collected via an essay procedure, having students write persuasive essays containing strong and forceful arguments either for or against the tuition increase. After this information came the Choice manipulation. In the Low choice condition, the instructions said that the participant had been *randomly assigned* to write an essay in favor of the tuition increase. In the High choice condition, the instructions said that the committee had finished collecting essays opposing the tuition increase and was now collecting essays supporting the tuition increase. However, writing an essay supporting a tuition increase was *completely voluntary*. At the bottom of each instruction sheet, participants signed a statement reinforcing the Choice manipulation (see Appendix G for the complete instructions).

Post-essay questionnaire and order manipulation. After writing their essays, students completed a questionnaire assessing students' actual opinions regarding the tuition increase. The survey contained six 11-pt. Likert-type items affording the two modes of dissonance reduction (i.e., attitude change and denial of responsibility: Gosling et al., 2006). In the Attitude first condition, participants first rated their agreement with three items concerning the tuition increase (the same three target items answered in the online survey two days prior), followed by three items concerning their personal responsibility for their actions (i.e., "I feel I had the choice to write arguments in favor of a 10% increase in tuition" [Argument item], "I feel personally responsible for what I have written" [Written item], and "I feel personally responsible for having agreed to participate in this study" [Participate item]). In the Responsibility first condition, the three responsibility items appeared before the three attitude items.

Memory questionnaire. After completing the post-essay questionnaire, participants completed a memory questionnaire. The first 14 items of this questionnaire were exactly the same as the pre-study online questionnaire – participants were instructed to think back to the initial online survey, and answer the items as they did *on the initial questionnaire*. The questionnaire also included three forced-choice items. One item asked which type of essay the participants had written (i.e., supporting or opposing the tuition increase). The remaining two items assessed participants' memory for the instruction they received (i.e., randomly assigned vs. free to choose [Instruction item]) and the statement they signed (i.e., randomly assigned vs. voluntary choice [Statement item]: see Appendix H).

To ensure that any differences on these Instruction and Statement memory items were the product of dissonance-induced memory distortion and not differences in the inherent "memorability" of the high vs. low choice instructions, we conducted a pilot test using an

independent sample of 60 undergraduates. These participants (n = 30 in each group) received the same instruction manipulation as presented above, but were asked to write an essay opposing a tuition increase (i.e., not a counterattitudinal essay). Participants then completed the same memory items. The number of errors participants in each group made for both of the questions was recorded. There was no difference in the number of memory errors between the two groups for either the Instruction item (high choice: 6.67%; low choice: 10%), χ^2 (1, N = 60) = .22, p = .64, or the Statement item (high choice: 6.67%; low choice 13.3%), χ^2 (1, N = 60) = .74, p = .39. These results suggest that the two instructions do not differ in their inherent memorability.

Procedure. Two days prior to their scheduled laboratory sessions, participants were emailed a link to the online questionnaire. Participants then came to the laboratory in small groups of 1 to 6 to complete the study. After collecting consent and verifying that participants had completed the online questionnaire, the experimenter (who was blind to the study's hypotheses) read the first part of the instruction sheet to participants, explaining the purpose of the study and the essay method being employed. The experimenter then gave each participant the instruction sheet, which contained the Choice manipulation, as well as a blank piece of paper on which to write their essays, and a blank envelope in which to place their essays when finished. Participants read their instruction sheet, signed the statement reinforcing the Choice manipulation, wrote their essays, and sealed them in their envelopes.

Afterward, experimenters collected participants' envelopes and gave them the post-essay survey containing the Order manipulation. The experimenter then handed participants the memory survey, and called their attention to the fact that the instructions for the memory survey asked that they recall their attitudes from the online survey. After participants completed the final survey, the experimenter probed for suspicion, gave participants a written debriefing, and

dismissed them. Finally, the experimenter examined participants' essays to verify that they had written the requested essay. Data from participants who did not write the requested essay were discarded.

Results

Denial of responsibility. In Hypothesis 3b, we predicted that participants in the High choice/Responsibility first condition would report less perceived personal responsibility for writing a counterattitudinal essay than those in the High choice/Attitude first condition, and comparable perceived personal responsibility to those in the Low choice conditions. To test this prediction, we conducted a 2 (Choice) × 2 (Order) MANOVA with the three responsibility items (Argument, Written, and Participation items) as dependent variables. The analysis revealed a significant multivariate effect of Choice, Wilks' $\lambda = .894$, F (3, 115) = 4.55, $p = .005$, $\eta^2 = .106$ [.012, .202]. Follow-up univariate analyses revealed significant main effects of Choice on the Argument, F (1, 117) = 5.57, $p = .020$, $\eta^2 = .045$ [.001, .137], and Written items, F (1, 117) = 11.88, $p = .001$, $\eta^2 = .092$ [.017, .200]. Participants in high choice conditions reported experiencing a greater degree of choice when deciding to argue in favor of a tuition increase (M = 6.21, SD = 3.54), and feeling more responsible for what they had written (M = 8.02, SD = 2.78) than those in the low choice conditions (Argument: M = 4.75, SD = 3.39; Written: M = 6.02, SD = 3.47). The univariate effect of Choice on participants' feelings of responsibility for having participated in the study was not significant, F (1, 117) = 1.39, $p = .24$, $\eta^2 = .012$ [.000, .077]. Neither the multivariate effect of Order, Wilks' $\lambda = .959$, F (3, 115) = 1.64, $p = .19$, $\eta^2 = .041$ [.000, .111], nor the predicted multivariate Choice × Order interaction was significant, Wilks' $\lambda = .999$, F (3, 115) = .02, $p = .995$, $\eta^2 = .001$ [.000, .005]. We did not replicate the denial of responsibility effect found by Gosling et al. (2006).

Dissonance effects on memories for initial attitudes. In Hypothesis 4a we predicted that, because they reduced dissonance via attitude shift, participants in the High choice/Attitude first condition would misremember their initial attitudes toward the tuition increase as more favorable than those in all other conditions. To test this hypothesis we computed memory shift indices for each of the three target tuition attitude items (i.e., Raise, Benefit, and Strain items). We subtracted participants' initial attitudes (from the online questionnaire) from participants' memory questionnaire ratings. For the Raise and Benefit shift indices, positive values indicate that participants misremembered their prior attitudes as more favorable toward a tuition increase, whereas negative values indicate that participants misremembered their attitudes as less favorable toward a tuition increase. Because the Strain item was worded in the opposite direction from the other two items, negative values on this index indicate participants misremembered their attitudes in a more favorable direction, whereas positive values indicate participants misremembered their attitudes in a less favorable direction.

We conducted a 2 (Choice) × 2 (Order) MANOVA with the three memory shift indices as dependent variables. The analysis revealed a significant multivariate effect of Choice, Wilks' $\lambda = .913$, F (3, 115) = 3.65, $p = .02$, $\eta^2 = .087$ [.003, .177]. Follow-up univariate analyses revealed significant main effects of Choice on participants' Raise, F (1, 117) = 7.07, $p = .01$, $\eta^2 = .057$ [.004, .153], and Benefit shift indices, F (1, 117) = 8.20, $p = .005$, $\eta^2 = .066$ [.006, .165]. Participants in high choice conditions experienced a greater positive shift in memory for their initial attitudes toward raising tuition ($M = .96$, $SD = 1.73$) and the perceived benefit of a tuition increase ($M = 1.79$, $SD = 2.59$) than those in low choice conditions (Raise: $M = -.31$, $SD = 3.20$; Benefit: $M = .33$, $SD = 3.53$). The univariate effect of Choice on the Strain shift index was not significant, F (1, 117) = .82, $p = .37$, $\eta^2 = .007$ [.000, .065]. Neither the multivariate effect of

Order, Wilks' λ = .991, F (3, 115) = .36, p = .78, η^2 = .009 [.000, .043], nor the predicted multivariate Choice × Order interaction were significant, Wilks' λ = .994, F (3, 115) = .25, p = .86, η^2 = .007 [.000, .033].

We also computed memory shift indices for the 11 filler items contained on the initial and memory questionnaires to examine if participants' memory distortion for their initial attitudes was confined to the target attitudes regarding a tuition increase (i.e., dissonance-related items), or generalized to greater satisfaction with school policies in general. We subtracted students' initial attitude ratings from their memories of their responses and analyzed them using a 2 (Choice) × 2 (Order) MANOVA. This analysis, however, failed to yield any significant multivariate effects, Fs (11, 107) < 1.7, ps > .09.

Dissonance effects on memories for experimental experience. In Hypothesis 4b we predicted that participants in the High choice/Responsibility first condition would misremember being presented with the Low choice instructions and signing the Low choice statement more often than those in the High choice/Attitude first condition. We coded participants' responses to the two forced-choice memory items (Instruction and Statement items) as either correct or incorrect and then entered these variables into separate hierarchical loglinear analyses with the Choice and Order variables. Ill-fitting paths were removed in a stepwise backward elimination procedure to arrive at the simplest model that adequately fit the data

The first hierarchical loglinear analysis on the Instruction memory variable yielded one significant path, with good model fit, Likelihood ratio χ^2 (6, N = 121) = .46, p = .98. A Choice × Instruction interaction showed that participants in the high choice condition (40.4%) were significantly more likely to misremember which instruction they were given than participants in the low choice condition (6.3%), χ^2 (1, N = 121) = 20.23, p < .001, ϕ = .41 [.249, .547]. A second

hierarchical loglinear analysis on the Statement memory variable yielded one significant path, with good model fit, Likelihood ratio χ^2 (6, N = 121) = 1.38, p = .97. Participants were more likely to accurately remember (86%) than misremember (14%) the statement they signed, irrespective of the experimental manipulations.

Mediation analyses. In Hypothesis 3a we predicted that participants in the High choice/Attitude first condition would reduce dissonance via attitude change and would shift their attitudes to be more favorable toward the tuition increase than those in all other conditions (i.e., Choice × Order interactions on attitude-shift measures). To examine this hypothesis we computed shift indices for each of three target tuition items (Raise, Benefit, and Strain items) to measure the amount and direction of attitude shift toward a tuition increase as a function of the manipulated variables: We subtracted participants' initial attitudes (from the online questionnaire) from their post-essay questionnaire ratings. For the Raise and Benefit shift indices, positive values indicate a shift in attitudes to be more favorable toward the tuition increase, whereas negative values indicate a shift in attitudes to be less favorable toward the tuition increase. Because the Strain item was worded in the opposite direction from the other two items, negative values on this index indicate a shift of attitudes in a more favorable direction, whereas positive values indicate a shift of attitudes in a less favorable direction.

We then conducted a series of hierarchical regression analyses to examine whether dissonance-induced attitude shift mediated the effect of dissonance on memory distortion for initial attitudes. First, the three attitude shift indices from the test of Hypothesis 3a were regressed on the Choice (0 = low, 1 = high) and Order (0 = responsibility first, 1 = attitude first) manipulations, and their residualized interaction term (see Cohen, 1978; Lance, 1988). Then, in Block 1 of a separate set of regression analyses, the three memory distortion indices from the test

of Hypothesis 4a were regressed on the manipulations and their residualized interaction term. In Block 2, the three attitude-shift indices were added to the model as predictors. These analyses are summarized in Table 3, and Figure 2 displays a model containing all significant paths.

Choice significantly predicted participants' attitude shift on two of the three indices (Raise and Benefit). Participants who were led to believe they chose to write the counter-attitudinal essay shifted their attitudes to be more favorable toward a tuition increase than those who were forced to write the essay. Choice did not significantly predict scores on the Strain index, possibly because some participants may have failed to notice that it was worded in the opposite direction. The Choice × Order interaction term did not significantly predict any attitude-shift indices. Overall, the results of tests of Hypothesis 3a and 3b suggest that our dissonance manipulation was successful. However, it appears participants in high choice conditions reduced dissonance via attitude shift regardless of the Order manipulation.

Consistent with previous analyses, Choice significantly predicted participants' degree of memory shift for their initial attitudes: Participants in high choice conditions (i.e., dissonance conditions) were more likely to misremember their attitudes as being more favorable toward a tuition increase on two of the three indices (Raise and Benefit) than participants in low choice conditions. The analyses also indicated that participants' memory shift was significantly predicted by the corresponding attitude shift items, and the inclusion of these variables significantly improved the explanatory power of each model. Additionally, the effects of the Choice manipulation on the memory indices were reduced to nonsignificance when these variables were included, suggesting that they mediate the effect of Choice on memory distortion.

Table 2

Hierarchical Regression Mediator Analyses for the Prediction of Distorted Memories for Initial Attitudes (Experiment 2)

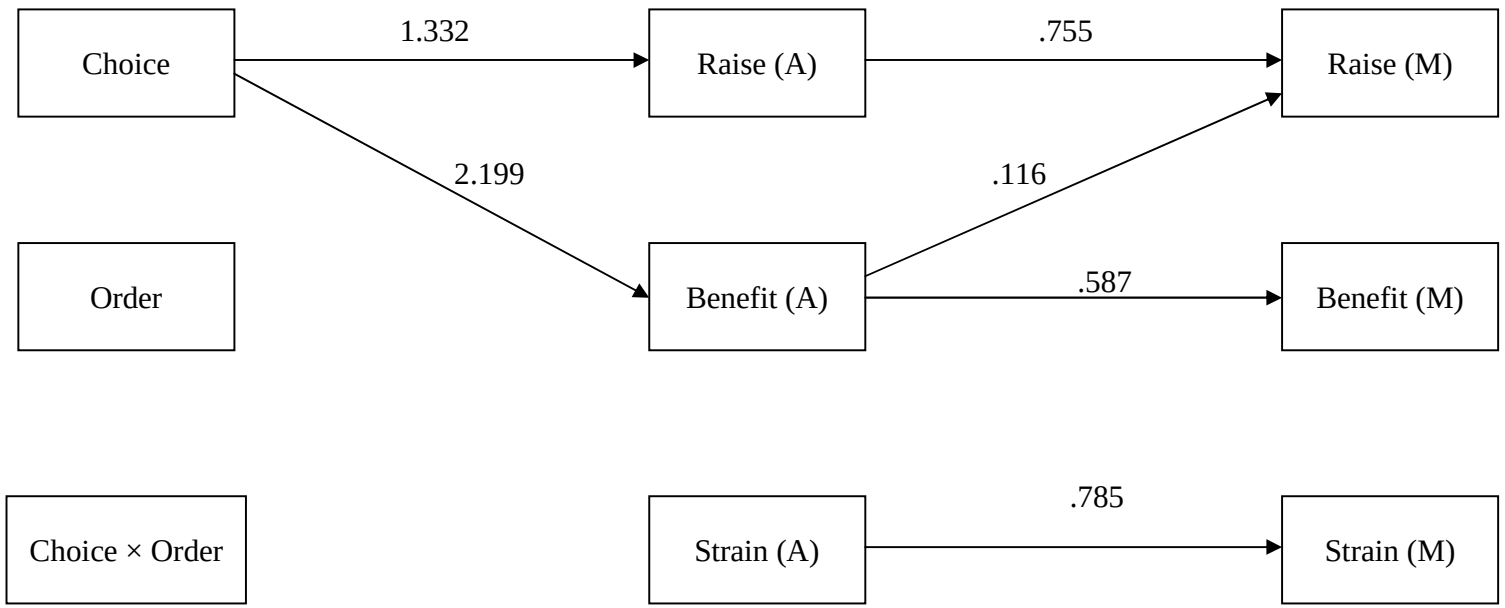
	Raise (M)			Benefit (M)			Strain (M)		
Predictor	Beta	*t*	*df*	Beta	*t*	*df*	Beta	*t*	*df*
Choice manipulation	.240	**2.69**	117	.256	**2.88**	117	-.086	-.93	117
Order manipulation	.085	.95	117	.084	.94	117	.021	.22	117
Choice × Order	-.056	-.62	117	-.025	-.28	117	.050	.55	117
(Block 1, R^2 change)	(.067*)			(.073*)			(.01)		
Choice manipulation	.004	.08	114	-.004	-.06	114	-.074	1.22	114
Order manipulation	.022	.51	114	.067	1.15	114	.037	.65	114
Choice × Order	.006	.13	114	-.030	-.52	114	.006	.10	114
Raise (A)	.785	**14.02**	114	.124	1.67	114	.120	1.63	114
Benefit (A)	.148	**2.59**	114	.700	**9.19**	114	.104	1.38	114
Strain (A)	-.002	-.05	114	-.048	.81	114	.763	**13.14**	114
(Block 2, R^2 change)	(.718*)			(.546*)			(.615*)		

Note: All *t*s in bold are significant at $p < .05$. A = attitude shift index, M = memory shift index

*$p < .05$

Figure 2

Test of Attitude-shift Mediation Models (Experiment 2)



Note: Unstandardized coefficients. Paths shown are significant, $p < .05$. A = attitude shift index, M = memory shift index.

In order to directly test these mediator relationships, we used the procedure for estimating indirect effects in simple and multiple mediation models (Preacher & Haynes, 2004, 2008). These analyses revealed that the indirect effects of Choice on the Raise memory shift index viathe Raise and Benefit attitude shift indices were both significant (*p*s < .008), whereas the direct effect controlling for these mediators was not significant (*b* = .019, *p* = .94). Similarly, the analysis revealed that the indirect effect of Choice on the Benefit memory shift index via the Benefit attitude shift index was significant (*p* = .001), whereas the direct effect controlling for this mediator was not significant (*b* = .039, *p* = .91). Contrary to Experiment 1, the results of Experiment 2 suggest that dissonance-induced attitude change mediates the effect of dissonance on memory distortion.

Discussion

The goal of Experiment 2 was to establish the generality of the empirical link between dissonance and memory distortion found in Experiment 1, and investigate the locus of the effect by examining two distinct modes of dissonance reduction. Consistent with classic dissonance research, we found that participants who were led to believe they chose to write an essay supporting a tuition increase (i.e., a counterattitudinal essay) shifted their attitudes to be more favorable toward a tuition increase than those who were forced to write the essay. It is generally accepted that dissonance-reduction is the mechanism that drives this attitude shift (see Harmon-Jones & Harmon-Jones, 2007). The knowledge that one "says one thing but does another" arouses dissonance. Shifting attitudes to be more consistent with one's behavior effectively reduces this dissonance. However, we failed to replicate the denial of responsibility route to dissonance reduction found by Gosling et al. (2006): Participants in high choice (i.e., dissonance) conditions utilized the attitude-shift mode of dissonance reduction regardless of Order condition.

The denial of responsibility mode of dissonance reduction may not be as robust as that of attitude change.

We replicated the distorting effect of dissonance on memory for initial attitudes. Participants in high choice conditions misremembered their initial attitudes as being more favorable toward a tuition increase (on two of the three critical items) than participants in low choice conditions. These results from Experiment 2 expand on the previous results in two ways. First, we found that dissonance-induced memory distortion was confined to those attitude items relevant to their experimental experience (i.e., writing a counterattitudinal essay supporting a tuition increase). Participants in high choice conditions misremembered their initial attitudes for the critical tuition items, but none of the other school policy items. This suggests that the memory distortion observed in these experiments is, in fact, due to dissonance reduction, and not simply a tendency to look back fondly on one's decisions and behaviors. Second, by assessing dissonance reduction on dimensions comparable to those assessing memory distortion, we found that dissonance-induced memory distortion is mediated by participants' dissonance-induced attitude shift. These results suggest that participants' distorted memories are informed by their dissonance-reduced attitudes.

We expected the mode by which participants reduced dissonance to influence the nature of their distorted memories. Specifically, we expected that those who shifted their attitudes would misremember their initial attitudes, and those who denied responsibility would misremember the experimental instruction as leaving them less choice to engage in the counterattitudinal behavior than they were actually given. Because we were unable to replicate the denial of responsibility mode of dissonance reduction, we could not cleanly test this prediction. However, one finding suggests that dissonance-induced memory distortion may not

be wholly confined by the mode of dissonance reduction employed. Participants in high choice conditions tended to reduce dissonance via attitude shift, but in addition to reporting distorted memories for their initial attitudes, they were far more likely to misremember their experimental instruction than those in low choice conditions (an effect that was only expected among those who reduced dissonance via denial of responsibility). It is unclear why this effect emerged for the Instruction item and not the Statement item. Overall, however, this effect may suggest that dissonance reduction can distort memories for numerous aspects that are relevant to one's initial dissonance experience. Additional research employing successful manipulations of numerous modes to dissonance reduction in the same paradigm is needed to further examine this possibility.

CHAPTER 7: GENERAL DISCUSSION

The results of the present studies supported one general hypothesis derived from an integration of Conway's (2005) SMS and Festinger's (1957) cognitive dissonance theory, namely that cognitive dissonance reduction can yield memory distortion. According to the SMS, encoding and retrieval processes are controlled by the working self, a concept that is driven by a need for coherence among goal- and self-relevant information. Because the real world is messy, however, the working self routinely shapes and distorts memorial information in accordance with its need for coherence (Conway et al., 2004). This need for coherence in the SMS is tantamount to the need for cognitive consistency among cognitions posited in dissonance theory. As a result, the same inconsistency that yields dissonance reduction in Festinger's model could yield memory distortion in the SMS. The primary contribution of the present studies is that they are the first to demonstrate an empirical link between cognitive dissonance and memory distortion. From this perspective, the memory distortion observed in the present studies occurred because the drive for consistency that caused participants' dissonance reduction (i.e., spread of alternatives in Experiment 1, attitude shift in Experiment 2) also distorted dissonance-relevant memorial information (i.e., experience of the initial decision in Experiment 1, initial attitudes and experimental instructions in Experiment 2).

Alternative Explanations for Dissonance Effects

Cognitive dissonance theory is one of the oldest and most influential theories in social psychology (Harmon-Jones et al., 2009). However, numerous alternative theoretical interpretations of dissonance effects have appeared over the decades. For example, Bem (1965) posited in his self-perception theory that what appeared to be dissonance-induced attitude changes were actually the product of non-motivational, cognitive forces. He argued that it was

not aversive anxiety or discomfort that produced attitude change, but merely the recognition that one's behavior reflects one's *true* attitudes: "I chose to write an essay favoring a tuition increase, so I must actually have a positive attitude toward a tuition increase." Tedeschi, Schlenker, and Bonoma (1971) argued that what were regarded as dissonance-induced phenomena were really the product of impression-management concerns. That is, attitude-shift or effort justification effects merely reflect people's desire to maintain positive images among their social audience (e.g., the experimenter), rather than a drive to reduce aversive arousal. To the extent that alternative explanations account for primary dissonance phenomena, secondary effects on memory distortion cannot be considered the product of dissonance processes.

Research directly testing these alternative explanations has generally yielded results favorable to the original dissonance theory (see Harmon-Jones, 2000b). Typical dissonance manipulations and their resulting behaviors influence participants' affective states: Negative affect increases during the manipulation of dissonance and decreases after self-reported attitude change occurs (e.g., Elliot & Devine, 1994, Harmon-Jones, 2000c). The motivational nature of dissonance arousal and reduction has been recently confirmed in tests of the action-based model of dissonance (e.g., C. Harmon-Jones et al., 2011; E. Harmon-Jones et al., 2009). Contrary to Bem's (1965), Tedeschi et al.'s (1971), and others' alternative explanations, overall the literature suggests that dissonance (i.e., aversive arousal-induced, motivated, self-focused cognition) does indeed underlie these effects. Therefore, although we did not include all the necessary control conditions and items to rule out these alternative explanations in our experiments, we are confident that cognitive dissonance is the mechanism that is driving the observed effects.

Limitations

Although successful in demonstrating that dissonance can yield memory distortion, our experiments did suffer some limitations. In Experiment 1, we opted to have participants choose from among smart phones because we believed they would be of greater value and more familiar to our participant pool than small kitchen and office products (as used in the original study: Brehm, 1956). Additionally, using a single class of product enabled us to assess memory spread for both options' characteristics using common metrics (e.g., minutes of battery life, processor speed). However, such specifications are difficult to remember (Alba et al., 1991) and the tests of dissonance effects on memory distortion for these specifications were stymied by small sample sizes. As suggested above, it is possible that a larger sample size would have enabled us to detect this effect. Future researchers should take care to assess dissonance-induced memory distortion using items that yield responses from most or all of participants, while protecting against test-induced artifacts in responding (e.g., acquiescence, lowered response criteria).

One of the goals of Experiment 2 was to examine how the mode of dissonance reduction might influence the types of memories that become distorted. However, participants did not use the denial of responsibility mode of dissonance reduction that was afforded to them and, as a result, we could not cleanly examine the locus of dissonance effects on memory. The denial of responsibility mode of dissonance reduction is relatively young in the literature (Gosling et al., 2006) and may not be as robust as some of the other modes (e.g., effort justification, trivialization). Future research should pit more "established" and robust modes of dissonance reduction against each other and assess memories along mode-specific dimensions to more strongly test this possibility.

Directions for Future Research

The present studies have rather clearly demonstrated that cognitive dissonance can yield memory distortion in certain circumstances. This contribution, however, is merely the first step in what can become a very large body of literature. Several follow-up issues deserve research attention.

Replication. First and foremost, research attention should be devoted toward establishing that the current findings are valid, robust, and generalizable. Conceptual replications of these effects using other established dissonance paradigms (e.g., effort justification: Aronson & Mills, 1959) and associated memory tests would further demonstrate our findings reflect a general effect of dissonance on memory, and are not specific to the paradigms we used (Meiser, 2011). Additionally, it is important that direct replications of the present studies be conducted. Whereas inconsistent results from conceptual replications could be attributed to myriad differences in content, procedure, and measures, evidence from direct replications of the present results will speak to whether our effects are robust and valid (see Paschler & Harris, 2012).

Mechanism of memory distortion. The SMS allows for two potential routes to memory distortion: The working self's drive coherence could encode salient but distorted, dissonance-reduced interpretations at the time of a particular experience, or the drive for coherence could distort memorial information at retrieval. Although the present studies were not designed to address this issue, some evidence from Experiment 2 supports the latter route. The effect of Choice on memory distortion indices (Raise and Benefit) was completely mediated by participants' degree of attitude shift on the corresponding indices. Additionally, the memory index that Choice did not affect (Strain) was similarly and strongly predicted by participants' attitude shift on the corresponding index. These results may suggest that participants used their

current attitudes to inform their memories of how they had initially responded to the survey, two days prior. Dissonance caused a shift in participants' attitudes (on two of the indices), which were then used in the same way as their "un-shifted" attitudes to construct memories. This mechanism seems consistent with how memories are typically constructed (i.e., guided by schema and expectations: Davis & Loftus, 2009), though additional research directly testing these mechanisms is necessary.

The task of discerning which mechanism accounts for dissonance-induced memory distortion appears to be an introspective task, one that behavioral measures might be unlikely to adequately assess. However, a neuropsychological approach may prove fruitful (Amodio & Harmon-Jones, 2012). The action-based model of dissonance relates dissonance arousal and reduction processes to those of conflict monitoring and resolution, processes that are associated with activation in specific areas of the brain (Harmon-Jones, 2004). As predicted by the model, Amodio et al. (2004) and van Veen et al. (2007) found that dissonance arousal was associated with activation in the anterior cingulate cortex. Although no published research has directly examined it, the model predicts that dissonance reduction should be associated with activation in left prefrontal cortex (see Amodio et al., 2007). By this reasoning, the differential activation of these two brain areas during encoding (i.e., during dissonance reduction) and at retrieval may indicate which mechanism underlies dissonance-induced memory distortion. One should observe activation in the anterior cingulate cortex during the arousal of dissonance, followed by activation in the left prefrontal cortex when dissonance has been reduced. If distortion occurs at encoding, these areas should not be activated at retrieval, because the retrieved memories would no longer be dissonant, and should not activate the conflict monitoring and resolution areas of the brain. If memory distortion occurs at retrieval, however, both of these areas of the brain

should show activation, as the relevant informational components would re-activate dissonance and require resolution. The addition of a memory phase to the methods employed by Amodio et al. (2004) or Harmon-Jones et al. (2008) may be useful in investigating these issues.

Moderators of the effect of dissonance on memory distortion. It is possible that situational variables determine the extent to which dissonance can yield memory distortion. Conway et al. (2004) proposed the notion of adaptive coherence for the SMS: There is an optimal level of retention for each experience that maximizes the reliance on coherence vs. correspondence and, consequently, fitness and survival. That is, the degree to which an individual seeks to maintain an accurate and detailed cognitive representation of an event differs according to the relevance and importance of the event (e.g., how relevant it is to overarching goals or the conceptual self). It is possible that situations that require greater detail (perhaps those that are more closely related to goals) may be likely to be driven more by issues of correspondence. As a result, these memories may be relatively immune to dissonance-induced distortion. Conversely, situations that require less detail (perhaps those that are more closely related to the conceptual self) may be more likely to be driven by issues of coherence: Memories for dissonance-inducing events in domains relevant to the self-concept, then, may be relatively more likely to produce false memories than those in goal-relevant domains.

People largely consider their own actions to be a reflection of who they are (see Stone & Cooper, 2001). Therefore, a particular event may simultaneously be goal- and self-relevant. It is likely, then, that the same events can be considered from either a goal- or self-relevant mindset (cf. approach- vs. avoidance-mindset in dissonance reduction: C. Harmon-Jones et al., 2011). For example, one can think about an event (e.g., choosing which college to go to) from the perspective of goal-relevant demands at the time of that situation (e.g., financial aid, cost of

living), or one can consider the same event in light of post-decision, self-relevant factors (e.g., experiences at one's chosen school, current career trajectory). The mindset in which one considers the initial event will likely influence the memories one constructs for that event (e.g., retrospective judgments of how pleased one was with the decision at the time). Manipulation of this mindset in the context of studies similar to ours may moderate whether dissonance-induced memory distortion occurs. Indeed, this may be one reason that we were able to detect such strong dissonance effects on memory for attitudes in Experiments 1 and 2, but had difficulty detecting distorting effects of dissonance on memories for phone specifications in Experiment 1. Attitudes may be more closely aligned to a self-relevant mindset, whereas characteristics of decision options may be more closely related to a goal-directed mindset.

Theoretical integration. The notion that dissonance may distort memories is not new. Psychologists have speculated about the possibility for decades (e.g., Bem & McConnell 1970; Neumann & Baumeister, 1996). Though others have investigated closely related effects (e.g., Goethals & Reckman, 1973; McIntyre et al., 2004; Frye, Lord, & Brady, 2012; Sharot, Fleming, Yu, Koster, & Dolan, 2012), our studies represent the first attempt to directly and empirically demonstrate that the two phenomena are linked. One reason that this issue, though talked about, has never been investigated may be the lack of an integrated theoretical perspective on motivated social cognition and memory. The present studies were guided by an integration of two unrelated models that appeared to be based on identical driving forces (i.e., coherence in the SMS, and cognitive consistency in dissonance theory). Though our results are merely a starting point, they suggest that, with additional research identifying the locus and boundaries of the effect of dissonance on memory distortion, a theoretical integration of memory and motivated cognition may be appropriate. Such a model would likely be useful in organizing what we know about

related motivational processes, as well as providing testable hypotheses to guide the development of future research.

Conclusion

The current experiments have established an empirical link between cognitive dissonance and memory distortion. Additionally, our integrated perspective of the SMS and dissonance theory has produced numerous testable hypotheses to guide follow-up empirical research and theory construction. Although the results reported here cannot directly speak to the mechanisms that accounted for Paul Ingram's memory distortion, nor the false memories and confessions that resulted in dozens of wrongful convictions, they may form the basis for the development of a theoretical model of memory and motivated social cognition that may eventually account for the human capacity to develop rich false memories to reconcile cognitive inconsistencies.

Appendix A

Example Product Profile

MARKETING SOLUTIONS INTERNATIONAL

Product Profile
PHONE A

Specifications:	**Typical Range:**
- 10 megapixel front camera (with flash)	1.3 – 10.2 Mpx
- Supports 24 languages	12 – 25 languages
- Up to 630 min of battery life (during regular usage)	270 – 630 min
- Holds up to 4500 songs	1500 – 5000 songs
- Holds approximately 148 apps	75 – 148 apps
- 1.5 GHz processor	.4 – 1.5 GHz
- Micro SD card compatible	
- 4G connectivity/download speeds	
- Tools: Calendar, Calculator, Flashlight, Contacts Back-up Assistant	
- Features: GPS, Bluetooth, Mobile Hotspot, Sync capable	

How would you rate the overall *quality* of this cell phone?

Very low quality	1	2	3	4	5	6	7	8	9	Very high quality

How would you rate the overall *value* of this cell phone?

Very low value	1	2	3	4	5	6	7	8	9	Very high value

How *attractive* is this cell phone?

Not at all attractive	1	2	3	4	5	6	7	8	9	Very attractive

How *desirable* is this cell phone?

Not at all desirable	1	2	3	4	5	6	7	8	9	Very desirable

Appendix B

Cell Phone Use Survey

MARKETING SOLUTIONS INTERNATIONAL

DEMOGRAPHICS AND CELL PHONE USE SURVEY

Please help us understand you better by answering a few questions…

Sex: _____ Male _____ Female

Age: _____ years

Year in School: _____ First year

_____ Second year

_____ Third year

_____ Fourth year

_____ Fifth year or beyond

Ethnicity: _____ East Asian

_____ Black/African-American

_____ Hispanic/Latino/a

_____ Middle-eastern

_____ South Asian

_____ White/Caucasian

_____ Other Please specify: _____

Do you have children? _____ Yes _____ No

If so, how many? _____

Do you currently own a cell phone(s)? _____ Yes _____ No

If not, do you share one with a friend or family member? _____ Yes _____ No

If so, how many do you own? _____

If you do not own or use a cell phone, please skip to page XX

CELL PHONE USE

Please list the Brand and Model (if known) of each cell phone you use:

_____

_____

_____

Approximately how many minutes a month do you spend using your cell phone to make phone calls?_____ hrs.

Approximately how many text messages do you send each day? _____ text messages

For the rest of this questionnaire, please answer the questions with regard to the cell phone you use MOST FREQUENTLY

What features does your phone have? (check all that apply)

_____ Camera

_____ Voice/Sound Recorder

_____ GPS/Navigation

_____ Games

_____ Music Player

_____ Global Calling

_____ Wi-Fi

_____ Touch Screen

_____ Contacts Back-up Service

_____ Video

_____ HTML Web Browser

_____ Social Networking Access

_____ Mobile Hotspot

_____ Email/Mobile Email

_____ Removable Memory

_____ Mobile Instant Messaging

_____ QWERTY Keyboard

_____ Bluetooth

For what purposes to you typically use your cell phone? (check all that apply)

_____ Entertainment

_____ Keeping in touch with friends/family

_____ Shopping/Ordering Products

_____ Long-distance calling

_____ Required for job (e.g., delivery)

_____ Other (please specify below)

_____

_____

_____

Please rate how often you use your cell phone to… (please circle one for each item)

	Almost never	Infrequently	Sometimes	Frequently	All the time
Check email	1	2	3	4	5
Take pictures	1	2	3	4	5
Take video	1	2	3	4	5
Browse the web	1	2	3	4	5
Download music	1	2	3	4	5
Download applications	1	2	3	4	5
Get directions	1	2	3	4	5
Stream videos/music	1	2	3	4	5
Play games	1	2	3	4	5
Use social networking services	1	2	3	4	5
Send instant messages	1	2	3	4	5
Electronic banking	1	2	3	4	5

How satisfied are you with your current cell phone? (please circle one)

Very unsatisfied	1	2	3	4	5	6	7	8	9	Very satisfied

What do you wish was better about your cell phone?

_____

_____

_____

Do you plan on purchasing a cell phone in the near future? _____ Yes _____ No

If so, what Brand(s), Model(s), if known? _____

_____

_____

CELL PHONE SERVICE

Who is/are your cell phone service provider(s)? (check all that apply)

_____ AT&T

_____ Boost Mobile

_____ Cricket

_____ Sprint

_____ T-Mobile

_____ Verizon

_____ Other (please specify below)

_____

_____

_____

Which type of cell phone plan(s) do you currently have? (check all that apply)

_____ Single line (contract)

_____ Prepaid (no contract)

_____ Family plan/multiple lines (contract)

_____ Other (please specify below)

_____

_____

_____

Do you have a data plan for your cell phone? _____ Yes _____ No

Approximately how much does your cell phone cost per month? (check one for each phone)

_____ less than $10

_____ $11 – $30

_____ $31 – $50

_____ $51 – $70

_____ $71 – $90

_____ more than $90

How satisfied are you with your current cell phone service? (please circle one)

Very unsatisfied	1	2	3	4	5	6	7	8	9	Very satisfied

What do you wish was better about your cell phone service?

_____

_____

_____

GENERAL QUESTIONS

Approximately how many hours per week do you spend…

watching TV? _____ hrs.

reading newspapers/magazines? _____ hrs.

listening to the radio? _____ hrs.

on the Internet? _____ hrs.

Where do you typically see the most cell phone advertisements?

_____ TV

_____ Radio

_____ Billboards

_____ Internet

_____ Newspaper/magazines

_____ Bus/subway/train

_____ Other (please specify below)

_____

What *three* things would you consider most important when purchasing a cell phone? (please mark with a 1, 2, and 3)

_____ Reception

_____ Ease of Use/Display

_____ Memory Storage Availability

_____ Connectivity (e.g., Bluetooth)

_____ Price

_____ Battery Life

_____ Durability

_____ Appearance/Color

_____ Performance (e.g., Speed)

_____ Music Capabilities

_____ Camera Capabilities

_____ Video Capabilities

_____ Gaming Capabilities

_____ Other (please specify below)

_____

_____

How knowledgeable would you say you are about cell phones?

Not very knowledgeable	1	2	3	4	5	6	7	8	9	Very knowledgeable

Appendix C

Example Consumer Review

MS
MARKETING SOLUTIONS
INTERNATIONAL

Consumer Review
PHONE A

"Overall, [Phone A] is a good phone. It's very easy to use and fits nicely in my hand **(+)***. It's a little awkward to hold up to my head when actually making phone calls, though **(–)**. The battery life is actually much longer than advertized most of the time when I'm using it to make calls or send text messages **(+)**, but it goes down a lot when using apps or browsing the web **(–)**. It has some trouble accessing web pages with a lot of pictures or Flash-based pages – it just takes a bit longer than I'd like **(–)**. For other websites with a mobile version, it's lightning fast **(+)**."

From this consumer review, what strikes you as particularly good about this phone?

_____

_____

_____

_____

_____

From this consumer review, what strikes you as particularly bad about this phone?

_____

_____

_____

_____

_____

*(+) denotes a positive sentence; (–) denotes a negative sentence. These symbols were omitted from the experimental materials.

Appendix D

Example Post-review Rating Form

MARKETING SOLUTIONS INTERNATIONAL

Post-Review Rating
PHONE A

How would you rate the overall *quality* of this cell phone?

Very low quality	1	2	3	4	5	6	7	8	9	Very high quality

How would you rate the overall *value* of this cell phone?

Very low value	1	2	3	4	5	6	7	8	9	Very high value

How *attractive* is this cell phone?

Not at all attractive	1	2	3	4	5	6	7	8	9	Very attractive

How *desirable* is this cell phone?

Not at all desirable	1	2	3	4	5	6	7	8	9	Very desirable

Appendix E

Example Memory Form

MARKETING SOLUTIONS INTERNATIONAL

Phone Specification Memory Form
PHONE A

Specification	Typical Range	Response	Can't Recall
Megapixels for *main* camera	1.3 – 10.2 Mpx	_____Mpx	_____
*Megapixels for *front* camera	1.3 – 10.2 Mpx	_____Mpx	_____
Languages supported	12 – 25	_____	_____
Minutes of battery life (*regular* usage)	270 – 630 min	_____ Min	_____
*Minutes of battery life (*web browsing*)	200 – 560 min	_____ Min	_____
Average number of songs stored	1500 – 5000	_____	_____
Average number of applications stored	75 – 148	_____	_____
*Usable memory	16 – 64 GB	_____ GB	_____
Processor speed	.4 – 1.5 GHz	_____ GHz	_____
*Maximum download speed	486 – 3505 Kbps	_____Kbps	_____
* Maximum microSD card size	1 – 128 GB	_____ GB	_____

* denotes items specifications that were not included on the Product Profile.

Appendix F

Pre-study Online Questionnaire

Sex: _____ Male _____ Female

Age: _____ years

Year in School: _____ First year

_____ Second year

_____ Third year

_____ Fourth year

_____ Fifth year or beyond

Ethnicity: _____ East Asian

_____ Black/African-American

_____ Hispanic/Latino/a

_____ Middle-eastern

_____ South Asian

_____ White/Caucasian

_____ Other

INSTRUCTIONS: Please rate your agreement with the following statements using the provided scales.

1. Students should be required to register for 12 or more credit hours to be considered full-time students.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

2. Students' lab/technology fees are determined fairly.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

3. I benefit from the lab/technology fees.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

4. Campus security is effective at minimizing crime at John Jay.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

5. The new building is a worthwhile investment.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

6. The new building will benefit me as a John Jay student.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

7. Tuition should be raised by 10% for the upcoming school year.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

8. A 10% increase in tuition would ultimately benefit me as a John Jay student.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

9. A 10% increase in tuition places too much strain on me as a John Jay student.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

10. John Jay's disciplinary procedures for academic dishonesty are fair.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

11. Students should be allowed to take reference books outside of the library.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

12. Items sold in the cafeteria are priced fairly.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

13. John Jay facilities are kept clean.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

14. Overall, I am satisfied with my experience as a John Jay student.

1	2	3	4	5	6	7	8	9	10	11
Strongly disagree										Strongly agree

Appendix G

Instructions and Choice Manipulation

Attitudes About School Policies

Today you will be participating in a study for the Priorities Committee, an organization that oversees, evaluates, and implements various school policies at John Jay College. The Priorities Committee sponsors research in the psychology department at John Jay and, in exchange for these funds, the Priorities Committee occasionally asks the department to collect data for it (e.g., conduct surveys).

The Priorities Committee is currently considering changing several college policies. One policy they are considering is *increasing tuition by 10% for the upcoming academic year*, and they are interested in assessing students' opinions about the issue. Students' opinions are being collected by using an essay technique, which involves having individual students write essays containing strong and forceful arguments in support of one side of the issue (i.e., either for the tuition increase, or against it). These essays will be sent to the Priorities Committee, who will consider students' opinions before making the decision about increasing tuition for the upcoming academic year.

[Low Choice] Instructions:

The Priorities Committee has finished collecting students' arguments against the tuition increase and is now ready to collect arguments *in favor of* the tuition increase. In order to finish the study and provide the committee with their data, participants are being **randomly assigned** to write that tuition *should* be increased for the upcoming academic year.

Please write a short statement saying why tuition should be increased by 10% for the upcoming academic year. After you have written your statement, place it in the enclosed envelope and seal it. The experimenter will collect your sealed envelope and deliver it to the Priorities Committee.

Please read and sign the following statement to continue your participation in this study.

I understand that I have been randomly assigned to write a statement arguing in favor of a 10% tuition increase for the upcoming academic year.

Signature: _____ Date: _____

[High Choice] Instructions:

The Priorities Committee has finished collecting students' arguments against the tuition increase and is now ready to collect arguments *in favor of* the tuition increase. Writing a statement in favor of the tuition increase is your choice, and **completely voluntary**.

Please write a short statement saying why tuition should be increased by 10% for the upcoming academic year. After you have written your statement, place it in the enclosed envelope and seal it. The experimenter will collect your sealed envelope and deliver it to the Priorities Committee.

Please read and sign the following statement to continue your participation in this study.

I understand that I have voluntarily chosen to write a statement arguing in favor of a 10% tuition increase for the upcoming academic year.

Signature: _____ Date: _____

Appendix H

Forced Choice Memory Items

Think back to when the experimenter told you about the essay portion of this study.

Which type of essay did you write? (Circle one)

Essay supporting a tuition increase Essay opposing a tuition increase

What instructions were you given regarding which essay you wrote? (Circle one)

The instructions said I was randomly assigned to write this type of essay The instructions said I was free to choose to write this type of essay

What did the statement you signed say regarding the essay you wrote? (Circle one)

The statement said I was randomly assigned to write this type of essay The statement said I voluntarily chose to write this type of essay

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