THE CONTINUED MARCH TOWARDS ECOLOGICAL VALIDITY IN LABORATORY STUDIES OF BLOCKED AND RECOVERED MEMORIES

A Dissertation

by

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ABSTRACT

The debate over the existence of recovered memories remains a divisive issue for mental health practitioners and cognitive scientists, in part due to a limited understanding of the processes underlying motivated forgetting behaviors. The present study argues motivated forgetting is best understood in the context of normal memory processes. For instance, previous studies utilizing a retrieval-biasing procedure, referred to as the dropout procedure, have shown that practiced avoidance activities can create profound memory blocks for lists of words and short stories. Experiment 1 addressed whether these forgetting effects extend to memories with greater personal significance, such as autobiographical memories. In Experiment 1 participants studied descriptions of target and non-target autobiographical events. Non-target memory descriptions were then re-presented several times during the practiced avoidance phase of the experiment. In contrast, target memory descriptions were "dropped out" of the study list and did not receive extra study exposures. On a subsequent memory test, significant memory deficits were observed for target memory descriptions when performance was compared to a control condition that did not participate in the practiced avoidance phase. These results provided evidence that emotionally-laden autobiographical memories are susceptible to memory blocks, and further support the theoretical contention that practiced avoidance could be used to regulate unwanted memories.

The present study also examined how and under what circumstances forgetting effects following the dropout procedure occur. Experiments 2 and 3 report dissociable

effects of avoidance activities involving competitive retrieval practice and incidental re-presentations of non-target items. Although both avoidance tasks resulted in significant forgetting effects, greater memory impairments were observed for target items following competitive retrieval practice of non-target items. This finding was consistent with predictions from inhibition theory, and suggests that different avoidance activities may recruit different forgetting mechanisms.

Finally, Experiments 2 and 3 examined the relationship between individual differences in repressive coping style and forgetting effects produced by the dropout procedure. Participants assessed to be repressive copers were more likely to forget negative target items, but only under conditions where avoidance tasks involved competitive retrieval practice. This finding was consistent with previous research demonstrating enhanced memory control abilities among repressive copers.

DEDICATION

To my family and friends, all my love and gratitude for seeing this long chapter to a close, and for giving me shelter from the many storms I encountered along the way. Your unwavering belief and encouragement made this dissertation possible.

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TABLE OF CONTENTS

	Page
ABSTRACT	ii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	vii
LIST OF TABLES	viii
CHAPTER I INTRODUCTION	1
Historical Context	7
Memory Blocking and the Dropout Procedure	15
Generality of the Dropout Procedure	22
Retrieval Inhibition as an Alternative Mechanism	30
Repressive Coping Style	38
Introduction to the Present Experiments	44
CHAPTER II EXPERIMENT 1	50
Method	52
Results	57
Discussion	62
CHAPTER III EXPERIMENT 2	64
Method	68
Results	73
Discussion	83
CHAPTER IV EXPERIMENT 3	88
Method	90
Results	91
Discussion	95

CHAPTER V SUMMARY AND CONCLUSIONS 98

Generality of the Dropout Procedure 99
Task-Specific Forgetting Mechanisms 102
Motivational Influences and Repressive Coping Style 106
A Caveat and Suggestions for Future Research 108
Concluding Remarks 114

REFERENCES 116

APPENDIX A 146

APPENDIX B 147

APPENDIX C 148

APPENDIX D 149

APPENDIX E 150

LIST OF FIGURES

		Page
Figure 1	A Functional Model of Blocked and Recovered Memories.....	6
Figure 2	Free Recall Performance for Target Memories as a Function of Study Condition and Target Valence in Experiment 1	59
Figure 3	Cued Recall Performance for Target Memories as a Function of Study Condition and Target Valence in Experiment 1	61

LIST OF TABLES

Page

Table 1 Descriptive Statistics for Memory Test Performance in Experiment 2 74

Table 2 Summary Poisson Regression Results of Free Recall Performance for Target Memories in Experiment 2 76

Table 3 Summary Poisson Regression Results of Cued Recall Performance for Target Memories in Experiment 2 81

Table 4 Descriptive Statistics for Memory Test Performance in Experiment 3 92

Table 5 Summary Poisson Regression Results of Cued Recall Performance for Target Memories in Experiment 3 94

CHAPTER I

INTRODUCTION

The romantic casting of forgetting as an adversary to memory is a familiar convention. This perception becomes reality when our memory falters over the course of the day and we fail to remember something we intended to do, or find that the name of an acquaintance or desired location has fallen just out of reach. Similarly, as memory declines with advancing age, the frequency of forgetting represents a fearful portent for cognitive decline—an *affliction* reflecting "a breakdown in an otherwise efficient mental capacity" (Nairne & Pandeirada, 2008, p. 179) and forecasting more grievous memory impairments, as in Alzheimer's disease or other dementias. For these reasons, forgetting has come to reflect the frailty of human memory, and is often regarded as a malady we must insulate ourselves against. However, by overemphasizing the negative consequences of forgetting, we risk losing sight of its significant adaptive value. Every day we are forced to navigate outdated or otherwise interfering information in an effort to adapt our knowledge base to a constantly changing world (see Bjork, 1978; 1989). In this way forgetting plays an integral part in the maintenance and updating of the cognitive system, ensuring that our performance on a given task is not undermined by intrusive thoughts and that we stay connected to our current goals and plans (Conway, 2009).

Forgetting may also function as part of a coping mechanism used to avoid unwanted or threatening memories from the past (e.g., Christianson & Engelberg, 1997).

This view is consistent with clinical studies showing that individuals with post-traumatic stress disorder actively engage in thought avoidance and attempt to suppress traumatic memories (for a reviews see Brewin, 2003; McNally, 2003), and in cases of psychogenic or dissociative amnesia where life periods (in whole or in part) become inaccessible to conscious recollection, particularly following traumatic experiences (for reviews see Christianson & Engelberg, 1997; Gleaves, 1996). As will be detailed below, the study of *motivated forgetting* behaviors has a long history in psychology, most notably in the psychoanalytical literature with Sigmund Freud and his controversial theory of repression.

One particularly divisive issue emerging from the motivated forgetting literature surrounds the alleged existence of *recovered memories*. A recovered memory generally refers to sudden recollections (often over the course of psychotherapy) of sexually abusive or other traumatic episodes that surface after extended periods of inaccessibility to the surprise of the victim[1]. Over the past three decades, memory recovery has cemented itself as a polarizing topic among clinicians and experimental psychologists. Much of this controversy stems from concerns over the accuracy of recovered memory accounts, and the worry that the therapeutic techniques used to excavate these buried memories may in fact foster the creation of *false* memories (e.g., for reviews see Ceci & Loftus, 1994; Crews, 1995; Loftus, 1993, 1996; Roediger & Bergman, 1998). For this reason, the recovered memory debate has also been referred to as the *false memory controversy*, or more sensationally the *memory wars* (Crews, 1995).

The false memory literature comprises a carefully-crafted evidence base that convincingly shows false memories can be created in the laboratory (e.g., Hyman, Husband, & Billings, 1995; Loftus & Pickrell, 1995; Pezdek, Finger, & Hedge, 1997), as well as real world situations for highly traumatic events (e.g., Ofshe, 1992; Pynoos & Nader, 1989). As a consequence, these findings have fostered skepticism among clinicians when evaluating the veracity of recovered memory accounts. For instance, in a recent survey study by Patihis, Ho, Tingen, Lilienfeld, and Loftus (2014), therapists' and laypersons' beliefs about repressed memories were compared. Their report revealed that 50% of surveyed clinical psychology researchers estimated that their beliefs about repressed memories changed during the mid-1990's, with only 16.7% of those respondents now endorsing that repressed memories could be true (but see Brewin & Andrews, 2014). Moreover, only 25% of participants surveyed from research-oriented psychological fields reported believing that repressed memories could be successfully recovered over the course of therapy.

Changing beliefs about repression and recovered memories over the past 20 years reflect, in part, a failure to find satisfactory laboratory evidence supporting the existence of unconscious repression. This has led some to categorically dismiss the existence of repressed memories all together (e.g., Holmes, 1974, 1990; Kihlstrom, 2001). However, in lieu of empirical evidence for unconscious repression mechanisms, there can be little doubt that genuine memory recovery experiences occur. For instance, Jonathan Schooler and his colleagues (Schooler, 1994; Schooler, et al., 1997; see also Christianson & Engelberg, 1997) report numerous case studies of recovered memory experiences that

include documented independent corroboration, not only of the abusive or traumatic episode, but also the interim period of forgetting and ultimate recovery. Similarly, the Recovered Memory Project (http://www.recoveredmemory.org) maintained by Ross Cheit, who himself recovered memories of childhood sexual abuse (see Pope, 1998; Schooler et al., 1997), currently houses 110 corroborated cases of memory recovery, including clinical case studies and cases from legal proceedings.

If the existence of veridical recovered memories is not in dispute, then one important question is *how* individuals forget memories for upsetting or undesirable experiences, even if only temporarily? Recent developments in the study of interference (e.g., Smith et al., 2003; Handy & Smith, 2012) and inhibitory control (e.g., Anderson & Green, 2001; Anderson et al., 2004; Depue, 2012) suggest that the cognitive bases of motivated forgetting may be explainable in terms of "normal" forgetting processes (see also Loftus, Garry, & Feldman, 1994). An important implication of this position is that motivated forgetting and memory recovery can be studied in the laboratory using paradigms that do not necessarily invoke special forgetting mechanisms, such as unconscious repression (e.g., Erdelyi, 2006).

The present study considers one such paradigm, referred to as the *dropout procedure* (e.g., Handy & Smith, 2012; see also Smith et al., 2003; Smith & Moynan, 2008; Gunawan & Gerkens, 2010), which demonstrates that practiced avoidance of unrehearsed memories can dramatically limit their accessibility. In that, a functional model of blocked and recovered memories is introduced which emphasizes the role of interference in creating profound memory blocks that are particularly potent when

retrieval is unaided by specific cues, as in free recall (see Figure 1). As will be discussed in later sections, this model dovetails with some concepts of experiential avoidance, which is a term referring to regulatory behaviors adopted by certain individuals to distance themselves from unwanted or distressing sensations, emotions, thoughts, or memories (for a review, see Hayes, Wilson, Gifford, Follette, & Strosahl, 1996).

There were three major goals of the present study. The first goal was to assess whether the dropout procedure could serve as a plausible functional model of memory blocking and recovery by extending its application to memories for autobiographical events. Although the development of the dropout procedure has taken incremental steps towards greater ecological validity, effectively inducing forgetting and recovery of emotional and non-emotional categorized lists, including expletives (Smith & Moynan, 2008), as well as emotional short stories (Handy & Smith, 2012), it is unclear whether these effects could also account for forgetting of personally-meaningful episodes. Establishing the generality of this procedure to autobiographical events would echo similar progress made by research programs in the retrieval-induced forgetting (e.g., Barnier, Hung, & Conway, 2004) and memory suppression (e.g., Noreen & MacLeod, 2012) literatures.

Having established that the dropout procedure is amenable to studying forgetting and recovery of complex, self-relevant memories, a second major goal of this study was to investigate *how* memories (even for personally-relevant events) are forgotten. To this end, the present study attempted to distinguish the putative mechanism(s) responsible for the pronounced forgetting effects produced by this procedure. Although the literature has

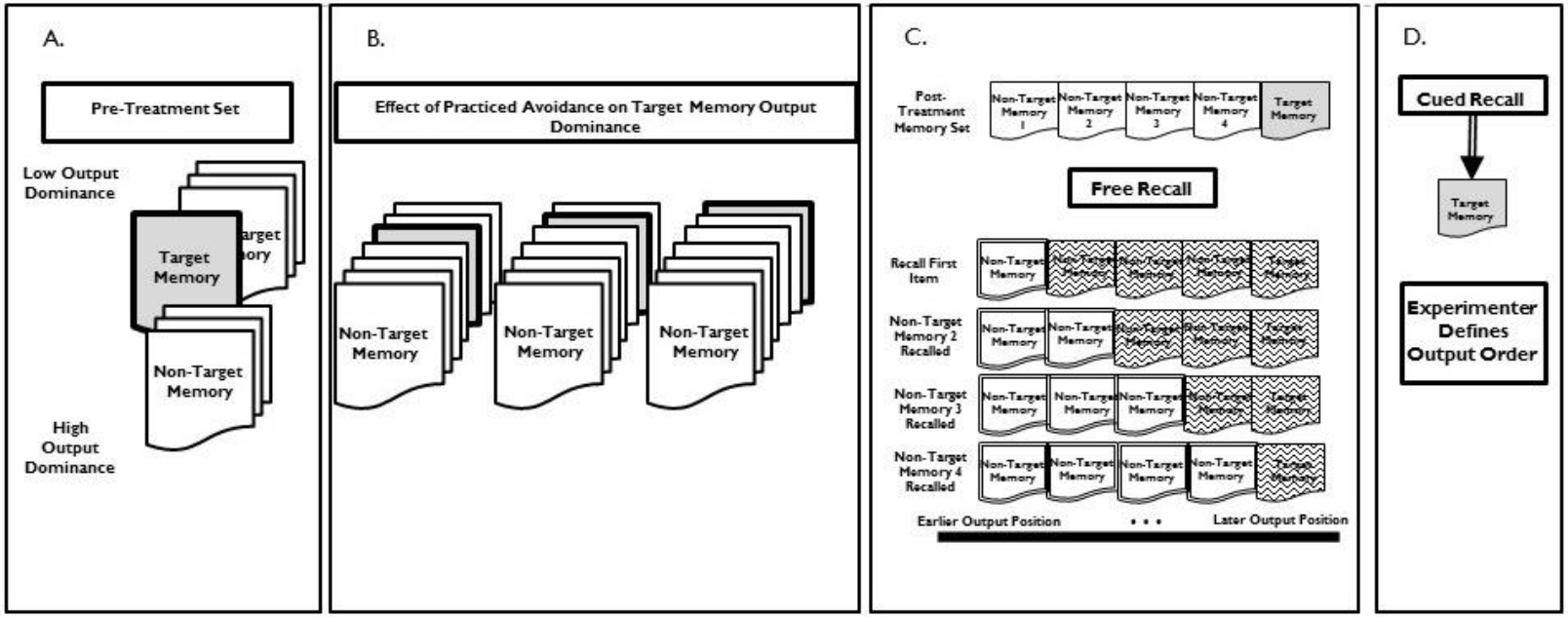

Figure 1. A Functional Model of Blocked and Recovered Memories. (A) The pre-treatment memory set includes a target memory and many non-target memories varying in output dominance. The model makes no assumptions about the initial retrieval strengths of memories in the pre-treatment set. For the purposes of illustration, the target memory is shown to have a moderate level of output dominance compared to non-target memories. (B) Avoidance activities directed at the target memory result in a downward shift in output dominance for this memory representation. In contrast, non-target memories gain retrieval strength as a consequence of the practiced avoidance activities. (C) Compared to pre-treatment output dominance, the target memory now boasts significantly less retrieval strength than its practiced competitors. When memory is probed using methods such as free recall, where items can be recalled in any order, non-target memories will come to mind first by virtue of their greater output dominance. With each successive non-target item recalled, output interference accrues for the target memory, increasing the probability that the target memory will not be recalled at all. (D) Memory blocks following practiced avoidance do not result in total erasure of the target memory, however. Under conditions where the order of retrieval is fixed (thus controlling for output interference), the target memory may be recoverable given the provision of an adequate retrieval cue.

previously attributed dropout-induced retrieval deficits to interference (e.g., Handy & Smith, 2012; Smith et al., 2003; Smith & Moynan, 2008), retrieval inhibition may serve as a viable alternative explanation. To address this possibility, the dropout procedure was modified in such a way as to distinguish the involvement of interference and inhibitory processes.

Finally, having addressed the mechanisms underlying forgetting in the dropout procedure, another point of emphasis was exploring *why* these memories may be forgotten. For instance, could certain personality characteristics be used to differentiate those with a greater propensity to memory blocking effects, and by extension a greater likelihood to recover those memories? This study focused on individuals possessing a repressive coping style (e.g., Weinberger, Schwartz, & Davidson, 1979), which has been described as a dispositional tendency towards avoidant processing of negative or threatening information (for reviews see Brewin & Andrews, 1998; Myers, 2010). Previous studies show repressors to be adept at forgetting when they are instructed to do so (e.g., Myers, Brewin, & Power, 1998; Myers & Derakshan, 2004), however it is unclear how these individuals would behave within the context of the dropout procedure where forgetting may not necessarily be driven by active inhibitory processes.

Historical Context

The study of motivated forgetting and recovered memories owes much to Sigmund Freud, whose early efforts to develop a treatment for obsessional neuroses and hysteria led to the advent of the psychoanalytic movement and his controversial theory of repression—the so-called "corner-stone on which the whole structure of

psychoanalysis rests" (Freud, 1914, p. 16). In his influential book on the topic, *Studies on Hysteria* (Breuer & Freud, 1896), Freud and the Austrian physiologist Josef Breuer advanced a theory of mental neurosis that was a dramatic departure from the prevailing theories of the time. Rather than attribute the development of hysterical symptoms to congenital degeneracy, as advocated by contemporary figures such as Pierre Janet and Jean Martin Charcot, Freud emphasized environmental factors over biological predispositions. Both accounts shared in common the notion that hysteria emerged in response to environmental *agents provocateurs*, however Freud regarded these triggers as a reference point for earlier memories (necessarily of a traumatic nature) that the patient willfully expelled from conscious awareness. Freud used the term "repression" to describe the process by which this memory censorship was achieved.

The formal introduction of the concept of repression occurred in *Preliminary Communications* (Breuer & Freud, 1893, in Breuer & Freud, 1896), with repressive distancing serving as a means to achieving "motivated forgetting" (Breuer & Freud, 1895, p. 10) of traumatic memories. In defining trauma, Freud referred to "[a]ny experience which calls up distressing affects—such as those of fright, anxiety, shame, or physical pain" (Breuer & Freud, 1895, p. 6), with childhood sexual abuse representing the source of the Nile for all psychopathology (Freud, 1896, p. 203). The idea of "seduction" during childhood became central to Freud's theorizing about the antecedent causes of hysteria later in life, as sexual abuse was a common thread tying together a vast majority of the 18 case studies reviewed in *Studies* (but see the case of Miss Lucy R.). In that, Freud conceived of the repression process as occurring in two distinct stages

separated by puberty. Because children are sexually immature, the seduction experiences of early childhood are not interpreted as traumatic when they occur. Rather, the memory is only given its proper framing after the child reaches puberty, at which point the memory becomes pathogenic. As Freud conjectures in *Studies:* "It is not the experiences themselves which act traumatically but their later revival as a *memory* after the subject has entered sexual maturity" (Freud, 1896, p. 164, his italics; see also McNally & Geraerts, 2009).

Repression then, was thought to be employed as a defensive response to the renascent memories only after they were evaluated retrospectively through the lens of sexual maturity. In this way, the repressive process was intended to resolve the conflict or "incompatibility" between the traumatic event and "the dominant mass of ideas constituting the ego" (Freud, in Breuer and Freud, 1895, p. 116). Repression—"the psychical mechanism of (unconscious) *defence*" (Freud, 1896, p. 162, his italics)—was therefore construed as a motivated activity, aiding the individual in turning away from an unpleasant memory as one might recoil from other pain-eliciting stimuli in the environment. In fact, it is precisely this "inclination to a *flight from pain*" (Freud, 1950[1895], p. 307, his italics) that Freud uses to describe the nervous system and its "aversion to directing psychic energy in such a way that unpleasure results" (Masson, 1985, p. 163).

The defensive process of repression is not without consequences to those employing it, however. Although memories are banished from consciousness due to the intolerable nature of their emotional contents, "the memories which have become the

determinants of hysterical phenomena persist for a long time with astonishing freshness and with the whole of their affective colouring" (Breuer & Freud, 1896, p. 9). The memories becomes pathogenic insofar as they seek expression through other channels (i.e., the "return of the repressed"), manifesting in the hallmark somatic symptoms of hysterical neuroses. The efforts of the ego to correct the contradiction posed by an undesirable thought leaves the memory "…'lodged in consciousness' like a sort of parasite, either in the form of an unresolvable motor innervation or a constantly recurring hallucinatory sensation" (Freud, 1894, p. 49).

Why then shouldn't traumatic memories be susceptible to the normal "wearing away process to which … all our memories succumb" (Breur & Freud, 1893, pg. 8, in Breuer & Freud, 1896)? Freud hypothesized that his patients were not afforded the opportunity for abreaction of the traumatic memory. The term "abreaction," which makes its first published appearance in *Preliminary Communications,* describes a cathartic reaction to traumatic memories in which the individual is able to strip the memory of its affective energy by acting out, such as "crying oneself out" or "blowing off steam." Breuer and Freud relied on what would become the psychoanalytic method to absolve the memory of its strangulated affect, first by identifying the operative cause of the somatic symptoms their patients exhibited (oftentimes through inferences drawn by the therapist), and then providing the patient with a means to gain access to the formerly inaccessible memory. In so doing, the authors relied on techniques such as guided imagery, association, hypnosis, and dream analysis for the purposes of memory excavation. The method produced great results, as the authors report in *Preliminary*

Communications: "*each individual hysterical symptom immediately and permanently disappeared when we had succeeded in bringing clearly to light the memory of the event by which it was provoked and in arousing its accompanying affect"* (Breuer & Freud, 1893, p. 6, their italics).

Although the seduction hypothesis was formulated between 1895-1897 (Boag, 2011), Freud rejected this theory as early as 1897 in a letter to friend and colleague Wilhelm Fleiss (Masson,1985) before its formal abandonment in 1906 with the publication of *My Views on the Part Played by Sexuality in the Aetiology of the Neuroses* (Freud, 1906). From this point forward, Freud de-emphasized the role of traumatic memories in evoking repression, instead conceiving of repression as a dynamic process intended to target what he termed as "instinctual impulses" (Freud, 1915). The basic tenet of this theory was that these impulses, which take the form of irrational, primordial fantasies and desires, exist within the unconscious but seek conscious expression. Any attempt to bring unconscious motivations into awareness is met with resistance from the ego in the form of repressive defense mechanisms, including regression, projection, reaction formation, sublimation, and repression proper. As stated by Freud (1915), "One of the vicissitudes an instinctual impulse may undergo is to meet with resistances which seek to make it inoperative. Under certain conditions … the impulse then passes into a state of 'repression'" (p. 146). Often referred to as the drive theory, this psychodynamic process became the centerpiece of Freud's theoretical thinking for much of his career (for a comprehensive reviews of Freudian defense mechanisms and drive theory, see Boag, 2011; also, Erdelyi, 2006).

Despite a handful of controlled laboratory studies (e.g., Flavell, 1955; Glucksberg & King, 1967; Merrill, 1954, Penn, 1964, Zeller, 1950, 1951) the field of experimental psychology remained mostly silent on the empirical status of repression until the rise of the recovered memory controversy in the late 1980's. In his influential review of the literature, Holmes (1990) went so far as to say that "...at the present time there is no controlled laboratory evidence supporting the concept of repression" (p. 96). Whereas the existence of repression has at best been regarded as an open question in the experimental field, others have diminished the concept to "clinical folklore" (McNally, 2004) and advocated for its abandonment in order to "break the Freudian death-grip on clinical practice" (Kihlstrom, 2004, p. 39).

One implication of Freud's reformulation of repression is that the process necessarily requires conflict between the ego and the fantasies and desires it defends against. This unconscious struggle is contrasted with "conflict-free traumatic neuroses," such as severe accidents or frightening experiences, in which repression should *not* occur, as they offer no threat to the self-concept. This is an important distinction, and is often overlooked when discussing repression in the context of the recovered memory debate. For example, predictions drawn from Freud's abandoned seduction theory are perennially invoked in relation to recovered memories (Holmes, 1990; Kihlstrom, 2002; Loftus & Ketcham, 1994). This amounts to what Boag refers to as a "gross oversimplification of Freudian theory" and a "pathology of science" (Boag, 2011, p. xv), echoing the cautionary words of Sandler and Sandler (1997) that "such a broad

formulation is inevitably imprecise, and it is important that the psychoanalytic meaning and usage of [repression]… be clarified" (p.163).

A recent attempt at rescuing the concept of repression in modern research was proposed by Erdelyi (2006) through the aptly-named Unified Theory of Repression. Erdelyi believed that much of the conflict surrounding the study of repression could be traced back to the assumption that the process must always occur unconsciously (for an excellent discussion of consciousness and repression, see Boag, 2010). Moreover, the theory posits that the popular rendering of repression as an unconscious process, with suppression representing its consciously-mediated counterpart, was not the work of Sigmund Freud, but rather his daughter, Anna (1936/1937). The driving force behind the unified theory is that the repression process need *not* be unconscious and can arise from the normal operations of attention and memory. Thus, the process of repression, as it occurs in everyday forgetting, can be isolated from the defensive purpose it serves when coping with an unbearable trauma—the cognitive mechanisms are the same in either case, and differ only in the underlying motive. Erdelyi goes on to differentiate between inhibitory (or subtractive) processes and elaborative transformations, as in denial.

Erdelyi's (2006) unified theory joins a growing research movement tasked with bringing together the largely disparate traditions of clinical and laboratory research. Through these efforts significant strides have been made in reframing the study of recovered memories, and repression more generally, as a tractable problem for experimental scientists. Although healthy skepticism is clearly warranted when appraising the utility of Freudian repression in the modern age of memory research, the

present discussion aligns with the central tenet of Erdelyi's theory; that is, the notion that motivated forgetting is subserved by normal forgetting mechanisms and these mechanisms can be investigated independently, outside the context of traumatic coping.

Several laboratory paradigms have been developed (or subsequently reframed) under the pretense that normal memory mechanisms may underlie repressive behaviors. For instance, retrieval inhibition has been implicated in studies using the list-method directed forgetting task (e.g., Basden, Basden, & Morales, 2003; but see Sahakyan & Kelly, 2002), the retrieval practice paradigm (e.g., Anderson, 2001; Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 2001), and the think/no-think procedure (TNT; e.g., Anderson & Green, 2001). Although these paradigms offer promising convergence of basic cognitive research with clinical theory, the conclusion drawn by many that these procedures serve as viable laboratory models of repression has been challenged on several fronts. Most notably, memory deficits following deliberate retrieval inhibition, as in the think/no-think procedure, are often judged to be much less impressive than the profound amnesia commonly associated with repression (e.g., Kihlstrom, 2002; 2004). In addition, many of these paradigms fail to address whether forgotten information is even recoverable, thus leaving a large piece of the recovered memory puzzle unaccounted for.

An innovative approach to modeling recovered memories in the laboratory was devised by Smith et al (2003) to illustrate how interference caused by practiced avoidance could produce memory blocks for to-be-forgotten materials. Critically, the dropout procedure, as this paradigm came to be known, comprehensively answered

several of the previously mentioned criticisms levied against other experimental treatments purported to show evidence supporting recovered memories. As will be reviewed in the sections that follow, the dropout procedure has reliably demonstrated large forgetting effects across a variety of emotional and non-emotional materials, as well as shown that forgotten materials to be recovered under certain conditions.

Memory Blocking and the Dropout Procedure

Anderson (2001) describes two potential pathways to motivated forgetting. One pathway involves the deliberate deactivation of mental representations, as achieved by a putative inhibitory control mechanism (e.g., Anderson & Green, 2001). Alternatively, individuals may take an active role in shaping their retrieval environments, thus creating situations where undesirable memories are made vulnerable to more passive forgetting processes. For instance, moving to a new neighborhood or initiating some other change in the mental or physical context may ensure that otherwise potent retrieval cues are rarely encountered, in turn diminishing the likelihood that unwanted thoughts are successfully reinstated (e.g., Tulving & Thomson, 1973). Another method of practiced avoidance proposed in some theories of psychogenic amnesia (e.g., Terr, 1991; Cloitre, 1992) involves selectively retrieving alternative memories that compete with memories of abuse sharing a common retrieval cue. This pattern of practiced avoidance could serve as a defensive strategy to reduce the probability of retrieving an unwanted memory, while also increasing the probability that non-offensive memories will be retrieved instead.

The development of the dropout procedure proceeded, in part, as a means to investigate the cognitive bases for emotionally-driven avoidant strategies, in addition to comparing continuous, recovered, and false memories within the confines of a single experimental setting. First introduced by Smith et al. (2003), this procedure was tailored to address issues pertinent to the recovered memory debate. For instance, are there phenomenological differences between recovered memories and false memories? What cognitive processes underlie successful memory blocking and recovery? The authors rightfully argue that identifying characteristics distinguishing these two classes of memories could provide an invaluable diagnostic tool in clinical settings where the veracity of recovered memory accounts is often suspect.

The procedure used by Smith et al. (2003) called for participants to study several taxonomic lists during an incidental learning task. For each list, participants wrote down category names along with all associated category exemplars, rank ordering the items for category typicality and thus ensuring that both category names and members were successfully encoded. Following the initial study period, participants in the control condition completed several non-verbal tasks for the duration of a 45-minute retention interval. In contrast, participants in the experimental "dropout" condition were re-exposed to many of the previously studied categorized lists, completing several tasks designed to reinforce learning of these materials. Among the intervening tasks was a list-recall task, a category name-recall task, a typicality rating task, a recall rating task, a pleasantness rating task, and a size-ranking task spread over the course of a 45-minute interval. Critically, unbeknownst to participants in the dropout condition, the

experimenters removed three of the categorized lists from the study list sequence (henceforth referred to as *target lists*) prior to re-presenting the remaining 18 lists (henceforth referred to as *non-target lists*) for extra study. To assess forgetting of the target lists, participants in both conditions were given an uncued recall test in which they were instructed to write down all category names and list members shown during the initial study phase of the experiment. Across three experiments, the authors reported a 30-40% difference in the number of target items recalled by dropout and control conditions. Most striking of all, 17% of the participants in the dropout condition failing to recall even a single target list (compared to 4% in the control condition). The disparity in recall for the target lists was dramatic when taking into consideration the fact that *both* groups of participants only saw these lists one time, during the initial study period.

A final feature of the dropout procedure is a test of memory recovery. Participants viewed the category names for each of the three target lists and were asked to write down as many of the previously studied category members as possible. To assess recovery, the proportion of target category members successfully recalled in both the initial uncued recall test and subsequent category cued recall test (defined as a *continuous memory*) was contrasted with the proportion of initially unrecalled target category members successfully recalled on the final test (defined as a *recovered memory*). In each of their three experiments, Smith et al. (2003) reported no difference in the proportion of target category members recalled in either experimental condition, regardless of whether the target category was successfully accessed in the initial uncued recall test. These powerful forgetting and recovery effects are quite robust and have been

reported in several subsequent studies (e.g., Gunawan & Gerkens, 2010; Handy & Smith, 2012; Smith & Moynan, 2008).

Interference has principally been used to explain the forgetting effects observed in the dropout procedure. Smith et al. (2003) proposed that memory blocks for unpracticed target items could be attributed to two mechanisms: a downward shift in output dominance paired with output interference accrued at the time of retrieval (see Figure 1). Specifically, after initial study, non-target items are hypothesized to be selectively strengthened over the course of interpolated re-exposure trials as participants perform ratings tasks or engage in some form of retrieval practice. A consequence of strengthening these non-target items is that they become hyper-accessible, leading to the creation of a so-called biased retrieval set (see Raaijmakers & Shiffrin, 1981). Meanwhile, target items, although available in memory, are rendered less accessible by virtue of the increased fluency of strengthened non-target items, to the point that efforts to retrieve additional items (i.e., the less dominant target items) may be abandoned all together. This is particularly likely when the entire memory set is accessed by a retrieval cue (i.e., when participants are instructed to recall all study items), as each set item is assumed to differ in terms of its relative strength of association to the cue. Under this theoretical framework, strengthening associative competitors should reduce the likelihood that a target response is elicited as it does not come to mind as easily as the non-target responses. Additionally, because target items struggle for expression, there is a greater likelihood that they will suffer output interference owed to retrieving the

competitor items first and thus be less accessible to recall (e.g., Roediger, 1974, 1978; Rundus, 1973).

To place this discussion within the context of the recovered memory debate, memory blocks produced via practiced avoidance in the dropout procedure may be analogous to some forms of experiential avoidance adopted by trauma survivors as a means to cope with distress caused by intrusive memories. Individuals that adopt avoidant coping strategies are described as being "unwilling to remain in contact with particular private experiences (e.g., bodily sensations, emotions, thoughts, memories, behavioral predispositions) and [take] steps to alter the form or frequency of these events and the contexts that occasion them" (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996, p. 1154). In this way, exerting experiential control (whether by way of cognitive, behavioral, or emotional avoidance) aligns with a basic instinct to flee from pain—in this case, psychical pain caused by intrusions from undesired thoughts or memories. The ultimate goal of practiced avoidance, therefore, is supplanting an unpleasant memory with other, less offensive memories.

To this point, Figure 1 depicts a functional model of memory blocking and recovery that illustrates one possibility for how practiced avoidance may operate at a cognitive level. A basic prediction of this model is that recurrent interference caused by successively retrieving alternative memories may, over time, reduce the probability that non-practiced memories will be retrieved. As depicted in Panel B, inaccessibility of the target memory is driven in part by a systematic reduction in its output dominance. When the now-biased memory set is probed, as in free recall where the order of recall is not

fixed, strengthened memories associated with the target will be generated first in the testing sequence as they will come to mind more frequently and with greater ease than the target (see Panel C). As a consequence, output interference will accumulate each time the target memory is unsuccessfully sampled from memory. As illustrated in various probability-based models of memory retrieval (e.g., Raaijmakers & Shiffrin, 1981), over time and with successive failures to retrieve additional items, the search process may be abandoned completely. Thus, it is the combined effect of a shift in output dominance for non-practiced target memories (during practiced avoidance), and output interference accrued at test, that results in these memories having limited accessibility under certain retrieval conditions.

Attempts at practiced avoidance may not always be successful however, as this model also illustrates conditions in which memory blocks may be lifted and memories recovered (see Panel D). Regarding the memory recovery effect, Smith and colleagues draw a distinction between the availability and accessibility of memories (Tulving & Pearlstone, 1966). That is, although a memory may be rendered less accessible to conscious recall, the memory nonetheless remains available and can be elicited given the provision of a retrieval cue with adequate strength and specificity (Tulving & Thomson, 1973). In the dropout procedure, an initial free recall test required participants to access the entire study episode containing all of the categorized word lists encountered throughout the experiment. This non-specific retrieval cue was entirely ineffective in guiding participants to retrieve the unpracticed critical item. However, when the participants received better retrieval cues, such as the category names of the unpracticed

study lists, they were able to produce the critical items as well as participants in the control condition. This result is consistent with an early experiment by Tulving and Pearlstone (1966) that showed impoverished recall for category exemplars in free recall, compared to when the categories were supplied as cues.

In summary, the dropout paradigm simulates one approach to goal-directed forgetting that involves engineering the retrieval environment to maximize the likelihood an unwanted memory will be forgotten by way of passive forgetting mechanisms. However, these methods of practiced interference do not alter the ability of retrieval cues to excavate an undesirable memory, as might be expected following alternative forgetting processes, such as retrieval inhibition (e.g., Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995). Rather, biasing retrieval by systematically strengthening competing memory representations may nonetheless fail if a particularly potent reminder is encountered. Along these lines, the dropout procedure constructs a situation that may be akin to actively avoiding thinking about a memory by practicing retrieving diversionary information that competes with the unwanted memory. As described by Smith et al. (2003): "if avoidance is practised [sic] and negatively reinforced through elimination or avoidance of pain, then the critical events could become habitually blocked" (p. 254). Within the context of the recovered memory debate, this situation could be referred to as a "weak" form of motivated forgetting (Anderson, 2001), as memory impairments do not necessarily arise from "active" processes requiring inhibitory control.

Generality of the Dropout Procedure

One challenge for the proposal that the dropout paradigm be used as a model for blocked and recovered memories is showing that this methodology can generalize to materials that are more ecologically valid, such as emotional materials and even autobiographical memories. As a first step, Smith and Moynan (2008) reported that distinctive, highly emotional verbal materials, including lists of expletives and death-related words, could be forgotten following practiced interference. Biasing retrieval using the dropout method produced virtually indistinguishable patterns of forgetting for emotional and neutral word lists in the forget condition. This was true even when the highly distinctive list of expletives was embedded among categorized lists of emotionally neutral words. Moreover, memory for critical lists was recovered in category cued recall, indicating that the critical items remained available in memory despite participants' inability to access them unaided in free recall. These results were surprising given overwhelming evidence that emotionally-arousing events are remembered differently from (and often better than) emotionally-neutral events. The emotional-enhancement effect has been reported in a number of studies probing memory for thematic, emotionally-evocative slide sequences (Brown, 2003; Christianson & Loftus, 1987, Experiment 1; Heuer & Reisberg, 1990), emotionally-arousing pictures (Harris & Pashler, 2005; Touryan, Marian, & Shimamura, 2007) and video stimuli (Loftus & Burns, 1982; Hulse, Allan, Memon, & Read, 2007), as well as highly emotional autobiographical events (Christianson & Loftus, 1990).

A more recent study by Handy and Smith (2012) generalized the procedure further by assessing forgetting of emotional and neutral text passages. In these experiments, participants read 22 vignettes that varied in emotional intensity. Critically, each vignette was accompanied by a descriptive title that participants were required to write down during the initial study phase of the experiment. After reading and making arousal ratings on all 22 vignettes, participants in the forget condition were re-exposed to 18 of the stories numerous times, whereas control participants performed non-verbal tasks for an equivalent amount of time. For each re-exposure task in the forget condition, participants performed ratings tasks for story content or practiced retrieval of the story titles. A free recall test assessed memory for the critical titles in both conditions. This testing format represented a subtle, but important variation to the original dropout procedure. In previous studies (e.g., Smith et al., 2003; Smith & Moynan, 2008), participants attempted to recall both the studied categories and category exemplars in an initial free recall test, and the test of recovery was always category cued recall. Arguably these two measures differ in terms of what participants are required to retrieve, and given this testing format it is unclear whether entire categories of unpracticed items are forgotten following the dropout procedure, or only select items within the categories. Handy and Smith eliminated this ambiguity by requiring that participants attempt to recall the vignette titles in both tests, thus assessing forgetting and recovery for the *same* items. Across three experiments, forgetting effects for the critical stories varied from 30-40% difference in recall when comparing forget and control conditions. This striking forgetting effect occurred despite admonishments from the experimenters to write down

brief descriptions for any story for which they could not think of the correct title. These memories were nonetheless recoverable in cued recall when participants were re-exposed to the critical short stories or provided with some other potent retrieval cue.

Taken together, the studies reviewed above demonstrate iterative steps towards aligning the dropout procedure with more naturalistic memory experiences, departing from strictly controlled laboratory-based materials to using materials possessing the phenomenal characteristics of personal memories (e.g., rich visual imagery, affect, a narrative structure). As discussed elsewhere (e.g., Erdelyi, 2006; Gleaves et al., 2004; Smith & Moynan, 2008; Loftus, 1996), false memory researchers have made a compelling case for the ubiquity of memory distortions and illusions, both inside and outside of the laboratory. As a result, the onus is placed on researchers advocating the legitimacy of recovered memory accounts to provide suitable evidence their theories may plausibly account for phenomena occurring in the "real" world. One means of achieving this end is to show that predictions derived from experimental studies using contrived laboratory materials translate to memories formed outside the laboratory; that is, autobiographical memories.

Autobiographical memory is often considered synonymously with episodic memory, if not a specific *type* of episodic memory. This notion is consistent with the conceptualization of episodic memory put forth by Tulving (1972, 1983) and retained in current memory frameworks of declarative memory (e.g., Schacter & Tulving, 1994; Squire, 1992). Within this framework, declarative memory is partitioned into two principal components: episodic memories, which are recollections of personally-

experienced events occurring over well-defined time frames, and semantic memories, which are characterized as general world knowledge, including language concepts and self-referent information. However, recent neuroimaging evidence argues that it may be more accurate to subdivide declarative memory further to include self or autobiographical memory as its own unique subsystem. The argument for three subsystems is based, in part, on neuroimaging evidence that suggests laboratory-based episodic memories and autobiographical memories are not supported by the same neuroanatomical networks, particularly during retrieval. According to these studies, areas of the anterior and mid-dorsolateral right prefrontal cortex, active during episodic retrieval of laboratory materials, are not active during autobiographical memory retrieval, as revealed using fMRI (e.g., Gilboa, 2004; Gilboa, Winocur, Grady, Hevenor, & Mascovitch, 2004; see also Maguire & Frith, 2003). Further, a recent quantitative meta-analysis performed by McDermott and colleagues (2009) revealed that the neuroanatomical networks supporting laboratory-based episodic retrieval and autobiographical retrieval scarcely overlap in activation. However, in interpreting these results, it is worth noting that recognition measures are typically employed in fMRI studies, and the effects of more effortful retrieval (such as free recall and cued recall) in comparative brain activation are unclear.

In spite of these functional differences in neural correlates, models of autobiographical memory retrieval, such as the self-memory system (SMS; e.g., Conway & Pleydell-Pearce, 2000), parallel classical models of episodic memory retrieval, such as the search of associative memory model (SAM; Raaijmakers & Shiffrin, 1981), by

suggesting similar cue-driven search processes involving sampling from long-term memory knowledge bases. According to the SMS, autobiographical memories are defined as "transitory mental constructions compiled from different types of autobiographical knowledge" (Conway, 1997) and are stored at various levels of specificity within the *autobiographical knowledge base.* The autobiographical knowledge base represents a structural hierarchy containing life periods, which are the largest and most general type of event memory (e.g., *when I was in elementary school*), more specific general events (e.g., *naptime* or *recess*), and finally event-specific knowledge, which is conceptualized as a store house of sensory and perceptual knowledge about specific events. Within this theoretical framework, retrieval from the autobiographical knowledge base proceeds using a search-access-verify model, similar to the retrieval process modeled in SAM. Specifically, cues in the environment prompt access to the autobiographical knowledge base, initiating a search for cue-consistent information that is then evaluated against a set of criteria. If the knowledge accessed is consistent with the search criteria, then the sampling process is terminated and the memory is retrieved. Otherwise, the whole process is repeated. One implication of the alignment of these two theoretical memory search models is that they share similar conditions for predicting memory occlusions, and ultimately retrieval failures.

What distinguishes the SMS from other probabilistic search models of memory is the inclusion of a *working self* component. As described by Conway (2005), the main function of the working self is to "maintain coherence (between goals) … by modulating the construction of specific memories, determining their accessibility and inaccessibility,

and in the encoding and consolidation of memories" (p. 597). The goal-directed nature of the working self has considerable implications for the study of motivated forgetting, as this theory suggests memories of experiences that are threatening or incompatible with a constructed self-image may be inhibited. To examine this possibility, several recent experiments have tested whether inhibitory control could be exerted over autobiographical memories, both as a function of intentional suppression after explicit instructions to forget (e.g., Barnier, Conway, Mayoh, Speyer, Avizmil, & Harris 2007; Noreen & MacLeod, 2012) and selective retrieval (e.g., Barnier, Hung, & Conway, 2004).

In one study examining the consequences of selective retrieval on autobiographical memory, Barnier, Hung, and Conway (2004) had participants provide brief memory descriptions in response to several different cue words, including negative (e.g., *horrified, sickness, tragedy*), neutral (e.g., *hardworking, patient, polite*), and positive (e.g., *entertaining, happy, excitement*) emotional categories. Critically, each memory description was accompanied by a one-word title, which the participants generated to help them recall the memory. The memory descriptions, personal words, and their associated category cues were used as experimental materials in a variant of the standard retrieval practice paradigm (e.g., Anderson, Bjork, & Bjork, 1994). During retrieval practice, participants practiced recalling some of the memories from some of the categories several times before taking a final recall test in which they verbally recalled all of the memories in response to the category cues. In addition to the standard finding that practiced memories were recalled better than memories from unpracticed

categories, a more striking finding was that the non-practiced memories from practiced categories were impaired below baseline. This was true especially for the emotional, as compared to neutral events (see also, Hauer & Wessel, 2006; Stone et al., 2013).

Autobiographical memories are also susceptible to overtly intentional memory suppression techniques, as reported in a recent study by Noreen and MacLeod (2012) using the think/no-think procedure (e.g., Anderson & Green, 2001). Similar to Barnier et al (2004), in this study autobiographical memories were probed using a version of the Galton-Corvitz word-cue technique (Corvitz & Schiffman, 1974; Galton, 1879). Participants provided brief descriptions of memories that corresponded to a selection of cue words (e.g., *PARK* or *BARBECUE*). The valence of these memories was manipulated by including a plus (+) or a minus (-) sign alongside each cue. As in Barnier et al.'s (2004) study, participants also thought of a unique "personal word" for each memory they reported. These personal words were intended to remind participants of their memories during a later session.

The second phase of the experiment involved what Noreen and MacLeod (2012) termed the autobiographical TNT (ATNT) task. Participants studied cue-personal word pairs and the memory descriptions they provided in the previous phase of the experiment. After learning cue-personal word pairs (and associated memory descriptions) to criterion, participants entered into the critical memory suppression phase of the experiment in which they were presented with a subset of the cue-personal word pairs and asked to either recall associated memories with as much detail as possible (respond trials) or attempt to not think about the associated memories (suppress trials).

Participants practiced responding to or suppressing target memories a total of 16 times each, for 256 trials total. For the final test phase, participants were told to recall all of the memories associated with all of the cue-personal word pairs.

Several notable findings emerged from this study. Critically, participants showed greater memory deficits for memories that they practiced suppressing, as compared to baseline levels of recall for memories not appearing in the TNT phase of the experiment. Interestingly, this negative control effect was most pronounced for the negatively valenced autobiographical memories (in Experiment 1). The authors further observed that the forgetting effects were not at the level of entire episodes, but were confined to memories for details of an event. Their results suggest that details of a to-be-forgotten event may be systematically forgotten, whereas the general gist of the event is retained in memory.

Taken together, these studies provide converging evidence that systematic forgetting reported for simple verbal or pictorial stimuli could extend to memories of events that are personally-relevant to the rememberer. Another important observation is that forgetting is not monolithic, as different situational contexts may demand the involvement of different mechanisms of forgetting. Although there is now convincing evidence that inhibitory control processes can exert influence over autobiographical memory, the same cannot be said for the forgetting processes modeled by the dropout procedure. This possibility was therefore addressed by the present study.

Retrieval Inhibition as an Alternative Mechanism

Although memory deficits in the dropout procedure are principally attributed to interference caused by the selective re-exposures to non-target items prior to the memory test, it is conceivable that retrieval inhibition could also underlie these effects, or that these mechanisms produce dropout-induced forgetting in combination. Previous studies have not systematically investigated the involvement of interference and retrieval inhibition in this procedure, however; moreover, the construction of the interpolated re-exposure tasks in these studies, which sometimes included some form of retrieval practice, have made it difficult to draw any firm conclusions about the underlying mechanism(s). For instance, in the previously reviewed study by Smith et al (2003) participants were re-exposed to non-target categorized lists over the course of six tasks; a number of these tasks required some manner of retrieval (e.g., list recall and category name recall tasks). Similarly, in Handy and Smith (2012) retrieval practice of all non-critical story titles served as the final interpolated task prior to the free recall test for all studied short stories. As will be reviewed below, there is substantial empirical evidence suggesting that competitive retrieval practice recruits inhibitory mechanisms to reduce interference caused by non-practiced items. The implications of this alternative forgetting mechanism within the context of the dropout procedure are discussed.

The dropout procedure shares many procedural similarities with research paradigms designed to capture retrieval inhibition, such as the retrieval-practice paradigm (e.g., Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995). In that, there is considerable evidence suggesting memory deficits following selective retrieval

in the retrieval-practice paradigm are owed to an inhibitory control mechanism operating on the availability of non-rehearsed memory representations. Further, the conditions necessary for engagement of inhibitory mechanisms have been distinguished from those supporting interference as a source for retrieval failures (e.g., Anderson & Levy, 1995).

In episodic memory retrieval, successfully recalling a desired memory may require that we foreclose on interfering memories that compete for expression. In our efforts to resolve response competition, one consequence of the selection process is that memories we select against may become less recallable over time. That is, the very act of remembering can cause forgetting. This phenomenon is referred to as retrieval-induced forgetting (RIF; Anderson, Bjork, & Bjork, 1994; Bjork, 1989) and is attributed to inhibitory control processes that actively suppress competing memory representations when recalling information from long-term memory.

Not unlike the dropout procedure, the retrieval-practice paradigm involves three phases: a study phase, a retrieval practice phase, and a surprise final memory test. During the study phase, participants usually study a series of category-exemplar pairs (e.g., *FRUIT – ORANGE, FRUIT – BANANA, DRINK – VODKA, DRINK – BOURBON*) presented individually in a randomized order. Following the study phase, participants engage in several rounds of retrieval practice for half of the items from half of the studied categories using a category-plus-stem cued recall task (e.g., *FRUIT – OR_____).* This manipulation creates three item classes: category exemplars receiving retrieval practice (e.g., *FRUIT – ORANGE*), unpracticed category exemplars from practiced categories (e.g., *FRUIT – BANANA),* and category exemplars from unpracticed

categories (e.g., *DRINK - BOURBON*). After a 20-minute delay, a surprise category cued recall test assesses memory for all studied items.

Two findings typically emerge from this version of the retrieval-practice paradigm. First, compared to baseline memory performance for category exemplars from unpracticed categories, retrieval practice facilitates memory for practiced exemplars. This confirms previous research showing the positive consequences of retrieval practice on subsequent memory for practiced items (e.g., Bjork, 1975). However, more interesting is the fate of unpracticed exemplars from practiced categories. Consistent with the prediction that selectively retrieving some members of a category will impair memory for unpracticed members that compete for retrieval, there is a significant deficit in memory performance for unpracticed exemplars from practiced categories, when compared to baseline. This finding constitutes the retrieval-induced forgetting effect, and is popularly considered an "inhibitory aftereffect" of selective retrieval efforts during retrieval practice (Anderson & Levy, 2010).

Retrieval-induced forgetting has been observed across a variety of different modalities, including text passages (Little, Storm, & Bjork, 2011), lexical categories (Bajo, Gomez-Ariza, Fernandez, & Marful, 2006), autobiographical memories (Barnier, Hung, & Conway, 2004), pictures (Ford et al., 2004), videos (Migueles & Garcia-Bajos, 2007), propositions (Anderson & Bell, 2001), social conversations (Coman, Manier, & Hirst, 2009), insight problems (Storm, Angello, & Bjork, 2011), and personality traits (Dunn & Spellman, 2003). Furthermore, the retrieval practice paradigm has been extended to emotionally valenced materials, including verbal stimuli (e.g., Blix &

Brennen, 2012; Dehli and Brennen, 2008; Kobayashi & Tanno, 2013; Kuhbandner, Bäuml, & Stiedl, 2009) and, most significantly, autobiographical events (e.g., Barnier, Hung, & Conway, 2004; Chui et al., 2011; Harris et al., 2010; Stone et al., 2013; Wessel & Hauer, 2006).

The basic finding of retrieval-induced forgetting is compatible with classic response competition theories (e.g., McGeoch, 1942) that consider forgetting to be a consequence of strengthening competing memory representations (or alternatively forging new associations to a given retrieval cue). The dynamics of this retrieval process are captured in several relative strength or ratio-rule models of retrieval (e.g., Anderson, 1983; Raajmakers & Shiffrin, 1981) in which the probability of recalling a specific memory is directly proportional to the strength of association it shares with a retrieval cue, relative to competing associates. Strengthening a competitor, as in retrieval practice, leads to an increase in the probability of recalling that memory trace, whereas the probability of retrieving other associates decreases. One defining characteristic of these theories is that they do not appeal to a special mechanism to explain forgetting. Rather, in the retrieval-practice paradigm described above, the selective advantage for *ORANGE* on the final test is a direct reflection of its strengthened association to the cue *FRUITS*, accomplished via retrieval practice. A consequence of strengthening *ORANGE* is that this strengthened representation within the *FRUITS* category could induce a retrieval block for the formerly competing category exemplar, *BANANA*. Parallels can be drawn between this alternative explanation of retrieval-induced forgetting and the operation of the dropout procedure on target items. Indeed, others (e.g., Gleaves et al., 2004) have

referred to the dropout procedure as an extension of the basic retrieval-practice paradigm.

An alternative explanation for retrieval-induced forgetting has gained significantly more notoriety in recent years and emphasizes the role of inhibitory control in selective retrieval. Within this theoretical framework, interference between competing memory representations is mitigated by an inhibitory control process that acts to direct the focus of conceptual attention away from distracting competitors onto the target of the retrieval search. As a consequence of this inhibitory process, the overall activation strength of associated competitors is reduced rendering these memories less accessible to recall when memory is later probed. Thus, forgetting is not the result of competition, per se, but is a consequence of the need to engage inhibitory mechanisms in response to competition.

Several properties of retrieval-induced forgetting argue for the inhibitory control account. First, as reviewed above, strength-based theories of interference point to associative competition as the locus of forgetting in the retrieval practice paradigm. Whereas selectively strengthening certain cue-target associations during retrieval practice leads to facilitation of those items in delayed recall, memory for weaker items that share the retrieval cue is impaired because the strengthened associate blocks access during the memory search. If forgetting was truly cue-dependent, as the blocking theory assumes, then testing memory using a novel cue should aid in retrieving non-strengthened targets. Alternatively, if forgetting is a result of an inhibitory process suppressing the memory representation itself, then memory impairments should

generalize to test conditions in which a novel cue is used. The *cue independence* property of retrieval-induced forgetting was tested in a study by Anderson and Spellman (1995) in which the retrieval practice paradigm was modified to include related study categories. For example, participants studied lists of red things and foods, which included exemplars such as *BLOOD, TOMATO, RADISH,* and *CRACKERS,* respectively. Note that some of the category exemplars, such as *tomato* and *radish*, share cross-category membership in the sense that they are both foods, but also red things. The critical question in this study was whether practicing items such as *RED – BLOOD* would produce memory impairments for non-practiced competitors from the same category, like *RED – TOMATO*, but also cross-category members, like *FOOD – RADISH*. The inhibitory control hypothesis predicts that, because practicing *RED – BLOOD* activates all associates sharing the common feature red (i.e., *TOMATO* and *RADISH*), then the memory representation for *RADISH* should be suppressed, as it serves as a source of interference for retrieving *BLOOD* and thus triggers inhibitory control. Consistent with this prediction, memory for cross-category members (i.e., *FOOD – RADISH*) was impaired when study items shared category membership with items receiving retrieval practice (i.e., *RED – BLOOD*), compared to when there is no association to the practiced category (i.e., *TOOLS – HAMMER*). The cue independence property of retrieval-induced forgetting has been reported in several other studies (e.g., Anderson & Bell, 2001; Anderson & Green, 2001; Johnson & Anderson, 2004; Levy et al., 2007; but see Camp, Pecher, & Schmidt, 2007; Perfect et al., 2004).

A second property of retrieval-induced forgetting that argues for the inhibitory control account is *retrieval specificity*. That is, selectively strengthening practice items via repeated study exposures is not sufficient to produce impairments for shared-category members. Rather, inhibition requires circumstances in which the need to override interference from competitors drives selective retrieval. Several studies support the retrieval specificity property by manipulating how practiced items are strengthened, either with extra study exposures or retrieval practice (e.g., Shivde & Anderson, 2001). Consistent with inhibition theory, memory for non-practiced members from practiced categories is unimpaired following extra exposures to associated competitors whereas these study items suffer significant deficits following retrieval practice.

Retrieval practice is important within the framework of inhibitory control theory insofar as it cultivates a retrieval environment where there is a great degree of interference produced by associated competitors. Studies evidencing the *interference dependency* property of retrieval-induced forgetting have done so by manipulating the taxonomic frequency of category exemplars, comparing memory impairments for low and high-frequency members following retrieval practice. For instance, Anderson et al. (1994) found that retrieval-induced forgetting only occurred when competing category exemplars were high in taxonomic frequency (e.g., *FRUIT – BANANA*), with no impairments when using low frequency competitors (e.g., *FRUIT – KIWI*). Interference dependency is also shown in studies that manipulate the demands of the retrieval practice task. Anderson, Bjork, and Bjork (2000) demonstrated that non-competitive retrieval practice, in which participants practice retrieval of category names when given

a two-letter stem and an associate member (e.g., *FR____ – ORANGE* for *FRUIT – ORANGE*), does not produce inhibition for unpracticed category members. Only when retrieval practice involved competitive retrieval (e.g., *FRUIT – OR_____*) was inhibition of associated competitors observed. Taken together, these studies underscore the importance of interference in motivating the need to utilize inhibitory control during retrieval.

The notion that retrieval inhibition and interference-based processes have dissociable effects on memory, as the previous review suggests, highlights the necessity in more clearly defining the forgetting mechanism(s) active in the dropout procedure. For example, according to the model first proposed by Smith et al (2003) and updated in the present study (see Figure 1), target items are made more susceptible to output interference during free recall because these responses become less dominant following the practiced avoidance phase of the experiment. In essence, the target memory is blocked by associated memories that the individual is biased to retrieve. The forgetting effect under this theoretical framework is therefore multiphasic, with the temporal locus of the effect occurring both prior to and during the initial memory test. That is, the consequences of the shift in output dominance incurred after selective avoidance of the target items do not manifest themselves until memory is tested, at which time output interference produced by first recalling the strengthened non-target items dramatically lowers the probability the less dominant target items will be retrieved. Although previous research on the dropout procedure argues for these interference-based forgetting effects, this assumption has not been tested empirically.

Repressive Coping Style

Another objective of the present research was to investigate dispositional qualities that may help identify individuals that are more or less susceptible to memory blocking and recovery. The importance of the individual in psychological research cannot be understated. This is especially true when assessing factors influencing forgetting and recovery of highly emotional events, as this phenomenon, by its very nature, operates selectively. To this point, a limitation of many laboratory approaches to investigating motivated forgetting has been an over-reliance on convenience samples that may not always account for important individual differences. As a result, failures to find evidence for significant forgetting effects in laboratory settings may not necessarily be due to failures of the experimental methodologies per se, but rather reflect the fact that not everyone is proficient at warding away unwanted memories.

Although early efforts to provide valid experimental evidence for the existence of unconscious repression enjoyed limited success (e.g., Holmes, 1990; McNally, 2003), a parallel line of research was developed in which repressive coping behavior was assessed as a trait. This new era of repression research, ushered in by Byrne (1964) and a seminal study by Weinberger, Schwartz, and Davidson (1979), was consistent with Freud's (Breuer & Freud, 1895/1955; Freud, 1915/1957) conceit that repressive tendencies are ubiquitous, although some individuals may rely on these defense mechanisms more than others. To this end, repression was conceptually reframed as an individual difference in cognitive and affective distancing behavior. Weinberger et al (1979) would go on to introduce a new taxonomy in which the term *repressor* was used

to describe individuals utilizing an avoidant processing style when exposed to threatening information. Specifically, repressors were described as: "…people who fail to recognize their own affective responses … who consider maintaining low levels of negative affect central to their self-concept [and] are likely to employ a variety of strategies to avoid conscious knowledge of their 'genuine reactions'" (Weinberger, 1990; p. 338).

Repressors are commonly identified from low scores on self-reported measures of anxiety, such as the Taylor Manifest Anxiety Scale (Taylor, 1953), combined with high scores on measures of defensiveness, as indexed by the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1964). This operationalization is consistent with behavioral and physiological profiles for repressive copers, as these individuals tend to subjectively report low levels of anxiety and distress in threatening situations, despite increased physiological activity (e.g., heart rate, perspiration). Combined scores on these measures have also been used to identify several control groups, including *low-anxious* (low anxiety, low defensiveness), h*igh-anxious* (high anxiety, low defensiveness), and *defensive high-anxious* (high anxiety, high defensiveness) subtypes.

As reviewed by Myers (2010), there is a considerable lack of consensus in the literature regarding the best methodological practice for identifying repressors and associated control groups. Various methods used in previous studies include: prescreening large numbers of participants and selecting only the most extreme scorers to fill each of the groups (e.g., Myers & Derakshan, 2004; Myers et al., 1998, Experiment 2); retaining the entire sample population and using median splits on the

measures of trait anxiety and defensiveness to differentiate repressors from control groups (e.g., Denollet, Martens, Nyklicek, Conraads, & de Gelder, 2008); others have relied in preset cut-offs for the anxiety and defensiveness scales, thus comparing repressors with all non-repressor groups (e.g., Cooke et al., 2003; Myers & Brewin, 1995).

Another innovative approach to identifying repressors, which was subsequently adopted in Experiments 2 and 3 of this study, was developed by Mendolia (2002) to measure dispositional tendencies towards repressive coping on a continuous scale. This operationalization of repressive coping assumes that all individuals engage in repressive distancing to some extent. Termed the Index of Self-Regulation of Emotion (ISE), this identification system uses a composite of trait anxiety and defensiveness scores from the MAS and SDS, respectively, subtracting defensiveness scores from measures of trait anxiety. The advantage of this measure is that it removes artificial boundaries between participants, thus representing the entire sample in the resulting distribution of scores. Specifically, those showing less proclivity towards repressive distancing behaviors are represented on the lower end of the distribution, whereas repressors are located at the upper end of the distribution.

Empirical studies of repressive copers reveal a number of consistent patterns. It is estimated that repressive coping styles are prevalent in 10-20% of non-clinical populations (Codd & Myers, 2009; Myers, Davies, Evans, & Stygall, 2007), with a prevalence of up to 50% in the elderly. The defining characteristic of these individuals is dispositional avoidance of negative affect, which has consequences for subsequent

memory. In particular, studies have shown that repressors have more difficulty retrieving negative autobiographical memories from childhood and adulthood (e.g., Myers & Brewin, 1994; Myers & Derakshan, 2004, 2009), and are worse than non-repressor control groups recalling negative stimuli in intentional and incidental learning paradigms (e.g., Myers & Brewin, 1995; Myers, Brewin, & Power, 1998; Myers & Derakshan, 2004). However, there is evidence suggesting these memory deficits are not universal, and may only manifest in certain situational contexts. As shown in a study by Davis (1987), repressors recalled fewer emotional autobiographical memories only when the task specified that the memory they recall be one in which they personally experienced a given emotion. In contrast, when repressors were prompted to recall memories in which other individuals experienced specific emotions, no group differences emerged.

To this point there is growing interest in how repressive tendencies interact with situational factors to affect behavior. At the heart of this issue is the basic question of *why* repressors repress? To address this question, Mendolia (1999; 2002; Mendolia et al., 1996) proposed an interactive model that relies on both dispositional and situational factors to better delineate when repressors will engage in distancing behavior. One consistent finding from the literature is that the most robust behavioral patterns of repressive coping emerge when the self-concept is threatened. Thus, how repressors appraise a given situation is a critical determinant. The model further postulates that repressors boast a natural hypersensitivity to emotionally laden information and that because they are driven to maintain consistency in their self-image, any event (positive or negative) that creates disharmony with that self-concept will be actively avoided.

Regarding the cognitive consequences of repressive coping behavior, there is growing evidence suggesting that memory deficits among repressors may be due to distinctive processes operating at the time of encoding and retrieval. For instance, a recent study by Mendolia and Baker (2008) showed that repressors rapidly disengaged attention from threatening stimuli during a target-detection task. The authors speculated that these attentional disengagement strategies may explain, in part, some of the difficulties repressors have in retrieving certain kinds of emotionally laden information, as this information may not have been successfully encoded in the first place.

Memory deficits, especially for negatively valenced information, have also been attributed to cognitive processes operating at the time of retrieval. In two experiments using the list method directed forgetting task, Myers, Brewin, and Power (1998) showed that repressors were more adept than non-repressors at forgetting negatively-valenced words that had been rated for self-descriptiveness in an incidental encoding task. In contrast, there were no group differences in recall of positive to-be-forgotten words; nor were there group differences in recall of to-be-remembered positive and negative words. On the basis of these results, the authors concluded that repressors were more skilled at intentional forgetting via retrieval inhibition.

In a follow-up study, Myers and Derakshan (2004) again examined intentional forgetting in repressors versus non-repressors. Of particular interest was whether emotional self-referent materials would be more or less likely to be targeted for forgetting by repressors. Additionally, they manipulated whether participants performed the task in public or private. Participants in the public condition were advised that a

lecturer (seen through a two-way mirror) would be evaluating them on their performance, whereas in the private condition participant confidentiality was explicitly stated and a curtain was placed over the two-way mirror. Previous research by Baumeister and Cairns (1992) showed that repressors were more likely to engage in avoidant behaviors when receiving negative feedback on tasks performed in private settings, as opposed to public settings. This finding was thought to reflect the fact that repressors are unable to maintain anonymity in a private setting, thus the greater need in defending against negative appraisals that might affect the self-concept.

Myers and Derakshan (2004) reported that repressors forgot more first list negative items than non-repressors, replicating the previous study by Myers et al. (1998). However, most intriguing was the fact that the directed-forgetting effect was only found for those negative items repressors rated for self-relevance, and only in the private condition. In contrast, repressors and non-repressors showed no difference in memory for second list words. These results were quite striking and would suggest boundary conditions for obtaining robust directed-forgetting effects with people possessing a repressive coping style.

Repressor's enhanced inhibitory control abilities were also evidenced in a study by Saunders, Worth, Vallath, and Fernandes (2014), this time with the retrieval-practice paradigm (e.g., Anderson et al., 1994). The retrieval practice paradigm was adapted such that repressor and non-repressor control groups studied lists of self-referential traits of negative and neutral valence. After this initial study phase, participants practiced retrieving either the neutral traits or the negative traits. When neutral traits were

practiced (thus designating the negative traits as RP- items), repressors showed a significantly greater retrieval-induced forgetting effect for non-practiced negative traits than any of the non-repressor control conditions. Critically, these group differences disappeared when the negative traits were practiced, suggesting that repressor's enhanced ability to exert control over their memories was limited to situations where they were faced with threatening information.

Taken together, these studies support the contention that repressors have a distinctive style of processing information they perceive to be threatening, and that this avoidant processing style has consequences for subsequent memory. Additionally, these studies underscore the importance of the situational context in determining when repressors will distance themselves from certain unpleasant memories, either generated in the lab or from their own personal histories.

Introduction to the Present Experiments

Historically, efforts to integrate psychoanalytic and experimental frameworks for studying blocked and recovered memories have been fraught with difficulties; difficulties owing to imprecise terminology, the perceived insufficiency of the stimuli used in experiments, and a lack of convincing evidence that such profound forgetting is even possible. In response, many modern theories of motivated forgetting (e.g., Anderson, 2001; Anderson & Huddleston, 2012; Erdelyi, 1995, 2006; Schooler et al., 1997; Smith et al., 2003) have distanced themselves from appeals to special forgetting mechanisms, such as unconscious repression, and instead consider explanations firmly rooted in "normal" cognitive processes. The present study advances one such research

program, which examines the effects of practiced avoidance on memory using the dropout procedure.

Experiment 1 addressed a fundamental issue for any experimental paradigm purported to model memory blocking and recovery—the generality of the procedure to more ecologically-valid materials. Although the dropout procedure has taken iterative steps towards using less contrived laboratory materials, such as the shift from categorized word lists (e.g., Smith et al., 2003; Smith & Moynan, 2007) to short stories (e.g., Handy & Smith, 2012), the question still remained as to whether these forgetting and recovery effects would extend to memories that were more personal and meaningful. As reviewed above, several prominent research programs investigating inhibitory control in selective retrieval (e.g., Barnier, Hung, & Conway, 2004) and memory suppression (e.g., Noreen & MacLeod, 2012) have successfully extended experimental procedures to memories for autobiographical events. Experiment 1 followed the progression of these studies by introducing an autobiographical memory variant of the dropout procedure to explore whether this experimental analogue is a feasible model for naturally-occurring recovered memory phenomena.

The dropout procedure has historically produced impressively large forgetting effects for a number of different materials, however there is reason to believe that autobiographical events may represent an important boundary condition for the effectiveness of practiced avoidance. For instance, autobiographical events tend to be very distinctive (e.g., Hunt & Smith, 1996; Smith & Hunt, 2000) and are more likely to be integrated with the sense of self (e.g., Klein & Kihlstrom, 1986; Klein & Loftus,

1989). As a consequence, it is possible that autobiographical memories may be more insulated against certain forgetting processes due to their being more memorable than laboratory-based episodic memories. Experiment 1 tested this possibility.

Having assessed the generality of the dropout-induced forgetting effect in Experiment 1, a second aim of the present study was to formally investigate the mechanisms underlying these effects. Two alternative accounts attribute forgetting in this procedure to interference and/or inhibitory processes. Experiments 2 and 3 examined these possibilities by varying the types of tasks participants performed during the critical avoidance phase of the experiment. Participants were initially shown several descriptions of positive and negative biographical events, along with associated memory titles. After study, some participants practiced retrieving the memory titles for the non-target memory descriptions whereas others were re-presented non-target memory titles and descriptions over the course of several ratings tasks that did not involve active retrieval. In Experiment 2 a free recall test for all studied memory titles followed. Retrieval biases against the target items dropped out of the study list were predicted across task conditions, when compared to a control condition.

Because the dropout procedure has traditionally assessed forgetting using free recall, any differences in forgetting owed to the varied avoidance tasks may be masked by output interference caused by the strengthened non-target items coming to mind more frequently. As studies from the retrieval-induced forgetting literature illustrate, active retrieval versus restudy produces dissociable effects on subsequent memory for those non-practiced items, but the effect is most prominent when output interference is

controlled for in cued recall (Murayama, Miyatsu, Buchli, & Storm, 2014). As such, a follow-up cued recall test was used in Experiment 2 to determine whether forgetting effects would persist in a more supportive retrieval environment where the output order of study items was fixed by the experimenter.

In previous experiments (e.g., Handy & Smith, 2012; Smith et al., 2003; Smith & Moynan, 2007), cued recall served as a measure of memory recovery because it removed one critical component of the hypothesized dropout-induced forgetting effect (i.e., the accumulation of output interference at test). These studies demonstrated that the memories rendered inaccessible to free recall were nonetheless available in memory and could be accessed successfully given the provision of adequate cues at test. In contrast, retrieval-induced forgetting should persist even when output interference is controlled; according to Anderson's (2001) selective retrieval hypothesis, memories that have accrued retrieval inhibition are not merely rendered inaccessible, but are unavailable for periods of time. Thus, whereas free recall performance would confirm that either interference or inhibition could account for the forgetting effects in this procedure, Experiments 2 and 3 used cued recall to dissociate the effects of different avoidance tasks in the dropout procedure.

A final aim of the present study was to investigate the effectiveness of practiced avoidance at the individual level. Repressive coping style has been associated with limited accessibility to unpleasant autobiographical memories (e.g., Davies, 1987; Myers, Brewin, & Power, 1992), and poorer intentional (e.g., Myers & Brewin, 1995) and incidental (e.g., Myers, Brewin, & Power, 1999) recall of emotional information,

particularly when the emotional information threatens the self-concept. Interactive models of repressive distancing behavior (e.g. Mendolia 1999, 2002; Mendolia et al., 1996) suggest that memory deficits among repressors may be attributed to attentional avoidance of threatening material at the time of encoding (Mendolia & Baker, 2008). Other studies have also examined the extent to which repressive copers can exert control over their memories. Studies using the directed forgetting (Myers, Brewin, & Power, 1998; Myers & Derakshan, 2004) and retrieval-practice paradigms (Saunders et al., 2014) have shown that repressors are more adept than non-repressors at intentionally forgetting emotional information when they perceive their self-concepts to be threatened.

In Experiments 2 and 3 repressive distancing behavior was assessed within the context of the dropout procedure. Following conventions established by Mendolia (2002), repressors were identified using the Index of Self-Regulation of Emotion (ISE), which places dispositional repressive coping behavior on a continuous scale. Of interest was whether repressors would show greater memory deficits following practiced avoidance of negatively-valenced material than non-repressors. Dovetailing with this issue was whether repressive coping style would interact with the type of task participants engaged in during the avoidance phase of the experiment. Specifically, previous studies associating repressive distancing with greater inhibitory abilities (e.g., Saunders et al., 2014) argue for the prediction that repressors should show more forgetting of negative target items following competitive retrieval practice.

To summarize, Experiment 1 tested the prediction that memories for meaningful, emotionally laden autobiographical events could be blocked and then recovered using

the dropout procedure. Insofar as Experiment 1 was designed to assess the ecological validity of the dropout procedure, Experiments 2 and 3 were used to define the mechanism(s) underlying the dropout-induced forgetting effect. The theoretical assumption was that avoidance activities involving deliberate competitive retrieval practice would recruit a different mechanism than incidental re-exposures to non-target items; that is, these tasks would involve retrieval inhibition and interference, respectively. As a result, dissociable effects of this task manipulation were expected when memory was tested for target items dropped from the study list, particularly under testing conditions where interference effects are experimentally controlled, as in category-plus-stem cued recall. Finally, Experiments 2 and 3 explored a motivational dimension of memory blocking and recovery by examining individual differences in the dropout-induced forgetting effect as a function of whether participants possessed a repressive coping style. Repressors are identified based on their use of avoidant processing styles; of interest was whether these individuals would therefore demonstrate greater memory deficits than non-repressors following practiced avoidance tasks in the dropout procedure.

CHAPTER II

EXPERIMENT 1

The primary goal of Experiment 1 was to examine blocking and recovery of memories corresponding to autobiographical events. This experiment falls in line with the progression of research on inhibitory control in retrieval-induced forgetting (e.g., Barnier, Hung, & Conway, 2004) and the think/no-think procedure (e.g., Noreen & MacLeod, 2012), which generalized forgetting effects using laboratory-based episodic stimuli to emotional, self-referent materials. In previous studies, forgetting and recovery effects following the dropout procedure were quite large and robust across a variety of basic laboratory materials, including categorized word lists (Smith et al., 2003; Smith & Moynan, 2008; Gunawan and Gerkens, 2010), lists of expletives (Smith & Moynan, 2008), and short narratives (Handy & Smith, 2012). Are emotionally-arousing autobiographical memories also susceptible to memory blocking manipulations in the dropout procedure?

In Experiment 1, a variant of the dropout procedure was developed for use with autobiographical memories. For this procedure, participants completed two experiment sessions. The first session was dedicated to generating sets of positive and negative autobiographical memories using a procedure adapted from the Galton word-cuing technique (e.g., Crovitz & Schifmann, 1974; Galton, 1879). Participants described an event from their personal histories in response to cue words, and provided each memory description with a descriptive one-word title (see also Barnier, Hung, & Conway, 2004).

These memory descriptions were then used as stimuli in the dropout procedure, which took place one week later.

For the dropout procedure, participants were randomly assigned to either the dropout or control conditions and studied a set of their autobiographical memory descriptions for a later memory test. Following the initial study period, participants in the dropout condition were re-exposed to a majority of the memory descriptions over the course several interpolated tasks, unaware that a subset of their memory descriptions was withheld from additional study. To gauge the effects of the critical retrieval-biasing manipulation, participants in the dropout and control conditions completed a free recall test for all previously-studied memory descriptions. Significant memory deficits for target (i.e., dropped out) autobiographical memories were predicted in free recall for the dropout condition, when compared to a control condition that did not receive extra exposures to non-target memory descriptions.

To illustrate that blocked memories were also recoverable, a follow-up cued recall test was administered. For this test, participants were re-presented cue words from the Session One autobiographical memory generation task. It was predicted that these highly specific cues would serve as potent reminders of target autobiographical memories, and thus produce no significant differences in cued recall performance across control and dropout conditions. This result would highlight the availability of target memories, despite their being rendered inaccessible to free recall.

Method

Participants

The participants were undergraduate volunteers from introductory psychology courses at Texas A&M University that enrolled in partial fulfillment of a course requirement. Thirty participants took part in Session One of the study. Two participants were excluded from Session Two because they did not provide an adequate number of memory descriptions in Session One. An additional six participants attended Session One, but did not return for Session Two. Thus, there were 22 participants that completed Experiment 1, with 11 participants in the Dropout condition and 11 participants in the Control condition.

Research Design

Experiment 1 used a 2 x 2 x 2 mixed design with condition (Dropout versus Control) and memory generation cue valence counterbalancing (positive or negative) serving as between subjects variables, and autobiographical memory valence (positive or negative) serving as a within subjects variable. Free recall of target memory titles and cued recall of target memory titles served as dependent measures, assessing forgetting and recovery, respectively.

Materials and Procedure

Session One. Thirty emotionally neutral words were selected from the Affective Norms for English Words (ANEW, Bradley & Lang, 2008) to use as cue words for the autobiographical memory generation task. These cues were divided into two sets, with each word accompanied by a plus (+) sign or a minus (-) sign (counterbalanced between

subjects), to designate whether participants should use the cue to think of a positive or negative valence memory, respectively. A complete list of the cue words used in Experiment 1 along with associated valence, arousal, and word frequency ratings for each word can be found in Appendix A.

For the autobiographical memory generation task, participants were tested individually in a study session that lasted approximately 90 minutes. Each participant was seated in front of a computer, which was used to transcribe memory descriptions using the Microsoft Word processor. Next to the participant work station was a second monitor used for presentation of task instructions and memory generation cues. Participants were told that they were taking part in a study examining individual differences in the ability to remember and think about autobiographical events. Specifically, they were told that they would see 30 words presented one at a time on a neighboring computer screen, and that these cue words should be used to think of a specific memory from any part of their life as quickly as possible. Following conventions used in previous experiments (e.g., Noreen & MacLeod, 2012) specific memories were defined as unique, single events that the participant experienced, typically measured in seconds, minutes, or even hours, but not days. Each cue was presented with a plus or minus sign. If the cue was presented along with a plus sign, participants were instructed to think of a positive memory that made them feel good; alternatively, if they saw a cue accompanied by a minus sign, they were to think of a negative memory that did not make them feel good. Participants had 60 seconds to verbally indicate they thought of a memory, otherwise the experimenter moved on to the

next cue word. In writing their memory descriptions, participants were told that their descriptions should be at least a few sentences long and that they should include as many details as possible. To aid participants in writing their memory descriptions, they were advised to think of the task similarly to writing a description in a diary or a journal after re-enacting the event in their minds. Furthermore, as a general rule they were told to try and answer three generic questions concerning the causes, consequences, and personal meaning of each event (cf. Harris, Sharman, Barnier, & Moulds, 2010; Noreen & MacLeod, 2012).

In addition to each memory description, participants were required to report the approximate age at which the event took place, as well as a unique personal word that acted as a "title" for their memory to use as a mnemonic aid to help remind them of the memory later. Participants were given two minutes to type out their memory descriptions, at which time the next cue was presented, and so on until all 30 cue words were seen.

Prior to Session Two each participant's memory descriptions were rank-ordered according to the amount of time it took them to respond "yes" after encountering each cue. Response latencies during memory generation were used to determine which memories were used for the dropout procedure. Specifically, 24 of the 30 memories were chosen based on the fastest response latencies and quality of memory descriptions. For instance, memory descriptions in which participants did not comply with the experimenter instructions were excluded from the experimental phase. Examples of non-compliance included memories that the participants themselves did not experience but

were told about by others, memories that were not of the appropriate valence category, and memories that did not correspond to specific events. Of the 24 memories selected for the dropout procedure, a subset of four items (two from each valence category) served as target memories. To select the target memories, the experimenter chose two memories from each valence category that produced the fastest response latency during generation. That is, the target memories were those participants recalled most fluently during the generation task.

Session Two. One week later, participants returned for Session Two. The dropout procedure adhered very closely to the variant of the procedure used by Handy and Smith (2012) with narrative vignettes. Participants were randomly assigned to either the Dropout or Control condition prior to returning for the second session. Upon their return, participants were told that for the next study they would read and make several judgments on some of the memories they generated in the previous session. For each memory, participants were shown the memory description they wrote during the previous session, as well as the original cue word they used to generate the memory and the associated personal word (e.g., PARK (+) or BARBECUE (-)). Prior to presenting each memory description, participants were instructed to write down their personal word for that description. The memory description then remained on the screen for 25 seconds. Participants were instructed to read the description and then recall how exciting the memory was when they retrieved it. Arousal ratings were based on a 7-point Likert scale (1 = *not very aroused* to 7 = *very aroused*). Participants were given 3 seconds to write their rating down on the response form next to their personal words. This process

continued until all 24 memory descriptions were read and given ratings, and participants had practice writing down each personal word. Importantly, all participants took part in this phase of the procedure, regardless of whether they were assigned to the Dropout or Control condition.

Following the first study phase of the experiment, participants in the Dropout condition performed several more ratings tasks, again using Likert-type scales for memory availability (1 = *comes to mind very easily* to 7 = *comes to mind with difficulty*), imaginability (1 = *very clear* to 7 = *very vague*) and vividness (1 = *very detailed* and 7 = *not detailed at all*). Representation of the memory descriptions was blocked by the specific rating task, with the order of presentation randomized in each block. For each memory description, participants wrote down each personal word and read the associated memory description before providing their ratings. Critically, only 18 of the initial 24 memories were re-presented during these intervening ratings tasks. Participants were given any indication that the experimenter excluded any of their memories in these tasks. The total duration for these ratings tasks was approximately 30 minutes.

For the control condition, following the initial study phase, participants performed several nonverbal tasks, including number search puzzles and long multiplication problems. These tasks lasted approximately 30 minutes.

In the test phase, both Dropout and Control conditions were tested for their memory of all autobiographical memories using free recall. Specifically, participants were asked to write down as many personal words as they could recall. The experimenter encouraged participants to try and think of all of the personal words for all

of the memory descriptions they encountered throughout the entire experiment. Further, memory descriptions were to be recorded in the order they came to mind. In the event participants were unable to think of a specific personal word, but still remembered details of the corresponding event, they were instructed to write down a brief one sentence description of the memory, ensuring that there was enough detail that an independent reader could easily identify the memory in question based on their description. This free recall period will last 3 minutes.

After the free recall task, participants were given a final cued recall test for each of the four target memory descriptions. Four cue words participants used during the Session One autobiographical memory generation task (e.g., PARK, BARBECUE) were represented as cues for recalling the corresponding personal words. Similar to the free recall task, if participants were unable to think of a specific personal word, but recalled details about the memory, they were instructed to write down a brief description. Note that participants also saw these cues during the initial study phase in Session Two, alongside the respective personal words and memory descriptions. Participants had 2 minutes to complete this task.

Results

Memory Blocking Effect

Blocking effects were assessed using a 2 x 2 x 2 mixed analysis of variance (ANOVA), comparing two between-subjects factors, condition (Dropout versus Control) and cue valence counterbalancing (positive versus negative), and a within-subjects factor, autobiographical memory valence (positive versus negative). The proportion of

target autobiographical memory titles correctly recalled in free recall served as the dependent measure.

All analyses were first conducted treating the counterbalancing subgroupings of memory generation cue valence as a between subjects factor. No significant difference was obtained comparing the proportions of target memories recalled in these subgroups ($F(1, 18) = 1.38$, $p = .256$), nor was there a simple interaction between memory generation cue valence and condition, $F(1, 18) = 2.15$, $p = .160$. Therefore, the data from these subgroups were combined in the results reported below.

Consistent with previous experiments using the dropout procedure (e.g., Handy & Smith, 2012; Smith et al., 2003; Smith & Moynan, 2008), a significant memory blocking effect was observed in the Dropout condition for free recall of target autobiographical memories ($M = 0.26$, $SE = 0.06$) when compared to retrieval of matched target autobiographical memories in the Control condition ($M = 0.64$, $SE = 0.06$), $F(1, 18) = 19.38$, $p < .0001$, $d = 1.76$. As shown in Figure 2, significant valence-specific blocking effects were observed in both study conditions, revealing an advantage for target memories of positive valence, $F(1, 18) = 4.54$, $p < .05$. In the Dropout condition, positive target memories ($M = 0.35$, $SE = 0.09$) were recalled more often than negative target memories ($M = 0.18$, $SE = 0.09$). A similar pattern was observed in the Control condition, with positive target memories ($M = 0.73$, $SE = 0.09$) again recalled more often than negative target memories ($M = 0.55$, $SE = 0.08$). The interaction between study condition and target memory valence was not significant, confirming the uniformity of this positivity bias across conditions, $F(1, 18) < 1$, $p = 1.00$.

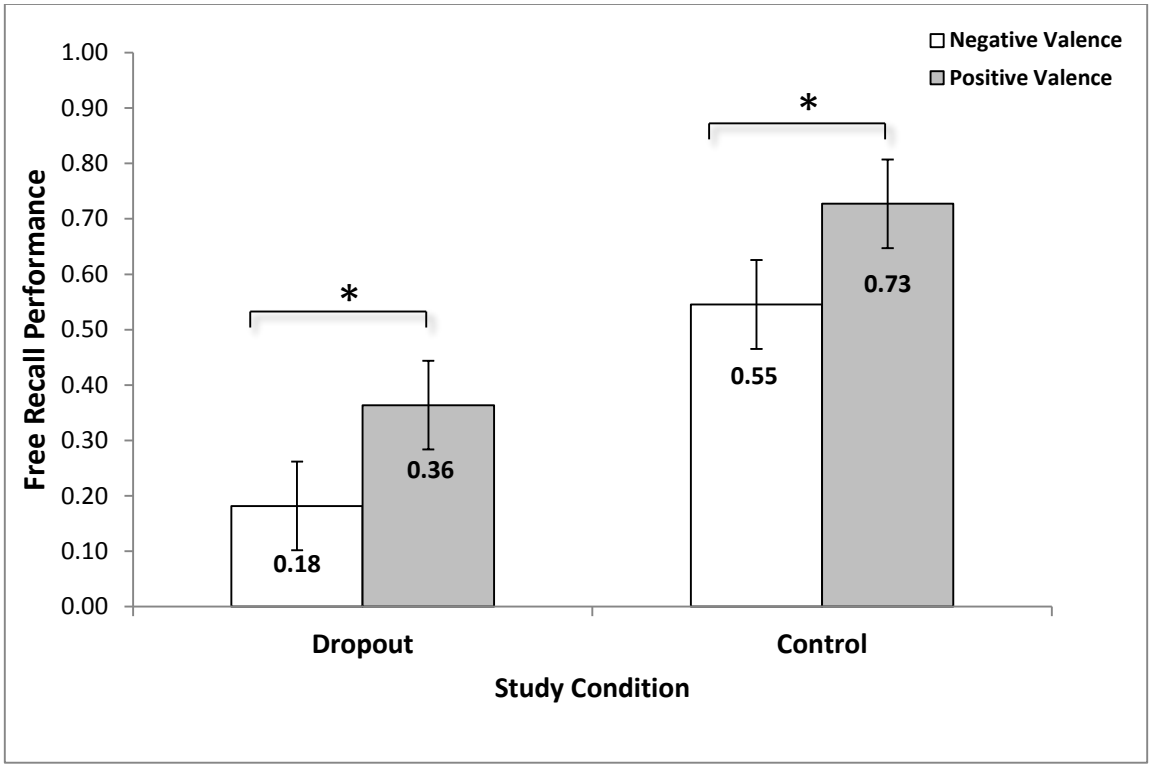

Figure 2. Free Recall Performance for Target Memories as a Function of Study Condition and Target Valence in Experiment 1. Note error bars represent standard errors. * $p < .05$

In contrast to the large blocking effect observed for target memories in the Dropout condition, interpolated re-exposures to non-target memories facilitated recall of associated memory titles. A 2 (Condition) x 2 (Target Memory Valence) mixed ANOVA revealed an advantage for non-target memories in free recall in the Dropout condition (M = 0.71, SE = 0.04) compared to Control condition performance (M = 0.58, SE = 0.04), $F(1, 18) = 4.93$, $p = .039$. There was no effect of non-target memory valence, $F(1, 18) = 1.03$, $p = .32$, nor was the interaction between filler valence and study condition significant, $F(1, 18) < 1$, $p = .67$.

Memory Recovery Effects

To assess memory recovery, a 2 (Condition) x 2 (Generation Cue Valence counterbalancing) x 2 (Target Memory Valence) mixed ANOVA was performed on the proportion of target memory titles retrieved in cued recall. Once again, there were no significant effects of generation cue valence counterbalancing on final cued recall performance ($F < 1$), nor was there a significant simple interaction between these subgroups and Condition (F (1, 18) = 3.32, $p = .085$). Therefore, the data from these subgroups were combined in the results reported below.

Although striking levels of forgetting were observed in free recall for critical memory titles, when participants were re-exposed to cue words used during the initial memory generation task, overall memory performance was comparable between conditions, $F(1, 20) = 1.48$, $p = .239$. As shown in Figure 3, performance was not affected by the valence of the target memories, $F(1, 20) < 1$, $p = 1.00$. However, there

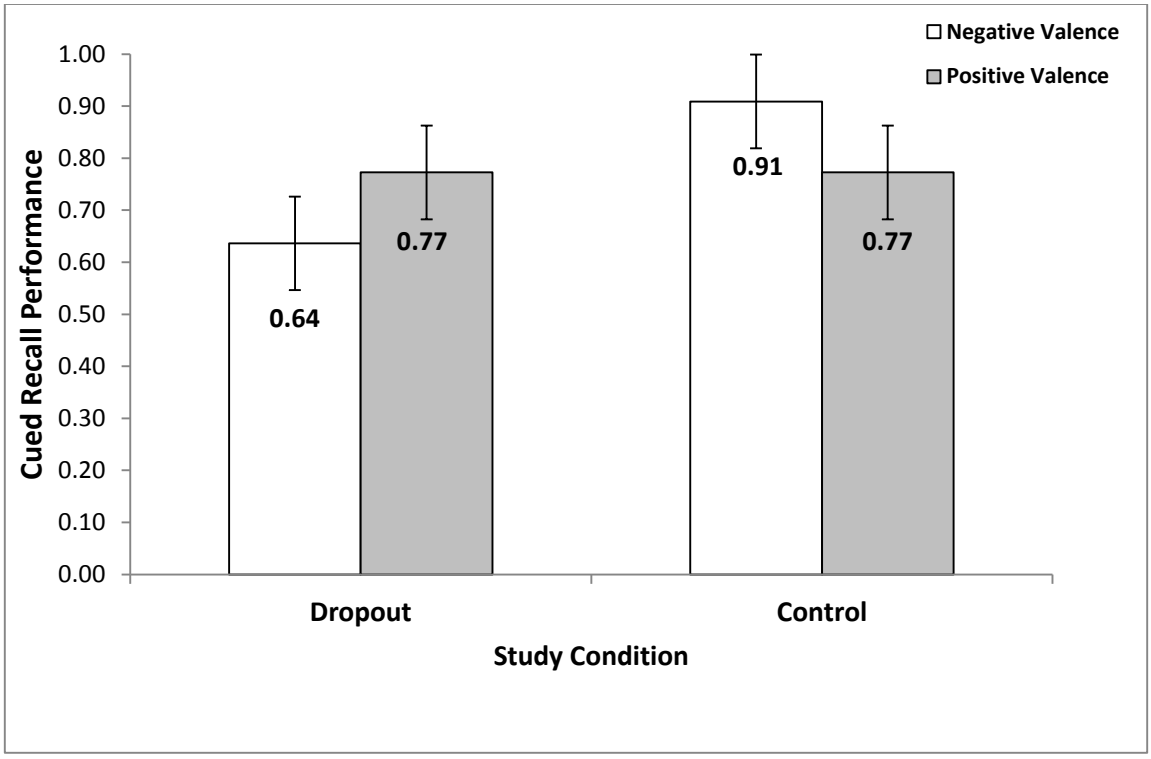

Figure 3. Cued Recall Performance for Target Memories as a Function of Study Condition and Target Valence. Note error bars represent standard errors.

was a trend towards a Condition x Valence interaction, $F(1, 20) = 3.91$, $p = .062$, which was driven by participants in the Control condition recalling a larger proportion of the negative valence target memories ($M = 0.91$, $SE = 0.09$) than the Dropout condition ($M = 0.64$, $SE = 0.09$).

Discussion

The results of Experiment 1 provide strong evidence that positive and negative autobiographical memories are susceptible to memory blocking effects produced by the experimental dropout manipulation. Selectively re-exposing participants to non-target autobiographical event descriptions over consecutive tasks significantly limited the accessibility of target memories, as measured by free recall of personal titles associated with the target memories. Moreover, the magnitude of the blocking effect ($d = 1.76$) was consistent with blocking effects reported in previous experiments examining dropout-induced forgetting using categorized word lists (average $d = 1.12$) and narrative vignettes ($d = 1.86$, averaged across three experiments).

One potential criticism of these results is that the large forgetting rates in the dropout condition may be accounted for by participants simply being unable to recall the personal memory titles that were associated with target memory descriptions. If this were the case, it could be argued the dropout procedure did not actually limit access to the target memories, per se; rather, selective re-exposures to the non-target items weakened the association between the target memories and their associated titles to a point where they were unable to be retrieved at test. However, one vital test instruction argues against this interpretation. Although participants were instructed to recall the

personal titles of all of the memories they could remember studying, they were also encouraged to produce a brief description of a memory description should they be unable to retrieve a specific personal memory title. The fact that participants in the dropout condition were unable to formulate even brief descriptions of the target memories when queried suggests that these memories were not readily accessible (i.e., blocked).

Also of interest was the effect of target memory valence on recall, as there was evidence of a significant positivity bias in both the dropout and control conditions. This result came as somewhat of a surprise, given that previous memory studies using young adult samples have reported a strong negativity bias when recalling emotional materials (e.g., Charles, Mather, & Carstensen, 2003; Mather & Knight, 2005; Tomaszczyk, Fernandes, & MacLeod, 2008).

Regarding memory recovery, supplying participants with more specific retrieval cues aided recall of target memories and resulted in comparable overall test performance across dropout and control conditions. The ease with which participants in the dropout condition were able to access target memories in cued recall was in stark contrast to the difficulties they encountered when recall was unguided in the initial free recall test.

CHAPTER III

EXPERIMENT 2

Whereas Experiment 1 illustrated that the dropout procedure could be successfully generalized to autobiographical memories, the central focus of Experiment 2 was exploring the cognitive processes underlying memory blocking and recovery effects in this procedure. Specifically, this experiment addressed an issue first posed by Smith et al. (2003) regarding the potential role of retrieval inhibition in the dropout-induced forgetting effect. Previous dropout-induced forgetting studies have relied on interpolated tasks that could arguably produce interference *and/or* retrieval inhibition for target memories. For instance, in addition to ratings tasks, retrieval practice trials are a common means of re-exposing participants to non-target items in this procedure. Competitive retrieval practice is argued to produce retrieval inhibition for non-practiced, but competing, memory representations (e.g., Anderson et al., 1993; Anderson & Spellman, 1995). Although Smith et al. (2003) and others (e.g., Handy & Smith, 2012; Smith & Moynan, 2008) have postulated that the locus of the dropout-induced forgetting effect is a combination of reduced output dominance for target memories and the accrual of output interference produced by strengthened non-target memories during retrieval, one possibility is that the inclusion of retrieval practice for non-target study items could also lead to non-practiced target memories accruing retrieval inhibition. The robust forgetting effect associated with the dropout procedure could therefore reflect the

cumulative effect of interference and retrieval inhibition acting on retrieval of target memories.

Experiment 2 addressed this possibility by experimentally manipulating interpolated tasks in the forgetting condition such that participants were either re-presented with non-target memories several times (an interference manipulation) or engaged in competitive retrieval practice of non-target memories (a retrieval inhibition manipulation). To ensure that target memories competed with non-target memories in the retrieval practice condition, the dropout procedure was modified to more closely resemble the standard retrieval practice paradigm used to measure retrieval inhibition (e.g., Anderson et al., 1994). Participants studied 24 memory descriptions adapted from a database of autobiographical memories collected in Experiment 1; these memory descriptions were organized into four categories: *Happy*, *Sad*, *Exciting*, and *Fear* memories. One memory description was chosen from each of the four categories to serve as target items, with the remaining five memory descriptions from each category serving as non-targets.

The retrieval practice variant of the dropout procedure departs from the traditional retrieval practice paradigm (e.g., Anderson et al., 1994) in several ways. First, rather than relying on category-exemplars that are semantically related to one another (e.g., a list of several fruits or alcoholic drinks), memory descriptions used in Experiment 2 were only episodically related to their respective categories. One potential pitfall of relying on episodically-defined materials is that non-practiced target items may not compete with practiced non-target items during the retrieval practice phase, thus

removing the need to engage in inhibitory control. However, as revealed in a recent meta-analysis by Murayama, Miyatsu, Buchli, and Storm (2014), retrieval-induced forgetting effects are generally reliable following episodic learning, although the magnitude of these forgetting effects is smaller than in studies using semantically-associated materials.

A second deviation from the standard retrieval-practice paradigm was designating only one memory description per category as a target item, as opposed to the convention of using half of the items from half of the practiced categories. Although this design choice limited the total number of critical observations used for comparisons in the final test (and thus sacrificed some statistical power), this organization parallels the prototypical dropout procedural design wherein participants study many non-target items and only a select few target items.

Third, and perhaps the most significant deviation from the traditional design of the retrieval-practice paradigm, was assessing retrieval-induced forgetting between-subjects. Typically, retrieval-induced forgetting is measured using a within-subjects design in which recall of non-practiced items from practiced categories (i.e., RP- items) is compared with recall of baseline items from non-practiced categories (i.e., NRP items). The nature of the dropout procedure precluded a within-subjects manipulation however. Therefore, memory deficits accrued for target items following retrieval practice or re-presentation of non-target items was compared with recall of these same items in a control condition. As previous studies have shown, between-subjects variants

of the retrieval practice paradigm remain a sensitive measure of retrieval inhibition (see Shaw, Bjork, & Handel, 1995; Saunders, Worth, Vallath, & Fernandes, 2014).

A secondary goal of Experiment 2 was to initiate an exploration of moderating factors in the dropout procedure. Specifically, this experiment assessed whether individuals possessing a greater disposition towards repressive distancing behavior were more susceptible to forgetting and recovery effects in the dropout procedure. Previous studies using list-method directed forgetting (Myers & Derakshan, 2004) and the retrieval practice paradigm (Saunders et al., 2014) have shown that repressors are more prone to forgetting negative, self-referent materials than non-repressors. These memory deficits have been described as motivated forgetting behaviors intended to protect repressors from threats posed by negative information to their self-concept. The effects of this avoidant processing style are not limited to negative valence, however. Studies have also shown that positively-valenced information may also be avoided if the information is inconsistent with their self-concept (e.g., Davis & Schwartz, 1987; Davis, 1987). An open question is whether repressors' enhanced forgetting abilities extend to contexts in which active inhibitory processes are not necessarily engaged, contrary to what is argued to occur in list-method directed forgetting and the retrieval-practice paradigm. That is, might repressors self-censor memories even when task demands do not require they engage in inhibitory control processes? If so, would memory performance for repressive copers differ following activities that promote active versus passive forgetting processes?

A related question concerns the durability of forgetting among those prone to repressive distancing. Are memories more or less recoverable among repressors? The dropout procedure offered a unique vehicle for examining the issue of memory recovery among those possessing avoidant processing styles, which is a topic rarely touched upon in the motivated forgetting literature. One might expect that because repressors possess superior forgetting capabilities for self-threatening information, they may also be more resistant to recovery factors, such as certain retrieval cues. Although, in the past, cued recall has served as an effective recovery tool following the dropout manipulation, whether repressive copers would be more or less likely to recover memories in cued recall is unclear.

Method

Participants

The participants were undergraduate volunteers drawn from introductory psychology courses at Texas A&M University in partial fulfillment of a course requirement. Enrollment in experiment sessions was voluntary, with each session conducted in small groups of 10 to 15 participants at a time. Because participants could randomly enroll in experiment sessions, the number of participants in each treatment condition was not equal. There were 71 participants in Experiment 2, with 25 participants in the Re-Presentation condition, 24 in the Retrieval Practice condition, and 22 in the Control condition.

Measures and Design

Experiment 2 used a 3 x 2 mixed design, manipulating treatment condition (Re-Presentation, Retrieval Practice, and Control) between subjects, and memory description valence (positive or negative) within-subjects. Free recall and cued recall performance served as dependent measures, assessing forgetting and memory recovery, respectively.

Repressive distancing was also assessed as a potential moderator for forgetting effects produced by the dropout procedure. To identify individuals with a greater disposition towards a repressive coping style, participants completed a shortened 20-item form of the Manifest Anxiety Scale (MAS; Bendig, 1956; Taylor, 1953) and the Crowne-Marlowe Social Desirability Scale (SDS; Marlowe & Crowne, 1960). For a complete list of the items included in each scale, refer to Appendices C and D.

Materials and Procedure

Memory descriptions used in Experiment 2 were adapted from a pilot study in which participants were given four emotion categories (e.g., *Happiness, Sadness, Excitement,* and *Fear*) and were asked to report a total of six autobiographical events corresponding to each category cue word. After accumulating a database of memory descriptions, the experimenter selected six representative memory descriptions from each of the four categories. The memory descriptions were edited for length and any names or locations were changed to maintain participant anonymity. Each memory description was assigned a descriptive one-word title, with the provisions that no memory title within a category began with the same letter and none of the words used as memory titles appeared in the body of the memory description text.

Participants were randomly assigned to one of three task conditions (Representation, Retrieval Practice, or Control) and tested in groups of 10-15 at a time. Regardless of task condition, all participants took part in the initial study phase in which they read 24 memory descriptions presented via PowerPoint presentation. Participants were told that these memory descriptions were sampled from participant responses in a larger study about autobiographical memories and their task was to rate these event descriptions based on several dimensions. All memory descriptions were matched for length (approximately one paragraph), and included a descriptive title. Additionally, each memory description was associated with one of four valence categories (e.g., *Happiness, Sadness, Excitement,* and *Fear*). These category cues appeared in bold-face red font color at the top of each slide, with corresponding memory titles and memory descriptions located below. All memory descriptions were blocked by valence category, such that all of the *Happiness* memories appear in succession, following by the *Sadness* memories, and so on until all categories and their associated members have been seen. A complete list of all the memory descriptions, their valence categories, and associated titles are located in Appendix B.

For each study item, participants were given a few moments to write down the memory title before the description appeared. The memory description remained on the screen for 30 seconds, after which participants made their ratings. Each memory description was rated on two dimensions using 7-point Likert-type scales. First, participants rated each memory description for excitement (1 = *not very aroused* to 7 = *very aroused*). Next, they rated each memory description for self-relevance (1 = *not very*

relevant to me to 7 = *very relevant to me*). In making their rating for self-relevance, participants were instructed to judge how much the memory description relates to events that have occurred in their lives. Participants were allotted three seconds to make each rating, in succession. This sequence was repeated until all 24 memory titles were written down and all memory descriptions were read and rated.

Following the initial study phase, participants entered into the critical phase of the experiment, which lasted approximately 30 minutes. The basic study procedure used in Experiment 1 was used in Experiment 2, with several important variations.

In the Representation condition, participants were re-exposed to 20 of the 24 initially-studied memory descriptions (5 from each valence category) and were asked to again make several ratings for valence (1 = *negative* to 7 = *positive*), imaginability (1 = *very clear* to 7 = *very vague*), and vividness (1 = *very detailed* to 7 = *not very detailed*). Prior to making each rating, participants were required to write down the memory title for each description. Participants were re-presented each memory description, title, and category cue a total of three times (once in each rating task block). The order of memory description presentation was block randomized.

In the Retrieval Practice condition, participants practiced retrieving non-target memory titles in response to their associated category cue for 20 of the 24 original study items (5 memory titles per category cue). For each retrieval practice trial, a category was presented alongside a two-letter stem that corresponded to one of the memory titles. For instance, for the practice item "*SADNESS – TR*_____" participants completed the letter stem with the appropriate memory title, in this case "*TRAUMA*." Participants had 5

seconds to write down the correct memory title before receiving feedback on the correct response. In addition to supplying participants with corrective feedback, they were also given the corresponding memory description again for 20 seconds. Regardless of whether or not they responded with the correct memory title, they were instructed to read the memory description again. This test-feedback procedure continued until all 20 of the study items were practiced. After completing one block of retrieval practice trials, there was be a brief 5 second break before the second block of trials began. Participants completed a total of 3 blocks of retrieval practice, with the order of category cue-stem pairs block randomized.

Mirroring Experiment 1, the control condition performed several non-verbal tasks (e.g., multiplication problems and number search puzzles) for an equivalent 30-minute duration.

For the test phase, participants completed two memory measures. As in Experiment 1, a free recall test was administered first. For this test, participants wrote down as many of the descriptive memory titles as they could remember. They were instructed to write the titles down in the order they came to mind, and were free to guess if they were unsure. Additionally, if they could not recall a specific title but remembered something about the memory, they were encouraged to write down a brief one sentence description of the memory event. The free recall test lasted for three minutes. In addition to free recall, participants also completed a category-plus-stem cued recall test. For each test question, a memory valence category was presented alongside a one-letter stem (e.g., *SADNESS – T*_____). Participants answered the test question with the correct

memory title. Three seconds was allotted for each test question before moving on to the next category cue-plus-stem, until all 24 memories have been tested.

Finally participants completed the Bendig short-form of the Taylor Manifest Anxiety Scale (Bendig, 1956; Taylor, 1953) and the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960).

Results

Analysis Strategy

A preliminary analysis of the data, collapsing across treatment conditions, indicated significant positive skew in the distribution of target memory items retrieved in free recall ($Z = 2.64$, $p < .05$), although the distribution of cued recall scores was not skewed ($Z = 0.77$, $p > .05$). To examine whether the distributions of sample means deviated significantly from normal, a series of Kolmogorov-Smirnov (KS) tests were used. As shown in Table 1, separate KS tests were used to approximate the shapes of the distributions for free recall and cued recall data, collapsing across treatment conditions. In addition, as there was interest in testing the main effect of treatment condition for each memory measure, separate KS tests were run for the Control, Re-Presentation, and Retrieval Practice conditions. The KS test confirmed that the distributions of scores in free recall and cued recall (overall) deviated significantly from normal and that when the data were conditionalized by treatment, the Poisson distribution provided a better goodness-of-fit (see Table 1). On the basis of these results, Poisson regression was judged to be the most appropriate statistical method for data analysis in Experiment 2, as

Table 1. Descriptive Statistics for Memory Test Performance in Experiment 2.

				Kolmogorov-Smirnov *D*	
				Null hypothesis—distribution is:	
Outcome	*M*	*SD*	*Skewness*	Normal	Poisson
Free Recall					
Overall (N = 71)	1.24	1.49	2.64*	2.80***	2.07***
Re-Presentation (N = 25)	1.12	1.53	2.14*	1.84**	1.37*
Retrieval (N = 24)	0.33	0.76	4.05*	2.46***	0.60
Control (N = 22)	2.36	1.33	-0.43	1.36*	.473
Cued Recall					
Overall (N = 71)	1.71	1.45	0.78	2.02***	1.34
Re-Presentation (N = 25)	1.92	1.47	0.14	1.21	0.74
Retrieval (N = 24)	1.00	1.32	2.10*	1.76**	1.06
Control (N = 22)	2.28	1.28	-0.23	1.46*	0.94

Note. * $p < .05$, ** $p < .01$, ** $p < .001$

opposed to more traditional methods based on the normal curve, such as ANOVA and regression by ordinary least squares (OLS)[2].

Index of Self-Regulation of Emotion (ISE)

The MAS (Taylor, 1953) and SDS (Crowne & Marlowe, 1960) were used to identify individuals showing a disposition towards repressive coping behaviors. Responses to these measures were converted into a single continuous measure using a formula specified by Mendolia (2002) for calculating an Index of Self-Regulation of Emotion (ISE): ISE = 20 – (MAS – SDS). Participants displaying less of a disposition towards avoidant processing were located at the lower end of the distribution, whereas participants displaying a greater disposition towards avoidant processing were located at the upper end of the distribution. The distribution of ISE scores were normally distributed (*skewness* = .23, *kurtosis* = .36), which supports the underlying assumption of the ISE that repressive distancing exists on a continuum, with most scores piled in the middle. For the purposes of the present analysis, ISE was centered at its mean to aid in interpretation of regression coefficients.

Free Recall

Regression coefficients for the various predictors of interest are shown in Table 2 for the number of target items recalled overall, as well as in each of the two valence categories. These models was fit in two steps. For the first step, a full model was specified to assess the presence of any interactions between treatment conditions and repressive distancing behavior on free recall scores. In the second step, interaction terms that were not statistically significant were dropped from the model. The resulting model

Table 2. Summary Poisson Regression Results of Free Recall Performance for Target Memories in Experiment 2.

	Overall			Negative Valence			Positive Valence		
Predictors	**B (SD)**	**χ^2**	**e(B)**	**B (SD)**	**χ^2**	**e(B)**	**B (SD)**	**χ^2**	**e(B)**
Step One									
Intercept (Control)	0.88 (0.26)	11.65**	2.42	-0.69 (0.31)	5.08*	0.50	-0.04 (0.31)	0.02	0.96
Retrieval	-1.99 (0.49)	16.75***	0.14	-3.20 (1.77)	3.27†	0.04	-2.04 (0.69)	8.77**	0.13
Re-Presentation	-0.84 (0.40)	4.47*	0.43	-0.52 (0.50)	1.06	0.60	-1.18 (0.55)	4.57*	0.31
ISE	-0.30 (0.04)	0.47	0.97	-0.06 (0.05)	1.79	0.94	0 (0.05)	0.01	1.00
ISE x Retrieval	0 (0.07)	0	1.00	-0.12 (0.21)	0.34	0.89	0.01 (0.09)	0	1.01
ISE x Re-Presentation	-0.01 (0.08)	0.01	0.99	0.03 (0.09)	0.09	1.03	-0.04 (0.11)	0.12	0.96
Step Two									
Intercept (Control)	0.89 (0.26)	11.82**	2.42	-0.69 (0.31)	5.14*	0.50	-0.04 (0.31)	0.01	0.96
Retrieval	-2.00 (0.49)	16.83***	0.14	-2.57 (1.05)	6.03	0.08	-2.04 (0.69)	8.86**	0.13
Re-Presentation	-0.83 (0.39)	4.62*	0.44	-0.59 (0.47)	1.56	0.56	-1.12 (0.52)	4.61*	0.33
ISE	-0.03 (0.03)	1.09	0.97	-0.06 (0.04)	2.61†	0.94	-0.01 (0.04)	0.05	0.99

Note. † $p < 10$, * $p < .05$, ** $p < .01$, ** $p < .001$

in Step Two was a main effects model used to test independent associations between treatment condition and repressive distancing on memory for target items.

Overall Performance. The primary research question in Experiment 2 was whether practiced avoidance involving selective retrieval practice of non-target items would produce memory blocks for target items, similar to blocks expected following re-presentation of non-target items. Furthermore, to what extent would the valence of the target items impact the susceptibility of these memories to forgetting? Prior to evaluating any valence-specific memory blocking effects, free recall performance for target items was tested as a function of treatment condition and repressive distancing behavior, collapsing across valence categories. The test of the overall model was significant, both for the full model (χ^2 (5) = 20.36, $p < .001$) and the main effects model (χ^2 (3) = 20.34, $p < .001$). As shown in Table 2, there was not a statistically significant interaction between the treatment conditions and ISE (Step One), therefore the interaction terms were dropped from the model and the predictors were instead interpreted as main effects (Step Two).

There was a significant main effect of re-presentation on the number of target items recalled, $B = -0.84$, χ^2 (1) = 4.62, $p < .05$. When compared to the control condition, participants in the re-presentation condition accounted for a 57% decrease in the number of target items recalled. Importantly, there was also a strong main effect of retrieval practice condition, $B = -1.99$, χ^2 (1) = 16.75, $p < .001$. The regression coefficient reflected an 86% decrease in the number of target items recalled, depending on if participants were in the retrieval practice or control conditions. Planned contrasts

revealed that retrieval practice of non-target items did indeed account for a greater percentage of forgetting than re-presentation, χ^2 (1) = 5.05, $p < .05$.

Finally, the individual differences analysis revealed there was no association between participants' ISE scores and overall free recall performance, B = -0.03, χ^2 (1) = 0.97, $p > .05$.

Negative Valence. To examine whether valence played a role in moderating memory blocking effects in the dropout procedure, the next set of analyses focused on free recall of negative and positively-valenced target items. Negatively-valenced target items were considered first. Once again, the test of the overall model was significant, both for the full model (χ^2 (5) = 14.01, $p < .05$) and the main effects model (χ^2 (3) = 13.44, $p < .01$). As in the analysis of overall free recall performance, there were no significant interactions between treatment conditions and repressive distancing. Thus, this analysis only focuses on the main effects model (see Table 2).

Although the main effect of treatment condition was significant (χ^2 (2) = 6.65, p = .036), as shown in Table 2, only retrieval practice of non-target items significantly influenced recall of target items, compared to the control condition (χ^2 (1) = 6.03, p = .01). However, planned contrasts revealed marginally significant trends in the predicted direction; that is, participants in the control condition tended to recall more negatively-valenced target items than participants in the either of the forget conditions (χ^2(1) = 4.57, p = .06), with greater recall deficits in the re-presentation condition when compared to the retrieval practice condition (χ^2(1) = 4.87, p = .055).

In terms of individual differences in recall of negatively-valenced target items, the data trended towards greater deficits in recall with increasing ISE (B = -0.06, $\chi^2(1)$ = 2.61, p = .10). This coefficient can be interpreted as a 6% decrease in the number of target items recalled for every one point increase in ISE.

Positive Valence. Turning next to recall of positively-valenced target items, both the full model (χ^2 (5) = 18.58, p < .01) and the main effects model (χ^2 (3) = 18.41, p < .001) were significant; however as shown in Table 2, in light of there being no significant interactions between treatment and repressive distancing, only the main effects model was interpreted.

For positively-valenced target items, both retrieval practice (B = -2.04, χ^2 (1) = 8.86, p < .01) and re-presentation (B = -1.12, χ^2 (1) = 4.61, p < .05) of non-target filler items were associated with greater deficits in recall when compared to the control condition, reflecting a 67% and 87% decline in the number of target items recalled, respectively. Planned contrasts revealed that the difference in the magnitude of forgetting between the two treatment conditions was not significant, χ^2 (1) = 2.03, p = .309.

Contrary to the pattern of results seen in free recall of negatively-valenced target items, there was no apparent association between repressive distancing behavior and memory for positively-valenced target items, B = -0.01, χ^2 (1) = 0.05, p > .05.

Category-Plus-Stem Cued Recall

To assess whether forgetting effects observed in free recall would persist in a more supportive retrieval environment, the number of target items retrieved in cued

recall was examined as a function of treatment condition and individual differences in ISE. The analysis strategy for cued recall data proceeded in a similar fashion to the free recall analyses described above. Namely, overall memory recovery was examined, collapsing across target item valence, before turning the analysis to valence-specific effects. As with the free recall analyses, a full model was fitted first to investigate potential interactions between treatment conditions and ISE. A main effects model was also fitted, and was used for the interpretation of parameter estimates in the event that interactions were not significant (and were subsequently dropped from the model).

Overall Performance. Although the full model (χ^2 (5) = 17.00, $p < .01$) and the main effects model (χ^2 (3) = 14.14, $p < .01$) were significant for overall cued recall performance, as there were no significant interaction effects, only the main effects model was used for interpretation of parameter estimates. As shown in Table 3, of the two forgetting manipulations, only the retrieval practice condition was associated with a significant decrease in the number of target items retrieved, $B = -0.84$, χ^2 (1) = 11.42, $p < .01$. Specifically, compared to the control condition, participants in the retrieval practice condition recalled 57% fewer target items, overall. In contrast, there was a non-significant 20% difference between the re-presentation and control conditions in cued recall.

Table 3 also shows that individual differences in repressive coping behavior did not account for any significant effects in cued recall, overall. Valence-specific effects of repressive distancing on memory recovery were assessed below.

Table 3. Summary Poisson Regression Results of Cued Recall Performance for Target Memories in Experiment 2.

	Overall			Negative Valence			Positive Valence		
Predictors	**B (SE)**	**χ^2**	**e(B)**	**B (SE)**	**χ^2**	**e(B)**	**B (SE)**	**χ^2**	**e(B)**
Step One									
Intercept (Control)	0.83 (0.14)	34.01***	2.30	-0.44 (0.27)	2.64	0.65	-0.25 (0.25)	0.99	0.78
Retrieval	-0.90 (0.26)	11.85**	0.41	-1.22 (0.56)	4.78*	0.30	-0.98 (0.48)	4.25*	0.38
Re-Presentation	-0.17 (0.21)	0.67	0.84	-0.40 (0.42)	0.91	0.67	-0.30 (0.37)	0.65	0.74
ISE	-0.01 (0.02)	0.22	0.99	-0.05 (0.04)	1.22	0.95	0.03 (0.04)	0.52	1.03
ISE x Retrieval	-0.05 (0.04)	1.53	0.95	-0.02 (0.08)	0.04	0.98	-0.11 (0.07)	2.59	0.90
ISE x Re-Presentation	0.02 (0.04)	0.22	1.02	0.04 (0.08)	0.24	1.04	-0.01 (0.07)	0.01	1.00
Step Two									
Intercept (Control)	0.84 (0.14)	35.05***	2.31	-0.43 (0.27)	2.63	0.65	-0.20 (0.24)	0.68	0.82
Retrieval	-0.84 (0.25)	11.42**	0.43	-1.17 (0.52)	4.98*	0.31	-0.90 (0.43)	4.49*	0.41
Re-Presentation	-0.22 (0.21)	1.16	0.80	-0.47 (0.41)	1.33	0.63	-0.39 (0.36)	1.17	0.68
ISE	-0.02 (0.02)	1.78	0.18	-0.04 (0.03)	1.86	0.96	-0.01 (0.03)	0.04	1.00

Note. † $p < 10$, * $p < .05$, ** $p < .01$, ** $p < .001$

Negative Valence. For the analysis of cued recall of negatively-valenced items, the full model was not significant (χ^2 (5) = 7.54, p = .18), although the main effects model was marginally significant (χ^2 (3) = 7.16, p = .06). Because there were specific *a priori* hypotheses related to treatment effects and the influence of individual differences on cued recall performance, parameter estimates from the main effects model were interpreted below. However, given that the model was only marginally significant, caution should be exercised when evaluating the predictive power of the variables in the model for these data.

As shown in Table 3, there was a significant effect of retrieval practice on the number of negatively-valenced items recalled, B = -1.17, χ^2 (1) = 4.98, p < .05. This treatment effect was associated with a 69% decline in cued recall, when compared to memory performance for the control condition. Although the re-presentation condition accounted for a 37% decrease in the number of negatively-valenced target items recalled, this difference did not reach statistical significance.

In regards to individual differences in memory recovery, consistent with the analysis of overall cued recall performance, there were no significant effects of repressive coping style on the number of negatively-valenced target items recalled.

Positive Valence. For the analysis of cued recall of positively-valenced items, neither the full model (χ^2 (5) = 8.01, p = .156), nor the main effects model approached statistical significance (χ^2 (3) = 4.90, p = .179). This suggests that the predictors selected for these models did not adequately account for the variance observed in cued recall

performance. For this reason, the parameter estimates were not interpreted for either of these models.

Discussion

One key finding in Experiment 2 was that both retrieval practice and re-presentation of non-target items effectively induced forgetting of target items in free recall, and that this forgetting effect was present across positive and negative valence categories. Furthermore, memory deficits were significantly worse following retrieval practice, especially for negatively-valenced items. Although these data suggest that task differences in the dropout procedure may affect the magnitude of forgetting, it is difficult to draw any firm conclusions about the underlying mechanism responsible for these effects on the basis of free recall performance alone. As studies from the retrieval-induced forgetting literature illustrate, free recall is not a sufficiently sensitive measure to dissociate associative blocking from retrieval inhibition (for a discussion, see Anderson, 2003). This is due to the fact that in free recall the effects of output interference are not controlled. Thus, whether forgetting of dropped out target items occurs as a result of a hypothesized shift in output dominance or the selective de-activation of these items in memory during the avoidance phase (as is suggested to occur following competitive retrieval practice, see Anderson, 2007), the outcome in free recall should be similar; that is, non-target items will be recalled first.

As first suggested by Anderson et al. (1994), a more precise way to determine the mechanism contributing to impaired recall of target items is to use cued recall, while also ensuring that target items are tested first. In Experiment 2, free recall was followed

by a cued recall test in which items from each emotion category were tested in blocks, beginning with the non-practiced target memory. Participants in the re-presentation condition showed marked improvement overall in their ability to retrieve target memories in cued recall, insofar as their performance did not differ significantly from the control condition. However, for participants in the retrieval practice condition, the forgetting effect persisted. This result is consistent with inhibition theory, which posits that competitive retrieval practice will recruit an inhibitory mechanism to resolve interference caused by non-practiced items (i.e., the dropped out items).

Somewhat puzzling was the fact that task condition was not a significant predictor of cued recall performance of positively-valenced target items. A small number of studies from the retrieval-induced forgetting literature have examined valence-specific effects in the retrieval practice paradigm, demonstrating impairments for both positive *and* negative stimuli (e.g., Amir, Coles, Brigidi, & Foa, 2001; Barnier, Hung, & Conway, 2004). It is possible that the null effect of task condition reflected insufficient power, given the considerable variability in the distribution of scores (see Table x). An examination of the average number of positively-valenced target items recalled across conditions suggests task-related decrements in performance, particularly when comparing the retrieval practice and control conditions.

Taken together, results showing memory impairments in cued recall for the retrieval practice condition support the view that avoidance tasks involving competitive retrieval of non-target memories recruit a different mechanism than avoidance tasks involving incidental re-exposure to non-target memories. Whereas both avoidance tasks

effectively limited the accessibility of target memories within the context of free recall, only the retrieval practice condition saw these effects extend to cued recall. The persistence of memory impairments for participants in the retrieval practice condition, even in the more supportive retrieval environment offered by cued recall, is therefore consistent with inhibition theory. In contrast, in the re-presentation condition, the forgetting effect is consistent with an associative blocking account whereby re-exposing non-target items results in biases against retrieving target items. The effects of this practiced interference would therefore be more pronounced in free recall, where shifts in output dominance for the target items would increase the probability these items would suffer output interference. However, as the retrieval-biasing manipulation is predicted to affect the accessibility of memory representations, rather than their availability, target items should be retrievable in cued recall. The pattern of results in Experiment 2 was consistent with this prediction.

A final aim of Experiment 2 was to examine whether individual differences in repressive coping style would moderate the effectiveness of practiced avoidance on subsequent memory. Although there was a marginally significant effect of repressive distancing in free recall of negatively-valenced target memory descriptions, repressive coping style did not interact with the type of task participants engaged in during the avoidance phase of the procedure.

Additionally, there was no indication that repressive coping style could be used to predict memory performance in cued recall. This result ran counter to predictions, given that other studies (e.g., Saunders et al., 2014) show evidence that repressors are

particularly adept at inhibitory control (the putative mechanism underlying memory deficits following competitive retrieval practice). For instance, Saunders et al. (2014) showed that negatively-valenced, self-referential trait words were forgotten more often by repressors when used as non-practiced items in the retrieval practice paradigm. In contrast, repressors and non-repressors showed equivalent levels of retrieval-induced forgetting when neutral, self-referential trait words were not practiced.

A number of factors could have contributed to these null effects. First, as specified in current models of repressive coping style (e.g., Mendolia, 2002; Mendolia et al., 1999), situational contexts are significant determinants of whether repressive copers will engage in defensive processing. Most notably, repressors will adopt avoidant strategies when faced with threats to their self-concept. One way this has been experimentally manipulated is to make an unpleasant stimulus self-referential (e.g., Mendolia & Baker, 2008; Myers, Brewin, & Power, 1999). In Experiment 2, negative and positively-valenced biographical memory descriptions were used as stimuli and participants were instructed during encoding to rate how relevant each description was to events that transpired in their own lives. The implicit assumption was that casting the memory descriptions in a self-referent light would increase the probability that repressors would attempt to distance themselves from the unpleasant items. It may be the case, however, that this manipulation was simply not powerful enough to elicit a defensive reaction.

Alternatively, the order of the memory tests may have impacted cued recall performance. This is an important issue to consider, not only in terms of evaluating

individual differences, but also for drawing firm conclusions about the validity of the follow-up cued recall test as a measure of retrieval inhibition. Because the cued recall test followed free recall, it is possible that performance on this final test was contaminated by output interference incurred for target memories during free recall. Thus, retrieval deficits for target items in the retrieval practice condition on the cued recall test could reflect the cumulative effect of inhibition *and* output interference. As a result, any inhibition-specific individual differences in cued recall may have been suppressed due to the increased probability that all participants in the retrieval practice condition would perform poorly, regardless of whether they are repressors or non-repressors.

Finally, the results of Experiment 2 *do* converge with results reported by Saunders et al. (2014, Experiment 2) with regard to recall of target items in the re-presentation condition. In their study, much like the present study, repressors did not differ from non-repressors in cued recall when non-target trait words were restudied, rather than used for retrieval practice. These results were used to support the inhibitory theory of retrieval-induced forgetting, and also established a potential boundary condition for the types of avoidance tasks repressors are most susceptible.

CHAPTER IV

EXPERIMENT 3

There was clear evidence in Experiment 2 that the type of avoidance task participants engaged in (i.e., re-presentation or retrieval practice of non-target items) significantly affected their ability to retrieve dropped-out target items on a subsequent memory test. However, the design of Experiment 2 precluded making any strong claims about the putative mechanisms recruited by these tasks. Specifically, as reviewed by Anderson (2003), category-plus-stem cued recall has been used in previous studies in the retrieval-induced forgetting literature as a diagnostic tool for differentiating forgetting effects caused by retrieval inhibition and interference from strengthening competitors (as occurs following extra study exposures). Although Experiment 2 included a category-plus-stem cued recall test for the purposes of making these distinctions, the fact that this test was preceded by free recall made it impossible to rule out the residual influence of output interference as a contaminate in cued recall performance. To address this concern, Experiment 3 further modified the design of the dropout procedure by removing the initial free recall test and thus assessing forgetting using only category-plus-stem cued recall.

Because output interference was sufficiently controlled for in Experiment 3, participants in the re-presentation condition were predicted to perform better in cued recall than those that engaged in competitive retrieval practice. This prediction was based on previous dropout studies in which forgetting effects observed in free recall

were overcome when adequate retrieval cues were provided on a follow-up test (see Handy & Smith, 2012). This recovery effect was interpreted as consistent with theoretical accounts of dropout-induced forgetting that explain memory blocks in terms of interference affecting the accessibility, and not the availability, of target memory representations. In contrast, inhibition theory predicts that, during competitive retrieval practice, non-practiced target items will accumulate retrieval inhibition that makes them less accessible, generally, even in the presence of a potent retrieval cue.

With regard to the moderating effect of repressive coping style, in previous studies employing the retrieval-practice paradigm, repressors were observed to suffer more retrieval-induced forgetting for negative self-relevant information than non-repressors (Saunders et al., 2014). This result suggests that memory impairments among those with a greater disposition towards repressive coping styles may be due their being more proficient at inhibitory control (see also Myers, Brewin, & Power, 1999; Myers & Derakshan, 2004). Thus, in Experiment 3, participants in the retrieval practice condition rated higher in repressive coping style (as indexed by the ISE) were predicted to show greater impairments in cued recall than non-repressors—particularly for negatively-valenced target items. Whether repressive coping styles would influence memory performance in the re-presentation condition was less clear, however. In the study reference above, Saunders and colleagues also compared memory performance of repressors and non-repressors following re-study of non-target competitors; although repressors accounted for significantly greater memory deficits for non-practiced negative trait words following retrieval practice of neutral traits, there were no appreciable

differences in performance in the re-study condition. On the basis of this result, one could predict that repressive copers in the re-presentation condition would behave similarly to non-repressors on the cued recall test; that is, they would recall more target items than those in the retrieval practice condition because the cues provided at test would ameliorate any effects of strengthening the non-practiced competitors during the avoidance phase.

Method

Participants

There were 91 undergraduate participants in Experiment 3. None had participated in Experiments 1 or 2. Experiment sessions were composed of 10-15 participants per session, depending on participant enrollment. This resulted in 32 participants in the Representation condition, 33 in the Retrieval Practice condition, and 26 in the Control condition.

Design and Procedure

The design and procedure for Experiment 3 were the same as Experiment 2 with two key exceptions. First, for the test phase, participants were only administered a category-plus-stem cued recall test, whereas in previous experiments the cued recall measure was preceded by free recall. Second, the target items chosen for Experiment 3 differed from Experiment 2 such that each memory title began with a unique letter (both within the critical item set, and within each memory category). This was done to ensure that target items were easily discriminable on the category-plus-stem cued recall test and mitigate interference caused by non-target items from the same valence category (i.e.,

positive or negative valence categories) sharing the same initial letter. Finally, rather than rely on a one-letter word stem, as in Experiment 2, Experiment 3 used two-letter word stems to further aid participants in discriminating between items that may share cross-category valence membership.

Results

Analysis Strategy

The analysis strategy used in Experiment 3 followed the conventions used in Experiment 2. As shown in Table 4, the shape of the distribution evidenced a significant departure from normal. *KS* tests revealed that the Poisson distribution provided a better fit for these data.

Index of Self-Regulation of Emotion (ISE)

The computation of ISE was the same as was specified in Experiment 2. Across conditions, there was evidence that ISE values were not normally distributed, with a greater number of participants falling on the right side of the distribution (*skewness* = -0.50; *kurtosis* = -0.43). As before, ISE was centered at its mean for ease of interpreting model coefficients.

Category-Plus-Stem Cued Recall

Overall Performance. As in Experiment 2, overall memory performance was examined first by collapsing across target item valence before assessing valence-specific memory effects. The full model was fitted first to investigate potential interactions between treatment conditions and ISE (χ^2 (5) = 15.80, p = .007). A main effects model was also fitted (χ^2 (3) = 12.71, p = .005), and was used for the interpretation of parameter

Table 4. Descriptive Statistics for Cued Recall Performance in Experiment 3.

				Kolmogorov-Smirnov *D*	
				Null hypothesis—distribution is:	
Outcome	*M*	*SD*	*Skewness*	Normal	Poisson
Overall (N = 91)	1.02	0.83	2.67*	2.46***	0.81
Re-Presentation (N = 32)	0.91	0.73	0.37	1.35*	0.52
Retrieval (N = 33)	0.67	0.69	2.83*	1.50*	0.51
Control (N = 26)	1.61	0.80	1.85*	1.22	0.82

Note. * $p < .05$, ** $p < .01$, ** $p < .001$

estimates in the event that interactions were not significant (and were subsequently dropped from the model). Although both of the models were significant over the intercept-only model, indicating that the additional predictors explained a significantly greater proportion of the variance in cued recall performance, as Table 5 shows, there were no significant interactions between treatment conditions and ISE. Parameter estimates were therefore interpreted for the main effects model only.

Overall, treatment condition had a significant influence on cued recall performance when collapsing across valence categories. Compared to the control condition, re-presenting non-target items during the practiced avoidance phase was associated with a 43% decline in the number of target items recalled, $B = -0.57$, $\chi^2 (1) = 5.24$, $p < .05$. Similarly, when participants engaged in competitive retrieval practice of non-target items, there was a 58% decline in the number of target items recalled, $B = -0.88$, $\chi^2 (1) = 10.96$, $p < .001$. Planned contrasts revealed that the difference in the magnitude of the forgetting effect between these two treatment conditions was not significant, $\chi^2 (1) = 1.20$, $p = .548$.

In addition, there was no indication that repressive coping style was associated with differences in overall cued recall performance.

Negative Valence. Although the full model ($\chi^2 (5) = 17.13$, $p = .004$) and main effects model ($\chi^2 (3) = 7.97$, $p = 0.05$) both provided significantly greater fits than the intercept only model, only the full model was considered due to the presence of a significant interaction between treatment conditions and repressive coping style.

Table 5. Summary Poisson Regression Results of Cued Recall Performance for Target Memories in Experiment 3.

	Overall			Negative Valence			Positive Valence		
Predictors	**B (SD)**	**χ^2**	**e(B)**	**B (SD)**	**χ^2**	**e(B)**	**B (SD)**	**χ^2**	**e(B)**
Step One									
Intercept (Control)	0.51 (0.16)	10.67**	1.67	-0.65 (0.28)	5.49*	0.52	0.13 (0.19)	0.45	1.14
Retrieval	-0.96 (0.27)	12.48***	0.38	-2.46 (0.98)	6.30*	0.09	-0.73 (0.30)	5.86*	0.48
Re-Presentation	-0.60 (0.25)	5.90*	0.55	-0.48 (0.42)	1.27	0.62	-0.68 (0.31)	4.73*	0.51
ISE	0.02 (0.02)	0.781	1.02	0.03 (0.03)	1.06	1.03	0.01 (0.02)	0.14	1.01
ISE x Retrieval	-0.06 (0.03)	3.20†	0.95	-0.21 (0.08)	7.46**	0.82	-0.02 (0.04)	0.19	0.98
ISE x Re-Presentation	-0.02 (0.03)	0.35	0.98	-0.06 (0.05)	1.41	0.94	0.01 (0.04)	0.01	1.01
Step Two									
Intercept (Control)	0.48 (0.16)	8.97**	1.61	-0.75 (0.29)	6.55*	0.47	0.12 (0.19)	0.41	1.13
Retrieval	-0.88 (0.27)	10.96***	0.42	-1.37 (0.58)	5.61*	0.26	-0.73 (0.30)	5.77*	0.48
Re-Presentation	-0.57 (0.25)	5.24*	0.57	-0.39 (0.44)	0.77	0.68	-0.65 (0.30)	4.62*	0.52
ISE	0 (0.01)	0.02	0.89	-0.02 (0.02)	0.52	0.47	0.01 (0.02)	0.78	1.01

Note. † $p < 10$, * $p < .05$, ** $p < .01$, ** $p < .001$

As shown in Table 5, competitive retrieval practice was associated with a 48% decline in the number of negatively-valenced target items recalled, when compared to performance in the control condition, $B = -2.46$, $\chi^2 (1) = 6.30$, $p < .05$. In contrast, there was no indication that the re-presentation condition was associated with significantly greater deficits in recall compared to the control condition. Planned contrasts comparing the number of target items recalled in the re-presentation and retrieval practice conditions revealed that the magnitude of the forgetting effect was indeed larger in the retrieval practice condition ($\chi^2 (1) = 6.39$, $p = .023$).

Critically, there was a significant interaction between treatment condition and ISE for these data. Specifically, this interaction was limited to participants that engaged in competitive retrieval practice of non-target items ($B = -0.21$, $\chi^2 (1) = 7.46$, $p < .01$). As to the nature of this interaction, the parameter estimate in Table 5 indicates that a one point increase in ISE was associated with an 18% decline in the number of negatively-valenced target items recalled in the retrieval practice condition.

Positive Valence. Neither the full model ($\chi^2 (5) = 7.44$, $p = .190$) nor the reduced main effects model ($\chi^2 (3) = 7.19$, $p = .066$) provided a significantly greater fit than the intercept-only model[3]. In addition, there was no indication that individual differences in repressive coping style differentially affected cued recall performance for positively-valenced target items, $B = 0.01$, $\chi^2 (1) = 0.78$, $p > .05$.

Discussion

The results of Experiment 3 partially replicated findings in Experiment 2, with regard to memory performance in cued recall. Consistent with Experiment 2, participants

in the retrieval practice condition showed significant memory deficits for non-practiced target items (particularly for negatively-valenced items), when compared to the control condition. Furthermore, these memory impairments could not be attributed to the influence of output interference, as the target items in each category block were positioned first in the testing sequence. Taken together, these results suggest that practiced avoidance activities involving selective retrieval may recruit an inhibitory mechanism to resolve interference from non-practiced competitors.

Interestingly, cued recall performance within the re-presentation condition ran counter predictions. Although previous studies using the dropout procedure report no significant differences between forget and control conditions in cued recall, this was not the case in Experiment 3 of the current study. In fact, when comparing overall cued recall performance (collapsing across valence), the re-presentation condition did not differ significantly from the retrieval practice condition in terms of the number of target items successfully retrieved.

As to why the re-presentation condition performed so poorly in cued recall, there are several possibilities. First, it must be noted that there was a numerical difference in the number of target items recalled in the forget conditions; thus, the failure of this numerical difference to reach statistical significance could be attributed to insufficient power. A second possibility has to do with the organization of stimuli in these experiments. Specifically, memory descriptions in Experiment 3 were organized into categories corresponding to specific emotional states; thus, target memories shared category membership with non-target memories, as well as retrieval cues on the test. In

previous dropout studies (e.g., Handy & Smith, 2012), study items were discrete, resulting in a 1:1 correspondence of retrieval cue to target memory. It is therefore possible that target items suffered from associative interference when they were encountered alongside the shared category cue at test, and this interference may have hindered participants' ability to fluently access the correct target memory.

Another prediction consistent with the results of Experiment 3 was that repressive copers in the retrieval practice condition would show greater memory impairments for non-practiced target items from negative valence categories. This result is consistent with results from a recent study by Saunders and colleagues (2014) that reported significantly greater retrieval-induced forgetting for negative trait words among repressive copers. These results suggest that avoidant processing in repressors may be attributed, in full or in part, to these individuals possessing greater proficiency in inhibitory control. In contrast, cued recall performance in the re-presentation condition did not differ as a function of dispositional repressive coping style. One word of caution is warranted in interpreting the results of the individual differences analysis, however. Given that the distribution of ISE scores deviated from normal, it is possible that individuals scoring lower on the index of repressive coping were under-represented in this sample. This may explain why the pattern of results in cued recall in Experiment 3 deviated from what was observed in Experiment 2; that is, that repressive coping style had no bearing on the dropout-induced forgetting effect in the retrieval practice condition.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary objective of the present study was to establish when and under what circumstances dropout-induced forgetting will occur. To this end, the results of Experiment 1 demonstrated that the dropout procedure could be successfully generalized from laboratory-based episodic memories to more ecologically-valid materials, such as emotionally-laden autobiographical events. Having established the generality of the dropout-induced forgetting effect in Experiment 1, Experiments 2 and 3 investigated the forgetting mechanisms underlying memory performance in this procedure. The results of these experiments suggest that different mechanisms may be recruited by avoidance tasks that involve competitive retrieval practice of non-target memories (i.e., inhibitory mechanisms) and non-competitive re-presentations of non-target memories (i.e., interference mechanisms). Moreover, the magnitude of the forgetting effects following these avoidance tasks differed depending on the measure used to probe participants' memory; that is, whether by free recall (Experiment 2) or category-plus-stem cued recall (Experiments 2 and 3). A final point of emphasis in the present study was examining how motivational influences might affect the dropout-induced forgetting effect. In Experiment 2, an exploratory analysis revealed that individuals possessing a repressive coping style were not more susceptible to dropout-induced forgetting than non-repressors in free recall. However, Experiment 3 provided some evidence that repressive coping was associated with greater memory impairments for dropped-out target items in

cued recall, but only when these participants engaged in competitive retrieval-practice prior to the memory test. A more in-depth discussion of these findings and their implications is presented in the sections that follow.

Generality of the Dropout Procedure

In Experiment 1, an autobiographical variant of the dropout procedure was developed in which the stimuli were memory descriptions of events drawn from participants' personal histories. Consistent with previous findings, large forgetting effects (d = 1.76) were observed in free recall for positive and negatively-valenced target memories dropped from the initial study list during the critical practiced avoidance phase of the experiment. Participants in the dropout condition were generally unable to recall target memory titles; more impressively, these participants were also unable to provide descriptions of the target events, even when admonished by the experimenter. The fact that participants not only failed to recall the descriptive memory titles (they themselves created as mnemonic devices), but also any details about the indexing event, suggests that practiced avoidance effectively limited conscious access to the entire episode, insofar as participants were unable to retrieve these memories in the context of the free recall test. However, as predicted by the functional model of blocked and recovered memories (see Panel D in Figure 1), when participants were provided more specific retrieval cues (i.e., the cue word they used in the initial memory elicitation phase of the experiment), they were generally able to accurately retrieve either the target memory titles or their associated descriptions.

The results of Experiment 1 are notable for several reasons. First, and most significant, by extending the dropout paradigm to autobiographical memories, this study was the first to demonstrate that personally-significant events are susceptible to dropout-induced forgetting. This finding also addresses a common criticism levied against other experimental procedures used to study motivated forgetting processes; that is, that the artificial nature of verbal learning materials used in these studies do not approximate the kinds of memories associated with defensive forgetting (Kihlstrom, 2002, 2004; Yuille & Cutshall, 1989). The present findings offer some evidence opposing this view, as the autobiographical variant of the dropout procedure effectively induced forgetting for complex, emotional events volunteered from participants' own personal histories (see also Barnier, Hung, & Conway, 2004; Noreen & MacLeod, 2012).

Experiment 1 was also the first to show that dropout-induced forgetting effects extend to both positive and negatively-valenced memories. Previous studies examining the effect of emotionality in this procedure have limited the scope of their investigations to emotional versus non-emotional materials, with the emotional category exclusively composed of negatively-valenced items (e.g., Handy & Smith, 2012; Smith & Moynan, 2007). Although the emphasis on negative valence in previous studies was relevant within the overarching discussion of recovered memories, as recovery events typically correspond to distressing or traumatic events, the fact that memory impairments associated with this procedure also extend to positively-valenced memories illustrates the ubiquity of the dropout-induced forgetting effect. However, a word of caution is warranted when interpreting valence-specific effects for autobiographical memory

recollections. As discussed by Noreen and MacLeod (2012), objectively classifying an autobiographical memory as positive or negative may not be as straightforward as one would imagine, given that reconstructing experiences from personal histories into a narrative format is a complex process that may involve reinterpreting the meaning and personal significance of these events. As a consequence, experiences that were subjectively experienced as negative at the time of the occurrence may be reframed as positive, in light of favorable outcomes, or vice-versa (see McAdams, Reynolds, Lewis, Patten, & Bowman, 2001; Walker, Skowronski, & Thompson, 2003).

Along these same lines, the fact that Experiment 1 demonstrated substantial dropout-induced forgetting for emotionally laden autobiographical memories does not necessarily imply that these effects should extend to memories of traumatic events. There is substantial evidence that trauma-related memories may be qualitatively different from other forms of declarative memory, in the sense that individuals may be unable to verbalize traumatic experiences in a coherent narrative form; rather, traumatic memories may manifest themselves as non-verbalizable body sensations or vivid mental images that lack apparent context and intrude on conscious awareness without warning (van der Kolk, 1994). Similarly, when highly emotional events are recounted, these reports tend to differ significantly in quality and coherence from less emotional events. In particular, memories for central details related to the most emotionally-evocative dimensions of a traumatic event may be well retained in memory, whereas peripheral details may not be recalled at all (i.e., the weapon-focus effect; for a comprehensive review, see Christianson, 1992).

These qualitative differences in memory have been linked to the effects of stress and high levels of emotional arousal on encoding processes, specifically with regard to the functions of the hippocampus (van der Kolk & Fisler, 1995). Metcalfe and Jacobs (1998) formalized this distinction by proposing a "hot" and "cool" systems model of memory under stress. According to the authors, the "cool," hippocampally-mediated memory system is the dominant system under moderate levels of emotional intensity and helps to consolidate autobiographical memories in coherent narrative form, with spatial-temporal contexts intact. At extreme levels of emotional arousal, the "cool" memory system becomes dysfunctional and control is assumed by a "hot," amygdala-mediated system, which is described as being inflexible, stimulus-driven, and responsible for producing fragmentary memories that are accompanied by a strong sense of reliving the experience. Thus, the phenomenological qualities of traumatic memories call into question whether they would be amenable to the type of procedure described in the present study. For instance, the procedure outlined for the autobiographical variant of the dropout procedure in Experiment 1 required participants to verbally report details of their memories as if they were recounting the events in a diary or journal. Imposing this type of narrative structure may not be possible for highly traumatic experiences, although several retrospective memory studies report successful retrieval of complex, traumatic events (van der Kolk & Fisler, 1995).

Task-Specific Forgetting Mechanisms

With regard to the mechanisms underlying the dropout-induced forgetting effect, Experiments 2 and 3 provided cursory evidence for dissociable processes operating on

target memories in the forget conditions. These experiments were premised on the notion that the types of tasks participants engaged in during the critical practiced avoidance phase of the experiment may recruit different forgetting mechanisms. When participants were simply re-presented non-target memories over the course of several ratings tasks, it was hypothesized that interference-based processes would serve as the locus of forgetting target memories dropped out of the initial study list. In contrast, avoidance activities that required participants to engage in competitive retrieval practice of non-target items was hypothesized to enlist inhibitory mechanisms that would lead to retrieval-induced forgetting of non-practiced target items on later memory tests.

In Experiment 2, following practiced avoidance tasks, participants in the re-presentation and retrieval practice conditions attempted to retrieve emotional biographical memory descriptions, first in free recall. When compared to a control condition that did not engage in practiced avoidance, the forget conditions accounted for significantly fewer target memories on the memory test. In addition, the magnitude of the forgetting effect was significantly larger for participants that engaged in retrieval practice. Although no *a priori* theoretical predictions were introduced to account for differences in free recall within the forget conditions, as discussed previously, it is possible that performance in the retrieval practice condition reflected the combined effect of output interference incurred during the recall test and retrieval inhibition built up over the course of competitive retrieval practice. Partial support for this inference was observed in the follow-up cued recall test in which the forgetting effects in free recall for the retrieval practice condition persisted, despite the fact that the cued recall test offered

a more supportive retrieval environment and controlled for output interference. In contrast, there was no statistically significant difference in cued recall performance for target items when comparing the re-presentation and control conditions.

Although the results of the category-plus-stem cued recall test in Experiment 2 suggested contributions from different forgetting mechanisms in each task condition, the threat of residual output interference originating from the initial free recall test precluded making any strong claims about the operative mechanisms in each avoidance task. Experiment 3 resolved this issue by eliminating the free recall test from the procedure entirely, and instead tested memory for the dropped-out target items using only a category-plus-stem cued recall measure. Replicating Experiment 2, participants in the retrieval practice condition recalled significantly fewer target items than the control condition; moreover, the magnitude of the effect was greater in the retrieval practice condition than the re-presentation condition, although there were no significant differences in cued recall performance as a function of avoidance task.

To recapitulate the discussion from Experiment 3, there are several reasons why forgetting effects emerged in cued recall for the re-presentation condition. Although previous studies have shown reliable recovery effects in cued recall (e.g., Handy & Smith, 2012; Smith et al., 2003; Smith & Moynan, 2007), insofar as performance did not differ significantly from the control condition, the composition of these memory sets differed substantially from those used in Experiment 3. For example, the stimuli used in Experiments 2 and 3 were modelled closely after the narrative vignettes used by Handy and Smith (2012). However, in the present study, memory descriptions were also

organized into categories corresponding to affective themes (e.g., *Happy, Sad, Fear, Excitement*). Thus, for each category, six biographical memory descriptions and associated titles shared an overarching affective category. This is in stark contrast to the study by Handy and Smith, in which each vignette shared a 1:1 correspondence to its descriptive title and there were no obvious thematic categories imposed on participants. As a consequence, the cues used during cued recall in Handy and Smith held greater specificity and eliminated the possibility of interference from other, non-target memories that might have shared the cue. The same could not be said for the memory descriptions used in Experiments 2 and 3 of the present study, in which multiple memories shared associations with the category cues. This interpretation is consistent with research on cue overload effects (e.g., Watkins & Watkins, 1975), otherwise referred as fan effects (Anderson, 1974), in which the probability of recalling a certain target item decreases based on the number of competitors it shares a retrieval cue with (see Isarida, Isarida, & Okamoto, 2005; Rutherford, 2004; Smith & Manzano, 2010). In the present study, the fact that six memory descriptions shared a common affective category may have hindered their discriminability in cued recall, when presented with the category as a cue for recall.

One way of isolating the contributions of inhibitory processes advocated in the retrieval-induced forgetting (e.g., Anderson & Spellman, 1995) and memory suppression (e.g., Anderson & Green, 2001) literatures is the use of an independent probe during cued recall. Cue independence is one theoretical property of retrieval inhibition which refers to the generalization of memory impairments to novel test cues not encountered

during retrieval practice. Beginning with a study by Anderson and Spellman (1995), there is now substantial evidence that showing reliable forgetting effects following competitive retrieval practice when extra-list cues are used at test (see Anderson, 2003 for a review). By comparison, in the retrieval-practice paradigm, when memory for non-practiced items is tested using extra-list cues following restudy trials, no significant deficits in retrieval occur. This dissociation in performance when novel cues are used at test has been used as evidence in favor of inhibition theory, which posits that inhibitory processes render target memories unavailable to conscious recall. The independent probe method could therefore represent a more diagnostic test of inhibitory effects following selective retrieval or other memory control activities, as these test cues share nothing in common with the original study cues should be immune to any effects of interference (but see Camp, Pecher, Schmidt, & Zeelenberg, 2009). On the basis of this literature, it would be advisable for future studies to incorporate extra-list cues into testing procedures as a more rigorous test of the mechanisms recruited by practiced avoidance.

Motivational Influences and Repressive Coping Style

A final aim of the present research was to examine motivational influences on the dropout-induced forgetting effect. Specifically, exploratory analyses in Experiments 2 and 3 assessed the role repressive coping style may play in moderating the magnitude of memory deficits produced by various practiced avoidance tasks. Previous studies from the directed forgetting (e.g., Myers, Brewin, & Power, 1999; Myers & Derakshan, 2004) and retrieval-induced forgetting (Saunders et al., 2014) literatures reported individuals with dispositions towards repressive coping behaviors to be more adept at tasks

requiring active suppression of information, particularly if the information was unpleasant or threatening to their self-concepts. Practiced avoidance, as modeled in the present experiment, could hypothetically result in forgetting following activities requiring active inhibitory processes (as in competitive retrieval practice) or more passive processes of interference (as in successive re-exposures to competing memory events). Regarding the latter case, it was unclear at the outset of these experiments whether repressive copers would be more prone to forgetting certain types of information incidentally; that is, when the task did not require that they foreclose on certain target memories. The results of Experiment 2 suggest that the type of practiced avoidance task repressive copers engaged in had no bearing on their performance in free recall, although there was a marginally significant trend indicating that greater dispositions towards repressive distancing were associated with worse memory performance for negatively-valenced target memories. This result was consistent with the literature on repressive coping (e.g., Myers, 2010), and in the absence of any significant effect of the forgetting manipulations, may point to potential deficits at encoding for these unpleasant memory descriptions—especially after participants were instructed to rate each description for self-relevancy (see also Mendolia & Baker, 2008). Across task conditions, participants were presented with the target items only once, at encoding. If repressors do possess avoidant attentional styles (e.g., Mendolia & Baker, 2008), then one could hypothesize that negative target memories were simply not encoded well and this faulty encoding led to their not being retrieved during free recall. As to the fate of non-target negatively-valenced memories, subsequent re-exposures to

these items in the retrieval practice and re-presentation conditions may, in turn, have ensured that those items were successfully encoded over time, and retained better as a consequence. To the best of the author's knowledge, no empirical study has investigated the effect that multiple presentations of threatening information would have on the subsequent memory for this information among repressors.

In Experiment 3, which examined the effects of repressive coping style in category-plus-stem cued recall following practiced avoidance, repressors demonstrated significantly greater memory deficits in the retrieval practice condition for negatively-valenced target memories. This result is consistent with a recent study by Saunders and colleagues (2014) that showed greater retrieval-induced forgetting among repressive copers for negatively-valenced trait words. Taken together, findings from these two studies offer early evidence that an inhibitory mechanism may underlie repressors' tendencies to forget threatening information, although more work is clearly needed in this area.

A Caveat and Suggestions for Future Research

The results of these three experiments provide converging evidence that the dropout-induced forgetting effect is a robust phenomenon, however memory impairments reported for participants in the forget conditions should not be interpreted as evidence that participants became amnesic to the target events they failed to retrieve on the memory test. Rather, dropout-induced forgetting observed in this study is more accurately characterized as a general inability to report information previously studied within the context of the experiment session. This distinction is particularly important

with regard to the results of Experiment 1, where participants failed to recall certain autobiographical events they formerly reported to the experimenter. The procedure did not cause these participants to forget that the target events ever occurred at all so much as cause participants to forget that the target events were among the memory descriptions they studied earlier in the experiment.

This interpretation shares several notable similarities with the phenomenon of *discovered* memories (e.g., Schooler et al., 1997; Shobe & Schooler, 2001), which is a term that was first used by Jonathan Schooler and his colleagues to describe certain types of memory recovery experiences reported in several case studies of individuals with corroborated histories of traumatic sexual abuse. The authors noticed several commonalities in the phenomenology of these experiences across cases, including the sudden onset of vivid recollective experiences (often brought on by a relevant cue encountered in the environment), and an overwhelming feeling of shock and surprise that followed. However, in the authors' view, what truly distinguished a discovered memory experience from the common characterization of a recovered memory was that, in at least two of the cases, there was documentation by romantic partners that the abuse victims had discussed their trauma at some point prior to the recovery experience. Moreover, the women reporting having recovered memories for these abusive episodes expressed surprise that they had discussed these events before, claiming they had no memory of ever having retrieved these memories before the alleged recovery experience. The term "discovered memory" was therefore argued to be preferred over "recovered

memory" or "repressed memory," as it kept open the possibility that the discovery experience may occur for a memory that was not entirely forgotten.

The contention that victims of childhood sexual abuse and other traumas may underestimate their prior remembering of traumatic events has gained considerable empirical support (e.g., Arnold & Lindsay, 2002, 2005; Geraerts, Arnold, Lindsay, Merckelback, Jelicic, & Hauer, 2006; Geraerts, Schooler, Merckelbach, Jelicic, Hauer, & Ambadar, 2007; for a comprehensive review, see Eich, Geraerts, Schooler, and Forgas, 2008). Moreover, this alternative view of the recovered memory phenomenon fits very well within the framework of the functional model proposed in the current study. This is particularly true in Experiment 1, where there is documented proof that participants were able to successfully retrieve target memories at one point in time, discuss them in detail, and even re-study them at a later point, only to lose access to these same target events following the dropout procedure. As noted elsewhere, these memories did not remain buried, as the follow-up cued recall test showed substantial memory recovery effects. Although not a perfect analogue, as it is unlikely that participants would claim to not remember having volunteered descriptions of the target events to the experimenter previously, the model still offers some insight into how a memory that was formerly readily communicable could be rendered inaccessible to conscious recall.

Along these same lines, although much of the focus in the present study, and indeed in many studies examining processes of motivated forgetting, has been on the putative mechanisms of forgetting, another area of future research warranting focus is

the process of memory recovery, itself. To this point, the dropout procedure serves as an excellent platform for examining memory recovery, insofar as it can be used to predict how and when memories may be recovered outside of the laboratory. For instance, there are several situational contexts in which a forgotten memory may be recovered. First, as studies using the dropout procedure have illustrated, access to adequate retrieval cues increases the probability that a given memory will be successfully retrieved. As shown in Experiment 1 of a study by Handy and Smith (2012), re-presenting the critical narrative vignettes in cued recall was an overwhelmingly effective means of recovering memory for critical story titles. However, as the authors note, real life situations rarely afford such powerful and direct reminders. To address this issue, the cued recall test was modified in Experiment 2 to include less informative cues. Specifically, they presented black and white line drawings corresponding to some detail of the unpracticed critical stories for participants to use to try and recall the critical story titles. Although not as effective as re-presenting the story itself, the line drawings nonetheless proved an effective means of illustrating that the critical memories remained available in memory.

Experiment 3 of Handy and Smith (2012) tested a hypothesis derived directly from the recovered memory literature; namely, that incidentally-encountered cues in the environment could lead to successfully accessing blocked memories. Numerous case studies of recovered memories of sexual trauma and violence attribute the initiation of the recovery experience to a chance encounter with an unexpected reminder (see Christianson, 1996; Shobe & Schooler, 2001). In line with this reasoning, Handy and Smith employed the same line drawings used to great effect in eliciting recovery in

Experiment 2, but embedded them within a simple picture-naming task that participants completed after the first memory test. Would incidentally encountering these picture clues help overcome the memory block? The answer, at least in this case, was no. On a second unaided free recall test, participants in both the control and forget conditions showed very little recovery of titles they failed to retrieve in the first memory test. In spite of these results, there is little denying that unexpected exposures to reminders stimulate memory recovery in retrospective reports. Elucidating the circumstances in which motivated forgetting can be overcome by incidental cues is an area warranting further study.

Another condition argued to lead to memory recovery involves multiple retrieval attempts. As Roediger and Bergman (1998) point out, a hallmark of memory recovery taking place within the context of psychotherapy is that a previously unrecallable experience is excavated after the client is encouraged to try and remember it. A parallel process studied in the laboratory comes from seminal work by Ballard (1913) on the phenomena of hypermnesia and reminiscence (for reviews see Erdelyi, 1996; Payne, 1987). Reminiscence is defined as the recovery of an event on a later test that could not be recalled on an earlier test (Ballard, 1913), whereas hypermnesia refers to the net gain in recall between tests, taking into account recovery of items between tests as well as inter-test forgetting; that is, items recalled on the first test are not recalled on the second test. The effect of multiple retrieval attempts on the durability of the dropout-induced forgetting effect has been examined in previous studies, first by Gunawan and Gerkens (2011), who developed a variant of the dropout procedure that included multiple free

recall tests. After three successive free recall tests, the authors report a modest recovery effect of 10%, which they used as evidence that memory blocks produced by the procedure could be overcome without the use of retrieval cues (however, see the above discussion of Handy & Smith, 2012, Experiment 3).

What is unclear from these studies of blocked and recovered memories is the degree to which participants are aware of the things that they have forgotten. The question of meta-awareness has not be addressed directly in the literature, however dating back to seminal work by Pierre Janet (1907) and Sigmund Freud (1896), there has been interest in the idea that inaccessible memories of trauma may persist in an implicit form to influence a victim's behavior. For instance, Fredrickson (1992) outlined several outlets by which the "return of the repressed" (Freud, 1896, p. 169) could emerge, including feeling memories, acting-out memories, and imagistic memories (see also van der Kolk, 1994). In other instances, individuals claiming to have recovered memories for traumatic events deny ever having any indication that they harbored buried memories outside of awareness. For example, Schooler (1994) describes the case of JR in which he recovered a memory of being molested by a priest years prior after watching a movie depicting acts of child molestation. JR, shocked by the sudden revelation that he, himself had been the victim of abuse, claimed in his interview with Schooler that, "If you had done a survey of people walking into the movie theater when I saw the movie…asking people about child and sexual abuse 'have you ever been, or do you know anybody who has ever been,' I would have absolutely, flatly, unhesitatingly sad 'no.'" (see also Shobe & Schooler, 2001; Schooler et al., 1997; Christianson & Engelberg, 1997).

Given the diverse phenomenology of memory recovery, one interesting extension of the work with the dropout procedure would be to examine the extent to which participants are metacognitively aware of items rendered inaccessible following practiced avoidance. In addition, given that these forgetting effects can be successfully reversed, what kinds of emotional reactions follow successful recovery? Are they akin to the sorts of *Aha!* moments following insights in problem solving? Alternatively, are there affective consequences that follow successfully recovering a memory? And are these consequences necessarily desirable?

Concluding Remarks

The present investigation has shown that the dropout procedure is a powerful tool for studying the effects of practiced avoidance on subsequent memory. Dropout-induced forgetting effects have now been demonstrated for materials as diverse as simple categorized word lists and highly emotional autobiographical events. As nascent theories of motivated forgetting continue to distance the field from the specter of Freudian repression, there is mounting evidence that unwanted memories can be successfully forgotten by way of normal mechanisms, such as interference and retrieval inhibition. The results of the present study were consistent with this "normal forgetting" interpretation, as practiced avoidance tasks argued to recruit different forgetting mechanisms differentially affected the dropout-induced forgetting effect on later memory tests. Future research should continue to explore the mechanism(s) underlying this procedure, as well as dispositional factors that may moderate the magnitude of the dropout-induced forgetting effect. Although the present study limited the focus of the

investigation to repressive coping style, individual differences in areas such as trauma history, dissociative tendencies, executive control, and others could potentially establish boundary conditions for memory blocking and recovery in the dropout procedure.

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APPENDIX A

NOTES

1. Smith and Gleaves (2007) define a recovered memory according to three criteria: "(1) the event or episode in question must have been successfully encoded, (2) memory for the encoded events must be inaccessible for a time, and (3) conscious memory must occur sometime after the period of inaccessibility" (p. 301). This definition removes the assumption that a recovered memory must always correspond to a traumatic event and that an unconscious process was responsible for the memory being barred from conscious awareness.

2. Poisson regression is a form of non-linear regression from the generalized linear model (GLiM; Dobson, 2002) family of analyses, and is principally used as a powerful method for analyzing count data (for a review, see Nussbaum, Elsadat, & Khago, 2008). Although outcome variables, such as memory performance, are typically scaled as ratios in the social sciences, the number of items correctly recalled on a given memory test may also be conceptualized as counts. Given that a Poisson distribution provided a greater goodness-of-fit for target memory performance in Experiment 2, the data were coded as counts such that larger counts corresponded to rare events and thus a lower overall mean. Structuring the data in this way allowed for the use of Poisson regression methods to analyze the effect of treatment condition on free recall and cued recall performance, as well as any potential moderator effects attributable to individual differences in repressive distancing behavior.

One of the underlying assumptions of Poisson regression is that the relationship between the predictor(s) and outcome variables are exponential. Thus, the Poisson regression model can be formally represented as: $E(Y_i) = e^{\beta 0 + \beta iXi}$ where $E(Y_i)$ represents the expected value of the outcome variable, and βiXi corresponds to the predictor variables in the model. Unstandardized coefficients (β) appearing in Poisson regression are therefore exponentiated such that changes in a predictor result in a multiplicative change in the outcome variable. Furthermore, parameter estimates are interpreted as risk ratios such that each one unit increase in the predictor results in a percentage change in the outcome variable.

3. There was evidence that treatment condition was a significant predictor of cued recall performance in the main effects model (χ^2 (2) = 7.42, p = .025). As shown in Table X, compared to the control condition, both the re-presentation (B = -0.73, χ^2 (1) = 4.62, p < .05) and retrieval practice (B = -0.73, χ^2 (1) = 5.77, p < .05) were associated with significant deficits in cued recall for positively valenced target items. The magnitude of these memory deficits was similar across treatment conditions, with the re-presentation condition recalling 48% fewer target items than the control condition, whereas the retrieval practice condition recalled approximately 52% fewer items. Planned contrasts confirmed that the difference in cued recall performance between these two treatment conditions was not significant, χ^2 (1) = 0.05, p = 1.00.

APPENDIX B

Cue Words	Valence	SD	Arousal	SD	Word Frequency
Money	7.59	1.4	5.7	2.66	265
City	6.03	1.37	5.24	2.53	393
Exercise	7.13	1.58	6.84	2.06	58
Vehicle	6.27	2.34	4.63	2.81	35
Fight	3.76	2.63	7.15	2.19	98
Vacation	8.16	1.36	5.64	2.99	47
Street	5.22	0.72	3.39	1.87	244
Teacher	5.68	2.12	4.05	2.61	80
Beach	8.03	1.59	5.53	3.07	61
Family	7.65	1.55	4.8	2.71	331
Dentist	4.02	2.23	5.73	2.13	12
Highway	5.92	1.72	5.16	2.44	40
Youth	6.75	2.29	5.67	2.52	82
War	2.08	1.91	7.49	2.16	464
Errand	4.58	1.74	3.85	1.92	7
Outdoors	7.47	1.8	5.92	2.55	6
Athletics	6.61	2.08	6.1	2.29	9
Dog	7.57	1.66	5.76	2.5	75
Movie	6.86	1.81	4.93	2.54	29
Birthday	7.84	1.92	6.68	2.11	18
Friend	7.74	1.24	5.74	2.57	133
Museum	5.54	1.86	3.6	2.13	32
Insect	4.07	2.16	4.07	2.46	14
Laughter	8.45	1.08	6.75	2.5	22
Holiday	7.55	2.14	6.59	2.73	17
Doctor	5.2	2.54	5.86	2.7	100
Pet	6.79	2.32	5.1	2.59	8
Hotel	6	1.77	4.8	2.53	126
Pride	7	2.11	5.83	2.48	42
Present	6.95	1.85	5.12	2.39	377
Average	**6.35**	**1.83**	**5.46**	**2.46**	**107.50**

APPENDIX C

THE TAYLOR MANIFEST ANXIETY SCALE

Read each statement and decide whether it is true as applied to you or false as applied to you. Remember to give your own opinion of yourself.

1. I find it hard to keep my mind on a task or job
2. I am happy most of the time.
3. I believe I am no more nervous than most others.
4. I am more sensitive than most other people.
5. I am a highly strung person.
6. I cannot keep my mind on one thing.
7. I have had periods of such restlessness that I cannot sit long in a chair.
8. At times I think I am no good at all.
9. I am usually calm and not easily upset.
10. I am not unusually self-conscious.
11. I work under a great deal of tension.
12. I am inclined to take things hard.
13. Life is a strain for me much of the time.
14. I certainly feel useless at times.
15. I sometimes feel that I am about to go to pieces.
16. I have sometimes felt that difficulties were piling up so high that I could not overcome them.
17. I feel anxiety about something or someone almost all the time.
18. I frequently find myself worrying about something.
19. I shrink from facing a crisis or difficulty.
20. I am certainly lacking in self-confidence.

APPENDIX D

THE MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE
Personal Reaction Inventory

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is *true* or *false* as it pertains to you personally.

True	False	1. Before voting I thoroughly investigate the qualifications of all the candidates.
True	False	2. I never hesitate to go out of my way to help someone in trouble.
True	False	3. It is sometimes hard for me to go on with my work if I am not encouraged.
True	False	4. I have never intensely disliked anyone.
True	False	5. On occasion I have had doubts about my ability to succeed in life.
True	False	6. I sometimes feel resentful when I don't get my way.
True	False	7. I am always careful about my manner of dress.
True	False	8. My table manners at home are as good as when I eat out in a restaurant.
True	False	9. If I could get into a movie without paying and be sure I was not seen I would probably do it.
True	False	10. On a few occasions, I have given up doing something because I thought too little of my ability.
True	False	11. I like to gossip at times.
True	False	12. There have been times when I felt like rebelling against people in authority even though I knew they were right.
True	False	13. No matter who I'm talking to, I'm always a good listener.
True	False	14. I can remember "playing sick" to get out of something.
True	False	15. There have been occasions when I took advantage of someone.
True	False	16. I'm always willing to admit it when I make a mistake.
True	False	17. I always try to practice what I preach.
True	False	18. I don't find it particularly difficult to get along with loud mouthed, obnoxious people.
True	False	19. I sometimes try to get even rather than forgive and forget.
True	False	20. When I don't know something I don't at all mind admitting it.
True	False	21. I am always courteous, even to people who are disagreeable.
True	False	22. At times I have really insisted on having things my own way.
True	False	23. There have been occasions when I felt like smashing things.
True	False	24. I would never think of letting someone else be punished for my wrongdoings.
True	False	25. I never resent being asked to return a favor.
True	False	26. I have never been irked when people expressed ideas very different from my own.
True	False	27. I never make a long trip without checking the safety of my car.
True	False	28. There have been times when I was quite jealous of the good fortune of others.
True	False	29. I have almost never felt the urge to tell someone off.
True	False	30. I am sometimes irritated by people who ask favors of me.
True	False	31. I have never felt that I was punished without cause.
True	False	32. I sometimes think when people have a misfortune they only got what they deserved.
True	False	33. I have never deliberately said something that hurt someone's feelings.

APPENDIX E

Happy Memories

Marriage

Last Christmas Day was probably my favorite Christmas. It was the first Christmas the family had after my grandfather had died so it was kind of rough. But my cousins and I had something so great planned for our grandma and we couldn't wait for her to open the gift from all of us. It was memorabilia of my pop who served in the Marines and had a bunch of pictures and old things of his in a shadow box. I remember her crying at first but then saying she loved it and was so happy we had done that for her. I felt like we had made her feel happy again since my pop passed and was so thankful we could do that for her.

Birthday

On sunny day in May my dad bought home this kennel but it looked like nothing was in it. This was weird because we didn't have a dog nor had we had one for like 3 years. I was very curious as to what he was doing with it. After dinner he called my sister and I downstairs to "talk" to us. He opened the kennel and inside was a sleeping chocolate lab puppy. We named him Champ.

Graduation

One day while wandering around NYC on Fifth Avenue my grandma and I saw the Plaza Hotel and decided to go inside and look around. We accidentally entered through a side entrance and ended up in a beautiful ballroom which looked like it was ready for some type of reception or banquet. We saw a bunch of young people standing around in their caps and gowns with their parents. My grandma and I kept sneaking through all these beautifully furnished and decorated rooms just being nosey. I remember being in amazement at how lovely and classy the Plaza was.

Surprise

When I was younger I wanted a pony so bad like every other little girl. Eventually, after being told "no" time and time again, I gave up the fight and convinced myself I would never have that pony I dreamed about. One day I got off the bus and walked to my house when I heard some weird noises in my backyard. I opened the gate to find a baby foal lying on the ground just hanging out there. My dad came out and said it was for me. I was so happy. I named my pony Spence.

Laugh

It was a Saturday night a few years ago. My girlfriend and I are huge Kings of Leon fans and finally got to hear them play live. Just after the show, we were walking back to the line to a catch a bus back to my girlfriend's apartment when we heard the distant sound of another concert finishing on a different stage. We ran over to the noise and made fools of ourselves. I taught her how to 2-step and dance to what was basically techno music.

Delight

Growing up, Dad always would ask my brother and me to make grocery lists for him. One day, he decided to take both of us with him. For us, we thought that we would have to push the cart and get everything off of the shelves. To our surprise, he got us both video games for going to the store with him and not complaining while we were there. After that, we both wanted to go to the store every time he did.

Excitement Memories

Sports

During one of our school's track meets, one of my team members wasn't able to run, so I had to sub in for her. I'm not a very fast runner, and I was up against my best friend who can run really fast. The odds were definitely stacked against me. I was really nervous, but everyone on my team urged me on, insisting I could beat her. The race began and the adrenaline started pumping. We were neck and neck the entire way. As the finish line approached, I glanced over and saw the worry in her face. I pushed on and just managed to cross the finish line first. My family and friends were so proud.

Adventure

We took a vacation down to Florida for the summer when I was little. This was the first time I ever saw the ocean. I couldn't wait to get there. The first day I was there I made a few friends and we decided to play in the sand. I had an idea to dig two holes and connect them using a tunnel. We successfully dug the holes and the tunnel about 5 feet deep. We were so proud that we actually did it that I crawled through first and the sand fell on top of me. I got out and we used that to build a huge castle inside of the hole. It was the largest sandcastle any of had ever built.

Challenge

I went on vacation to Washington DC when I was younger with my family and it was a big city. I saw a lot of monuments and stuff and it was pretty amazing. It was hot and sunny in the summer and each place was so far away from each other, so it was an exhausting day. But I remember it was one of the first times I ever saw so many people walking around on the streets without that many cars. It was so much bigger than downtown Dallas where I grew up.

Thrill

When I was in 4th grade I had a friend whose dad drove a convertible. One time he gave me a ride home from school and we rode on the highway with the top down. The rush I felt from the wind was like no other. It felt like I was flying almost. That was the first and last time I rode in a convertible but I still want to try it again. That feeling is one I will never forget.

Drama

My church youth group had a food fight one night over the summer before my freshman year. We had a huge tarp spread out over the parking lot outside with huge coolers of food ready to be thrown on each other. We would take a food and one person from each line (there were about 12) would go onto the tarp and throw food at each other until our time was up. It was fun being able to not care what you were throwing at others.

Ecstasy

I had braces on for just over 3 years and had been told they were going to come off for the past 2. I finally got to go in and was told that today was the day. I was so excited about it. It was painful for them to be removed but by the end of it I couldn't have been happier with it. The joy that came from the removing of them overpowered any pain or disappointment from the past and even that day. I was finally able to eat foods I couldn't before.

Sad Memories

Suicide

My cousin was in the Gulf War and when he came back I knew that there was something that just wasn't right about him. He spent a lot of time by himself, drinking and had terrible mood swings. He was later diagnosed with PTSD. He dealt with it for a few years and he never told us how bad it was. One night we got a call that he was missing. We spent the whole night looking for him, but we couldn't find him anywhere. A few days passed before we received the phone call we all were dreading. The police let us know that they found my cousin. He had killed himself. I will never get over that, and will always wonder if there was something more I could have done?

Hopeless

This past New Year's Eve we had a bad experience with my uncle, who has been fighting alcoholism for years. He drank a lot and became violent with some other people at the bar. We could not control him until his mood changed and he started crying. As angry as I was that his fights ruined the evening for us, it was very upsetting seeing how ashamed he was, and how much pain his drinking caused him.

Trauma

We were on our way to east Texas to go see some family. I got to ride with a friend in the car that night and saw a guy on a motorcycle do a wheelie across the bridge. We were so thrilled by it until we found him lying in the middle of the road 3 miles later. His bike had slipped in the rain and launched itself 500 feet away from him. He laid there bleeding and nearly dead until my parents got the ambulance there. Seeing him lifeless was a horrible experience to me.

Motionless

Football season of my high school year was amazing until my best friend was injured and went into a coma for a week. I still remember him lying like a ragdoll after hitting his head. I checked to see if he was okay, but he wouldn't wake up. The ambulance rushed in and took him to the nearest hospital. We all went to visit him after the game, but there was nothing we could do. I felt so helpless.

Remorse

My neighbor's parents surprised them with a puppy for Christmas, and my brother and I were as excited as they were to see her. It was a Golden Retriever, which is my favorite kind of dog. The four of us were playing with her, when she accidentally got outside and ran on to the street. My brother and I ran after her, but she was already on the street when a car was driving out. My brother yelled for it to stop, but it was too late and the dog was killed.

Widow

My grandfather passed away after being in a coma for about a week. It was a day in October and I remember it vividly. This was one of the hardest days of my life because I felt very lost and broken; my pop was like my best friend. I was very angry because I didn't understand why he had to go. I remember going to my grandma's house and not knowing what to say. I felt so bad for her. She had lost her husband and the father of her children.

Fear Memories

Violence

When I went to Matamoros, Tamaulipas, a city in the country of Mexico, I had the worst experience of my life. It started out as a normal day. We were taking in the sights, enjoying touristy activities when all of a sudden we heard gunfire. We threw ourselves to the ground as the entire market became a warzone between drug cartels. There was nothing we could do but hide, and I prayed so hard that we wouldn't get hurt. It was chaos.

Threat

After school one day there was a fight that was taken to a local park. It was ended very quickly after one kid broke his hand. However, as we were all leaving someone threw a rock at someone's truck and it erupted into a huge brawl. The kid who owned the truck pulled out a knife and threatened all of us. I was cornered as the kid stalked me with the knife, cursing and promising to make me pay for the damage to his truck. I didn't know what to do, and panic set in. One of my friends tackled him and we took the knife and threw it into the bushes. All we could do was run as we heard the sound of police sirens approaching. I spent the rest of that year looking over my shoulder, just in case the guy came back for revenge.

Darkness

Late one night, I heard my parents fighting. I walked to their room and put my ear to the closed door to hear what was going on. Through the door, I could hear my parents screaming at each other, then just the sound of my father's voice yelling awful things at my mother. There was a loud crash and I heard my mother whimpering. Being so young I couldn't do anything about it. The door was locked and all I could think to do was run to my room and hide under the covers.

Monster

In middle school we had an assistant principal who would come and fill in for teachers every once in a while when they were out sick. He was a very creepy man who stared at all of the girls at the school very strangely, including me. One day during 8th grade year the police came and took him away in handcuffs. We found out later that he was arrested for child pornography. Right before he had to testify in court he hung himself. He couldn't take the beatings while in prison anymore. It was really disturbing watching all of it on the news and knowing we were around him.

Anxiety

On Christmas my family and I were flying back to California from Texas to spend the holidays with our family. We drove to the airport in Dallas and it was snowing really badly. I remembered being worried about the weather and flying in it but my parents kept reassuring us everything was fine. When we got inside of the plane, things became terrifying. We were trying to take off but the snow blocked our pilots view and we had to land immediately. Little did we know, there was black ice on the runway, which sent the plane into a tailspin until the pilot could regain control. I have been very afraid of planes from that day on.

Scream

When I was a kid, I always loved bananas. My parents always bought them bagged in a bunch, fresh from a local market. One morning, I opened I grabbed a banana and noticed a bunch of tiny white dots all over the outside. Looking closer, I could see they were moving. I cried out I realized what they were and my parents came running into the kitchen to see if I was okay. They were shocked to see the entire inside of the bag of bananas was covered with tiny baby spiders. I haven't had a banana since.