ANXIETY BUFFER DISRUPTION: INTERPLAY BETWEEN
NEUROCOGNITIVE FUNCTIONING AND WORLDVIEW DEFENSE IN
POSTTRAUMATIC STRESS DISORDER

by

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ABSTRACT

According to anxiety buffer disruption theory, traumatic experiences can disrupt one’s ability to manage anxiety. There are several studies finding that after reminders of death, individuals high in trauma symptoms respond atypically – that is, whereas most individuals respond to reminders of death with increased self-esteem striving, traumatized individuals do not. Prior research has found that a certain level of cognitive resources are integral to the process of managing death-related thoughts; because traumatized individuals often report cognitive deficits, it may be that atypical responses to reminders of death stem from trauma-related cognitive impairments. Ninety-three participants were recruited via the psychology department at the University of Colorado Colorado Springs. Participants were administered a working memory task and randomly assigned to one of two conditions: a mortality salience prime, or a neutral prime. Though it was hypothesized that working memory performance and PTSD symptoms would moderate the effect of MS on death-thought accessibility and judgment of moral transgressions, the results did not provide support these hypotheses. Possible explanations and future directions are discussed.
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CHAPTER I

INTRODUCTION

Anxiety Buffer Disruption Theory (ABDT) is a social-cognitive theory of Posttraumatic Stress Disorder (PTSD), which posits that PTSD symptoms occur when a traumatic event impacts one’s ability to manage anxiety (Pyszczynski & Kesebir, 2011). ABDT builds on Terror Management Theory (TMT) to explain how the anxiety buffer – a psychological system consisting of self-esteem, cultural worldview, and close, interpersonal relationships, that generally provides protection from existential anxiety – can be disrupted by the experience of trauma. Building on the basic tenets of Shattered Assumptions Theory (Janoff-Bulman, 1992), ABDT posits that anxiety buffer disruption can occur when a traumatic event challenges core assumptions a person holds.

Pyszczynski and Kesebir (2011) suggest that experiencing a trauma may lead a traumatized individual to believe that nothing – including one’s anxiety buffer – can truly keep one safe from their eventual and inevitable death. However, the exact mechanisms through which anxiety buffers are disrupted have not been specifically investigated. Prior TMT research has demonstrated that significant cognitive resources are necessary for managing existential anxiety (Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997). Considering that PTSD is often associated with diminished cognitive functioning, it may be that anxiety buffer disruption stems, in part, from a deficit in the cognitive resources that healthy individuals typically use to manage existential anxiety. The present study
will investigate cognitive functioning as a possible mechanism underlying anxiety buffer disruption among individuals with PTSD.

Posttraumatic Stress Disorder

Posttraumatic Stress Disorder (PTSD) is a psychiatric disorder that can develop after the experience of one or more stressful life events that involve life-threat or serious injury (American Psychiatric Association [APA], 2013). The most recent Diagnostic and Statistical Manual for Mental Disorders (DSM-5) criteria for a PTSD diagnosis includes four symptom clusters, in addition to the stressor criterion of exposure to an event involving life-threat or serious injury (e.g., motor vehicle accident, sexual assault, unexpected death of a relative; APA, 2013). The four symptom clusters include: re-experiencing symptoms, in which aspects of the traumatic memory are relived in some way (e.g., nightmares, flashbacks); avoidance symptoms, in which the individual attempts to avoid thinking about or being reminded of their trauma; negative alterations in cognitions and mood, in which the traumatized individual experiences memory loss, persistent negative emotion, or negative beliefs about oneself and the world in relation to their trauma (e.g., persistent shame, excessive blame for the traumatic event, difficulty experiencing positive affect); and hyperarousal symptoms, in which the person experiences increased physiological reactivity and arousal that began or worsened after the trauma (e.g., irritability, risk-taking behavior, difficulty sleeping). Though these symptom clusters comprise the diagnosis of the disorder, PTSD is a heterogeneous disorder that can vary greatly in its presentation. For example, PTSD was originally conceptualized as a fear- or anxiety-based disorder; however, empirical and clinical
evidence suggest that PTSD can be characterized by shame, anger, and dysphoria as well (Gillihan, Cahill, & Foa, 2014).

In addition to the diverse presentations of PTSD, there are several comorbidities that can further complicate the conceptualization and treatment of the disorder. A recent meta-analysis found that 52% of individuals with PTSD have co-occurring Major Depressive Disorder (MDD) (Rytwinski et al., 2013). Similarly, rates of PTSD with co-occurring Substance Use Disorder ranges from 19% to 35%, and rates of PTSD with co-occurring Alcohol Use Disorder are estimated to be as high as 50% (Pietrzak et al., 2011). In general, these comorbid disorders are associated with greater impairment in social and occupational functioning, poorer outcomes in therapeutic interventions, and suicidality (Flory & Yehuda, 2015; Pietrzak et al., 2011; Schäfer & Najavits, 2007).

Traumatic Brain Injury (TBI), which co-occurs with PTSD frequently, may further complicate the presentation of PTSD (Tanev, Pentel, Kredlow, & Charney, 2014). The presence of comorbid TBI with PTSD symptoms (versus PTSD alone) has been associated with greater cognitive difficulties, sleep difficulties, and depression symptoms (Dolan et al., 2012; Morisette et al., 2011).

**Cognitive Deficits in PTSD.** Many individuals with PTSD exhibit deficits in neurocognitive functioning, which has been associated with greater impairment in overall functioning as well as poorer outcomes in cognitive-behavioral therapy (Falconer et al., 2013; Geuze et al., 2009). Consistent with the general idea that PTSD is a disorder of dysfunctional learning and memory (Brewin & Holmes, 2003; Gillian, Cahill, & Foa, 2014), PTSD is often accompanied by abnormalities in memory, attention, and concentration (Aupperle, Melrose, Stein, & Paulus, 2012). A recent meta-analysis found
that individuals with PTSD do significantly poorer on tasks related to verbal learning, information processing, attention, working memory, and verbal memory (Scott et al., 2015). However, the majority of the studies included in this meta-analysis were cross-sectional in nature and did not always account for the presence of comorbidities, which may obscure the extent to which these observed effects on memory, information processing, and attention can be truly attribute to the experience of trauma exposure and PTSD.

Furthermore, it is not entirely clear as to how PTSD and neurocognitive functioning deficits are related. Two current perspectives in PTSD and neurocognitive functioning propose different mechanisms through which individuals with PTSD present with lower neurocognitive functioning. The neurotoxicity framework posits that the impact of trauma and the subsequent PTSD symptoms create severe stress and dysregulated arousal, subsequently impacting brain structures and functions. This is consistent with research finding that hippocampal volume is decreased in those diagnosed with PTSD relative to those not diagnosed with PTSD (Kitayama et al., 2005). On the other hand, the vulnerability framework suggests that pre-trauma variations in neurocognitive functioning creates vulnerability to the onset of PTSD after trauma exposure. For example, smaller hippocampal volume has been found to predict vulnerability to the onset of PTSD (Gilbertson et al., 2002). Because most of the existing research is cross-sectional or studies individuals who have already been traumatized, it is not clear which framework is “best.” More recently, it has been suggested that there may be a bi-directional relationship between premorbid functioning and the effect of the trauma on neurocognitive functioning (Vasterling & Brailey, 2005).
Longitudinal investigation of PTSD, TBI, and neurocognitive functioning in deployed service-members, it was found that pre-deployment performance on cognitive assessments was inversely related to PTSD symptoms after deployment; however, PTSD symptom increases over time were related to impaired cognitive functioning (Vasterling et al., 2017). This provides initial evidence for how vulnerability and neurotoxicity might interact within PTSD to affect neurocognitive functioning.

**Social-Cognitive Theories of PTSD.** Perhaps due to the vast array of symptom presentation and comorbidities associated with PTSD, there are several theories that have been proposed to explain the onset and maintenance of PTSD. Though these theories differ in several ways, most converge on the central tenet that PTSD is essentially a disorder of abnormal learning (Brewin & Holmes, 2003; Gillian et al., 2014). That is, information about the traumatic event(s) has been integrated into one’s memory in a way that causes prolonged distress or dysfunction. However, different theories emphasize different aspects of the memory integration process and subsequently differ in their explanations of how PTSD symptoms ensue. Social-cognitive theories of PTSD assume that people maintain internal assumptions or beliefs about the world that provide a sense of safety and control. According to these theories, trauma can undermine or “shatter” these assumptions (Janoff-Bulman, 1992). Thus, PTSD symptoms develop because the individual is not able to reconcile the traumatic event with their existing assumptions or schemas. Consequently, the traumatized individual is left without the security that these assumptions would otherwise provide. From the perspective of social-cognitive theories of PTSD, it is the conscious or unconscious appraisal of the trauma(s) that leads to PTSD. Social-cognitive theories, relative to other theories of PTSD, tend to explain the
broader effect that trauma can have on one’s beliefs about oneself and the world; however, these theories have been criticized for their lack of specificity in explaining the onset of PTSD versus other posttraumatic outcomes, such as mood disorders and substance use disorders (Brewin & Holmes, 2003; Gillihan et al., 2014).

Information processing theories of PTSD focus on the encoding, storage, and recall of the traumatic event(s) into and from one’s memory, proposing it is the *structural characteristics* of the traumatic memory or memories (as opposed to the content of appraisals surrounding the event) that cause dysfunction (Brewin & Holmes, 2003; Foa, Steketee, & Rothbaum, 1989). These theories generally posit that the memory of the traumatic event is not processed “correctly,” therefore causing overgeneralized associations with trauma-related stimuli that eventually lead to the onset of PTSD symptoms. For example, Foa et al.’s (1989) application of Emotional Processing Theory (Foa & Kozak, 1986) to PTSD states that traumatic experiences can lead to the development of particularly strong and overgeneralized fear networks in one’s memory. These overgeneralized fear networks are activated easily by trauma-related triggers, subsequently causing re-experiencing and arousal symptoms in traumatized individuals. However, these theories typically only account for fear- or anxiety-based PTSD and do not provide adequate clarification for other presentations of PTSD (such as dysphoria or shame-based PTSD) as well as other trauma-related outcomes (Gillihan et al., 2014).

In addition to overarching theories of PTSD, theoretical models have been applied to explain specific mechanisms in PTSD. Models of thought suppression have been applied to understand re-experiencing symptoms in PTSD. These models rely on the theoretical framework of Ironic Process Theory (Wegner, 1994) to understand thought
suppression deficits in PTSD. According to Ironic Process Theory, when people attempt to exert control over a particular mental state (such as suppressing a distressing thought, feeling or memory), two processes are initiated. The operating process – which is a conscious, effortful attempt – aims to enact the desired control through suppressing unwanted states and searching for desired states. The monitoring process – which is unconscious and takes less effort than the operating process – searches for failures in the operating process so they can be addressed (Wegner, 1994). Furthermore, Wegner proposed that when mental resources are taxed by a competing task, the operating process is impaired, and the monitoring process becomes more prominent. This ironically leads people to experience an increase of the mental states they were trying to avoid (Wegner 1994; Wegner, Schneider, Carter, & White, 1987).

Wegner introduced two paradigms for investigating ironic effects of thought suppression. In the thought suppression paradigm, participants are generally encouraged to verbalize every thought that comes to mind during three intervals of the same time length. The first interval serves as a baseline (“baseline monitoring”) prior to the second interval, where participants are explicitly asked to not think of a specific word (“suppression interval”). Thought suppression failures during the suppression interval are referred to as an “enhancement effect.” During the final interval (“post-suppression monitoring”), participants are told they can think of anything – including the word they were previously asked to suppress – and asked again to verbalize every thought that comes to mind. This interval provides an assessment of a possible “rebound effect,” which occurs when a participant reports an increase in thoughts of the word they were previously told to suppress in the suppression interval (Wegner et al., 1987; Wenzlaff &
Most studies find that participants are successful at suppressing thoughts but exhibit a rebound effect in the post-suppression monitoring stage (Wenzlaff & Wegner, 2000). A second paradigm – in which participants are exposed to cognitive load – was introduced to investigate how ironic processes might occur when one’s cognitive resources are split among tasks. The cognitive load paradigm typically involves asking participants to remember a nine-digit number while concurrently engaging in the suppression task. Several studies have found that participants tend to exhibit thought suppression failures during suppression intervals (that is, report thinking of the word they were asked to not think of) when under cognitive load (Wegner & Erber, 1992; Wegner et al., 1993). Ironic Process Theory and these two paradigms have yielded frameworks for studying thought suppression and re-experiencing symptoms in PTSD.

Shipherd and Beck (1999) used the three-interval thought suppression paradigm to investigate rape-related thought suppression deficits in rape survivors, half of whom were diagnosed with PTSD. Participants did not differ on rape-related thoughts during the suppression interval; however, those with PTSD reported significantly more rape-related thoughts than those without PTSD in the post-suppression monitoring phase. In other words, participants with PTSD demonstrated a rebound effect, whereas those without PTSD did not. A follow-up by Shipherd and Beck (2005) used this paradigm to investigate trauma-related and neutral thoughts in motor vehicle accident survivors. Results showed that individuals with PTSD had significantly more trauma-related thoughts in both the suppression interval and post-suppression monitoring phase as compared to those without PTSD; however, there were not differences between individuals with and without PTSD on neutral thought suppression, suggesting that
trauma-related thoughts are responded to differently than neutral thoughts. Shipherd and Beck’s (2005) study effectively replicated the 1999 study, demonstrating that individuals with PTSD exhibit a rebound effect of trauma-related thoughts after suppression, relative to individuals without PTSD. However, the discrepancy in suppression failures between studies – where individuals with PTSD had significantly higher trauma-related thoughts compared to the controls during the suppression interval in the 2005 study but not the 1999 study – was not addressed.

Nixon and Rackebrandt (2016) applied the thought suppression paradigm and cognitive load paradigm to individuals diagnosed with Acute Stress Disorder, a trauma-related disorder diagnosed in the four weeks immediately after the experience of a traumatic event (whereas PTSD cannot be diagnosed until at least four weeks after the traumatic event has elapsed; APA, 2013). Participants with Acute Stress Disorder (versus trauma-exposed controls) demonstrated significantly more trauma-related thoughts during suppression and the post-suppression monitoring intervals. Additionally, participants with Acute Stress Disorder who were exposed to cognitive load (versus not exposed to cognitive load) had significantly more trauma-related thoughts during suppression and post-suppression monitoring intervals. This study was consistent with the findings of Shipherd and Beck (1999; 2005), such that traumatized individuals struggle to suppress trauma-related thoughts and exhibit more thought suppression deficits than non-traumatized individuals. This study also demonstrated that cognitive load further increased these deficits in traumatized individuals. Working memory functioning was investigated as a potential moderator in this study, based on prior findings that working memory capacity predicts one’s ability to suppress unrelated thoughts.
thoughts in non-clinical samples (Brewin & Beaton, 2002; Brewin & Smart, 2005; Crowe, Matthews, & Walkenhorst, 2007). Working memory functioning was assessed with the Letter Number Sequencing Task from the Wechsler Adult Intelligence Scale (WAIS-III; Wechsler, 1997) in a battery of assessments administered after the thought suppression paradigm. However, working memory functioning was not found to moderate any effects in this study.

Inconsistent research findings in working memory functioning could be related to methodological issues, including the usage of different working memory tasks. Whereas Nixon and Rackebrandt (2016) used a WAIS-III test – a test frequently used in clinical psychology – other researchers such as Brewin and Beaton (2002) and Brewin and Smart (2005) used the Operation Span with Words task (OSSPAN; Turner & Engle, 1989), a test that Nixon and Rackebrandt described as a “more stringent” reflection of working memory functioning. This possibility of methodological issues in neuropsychological functioning research is further supported by Crowe et al.’s (2007) findings on working memory functioning in a non-clinical sample. Crowe and colleagues (2007) administered six working memory tests – WAIS-III Digit Span Forward, WAIS-III Digit Span Backward, the Visual Patterns Test, Spatial Span Forwards, Spatial Span Backwards, and the Dual Task. Thought suppression uniquely predicted performance on Digit Span Backward but did not significantly predict performance on other tasks. Furthermore, other independent variables such as self-reported anxiety and worry inconsistently predicted working memory functioning in this study – for example, self-reported worry significantly predicted performance on Spatial Span Reverse and the Dual Task.
Aikins et al. (2009) expanded on thought suppression models of PTSD by proposing a cognitive load hypothesis of thought suppression failures. Specifically, Aikins and colleagues suggest that individuals with PTSD might engage in an ongoing effort to suppress trauma-related thoughts, creating a non-stop state of “cognitive load” that would undermine their ability for other information-processing tasks. This cognitive load hypothesis is consistent with the hypothesis that neurocognitive deficits in PTSD stem from the effects of trauma-related stress and emotional interference. Using the thought suppression paradigm, Aikins et al. (2009) found that individuals with PTSD (versus those without PTSD) showed an increase in neutral thoughts after being asked to suppress them during both the suppression interval and post-suppression monitoring interval. Individuals with PTSD also reported trauma-related thoughts during the suppression interval, but not the post-suppression monitoring interval. This is directly contrary to the findings of Shipherd and Beck (2005), who found that participants did not differ in neutral thought suppression, regardless of PTSD status. Though more research would clarify this discrepancy, Aikins and colleagues suggest that Shipherd and Beck’s investigation of trauma-related thoughts and neutral-related thoughts in a counter-balanced paradigm may have affected how participants dealt with neutral-related thoughts. That is, Aikins et al. (2009) hypothesize that participants were not particularly focused on the neutral thought task, as they were concerned with or affected by the trauma-related task in the design.

The existing research provides some evidence to suggest that individuals with PTSD, relative to trauma-exposed individuals without PTSD as well as non-exposed individuals, experience greater neutral and trauma-related thought suppression failures.
According to Ironic Process Theory, these thought suppression failures may occur due to decreased cognitive resources that result from PTSD symptoms and trauma-related stress. This is consistent with findings that suggest individuals with PTSD experience poorer neurocognitive functioning compared to individuals without PTSD, as well as findings that working memory functioning – a domain of cognitive functioning that appears to be particularly impacted by PTSD – is specifically associated with one’s ability to suppress thoughts. Therefore, there is evidence to suggest that individuals with PTSD experience struggles or deficits with cognitive tasks that involve thought suppression.

However, research on thought suppression in PTSD is unclear about the role of the content of thoughts to be suppressed. Are these suppression deficits specific to trauma-related thought or any kind of thought? Whereas Shipherd and Beck (2005) found suppression deficits for only trauma-related thoughts in traumatized individuals, Aikins et al. (2009) found deficits for both trauma-related thoughts and neutral thoughts among traumatized individuals. Furthermore, thought suppression paradigms have not been applied to other threatening or negative content processing in PTSD, such as death-related thoughts – therefore, it is unclear whether individuals with PTSD would differ in thought suppression ability for other distressing thoughts as compared to trauma-related thoughts and neutral thoughts. Research on TMT shows that people often respond to reminders of death by suppressing death-related thoughts (Hayes et al., 2010). If traumatized individuals do not have the cognitive resources to suppress death-related thoughts, it could account for atypical reactions to death reminders that have been demonstrated in TMT and ABDT research.
Terror Management Theory

TMT is a broad theory of motivation that states that several areas of human behaviors are driven by the pursuit of self-esteem, meaning, and close relationships (Greenberg, Pyszczynski, & Solomon, 1986; Pyszczynski, Solomon, & Greenberg, 2015). Building on the work of cultural anthropologist Ernest Becker, TMT states that humans’ unique ability for self-awareness – which includes the realization that one will eventually perish – creates a potential for terror that must be managed. According to TMT, this potential for overwhelming terror is managed through the tripartite anxiety buffer, a psychological system consisting of one’s cultural worldview, self-esteem, and close interpersonal relationships (Pyszczynski et al., 2015). The three components of the anxiety buffer serve to provide a sense of safety, meaning, and purpose in life. Furthermore, these psychological structures can provide a sense of literal or symbolic immortality.

Cultural worldviews – which involve beliefs and rules about the world typically shared by a particular group (e.g., nation, religion, political party) – provide explicit standards for how one should navigate the world. By living up to the standards of one’s cultural worldview, one can feel that one is contributing to something larger than oneself, subsequently achieving symbolic immortality. Similarly, some cultural worldviews, such as religion, involve beliefs of literal immortality that are attainable if you meet or exceed the values of that particular worldview. By living up to the standards of one’s cultural worldview, one derives a sense of self-esteem – that is, that one is a good, deserving person in a meaningful world. Close, interpersonal relationships (the third component) provide a sense of attachment and security in addition to further bolstering self-esteem.
and validating that one is living up to one’s cultural worldview (Hart, Shaver, & Goldenberg, 2005).

TMT researchers have relied on three hypotheses for testing these theoretical propositions. According to the mortality salience (MS) hypothesis, if any given psychological structure buffers an individual from existential anxiety, then priming individuals with the existential anxiety should lead them to utilize that psychological structure (Greenberg, Solomon, & Pyszczynski, 1997). This hypothesis is tested by experimentally inducing mortality salience (MS) prior to providing participants with an opportunity to defend their worldviews, self-esteem, or close relationships. These primes typically involve two open-ended prompts about the topic of death (e.g., “please describe the emotions that the thought of your own death arouses in you”). Other primes have included administering death anxiety scales to participants, presenting death-related stimuli subliminally, and interviewing participants in front of death-related objects or environments (e.g., a funeral home, a graveyard). These primes presumably work by increasing the accessibility of death thoughts (DTA) that would presumably instill existential anxiety if not dealt with. Prior studies have found that after reminders of death, people exhibit greater liking for others who share their worldview, increased effort towards activities central to their self-esteem, and increased desire for intimacy in their relationships (Castano, Yzerbyt, Paladino, & Sacchi, 2002; Mikulincer & Florian, 2002; Taubman-Ben-Ari, Florian, & Mikulincer, 2002).

The anxiety-buffer hypothesis in TMT posits that if a given psychological structure buffers existential anxiety, then activation of that mechanism should reduce existential anxiety (Greenberg, et al., 1992). Harmon-Jones et al., (1997) tested this
hypothesis by experimentally manipulating self-esteem (by providing a positive or neutral bogus personality test result) before inducing MS and testing worldview defense. Individuals who were provided with a positive personality test result that boosted their self-esteem did not engage in worldview defense after reminders of death, as compared to individuals who received neutral feedback from their bogus personality test. Likewise, reminding participants of romantic commitment reduced the effects of MS on worldview defense (Florian, Mikulincer, & Hirschberger, 2002). Schmeichel and Martens (2005) found that self-affirmation (a task in which participants write about how they explicitly live up to important cultural standards) was related to lower DTA and worldview defense after MS. These studies demonstrated that self-affirmation (i.e., bolstering one’s anxiety buffer) reduced the need to defend against death-related thoughts after MS as self-affirmation served as an early defense for the potential for existential anxiety.

The death-thought-accessibility (DTA) hypothesis states that if a psychological structure buffers existential anxiety (and subsequently, death-related thoughts), undermining that structure should increase death-related thought and strengthening that structure should reduce DTA (Schimel, Hayes, Williams & Jahrig, 2007). Whereas boosting self-esteem reduces DTA and worldview defense, undermining self-esteem should increase DTA and worldview defense. In a series of studies, Hayes et al., (2008) demonstrated that when participants received negative feedback (compared to participants receiving neutral or no feedback) regarding their intelligence or career path, they exhibited greater DTA. Likewise, when individuals are asked to think about separating from their romantic partner (thus, undermining the security provided by the close, interpersonal relationships aspect of the anxiety buffer), they exhibit higher DTA.
Another study found that when Canadians read an article critical of Canadian values intended to undermine participants’ worldview associated with their Canadian identity, they exhibited higher DTA (Schimel et al., 2007). Other research has shown that boosting self-esteem, faith in one’s worldview, or close relationships decrease DTA (see Hayes et al., 2010 for a review). Together, these three hypotheses have provided converging evidence for the central propositions of TMT and demonstrated the reciprocal relationship between death-related thoughts and the anxiety buffer.

The underlying cognitive architecture of TMT has been researched to further understand the different processes involved in managing death-related thoughts. The dual process model of defense proposes two distinct defense processes that are activated by death-related thoughts (Pyszczynski, Greenberg, & Solomon, 1999). Immediately after reminders of death, people exhibit low DTA, low worldview defense, and use cognitive distortions to rationally deal with the problem of death. After a delay and distraction, people exhibit high DTA and increased worldview defense, suggesting that anxiety-buffering occurs when death thoughts are out of focal consciousness, yet highly accessible (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994). Further support for the idea that anxiety buffering occurs when death-related thoughts are out of focal consciousness was provided through studies of subliminal priming. Arndt, Greenberg, Pyszczynski, and Solomon (1997) hypothesized that subliminal priming – a paradigm where stimuli are presented so rapidly that one is not consciously aware of the stimuli – would yield immediate DTA and worldview defense because these defenses emerge when death-related thoughts are on the fringes of unconscious yet highly accessible. In
three studies, subliminal priming was related to immediate DTA and worldview defense, whereas participants exposed to MS at a conscious level (supraliminally) did not exhibit immediate DTA and showed worldview defense only after a brief delay and distraction.

Arndt, Greenberg, Solomon, et al. (1997) further explored this dual-defense system by using Wegner’s Ironic Process Theory as a framework for understanding the suppression of death-related thoughts. As discussed earlier, Ironic Process Theory suggests that unwanted mental states (such as an undesirable thought, feeling, or memory) are suppressed with two processes – a conscious operating process, which searches for desired mental states, and an unconscious monitoring process that searches for remnants of the unwanted mental state (Wegner, 1994). Arndt and colleagues (1997) posited that immediately after mortality salience, death-related thoughts are actively suppressed by the operating process; however, the resource-demanding operating process eventually gives way to the monitoring process, which maintains death-related thoughts on the fringes of consciousness. This idea was tested with a cognitive load paradigm, where participants were asked to remember a 9-digit number while undergoing a typical TMT study in which they were asked to think about death before filling out DTA and worldview defense measures. Participants under load exhibited immediate DTA and worldview defense, whereas participants who were not under load at the time of MS did not. These studies suggest that people typically respond to explicit reminders of death with immediate suppression of death-related thought, which eventually relaxes and yields the unconscious existence of death-related thoughts associated with worldview defense. Furthermore, suppression of death-related thought requires a certain degree of cognitive resources – if these resources are depleted or impaired, then it is possible that one may
struggle to suppress death-related thoughts after reminders of death, which would result in atypical responses to reminders of death. Research on ABDT – the application of TMT to the understanding of posttraumatic stress – has shown that traumatized individuals tend to respond to reminders of death atypically. However, the cognitive mechanisms through which anxiety buffers are disrupted have not been investigated. It may be that the atypical reactions to reminders of death observed in traumatized individuals stems from trauma’s effect on the cognitive resources generally used to suppress thoughts.

**Anxiety Buffer Disruption Theory**

ABDT integrates TMT with social-cognitive theories of PTSD to explain the onset and maintenance of PTSD. According to ABDT, traumatic events can disrupt one’s anxiety buffering mechanisms, which serve to soothe existential anxiety and facilitate psychological well-being (Pyszczynski & Kesebir, 2011; Routledge et al., 2010). A disrupted anxiety buffer leaves a traumatized individual vulnerable to overwhelming anxiety and reduced resources for maintaining well-being. Pyszczynski and Kesebir (2011) suggest this disruption occurs when trauma violates unconscious assumptions that the world is benevolent and one is safe, and that this disruption may be associated with a realization – either implicitly or explicitly – that nothing can truly keep one safe from harm and death.

ABDT’s assertion that anxiety-buffer disruption stems from one’s trauma-related realization that nothing can truly keep one safe from harm is consistent with other social-cognitive theories of PTSD. Social-cognitive theories emphasize the importance of one’s existing beliefs about the world and how the traumatic event(s) can undermine or challenge these beliefs. ABDT is most closely related to (and explicitly cites) Janoff-
Bulman’s (1992) Shattered Assumptions Theory. At the heart of these theories (both of which were influenced by Ernest Becker’s seminal writings) is the idea that people maintain unconscious yet core assumptions that are challenged during trauma and subsequently cause the onset of PTSD. Janoff-Bulman states that there are three common assumptions relevant to the experience of traumatic stress: 1) the world is benevolent, 2) the world is meaningful, and 3) the self is worthy. These assumptions are generally consistent with TMT’s assertion that one’s anxiety buffer – and cultural worldview in particular – help maintain the belief that the world is a safe, meaningful place. Therefore, when trauma challenges these assumptions, the functioning of the anxiety buffer is undermined and rendered ineffective.

Though there is a great deal of empirical support for social-cognitive theories of PTSD, these theories have been criticized in that fundamental assumptions are typically described as “unconscious,” yet researchers tend to measure these assumptions through self-report measures which arguably tap into “conscious” beliefs (Edmondson et al., 2011). It is possible that asking individuals about the effect of trauma on their overall beliefs about themselves and the world might be affected by attempts to deny or avoid the impact of trauma (Maercker & Zoellner, 2004). Edmondson et al. (2011) argues that ABDT provides a unique contribution to social-cognitive theories of PTSD in that ABDT provides a direct way of testing worldview function (or lack thereof) in traumatized individuals, rather than relying on self-report. TMT’s three central hypotheses (the MS hypothesis, the anxiety buffer hypothesis, and the DTA hypothesis) provide testable avenues for directly observing how worldviews function in healthy individuals and fail to function in traumatized individuals.
These hypotheses have been tested several times from the framework of ABDT. In a sample of domestic violence survivors, individuals with PTSD showed atypical responses to MS as compared to survivors without the PTSD diagnosis – specifically, survivors without PTSD responded to reminders of death with harsher judgments of moral transgressions (replicating prior TMT studies), whereas survivors with PTSD responded with significantly more lenient judgments after MS (Kesebir, Luszczynska, Pyszczynski, & Benight, 2010). This finding was consistent with the ABDT idea that PTSD is associated with atypical reactions to reminders of death. However, an alternative hypothesis could be that individuals with PTSD generally support leniency towards moral transgressors. Kesebir and colleagues (2010) address this possibility but argue that such responses to the moral transgressions are unusual and may reflect an apathy or avoidance rather than forgiveness.

Abdollahi, Pyszczynski, Maxfield, and Luszczynska (2011) investigated peritraumatic dissociation and worldview function in the aftermath of a severe earthquake in Iran. Results showed that, four weeks after the earthquake, individuals high in peritraumatic dissociation did not increase worldview defense (as evidenced by a measure of attitudes towards receiving aid from Western countries) after reminders of death, whereas individuals low in peritraumatic dissociation responded to MS with more negative attitudes towards foreign aid (replicating prior TMT studies). A two-year follow-up of these same participants found that PTSD symptom severity significantly predicted responses to MS: whereas those with low PTSD symptoms showed typical increased adherence to cultural norms after MS, those with high PTSD symptoms did not. Furthermore, low levels of worldview defense mediated the oft-found relation between
peritraumatic dissociation at time 1 and later PTSD symptom severity (Ozer, Best, Lipsey, & Weiss, 2003). Of particular interest is that four weeks after the earthquake, individuals high in peritraumatic dissociation exhibited no response to MS, whereas 2 years later, individuals high in PTSD symptoms exhibited an atypical response to MS, such that they decreased worldview defense, exhibiting counter-cultural attitudes. The authors suggest that this response may be an attempt at managing existential threat in an alternative way, although it could also be consistent with Kesebir and colleagues’ suggestion that atypical responses to MS reflect avoidance or apathy.

In addition to studies of worldview defense, DTA has been examined in ABDT research. Chatard et al. (2011) found that whereas individuals low in PTSD symptoms reminded of death did not differ on DTA from low-trauma individuals reminded of a control topic (consistent with the idea that people typically suppress death thoughts immediately after MS), individuals high in PTSD symptoms did show elevated DTA after reminders of death, relative to high-trauma individuals reminded of a control topic. This study indicates that the typical processes that most people engage in response to explicit reminders of death are not being engaged among traumatized individuals. The anxiety buffer hypothesis was tested in a sample of college students, where a self-esteem boost was experimentally induced prior to priming the students with MS and measuring DTA (Edmondson et al., 2011). Whereas students low in trauma symptoms did not exhibit increased DTA after reminders of death (consistent with the anxiety buffer hypothesis), students high in trauma symptoms did exhibit increased DTA after MS, demonstrating that bolstering one’s anxiety buffer did not seem effective in managing death-related thoughts in traumatized individuals. Edmondson et al.’s (2011) finding was
replicated and extended by Vail, Morgan, and Kahle (2018) as well, who administered self-affirmation to groups of individuals with high or low PTSD symptoms. Results indicated that self-affirmation did not reduce DTA after MS for traumatized individuals, whereas it did for low trauma individuals (Vail et al., 2018). These studies further provide evidence that PTSD symptoms are associated with atypical reactions to reminders of death, such that death-related thoughts are not suppressed after MS, nor are death-related thoughts successfully reduced through the mechanisms that healthy individuals typically utilize.

Despite the growing body of evidence supporting some of the theory’s central propositions, the mechanisms of anxiety-buffer disruption remain unclear. ABDT – like other social-cognitive theories of PTSD – posits that worldview loss is the mechanism that causes anxiety buffer disruption. However, it is difficult to directly test this assertion, as self-report measures of trauma-related worldview change have received criticism for validity issues (Edmondson et al., 2011; Kaler et al., 2008). More importantly for present purposes, the cognitive mechanisms through which trauma-related worldview change leads to an absence of worldview defense have not been identified. Without directly clarifying the different mechanisms of anxiety buffer disruption, it is difficult to know what should be addressed in PTSD treatment from an ABDT perspective. Considering the complexity of PTSD, it is likely that there are several mechanisms contributing to anxiety buffer disruption. In particular, the role of neurocognitive functioning could be important in understanding the atypical responses to MS exhibited by traumatized individuals.
The Role of Cognitive Deficits in Anxiety-buffer Disruption. Prior TMT studies have demonstrated that cognitive resources are used to immediately suppress DTA, which is then typically followed by worldview defense when the suppression process relaxes (Arndt, Greenberg, Solomon, et al., 1997). Consistent with this, individuals with PTSD appear to demonstrate relative deficits in working memory and attentional processes, compared to trauma-exposed controls and individuals who have not experienced trauma (Aupperle et al., 2012; Scott et al., 2015). These deficits appear to stem from the effect of trauma on one’s ability to regulate and cope with arousal, stress, and emotion. Furthermore, research in thought suppression and PTSD has demonstrated that traumatized individuals struggle to suppress trauma-related and neutral thoughts, presumably because of these deficits (Aikins et al., 2008; Nixon & Rackebrandt 2015; Shipherd & Beck, 1999; Shipherd & Beck, 2005). According to ABDT, trauma can challenge a person’s unconscious assumptions about the world. This can lead to the realization that nothing can truly keep one safe from harm and death. This realization renders one’s anxiety buffer ineffective, subsequently leaving one open to the onset of PTSD symptoms with few resources for managing these symptoms. Cognitive fluctuations associated with PTSD symptoms may further perpetuate anxiety buffer disruption, to the extent that cognitive impairments impede one’s ability to suppress death-related thoughts after reminders of death. Therefore, it is possible that trauma undermines the cognitive resources needed to suppress death-related thoughts, subsequently contributing to atypical responses to MS in traumatized individuals. The current study aims to investigate the cognitive mechanisms of anxiety buffer disruption.
Current Study

Specifically building on previous work suggesting that cognitive resources are needed to effectively respond to MS, this study aimed to assess the possibility that cognitive impairments related to PTSD play an important role in the process that leads traumatized people to show atypical responses to MS. The experience of trauma can shatter one’s assumptions about the world (Janoff-Bulman, 1992). This subsequently impedes the viability of the anxiety buffer and makes one vulnerable to PTSD symptoms, as well as social and emotional dysfunction (Pyszczynski & Kesebir, 2011). Intrusive symptoms, dysregulated arousal, and rumination associated with PTSD symptoms then contribute to cognitive impairments in traumatized individuals (Vasterling, Brailey, Constans, & Sutker, 1998). These cognitive impairments may further perpetuate distress and dysfunction as they undermine one’s ability to effectively respond to mortality-related thoughts. The present study investigated the assertion that cognitive impairments are related to atypical responses to MS in trauma-exposed individuals. To assess this possibility, participants who had experienced at least one traumatic event were recruited for the study; their trauma exposure history and current PTSD symptoms were measured. Then, their working memory functioning was assessed before being randomly assigned to MS or an aversive control condition. The main dependent measures were death-thought accessibility and judgment of moral transgressions (which serves as a measure of worldview defense).

First, the current study investigated the moderating role of PTSD symptoms on the effect of MS on DTA and worldview defense. It was hypothesized that PTSD symptoms would moderate the effect of MS on DTA and worldview defense, such that
higher PTSD symptoms would be related to higher DTA after MS. Similarly, it was hypothesized that PTSD symptoms would moderate the effect of MS on worldview defense, such that PTSD symptoms would be related to decreased worldview defense after MS. PTSD symptoms would not be associated with DTA nor worldview defense in the control condition, where participants are asked to reflect on the experience of dental pain. These findings would be consistent with several published ABDT studies, in which PTSD symptoms were related to higher DTA levels immediately after MS and lower worldview defense after a delay and distraction (Chatard et al., 2012; Edmondson et al., 2011). From the perspective of ABDT, these findings indicate that individuals with PTSD do not defend against reminders of death with anxiety buffer engagement. Whereas healthy individuals respond to MS with immediate suppression of DTA and worldview defense after a delay and distraction, traumatized individuals tend to show the opposite effect – that is, they decrease worldview defense or do not seem to be affected by the MS manipulation. Therefore, this study effectively serves as a replication attempt of previous ABDT research while setting the foundation for further exploration into anxiety buffer disruption.

Second, the role of working memory functioning was investigated. Specifically, working memory capacity was measured and its relation to atypical responses to MS was assessed. Combining evidence from research on PTSD-related cognitive functioning and the cognitive architecture of TMT suggests that one mechanism of anxiety buffer disruption may involve the effect of trauma on one’s cognitive resources. Arndt, Greenberg, Solomon, et al. (1997) demonstrated that cognitive resources are necessary for immediate suppression of death-thoughts; if one is not able to suppress one’s death
thoughts immediately, the death thoughts may remain in active consciousness for longer, which could impede anxiety buffering. Following this line of reasoning, working memory functioning should predict anxiety buffer disruption, as working memory capacity is related to one’s ability to suppress thoughts (Brewin & Beaton, 2002; Brewin & Smart, 2005). It was hypothesized that working memory functioning would moderate the effect of MS on worldview defense, such that lower working memory would be related to high DTA and decreased worldview defense after MS. Working memory would not be associated with DTA nor worldview defense in the control condition, where participants are asked to reflect on the experience of dental pain. Furthermore, it was hypothesized that working memory functioning would account for or mediate at least some of the moderating effect of PTSD symptoms on the MS effect, such that lower working memory capacity would be associated with higher PTSD symptoms. This would follow the reasoning that PTSD-related working memory deficits underlie PTSD’s moderating effect of the MS effect. To the author’s understanding, no studies have investigated how working memory functioning might relate to the effects of MS on DTA and worldview defense.

Alternatively, it is possible that working memory functioning does not serve as a mediating mechanism underlying the moderating effect of PTSD on responses to MS. Though there is a general trend in research for PTSD to be associated with working memory deficits, some studies that have failed to show a significant association between PTSD and working memory functioning (Crower et al., 2002; Zalewski, Thompson, & Gottesman, 1994). Furthermore, there are studies that have shown that working memory functioning is related to thought suppression in non-clinical samples (Brewin & Beaton,
(2002). This might suggest that working memory deficits do not need to be associated with trauma for there to be thought suppression failures; though PTSD appears to be related to working memory impairment, it could be that pre-trauma working memory functioning predisposed individuals to 1) be more susceptible to the onset of PTSD symptoms and 2) experience difficulties in suppressing thoughts, particularly emotionally-evocative ones. Therefore, moderated moderation was also be tested in the present study. In moderated moderation, the “moderation of one variable’s effect by another is itself moderated” (Hayes, 2013). That is, the effect of the independent variable on the dependent variable has two components determined by the effect of the two moderators – this analysis is often referred to as a three-way interaction. Moderated moderation was used to investigate the effects of PTSD symptoms and working memory, and significant interactions were probed to ascertain where the effects of PTSD and working memory are significant. In addition to the moderating roles of PTSD and working memory on the MS effect being investigated as described above, the simultaneous conditional effects of PTSD and working memory were investigated coinciding with the MS effect. In investigating the conditional effects of PTSD, working memory, and MS on DTA, it was hypothesized that the three-way interaction will be significant. Specifically, it is expected that levels of working memory functioning would moderate the effect of PTSD on MS’s effect on DTA, such that PTSD will have a stronger effect on MS’s effect on DTA when working memory functioning is low, versus when working memory functioning is high. In investigating the conditional effects of PTSD, working memory, and MS on judgment of moral transgressions, it was hypothesized that the three-way interaction will be significant. Specifically, it was
expected that levels of working memory functioning would moderate the effect of PTSD on MS’s effect on judgment of moral transgressions, such that PTSD will have a stronger effect on MS’s effect on judgment of moral transgressions when working memory functioning is low, versus when working memory functioning is high.
CHAPTER II

METHOD

Participants

Participants were recruited from prior studies they participated in (in which they indicated interest in future studies and gave consent to be contacted) and the UCCS psychology department’s SONA system. Participants were compensated $10 for their participation or 2 SONA extra credit point if they were recruited from the UCCS psychology department. It was required that participants were 18 years or older and had experienced a traumatic event as defined by Criterion A of the DSM-5 (APA, 2013). Participants were recruited based on the screening questionnaire typically used in the THHC trauma registry, which covers demographics, trauma status, and TBI status.

G*Power software was used to determine the appropriate sample size by a power analysis where the parameters were: multiple linear regression, $R^2$ deviation from zero, $\alpha = .05$, power $(1 - \beta) = .80$, 5 predictors. The sample size appropriate for this analysis was determined to be 92. The final sample size for analysis was 93 participants.

Procedure, Materials, and Methods

Participants were randomly assigned to one of two conditions, with 47 participants in the control condition and 46 in the experimental (MS) condition. Random assignment was done via the Qualtrics “randomizer” option, where the program randomly presents one of two options. Therefore, researchers were blind to the condition to which participants were assigned. Participants in the control condition answered open-ended
questions about dental pain, whereas participants in the MS condition answered open-ended questions about death. Apart from these differences, participants experienced the study in the exact same format. Participation was slightly different depending on the recruitment source. Participants recruited from other studies (versus those directly recruited from the UCCS SONA system) did not have the PASAT administered during the data collection session; these participants had completed the PASAT in another study within 30 days of their participation of the current study. The PASAT was not re-administered during these sessions as to avoid potential practice effects. Other participants completed the PASAT immediately prior to completing the other study materials. All participants read and signed a consent statement prior to participation. For participants recruited from the UCCS psychology department, a trained research assistant administered the PASAT before completing the questionnaires. All participants used laboratory computers to complete the in-lab measures. The following measures were administered in the order presented:

**Working memory task.** The Paced Auditory Serial Addition Test (PASAT; Gronwall, 1977) is a measure of cognitive function that assesses auditory information processing ability and working memory. The PASAT consists of two administrations of 60 items that are nearly identical – in both administrations, participants listen to a recording (played through a computer) in which single digit numbers are stated at regular intervals, and they are asked to add the number they just heard to the one that preceded it (e.g., After hearing “5” then “2,” the participant would answer “7.” After hearing “3,” the participant would answer “5.”). During the first trial, the numbers are stated every 3 seconds; in the second trial, the numbers are stated every 2 seconds. Scoring typically
involves summing the number of correct responses, although the separate PASAT trials are sometimes analyzed separately (Johnsen et al., 2008; Meewisse et al., 2005; White et al., 2001). Research has found that individuals with PTSD tend to score lower on the PASAT compared to those without PTSD (Jenkins, Langlais, Delis, & Cohen, 2000; Meewisse et al., 2005), although some studies have not found this difference. For example, Stein, Kennedy, and Twamley (2002) found that individuals who had experienced intimate partner violence did significantly poorer on the PASAT; whether or not they had PTSD did not affect their performance. PASAT performance was used as a predictor in regression analyses on the dependent variables, DTA and worldview defense.

**Trauma Exposure.** The Trauma History Questionnaire (THQ; Hooper, Stockton, Krupnick, & Green, 2011) is a 24-item assessment of lifetime trauma exposure. The THQ consists of various experiences that potentially meet Criterion A of the DSM-5 criteria for PTSD – that is, the person was exposed to death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence. Participants respond as to whether or not they were exposed to the event, to identify the number of times it happened, and the approximate age(s) it occurred. Some items ask for further specification of a particular event – e.g., “Have you ever experienced a ‘man made’ disaster…where you felt you or your loved ones were in danger of death or injury? If yes, please specify” and “Has anyone ever made you have intercourse or oral or anal sex against your will? If yes, please indicate the nature of the relationship with the person.” The THQ can be used to categorize trauma type, which has been found to differentiate trauma-related outcomes among individuals with PTSD. Specifically, individuals who have experienced interpersonal violence tend to have greater emotion dysregulation and poorer
interpersonal functioning than those who experience non-interpersonal traumas, such as motor vehicle accidents (Ehring & Quack, 2010; Hetzel-Riggin & Roby, 2013). This measure was administered during the in-lab data collection session and was used to confirm that participants had experienced at least one Criterion A event. Only participants who met this criterion were included in data analyses. Of the 105 participants who completed the study, 93 met this criterion.

**PTSD symptoms.** The Posttraumatic Stress Checklist (PCL-5; Weathers et al., 2013) is a 20-item self-report measure (0 = *Not at all*, 4 = *Extremely*) which assesses PTSD symptoms associated with a specific traumatic event. The PCL-5 consists of questions regarding different experiences and responses to the specific traumatic event – e.g., “loss of interest in activities that you used to enjoy?” “repeated, disturbing dreams of the stressful experience?”. Participants respond on a Likert-type scale regarding how much they experience symptoms: “not at all,” “a little bit,” “moderately,” “quite a bit,” and “extremely.” PCL-5 items correspond to DSM-5 criteria for PTSD, such that symptom cluster severity scores can be calculated. Recent research has investigated the role of PTSD symptom clusters in posttraumatic functioning – for example, symptom clusters have been found to be differentially related to alcohol misuse, anger, and depression in veterans and service-members (Hellmuth et al., 2012; Jakupcak et al., 2010). Furthermore, the PCL-5 items can be summed for an overall symptom severity score. The PCL-5 was administered during the in-lab data collection session, as part of the self-report measures. In the current study, the PCL-5 was internally consistent (α = .95) and overall symptom severity was used as an independent variable.
**MS Manipulation.** The MS manipulation involves participants reading and responding to two open-ended questions. For participants receiving the experimental condition (MS), the two questions are “Please briefly describe the thoughts and emotions that the thought of your own death arouses in you,” and “Jot down, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead.” The control condition involved participants responding to two similarly worded questions about dental pain, a topic that has been used in the past to provide an aversive topic not related to death to compare with the MS condition (Hayes et al., 2010).

**Death Thought Accessibility.** The DTA measure is a 36-item word-stem task in which some of the word stems can be completed with either death-related words or non-death related words (e.g., K I _ _ E D could be “KISSED” or “KILLED.”; Gilbert & Hixon, 1991). Greenberg et al. (1994) modified existing word-stem measures to assess the accessibility of death-related words; these measures assume that if a particular topic is highly accessible, it will influence responses to ambiguous stimuli (Hayes et al., 2010). This measure is sometimes administered immediately after MS (to measure proximal defense) and other times administered after a delay and distractor (to measure distal defense). The DTA measure was administered immediately after MS in the current study, as traumatized individuals do not appear to suppress death-related thoughts immediately after MS (as compared to healthy individuals, who respond to MS with immediate suppression of death-related thoughts; Chatard et al., 2012; Hayes et al., 2010). Scoring involves assigning a score of “0” or “1” based on whether participants responded with a death-related word to a word-stem with potential death-relatedness. Scores are summed,
so that higher scores reflect higher accessibility of death-related cognitions. DTA is one of the major dependent variables investigated in this study.

**Affect Measure.** The Positive and Negative Affect Schedule (PANAS-X; Watson & Clark, 1994) was used to assess positive (e.g. “cheerful,” “lively,”) and negative (“ashamed,” “disgusted with self,”) affect after the MS manipulation. Participants are provided with 60 words and phrases that describe different emotions and asked on a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely) to what extent they are experiencing that feeling at the moment. TMT studies often measure affect after MS to assess whether the MS manipulation caused a change in affect, which could explain some of the effects of MS. Although most studies do not show a change in affect, this measure is typically included to assess this possibility. Additionally, ABDT studies have shown that individuals with high levels of PTSD symptoms do experience a change in affect after MS, presumably because their anxiety buffers are disrupted (Abdollahi et al., 2011; Vail et al., 2017). As in previous research (Watson & Clark, 1994), two subscales of the affect measure were computed: positive affect and negative affect; both subscales were internally consistent, with α’s of .91 and .71, respectively.

**Delay and distraction.** TMT paradigms typically involve a delay and distraction task after MS to allow death-related thoughts to fade into the fringes of consciousness. A reading task, which has been used in prior TMT research, was included in the study after the DTA measure for the purpose of maintaining the delay and distraction in the present study. Specifically, participants read a short story involving a man traveling on a dark, rainy night.
Judgement of Moral Transgressions. The Judgment of Moral Transgressions Scale (JMT; Florian & Mikulincer, 1997) is a 20-item measure of judgment of moral transgressions, as measured by responses to 10 vignettes of moral transgression, such as a burglar destroying an artistic masterpiece or a doctor amputating the leg of the wrong patient. Participants rated the severity of the wrong-doing in the situation on a 15-point scale (1 = “extremely minor,” 15 = “one of the worst things a person could do.”). Likewise, participants were asked to rate the severity of the punishment they believe the perpetrator deserves on a 15-point scale (1 = “no punishment,” 15 = “most severe punishment possible.”). Scores were summed such that higher scores will indicate stronger judgment. Prior research has demonstrated that MS is related to harsher judgment (e.g., Florian & Mikulincer, 1997; Maxfield et al., 2007). Furthermore, Kesebir et al. (2010) found that survivors of intimate partner violence diagnosed with PTSD (as compared to survivors without the PTSD diagnosis) responded to MS with less severe judgments of moral transgressions, demonstrating anxiety buffer disruption. The JMT is the primary dependent variable in the present study.

Demographics. Participants were asked to report age, race, ethnicity, education level, religious affiliation, military status, and sexuality.
CHAPTER III

RESULTS

All the variables of interest were found to be relatively normally distributed, based on skewness (ranging from -1.34 to 1.23) and kurtosis (ranging from -1.07 to 2.11) values. Likewise, all quantitative variables demonstrated acceptable internal consistency. Of the 93 participants included for analyses, 36 identified as males, 55 identified as females, and 2 indicated non-binary/prefer not to say. Furthermore, participants – depending on recruitment source – received the study materials in slightly different ways. That is, those who had been recruited after participating in previous studies did not receive the PASAT during the data collection session, as they had been administered the PASAT during the study they were recruited from. In the present study, 30 participants were recruited from another study and subsequently were not administered the PASAT during the present study’s data collection session. Sixty-three participants were recruited directly from the UCCS SONA system for the current study and were administered the PASAT prior to completing the other study materials. These two groups differed significant in age (p < .005), and judgment of moral transgressions (p < .05), with the group recruited from other studies being older and having overall harsher judgments toward moral transgressions. Table 1 displays descriptive statistics of the sample as a whole and split into two groups (those who received the PASAT during the data collection session and those who received it before). Although the two groups differed in
some ways, the analyses were done with the entire sample for the purpose of statistical power.

Table 1

Descriptive Statistics

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>Mean (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire sample</td>
<td>PASAT scores</td>
<td>88.5 (18.88)</td>
</tr>
<tr>
<td></td>
<td>PTSD symptoms</td>
<td>22.35 (18.21)</td>
</tr>
<tr>
<td></td>
<td>DTA</td>
<td>2.74 (1.42)</td>
</tr>
<tr>
<td></td>
<td>Judgment of Moral Transgressions</td>
<td>10.14 (1.99)</td>
</tr>
<tr>
<td></td>
<td>Negative Affect</td>
<td>1.43 (.40)</td>
</tr>
<tr>
<td></td>
<td>Positive Affect</td>
<td>2.68 (.92)</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>27.44 (11.60)</td>
</tr>
<tr>
<td>PASAT administered during data collection</td>
<td>PASAT scores</td>
<td>79.03 (19.04)*</td>
</tr>
<tr>
<td></td>
<td>PTSD symptoms</td>
<td>20.22 (18.51)</td>
</tr>
<tr>
<td></td>
<td>DTA</td>
<td>2.67 (1.48)</td>
</tr>
<tr>
<td></td>
<td>Judgment of Moral Transgressions</td>
<td>9.85 (1.95)**</td>
</tr>
<tr>
<td></td>
<td>Negative Affect</td>
<td>1.44 (.43)</td>
</tr>
<tr>
<td></td>
<td>Positive Affect</td>
<td>2.60 (.92)</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>22.84 (6.28)***</td>
</tr>
<tr>
<td>PASAT administered before data collection</td>
<td>PASAT scores</td>
<td>86.6 (17.8)*</td>
</tr>
<tr>
<td></td>
<td>PTSD symptoms</td>
<td>26.83 (16.97)</td>
</tr>
<tr>
<td></td>
<td>DTA</td>
<td>2.90 (1.29)</td>
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<tr>
<td></td>
<td>Judgment of Moral Transgressions</td>
<td>10.74 (1.95)**</td>
</tr>
<tr>
<td></td>
<td>Negative Affect</td>
<td>1.42 (.35)</td>
</tr>
<tr>
<td></td>
<td>Positive Affect</td>
<td>2.86 (.90)</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>37.10 (14.13)***</td>
</tr>
</tbody>
</table>

Notes. Means and standard deviations of sample and by group. *p < .10, **p < .05, ***p < .005

To test the current study’s hypotheses and to perform exploratory analyses, IBM SPSS version 25.0 was used; furthermore, the PROCESS macro for mediation and
moderation was used for more advanced analyses (e.g., moderated moderation). In moderation analyses, PROCESS is able to probe interactions at the 16th, 50th, and 84th percentile as well as conduct the Johnson-Neyman technique, an analysis that identifies the range at which a variable moderates the interaction. Hayes (2013) recommends probing at the 16th, 50th, and 84th percentiles as opposed to 1 standard deviation above and below the mean to account for times when the moderator may be heavily skewed and +/- 1 standard deviation may yield a value outside of the bounds of measurement. PROCESS is set to probe interactions when the overall interaction is significant at $p < .10$.

Both mediation and moderation analyses were proposed for the current study, based on the somewhat tenuous nature of the existing evidence as to what extent PTSD is associated with working memory impairments. Though there are several studies suggesting that PTSD is associated with cognitive impairment, including working memory deficits, other studies have not found this association (Crowell et al., 2002; Johnsen et al., 2008). Due to the results of preliminary analyses, only moderation analyses are presented here. The first step in demonstrating mediation for the present study would require PTSD symptoms to predict working memory function; however, a regression analysis investigating the relationship between PTSD symptoms and PASAT scores was non-significant, $R^2 = .009, F (1, 90) = .79, p = .38$. This suggests that PTSD symptoms do not significantly predict working memory functioning and that a mediational analysis is not appropriate for investigating the independent variables associations with either of the dependent variables. Consequently, the moderating effects
of both independent variables on MS’s effect on judgment of moral transgressions and DTA were investigated.

**Bivariate correlations**

Bivariate correlation analyses were applied to all of the variables of interest: PASAT, PTSD, mean Judgment of Moral Transgressions, positive and negative affect, and MS (see Table 2). Most variables were uncorrelated with one another. The PASAT sum score was associated with state positive affect ($r (92) = .28, p = .006$) and state negative affect ($r (92) = -.24, p = .02$), suggesting that higher working memory is associated with higher state positive affect and lower state negative affect. Likewise, as expected, PTSD symptoms were associated with low state positive affect ($r (93) = -.31, p = .003$) and high state negative affect ($r (93) = .45, p < .001$).

**Table 2**

*Bivariate Correlations of Primary Independent and Dependent Variables*

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASAT Scores</td>
<td>-</td>
<td>-.093</td>
<td>.044</td>
<td>.007</td>
<td>-.061</td>
<td>.283**</td>
<td>-.237*</td>
</tr>
<tr>
<td>PTSD Symptoms</td>
<td>-.093</td>
<td>-</td>
<td>.026</td>
<td>.159</td>
<td>.128</td>
<td>-.307**</td>
<td>.449**</td>
</tr>
<tr>
<td>MS Manipulation</td>
<td>.044</td>
<td>.026</td>
<td>-</td>
<td>.165</td>
<td>-.141</td>
<td>-.038</td>
<td>.049</td>
</tr>
<tr>
<td>DTA</td>
<td>.007</td>
<td>.159</td>
<td>.165</td>
<td>-</td>
<td>.015</td>
<td>-.007</td>
<td>.110</td>
</tr>
<tr>
<td>Judgment of Moral Transgressions</td>
<td>-.061</td>
<td>.128</td>
<td>-.141</td>
<td>.015</td>
<td>-</td>
<td>-.067</td>
<td>.013</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>.283**</td>
<td>-.307**</td>
<td>-.038</td>
<td>-.007</td>
<td>-.067</td>
<td>-</td>
<td>-.154</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>-.237*</td>
<td>.449**</td>
<td>.049</td>
<td>.110</td>
<td>.013</td>
<td>-.154</td>
<td>-</td>
</tr>
</tbody>
</table>

*Notes. Bivariate correlations of the primary independent and dependent variables.  
* $p < .05$, ** $p < .01$. 
Judgment of Moral Transgressions

The effects of MS and PTSD symptoms were investigated on judgments of moral transgression using linear regression (see Figure 1). The overall regression analysis was non-significant, $R^2 = .04, F(3, 89) = 1.15, p = .33$), suggesting that the proposed model does not significantly account for more variance than the intercept-only model. This indicates that PTSD symptoms did not moderate the effect of MS on judgments of moral transgressions.

![Figure 1](image)

*Figure 1.* The interaction of PTSD symptoms and MS manipulation (-1.00 = control, 1.00 = MS) on judgment of moral transgressions, $R^2 = .04, F(3, 89) = 1.15, p = .33$.

The effects of MS and PASAT scores were investigated on judgment of moral transgression using linear regression (see Figure 2). The overall regression analysis was non-significant, $R^2 = .03, F(3, 88) = .78, p = .50$, suggesting that the proposed model does not significantly account for more variance than the intercept-only model. This
indicates that PASAT scores did not significantly moderate the MS effect on judgment of moral transgressions.

The effects of MS, PASAT scores, and PTSD symptoms were investigated on judgment of moral transgression using linear regression (see Figure 3). The overall regression analysis was non-significant, $R^2 = .09$, $F (7, 84) = 1.20$, $p = .31$, suggesting that the proposed model does not significantly account for more variance than the intercept-only model. This indicates that PASAT scores and PTSD symptoms did not significantly moderate the MS effect on judgment of moral transgressions.

**Death-thought Accessibility**

The effects of MS and PTSD symptoms were investigated on DTA using linear regression (see Figure 4). The overall regression analysis was non-significant, $R^2 = .05$, 

Figure 2. The interaction of PASAT scores and MS manipulation (-1.00 = control, 1.00 = MS) on judgment of moral transgressions, $R^2 = .03$, $F (3, 88) = .78$, $p = .50$. 


Figure 3. The interaction of PTSD symptoms, PASAT scores, and MS manipulation (-1.00 = control, 1.00 = MS) on judgment of moral transgressions, $R^2 = .09, F(7, 84) = 1.20, p = .31$.

Figure 4. The interaction of PTSD symptoms and MS manipulation (-1.00 = control, 1.00 = MS) on death thought accessibility, $R^2 = .05, F(3, 89) = 1.64, p = .19$. 
$F(3, 89) = 1.64, p = .19$, suggesting that the proposed model does not significantly account for more variance than the intercept-only model. This indicates that PTSD symptoms did not significantly moderate the MS effect on death-thought accessibility.

The effects of MS and PASAT scores were investigated on DTA using linear regression (see Figure 5). The overall regression analysis was non-significant, $R^2 = .03, F(3, 88) = .96, p = .41$, suggesting that the proposed model does not significantly account for more variance than the intercept-only model. This indicates that PASAT scores did not significantly moderate the MS effect on death-thought accessibility.

![Figure 5](image)

*Figure 5.* The interaction of PASAT scores and MS manipulation (-1.00 = control, 1.00 = MS) on death thought accessibility, $R^2 = .03, F(3, 88) = .96, p = .41$.

The effects of MS, PASAT scores, and PTSD symptoms were investigated on DTA using linear regression (see Figure 6). The overall regression analysis was non-significant, $R^2 = .09, F(7, 84) = 1.19, p = .39$, suggesting that the proposed model does
Figure 6. The interaction of PTSD symptoms, PASAT scores, and MS manipulation (-1.00 = control, 1.00 = MS) on death thought accessibility, $R^2 = .09$, $F(7, 84) = 1.19$, $p = .39$.

not significantly account for more variance than the intercept-only model. This indicates that PTSD symptoms and PASAT scores did not significantly moderate the MS effect on death-thought accessibility.

Negative Affect

The effects of MS, PASAT scores, and PTSD symptoms were investigated on negative affect. Research in TMT and ABDT typically investigates the effect of MS (and when relevant, PTSD symptoms) on affect to determine whether MS might change state affect.

A regression analysis was utilized to investigate the effects of PTSD and MS on negative affect (see Figure 7). The overall regression analysis was significant, $R^2 = .22$, $F$
(3, 89) = 8.18, \( p < .001 \). There was a main effect of PTSD symptoms, such that higher PTSD symptoms were associated with higher negative affect \( \beta = .45, p < .001 \). However, the \( R^2 \) change due to the addition of the interaction term was not significant, \( \Delta R^2 = .01, F\text{-change} (1, 89) = .01, p = .22 \), suggesting that the addition of interaction term does not significantly improve the model.

The interaction of PTSD symptoms and MS manipulation (-1.00 = control, 1.00 = MS) on negative affect, \( R^2 = .22, F (3, 89) = 8.18, p < .001 \). PTSD symptoms significantly predicted negative affect, \( \beta = .45, p < .001 \).

The interaction of PASAT scores and MS on negative affect were investigated with a linear regression analysis (see Figure 8). The overall regression was trending towards significant, \( R^2 = .07, F (3, 88) = 2.33, p = .08 \). There was a main effect of the PASAT, such that higher scores on the PASAT (indicating higher working memory ability) were associated with lower negative affect \( \beta = - .29, p = .02 \). However, the \( R^2 \)
change due to the addition of the interaction term was not-significant, $\Delta R^2 = .01$, $F$-change (1, 88) = 1.26, $p = .26$, suggesting that the interaction term does not significantly account for additional variance in the model.

Figure 8. The interaction of PASAT scores and MS manipulation (-1.00 = control, 1.00 = MS) on negative affect, $R^2 = .07$, $F (3, 88) = 2.33$, $p = .08$. PASAT scores were associated with lower negative affect, $\beta = -.29$, $p = .02$.

The conditional effects of PTSD, PASAT scores, and MS on negative affect were investigated in a moderated moderation analysis (see Figure 9); the overall model was significant, $R^2 = .23$, $F (7, 84) = 4.85$, $p < .001$. Although the significant main effect of PTSD and PASAT scores remained, the $R^2$ change for models 2 and model 3, which included the two-way (PTSD x PASAT, PTSD x MS, and PASAT x MS) and three-way (PTSD x PASAT x MS) interactions were non-significant, $ps > .19$. 
Figure 9. The interaction of PTSD symptoms, PASAT scores, and MS manipulation (-1.00 = control, 1.00 = MS) on negative affect, $R^2 = .23$, $F(7, 84) = 4.85$, $p < .001$. PTSD symptoms were positively associated with negative affect, $\beta = .43$, $p < .001$. PASAT scores were negatively associated with negative affect, $\beta = -.20$, $p = .04$.

**Positive Affect**

A linear regression analysis was applied to test the main effects and interaction of PTSD symptoms and MS on state positive affect (see Figure 10). The overall regression was significant, $R^2 = .14$, $F(3, 89) = 4.69$, $p = .004$. There was a main effect of PTSD symptoms, such that PTSD symptoms were negatively related to positive affect $\beta = -.31$, $p = .003$. Furthermore, the addition of the interaction term to the model demonstrated a significant contribution to the model, $\Delta R^2 = .04$, $F$-change (1, 89) = 4.29, $p = .04$. The PTSD by MS interaction predicting positive affect was significant as well $\beta = .33$, $p = .04$. To explore this interaction, tests for simple main effects of MS were conducted at the 16th, 50th, and 84th percentile of PTSD symptoms using PROCESS for SPSS. At low levels of PTSD, MS had a trending effect on positive affect, such that MS led to less
Figure 10. The interaction of PTSD symptoms and MS manipulation (-1.00 = control, 1.00 = MS) on positive affect, $R^2 = .14, F(3, 89) = 4.69, p = .004$. The interaction of PTSD symptoms and MS was significant, $\Delta R^2 = .04, F$-change $(1, 89) = 4.29, p = .04$. The negative association between PTSD symptoms and positive affect was significant in the control condition $\beta = -.50, p = .005$) but was non-significant in the MS condition $\beta = -.13, p = .35$.

positive affect than the control condition $\beta = -.26, p = .08$. There was no effect of MS at the 50th percentile, nor the 84th percentile, $ps > .15$. Looked at differently, the association between PTSD symptoms and positive affect was significant in the control condition $\beta = -.50, p = .0005$ but was non-significant in the MS condition $\beta = -.13, p = .35$. Thus, among control participants, PTSD symptoms were associated with a lower positive affect; this relationship was not observed among those who received MS.

The interaction of PASAT scores and MS on positive affect was investigated with a linear regression analysis (see Figure 11). The overall regression was significant, $R^2 = .09, F(3, 88) = 2.72, p = .05$. There was a main effect of the PASAT, such that higher scores on the PASAT (indicating higher working memory ability) were associated with
Figure 11. The interaction of PASAT scores and MS manipulation (-1.00 = control, 1.00 = MS) on positive affect, $R^2 = .09$, $F(3, 88) = 2.72$, $p = .05$. PASAT was positively associated with positive affect, $\beta = .29$, $p = .006$.

higher positive affect $\beta = .29$, $p = .006$). However, the $R^2$ change due to the addition of the interaction term was not-significant, $\Delta R^2 = .05$, $\chi^2(1) = .05$, $p = .65$, suggesting that the interaction term does not significantly account for additional variance in the model.

The conditional effects of PTSD, PASAT scores, and MS on positive affect were investigated in a moderated moderation analysis (see Figure 12); the overall regression model was significant, $R^2 = .21$, $F(7, 84) = 3.14$, $p = .005$. Although the significant main effects of PTSD and PASAT scores remained, the $R^2$ change for the second and third models, reflecting the two-way (PTSD x MS, PTSD x PASAT, and PASAT x MS), and three-way (PTSD x PASAT x MS) interactions, were non-significant, $ps > .24$. 
Figure 12. The interaction of PTSD symptoms, PASAT scores, and MS manipulation (-1.00 = control, 1.00 = MS) on positive affect, $R^2 = .21$, $F (7, 84) = 3.14$, $p = .005$. PTSD symptoms negatively predicted positive affect, $\beta = -.28$, $p = .005$. PASAT scores positively predicted positive affect, $\beta = .26$, $p = .01$. 
CHAPTER IV

DISCUSSION

The present study investigated the roles of working memory functioning and PTSD in anxiety buffer disruption. It was hypothesized that PTSD symptoms and working memory functioning would separately moderate the effects of MS on death-thought accessibility and worldview defense. Likewise, it was hypothesized that PTSD symptoms and working memory functioning would moderate one another in addition to moderating the effects of MS on the dependent variables (i.e., a three-way interaction). However, these hypotheses were not supported.

It was expected that PTSD symptoms would moderate the effects of MS on DTA, such that PTSD symptoms would predict higher levels of DTA immediately after reminders of death, whereas there would not be a relationship between PTSD and DTA for those reminded of dental pain. This hypothesis was not supported. This null finding is inconsistent with existing studies finding that PTSD symptom levels are associated with higher DTA immediately after reminders of death (Chatard et al., 2012). Likewise, PTSD symptoms did not moderate the effects of MS on judgments of moral transgressions, contrary to the hypothesis that PTSD symptoms would be associated with more lenient judgments after MS (versus control condition). Again, this finding (or lack thereof) is inconsistent with a previous ABDT study finding that individuals diagnosed with PTSD (versus trauma-exposed individuals without PTSD) judge moral transgression more leniently after MS (Kesebir et al., 2011). It is worth noting that both of the previous
studies showing these effects were collected from samples that had all experienced the same trauma or same type of trauma. Chatard and colleagues sampled college students who had recently been exposed to the Côte d'Ivoire civil war. Kesebir et al. (2011) sampled domestic abuse survivors currently in a domestic violence shelter. Both samples were homogenous in the trauma type; furthermore, it is likely that in both samples, most participants had experienced the trauma somewhat recently. This might suggest that the present study’s heterogeneous sample of students and community members with a diverse array of trauma experiences may have contributed to “noise” in the data. In particular, not being able to control for or sample for time since trauma could be an important factor, as trauma coping may be a nonlinear process which involves gains and losses in recovery over time (Benight, Shoji, and Delahanty, 2017).

The possibility that time since trauma exposure is relevant to anxiety buffering is supported by the findings of Abdollahi and colleagues (2011). Earthquake survivors were sampled 1 month and 2 years after trauma exposure. In the direct aftermath of the earthquake, trauma-exposed individuals experiencing high levels of dissociation did not appear to respond to the effects of MS on worldview defense in the way that those with low levels of dissociation did. However, two years later, these same individuals responded to the effects of MS with lower levels of worldview defense, what might be termed a “counter-cultural response” in which they indicated greater disagreement with Iranian cultural norms, relative to those not reminded of death. Though both findings are indicative of “abnormal” responses to death reminders, they are not the same pattern of “abnormality.” This might suggest that time since trauma exposure is an important factor for anxiety buffer disruption, where those who have been dealing with the effects of
trauma exposure for years have potentially developed compensatory strategies for dealing with existential threat. Unfortunately, time since trauma exposure was not measured in the present study; however, future research should consider this as a potential factor in anxiety buffer disruption.

The effects of working memory functioning, as measured by scores on the PASAT, were also investigated in this study. It was expected that lower levels of working memory performance would be associated with higher DTA after MS, relative to those reminded of the control topic. Likewise, it was expected that lower levels of working memory performance would be associated with more lenient judgments of moral transgressions among participants reminded of death, relative to those who were not. The hypotheses that working memory function would moderate the effect of MS on DTA and judgment of moral transgression were not supported. These findings were inconsistent with a number of studies that suggested that working memory functioning might be implicated in responses to MS. Specifically, Arndt and colleagues (1997) found that when participants are subjected to cognitive load, they did not suppress death-related thoughts immediately after MS – presumably because the load impaired their ability to suppress thoughts. Along these lines, good working memory functioning predicts more effective thought suppression ability in non-clinical samples (Brewin & Beaton, 2002; Crowe et al., 2007). Therefore, it followed from the findings of several studies across subfields of psychology that traumatized individuals with working memory impairments should not suppress DTA after MS as well as individuals with low trauma symptoms.

Though several studies have linked thought suppression and working memory, it has been suggested that functioning in other cognitive domains such as inhibitory control
may also be relevant to thought suppression ability (Rackebrandt & Nixon, 2016). Future research may consider a small battery of relevant cognitive tasks, rather than relying on one measure of working memory. Along these lines, there is variety in existing working memory measures, with some measures of working memory being criticized for a lack of construct validity (Shelton et al., 2009). It may be that some tests of working memory – such as the OSPAN, which involves remembering sequentially presented words at the same time as solving simple math problems – are a better indication of thought suppression ability than the PASAT, which involves the serial addition of single digit numbers.

Testing the conditional effects of working memory functioning, PTSD symptoms, and MS simultaneously did not yield significant results either. It is possible that if working memory was an important part of trauma-related anxiety buffer disruption, significant results would not emerge until the three independent variables were included in one model together. It was hypothesized that at high levels of PTSD symptoms and low levels of working memory functioning, MS would cause high levels of DTA and more lenient judgments of moral transgressions. However, these hypotheses were not supported.

The effects of working memory, PTSD symptoms, and MS on positive and negative affect were also investigated in the present study. Though these were not primary dependent variables, it is customary to test the effects of the independent variables on affect in TMT studies. In most TMT studies, these analyses are to determine whether MS potentially caused a change in affect that would subsequently be responsible for the change in the dependent variables. In general, MS does not appear to cause a shift
in self-reported or explicit affect (Greenberg et al., 2015). This is consistent with the dual process model of defense in TMT, where proximal defenses engaged immediately after MS suppress death-related thoughts as to reduce the potential for existential anxiety.

In previous ABDT studies, it is more common to observe MS-related fluctuations in state affect, which would be expected if one’s anxiety-buffer is not functioning effectively. However, these changes have not been consistent across study. For example, Abdollahi and colleagues (2011) found that a month after trauma exposure, individuals high in dissociation showed lower positive affect and higher negative affect in response to MS; two years later, those same individuals showed increased positive affect and no change in negative affect in response to MS, relative to participants primed with a control topic or trauma salience. Another study found main effects of PTSD symptoms for lower positive affect and higher negative affect; an interaction effect of MS x PTSD was also found, such that high trauma individuals had lower positive affect in the MS condition than the pain condition (Vail et al., 2018).

In the present study, it was found that PTSD symptoms and MS interacted to predict state positive affect. First, there was a main effect of PTSD symptoms such that PTSD symptoms were negatively related to positive affect, regardless of the MS manipulation. In addition, PTSD interacted with the MS manipulation to affect state positive affect as well, such that the association between PTSD symptoms and positive affect was observed in the control condition, but eliminated by MS. Likewise, it appeared that there was no effect of MS on affect at moderate and high levels of PTSD; instead, MS was only associated with lower levels of positive affect, compared to the control condition, at low levels of PTSD. This finding is not consistent with the published
findings described above. For one, it is not typical to see individuals with low PTSD symptoms experience conscious change in affect after MS (Greenberg et al., 2015). Secondly, it would be expected that affect would change for those with high PTSD symptoms, due to their disrupted anxiety-buffering system. Again, this inconsistency could stem from this study’s small sample comprising a great deal of diversity in trauma exposure and trauma type. Abdollahi and colleagues (2011) observed a decrease in positive affect after MS in traumatized individuals one month after earthquake exposure and an increase in positive affect after MS in traumatized individuals two years after earthquake exposure. If the trauma coping trajectory has implications for affect changes after MS, a sample consisting of individuals who have experienced a variety of traumas at different times in their lives may respond to the MS manipulation in vastly different ways. That is, some participants may have had lower positive affect after MS, whereas others may have had higher positive affect after MS as a compensatory strategy.

Interestingly, PASAT scores were significantly related to lower negative affect and higher positive affect. Prior research has found that daily fluctuations in positive affect predict working memory performance, such that higher positive affect was associated with better working memory performance (Brose, Lovden, & Schmiedek, 2014); similarly, daily fluctuations in negative affect predicted working memory performance, such that higher negative affect was associated with poorer working memory performance (Brose, Schmiedek, Lovden, & Lindenberg, 2012). It has been hypothesized that high working memory functioning may facilitate emotional regulation, which would improve positive affect and reduce negative affect (Schmeichel & Demaree, 2010).
Another possibility for the null results in this study is that working memory functioning is simply unrelated to anxiety buffer disruption. The notion that working memory would be associated with anxiety buffer disruption is a novel one, though supported by various findings in the areas of PTSD, cognitive functioning, thought suppression, and TMT. However, ABDT posits a shattered assumptions perspective, which suggests that PTSD symptoms stem from one’s unconscious assumptions about the world being undermined by the traumatic experience. According to ABDT, the anxiety buffer serves to validate and maintain the unconscious assumptions that provide protection against anxiety; thus, there is no need to utilize an anxiety buffer when one no longer holds those assumptions. It could be that anxiety buffer disruption truly works through shattered assumptions and that neurocognitive functioning is irrelevant to the process. This would be easier to conclude if the typical effects of PTSD symptoms moderating the MS effect on DTA and judgment of moral transgressions were observed. Because the present study obtained mostly null findings, it is difficult to conclude very much; future research will hopefully clarify under what conditions and for whom anxiety buffer disruption occurs.

The current study was potentially impacted by a number of mitigating factors. In particular, the order of tasks and measures might have led to certain tasks impacting responses to other tasks. For most participants, the PASAT was presented at the beginning of the data collection session, right before participants filled out the self-report questionnaires. This was done so the effects of the MS manipulation and the effects of filling out trauma questionnaires did not affect PASAT performance. However, the PASAT is well-known to be anxiety-provoking for some individuals, particularly those
who are not confident in their mathematics performance (Tombaugh, 2006). It may be that the PASAT affected levels of self-esteem and affect in participants – those who perceived themselves doing well may have experienced an increase in state self-esteem, whereas those who perceived themselves as doing poorly may have experienced a reduction in state self-esteem. The challenge of the PASAT subsequently could have impacted the way that participants responded to the MS manipulation. This possibility was not tested in the present study as the groups were quite small (with 30 participants in one group, and 63 in the other) – the analyses would have been underpowered and potentially unstable. Future research should consider the best way to administer several potentially emotionally-evocative tasks in the same session without the tasks potentially contaminating one another, or perhaps better, assess PASAT in one session and the effects of MS in the other.

As previously discussed, another possible weakness of this study is its small yet heterogeneous sample. Participants ranged in trauma type and time since trauma; considering that atypical responses to MS might change over time – as was demonstrated in Abdollahi et al.’s (2011) longitudinal study of earthquake survivors – a sample that is diverse in its trauma exposure and time since trauma may make it more difficult for a clear pattern to emerge. Though a few other ABDT studies have been conducted with diverse samples (Edmondson et al., 2011; Vail et al., 2018), these studies had much larger sample sizes than the present study. Collecting from a homogenous sample of individuals who experienced the same type of trauma and/or experienced a significant trauma around the same time in relatively close proximity to data collection may aid in
understanding anxiety buffer disruption. Furthermore, future designs could aim to investigate the longitudinal impact of traumatic stress on anxiety buffering.

In conclusion, the present study did not provide evidence to support the hypotheses that working memory functioning is related to anxiety buffer disruption, nor did it replicate existing findings in ABDT. It was found that PTSD symptoms and PASAT scores are significantly related to negative and positive affect, consistent with existing research (Brose et al., 2012; Brose et al., 2014). Furthermore, PTSD symptoms and PASAT scores were not correlated, further complicating the current research on PTSD and working memory. Though several studies have shown that PTSD and working memory functioning are related, others – including the present study – have failed to find this relationship. As research in PTSD and neurocognitive functioning clarifies to what extent and how exactly PTSD is related to working memory functioning, it may become clearer as to how exactly working memory functioning subsequently relates to anxiety buffer disruption.
REFERENCES


https://doi.org/10.1037/a0021431


APPENDIX

IRB Approval

UCCS University of Colorado
Colorado Springs
Institutional Review Board (IRB) for the Protection of Human Subjects

Date: 1/17/2019

IRB Review

IRB PROTOCOL NO.: 19-084
Protocol Title: Personality and Cognitive Functioning
Principal Investigator: McKenzie Lockett
Faculty Advisor if Applicable: Dr. Tom Pyszczynski
Application: New Application
Type of Review: Exempt Category 2.iii
Risk Level: No more than Minimal Risk
This Protocol involves a Vulnerable Population: N/A (No Vulnerable Population)
Expires: N/A

*Note, if no expiration date is indicated: Changes in the research need to be approved before implementation, and you need to report an adverse events. Requests for status updates may be sent by the IRB. In addition, the protocol may match more than one review category not listed.

Externally funded: ☒ No ☐ Yes

Thank you for submitting your Request for IRB Review. The protocol identified above has been reviewed according to the policies of this institution and the provisions of applicable federal regulations. The review category is noted above, along with the expiration date, if applicable.

Once human participant research has been approved, it is the Principal Investigator’s (PI) responsibility to report any changes in research activity related to the project:

- The PI must submit all protocol, recruitment, advertising, and consent form amendments/rewrites to the IRB for approval.
  - The IRB must approve these changes prior to implementation.
- If you are a student, please note that it is required to include the IRB approval letter to the library when you submit the dissertation/thesis.
- The PI must promptly inform the IRB of all unanticipated serious adverse events (within 24 hours). All unanticipated adverse events must be reported to the IRB within 1 week (see 45 CFR 46.108(a)(4)(i)). Failure to comply with these federally mandated responsibilities may result in suspension or termination of the project.
- If required, renew the study with the IRB at least 10 business days prior to expiration
- Notify the IRB when the study is complete

If you have any questions, please contact Research Compliance Program Director in the Office of Sponsored Programs and Research Integrity at 719-255-3003 or irb@uccs.edu

Thank you for your concern about human subject protection issues, and good luck with your research.

Sincerely yours,

Michael Sanderson

Michael Sanderson, MBA
IRB Committee Member