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# An investigation of the peritraumatic encoding disruption hypothesis : introducing event segmentation as a marker of moment-to-moment processing

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ABSTRACT

AN INVESTIGATION OF THE PERITRAUMATIC ENCODING DISRUPTION HYPOTHESIS: INTRODUCING EVENT SEGMENTATION AS A MARKER OF MOMENT-TO-MOMENT PROCESSING

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Cognitive theories of PTSD assume that increases in peritraumatic anxiety and dissociation disrupts standard encoding processes, namely with an attentional bias toward perceptual information and away from conceptual information. However, this assumption currently lacks supporting evidence using moment-to-moment markers of encoding processes. This project explores if one specific encoding process, event segmentation, is impacted during a stressful event and if such an impact affects memory for the event. Event segmentation is an encoding process that involves chunking streams of continuous spatiotemporal information into discrete units. In studies measuring event segmentation during non-stressful events, findings suggest that segmentation ability positively predicts event memory. To date, no studies have assessed the impact of stress on event segmentation and subsequent memory.

This project measured moment-to-moment event segmentation during a non-stressful film and a stressful film using a paradigm that requires participants to indicate boundaries between "meaningful units of activity" while watching each film. The aim of this project is to

use the event segmentation task as a measurable, non-invasive, moment-to-moment marker of one encoding process during a stressful experience to provide an analog test of a core assumption within cognitive theories of PTSD. Specifically, unsystematic event segmentation was used as a marker for anxiety- and dissociation-impacted encoding based on the premise that any factor that affects attentional engagement in an experience is expected to decrease the systematicity of segmentation. Attentional engagement allows event segmentation to be influenced by (a) changes in the physical environment and (b) prior knowledge.

This project was motivated by four hypotheses, all conceptually based on cognitive theories of PTSD and the empirical literature on event segmentation. Hypothesis 1 proposed that segmentation of stressful experiences is less systematic when compared against the segmentation of everyday, non-stressful experiences. Hypothesis 2 proposed that affective and dissociative responses within stressful experiences result in reduced systematicity of segmentation. Hypothesis 3 proposed that reduced segmentation systematicity results in poor voluntary memory (recall and recognition). Hypothesis 4 proposed that reduced systematicity of segmentation is a conduit (i.e., mediator) through which anxiety and dissociation have a negative effect on voluntary memory.

The final sample included 73 mixed-gendered NIU students (predominantly freshmen) with no sexual assault histories or symptoms of PTSD. Planned analyses indicated no support for any of the four hypotheses. However, data analyses revealed numerous significant effects. Each significant effect was in the opposite direction of predictions. Most critically, and opposite of the direction predicted by Hypothesis 1, the stressful film resulted in higher segmentation scores than the non-stressful film. The remaining hypotheses assumed stressful experiences

would diminish (not enhance) segmentation scores; therefore, it was not surprising to discover the remaining analyses produced results that trended (often significantly) in the opposite direction of predictions. Other unexpected significant effects included positive effects of anxiety and dissociation on segmentation systematicity (opposite of Hypothesis 2), a negative effect of segmentation systematicity on recognition of the stressful film (opposite of Hypothesis 3), and mediating effects of high (not low) segmentation systematicity on the negative relationship between anxiety and dissociation on event memory (opposite of Hypothesis 4).

One possibility is that anxiety and dissociation may enhance segmentation systematicity in a manner that is consistent with theories of PTSD that emphasize increased sensitivity to perceptual features during traumatic events. Research on event segmentation has consistently showed that segmentation happens when there is perceptual change. The finding that segmentation was negatively correlated with memory performance for the stressful film but was positively correlated with memory performance for the non-stressful film lends credence to this interpretation. Given the unexpected nature of the findings, this interpretation should be considered with caution and would benefit from replication. Although the significant findings were unexpected, the results suggest measuring anxiety- and dissociation-induced change to at least one encoding process (i.e., event segmentation) is possible within the laboratory. This is the first known study to demonstrate that encoding during an analog traumatic event can be measured moment-to-moment and has interpretable implications on memory. The results of this study lend credence to future research exploring the relationship between segmentation and memory in the context of traumatic experiences.

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BY

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This document is strong evidence of the many privileges in my life. For me, there is no greater privilege than being able to pursue my values of science, education, and the alleviation of human suffering. I owe this privilege to many people. However, a select few have spent countless hours equipping me with concrete and pragmatic tools needed for a successful career as a clinical psychologist. I feel prepared for my career because I am taking pieces of each mentor with me.

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I am not yet a composite of all these pieces. Though, my foundation is fairly solid and I am excited to continue stacking each piece upon another. I am deeply grateful for the village that raised me, which includes faculty members, collaborators, and students not mention here. I am fully committed to pass along this privilege.

# DEDICATION

To my wife –

To my mum and dad –

To every branch of my family tree –

I have finally run out of school. After leaving home, my journey took me through the cypress domes of the South, the frozen cornfields of the Midwest, the damp rainforests of the Pacific Northwest, and even the eucalyptus groves of a Land Down Under. My destination has always been "home" – to return physically, figuratively, and sincerely. Thank you for granting me freedom to pursue my journey and for providing support to keep me moving. Finally, it is time to come home. I hope you like this document – it's a one-of-a-kind souvenir.

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# CHAPTER 1

# INTRODUCTION

Memory disturbance in posttraumatic stress disorder (PTSD; American Psychiatric Association, 2013) has two general characteristics: (a) perceptually based involuntary recollections of the traumatic event that are often experienced as vivid and salient and (b) conceptually based voluntary recollections of the traumatic event that are often experienced as incomplete, disorganized, and fragmented (Brewin, 2011). Cognitive theories of PTSD (Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000) share the central etiological premise that alterations in affect and dissociation during a stressful experience will disrupt standard encoding processes, namely with an attentional bias toward perceptual information and away from conceptual information. This theoretical assumption is called the *peritraumatic encoding disruption* (PED) hypothesis. For the past several decades, one major research objective has been to better understand how characteristics of peritraumatic encoding might contribute to a memory-based etiological pathway to psychopathology.

One construal of the PED hypothesis that has received significant research attention is Brewin and colleagues' *dual representation theory* (DRT; Brewin et al., 1996; Brewin, Gregory, Lipton, & Burgess, 2010; for a review, see Brewin, 2014). According to DRT, maladaptive peritraumatic encoding results from a stress-induced down-regulation of the episodic memory system (Elzinga & Bremner, 2002; Payne et al., 2006; Vyas, Mitra, Rao, & Chattarji, 2002).

During this down-regulation, preference is given to encoding survival-related information such as threat-related images and sounds, which comes at the cost of encoding more abstract, conceptual information such as causal inferences and spatiotemporal context. In other words, perceptual processing is decoupled from conceptual processing. This decoupling leads to (a) perceptual memory representations that are not contextualized within one's autobiographical memory and (b) episodic memories that do not retain potentially important perceptual details.

DRT assumes that memory for traumatic events are dominated by perceptual details and lack important conceptual/situational content (e.g., spatially, temporally, and causally related sequence of events). As such, environmental or internal cues can trigger perceptual representations (e.g., intrusive images) without also retrieving the appropriate autobiographical context of the full traumatic event. For example, a combat veteran may hear a firework explosion on New Year's Day 2015, which then triggers intrusive images of an incinerated Humvee and dead soldiers but does not cue events associated with a specific episode, such as an attack that happened in Iraq during summer of 2006. The firework explosion can also trigger previously experienced emotions and physiological reactions, a phenomenon known as re-experiencing. These memory disturbances are proposed to persist until the perceptual representations and episodic memories are adequately integrated, which may occur through natural recovery or clinical interventions that require repeated rehearsal of the complete memory within a safe environment.

Despite the claim that PED is critical to the development of PTSD-related memory problems (Brewin et al., 1996; Ehlers & Clark, 2000), there is currently no evidence directly linking PTSD-related memory problems to encoding mechanisms measured moment-to-moment.

Accordingly, the PED hypothesis has excited a contentious controversy as to whether or not "special trauma mechanisms" such as the "decoupling of perceptual and conceptual processing" are needed in etiological models of PTSD (Berntsen & Rubin, 2006; Pearson, 2014; Peace, Porter, & ten Brinke, 2008; Porter & Birt, 2001; Rubin, Berntsen, & Bohni, 2008; Rubin, Boals, & Berntsen, 2008; Shobe & Kihlstrom, 1997).

Opponents of the PED hypothesis argue that the "event amnesia" criterion of PTSD is not empirically supported (Berntsen & Rubin, 2014) while the basic (i.e., non-clinical) memory research suggests voluntary memories of stressful experiences should be *enhanced* due to the facilitative effect of stress on memory (e.g., Buchanan & Lovallo, 2001; Schwabe et al., 2009). This argument implies the relationship between memory formation and stress has been strongly established; however, this relationship is considerably nuanced and complex and has not yet been rigorously tested (Roediger, 2008). Additionally, even if stress is shown to predict the encoding of a larger quantity of retrievable information, only a moment-to-moment marker of encoding processes can elucidate the manner in which stress might impact encoding processes and how these changes may subsequently affect memory. Therefore, the PED hypothesis remains an empirical question. As Brewin (2014) argues, this controversy will be most adequately addressed not by determining the validity of "special trauma mechanisms" but rather understanding how standard memory mechanisms operate during both non-stressful experiences and stressful experiences. As such, a closer examination is needed in the context of moment-to-moment encoding processes during experiences that vary in affective response and how these affect-related processes might potentially influence trauma-related memory disturbance.

Human memory is commonly described as an information processing system that has three broad stages: encoding, storage, and retrieval. While all three stages are relevant to this project, particularly close attention is given to encoding due to its emphasis within the PED hypothesis. Encoding refers to the general concept of transforming physical sensations into units of information that can be stored in memory (Tulving, 2001). The ontological nature of these "units of information" has long been controversial in cognitive science and is beyond the scope of the current project. However, it is important to highlight how the broad concept of encoding encapsulates many theoretical "encoding processes" including, to name a few, visual encoding, acoustic encoding, semantic encoding, and organizational encoding. It is infeasible to test all encoding processes simultaneously. Thus, to test the PED hypothesis, a researcher can only target a limited number of encoding processes. In this project, one potentially fruitful encoding process was used due to its temporally dynamic quality and ease of measurement: event segmentation. In this document, readers should be cognizant that the broad concept of encoding is specifically addressed with event segmentation as just one of many encoding processes. Findings related to event segmentation provide no direct insights regarding other encoding processes.

What is event segmentation? First, consider the possibility that encoding an event, whether traumatic or non-traumatic, involves a system of perception processes by which an observer can detect spatiotemporal entities (i.e., events) within temporally extended information and then recognize such entities as belonging to a class (i.e., what kind of event; Zacks, 2008). To illustrate these processes, consider how one typically perceives the start of a baseball game: the ceremonial first pitch, the national anthem, the actual first pitch, etc. The current study

specifically focuses on the first half of this detect-and-recognize sequence, event segmentation. Event segmentation is the process by which a person is able to identify the boundaries between smaller events that make up a larger event (Zacks, Speer, Swallow, Braver, & Reynolds, 2007). This process allows one to efficiently chunk streams of continuous information. For example, when washing the dishes, one is able to identify that the activity is comprised of an iterative set of actions, such as reaching for a dish, washing the dish, and placing the dish in a drain board. When recalling a past experience of dish washing, the complete and linear stream of activity is less likely to be represented than a quick series of images of your hands scrubbing or touching plates, bowls, and silverware.

The ability to segment non-stressful experiences into a coherent structure of smaller units has been positively linked to the quality of the memory for that experience (e.g., Bailey et al., 2013; Kurby & Zacks, 2011; Zacks, Speer, Vettel, & Jacoby, 2006), even after controlling for other cognitive factors associated with memory (Sargent et al., 2013). To date, no studies have assessed the impact of stress, or specifically anxiety and dissociation, on event segmentation and subsequent memory. Moment-to-moment event segmentation is commonly measured by a paradigm referred to as the *event segmentation task* (Newtson, 1973; Zacks & Tversky, 2001), which requires research participants to indicate boundaries between "meaningful units of activity" while experiencing an unfolding event (e.g., watching a video or reading a narrative). Using this task, event segmentation may potentially be used as a measurable, non-invasive, moment-to-moment marker of encoding during a stressful experience, which can provide a basis for testing the PED hypothesis.

There has been a concerted effort in clinical research to identify the mechanisms that underlie the chronic memory difficulties of PTSD (for reviews, see Bedard-Gilligan & Zoellner, 2012; Brewin, 2011, 2014). However, this research has not yet addressed the important role of event segmentation on memory. The current study examines the relationships between stressful responding, event segmentation, and event memory difficulties. Specifically, using a trauma analog design using the stressful film paradigm (SFP), the current study investigates if stressful responding results in memory disturbance indirectly through unsystematic event segmentation. The PED hypothesis has long assumed a mediating role of encoding disruption. The current study introduces unsystematic event segmentation as a marker for encoding disruption, based on the premise that any factor that affects attentional engagement in an experience is expected to decrease the systematicity of segmentation. Attentional engagement allows event segmentation to be influenced by (a) changes in the physical environment and (b) prior knowledge (Zacks et al., 2007). Importantly, stressful experiences are marked by a wide variety of responses that may negatively affect attentional engagement including alterations in a class of affect-related characteristics such as state anxiety and state dissociation (Brewin, Andrews, & Rose, 2000; Rizvi, Kaysen, Gutner, Griffen, & Resick, 2008).

The following literature review will include a discussion regarding limitations of the current empirical support for the PED hypothesis, particularly the theoretical implication that PED should lead to memory disturbance. In addition, the following literature review will include a discussion of the theoretical and methodological underpinnings of event segmentation research. The current study addresses the lack of moment-to-moment encoding data by investigating PED

within the context of an event segmentation task, which can provide a non-invasive marker of encoding disruption.

# CHAPTER 2

# LITERATURE REVIEW

## Posttraumatic Stress Disorder (PTSD)

The current *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) defines PTSD as a constellation of the following symptoms presenting for at least one month after direct or indirect exposure to a traumatic event: (a) intrusive experiences (e.g., flashbacks and high physiological reactivity to trauma reminders), (b) avoidance of trauma-related memories and external reminders, (c) negative alterations in cognitions and mood (e.g., inability to recall key features of the traumatic event), and (d) alterations in arousal and reactivity (American Psychiatric Association, 2013). Within *DSM-5*, the unique facet of these diagnostic criteria for PTSD, as well as other trauma- and stressor-related disorders, is the requirement of exposure to an environmental antecedent, specifically, an index traumatic event.

Although many affective states (or "peritraumatic reactions") may occur during exposure to a traumatic event, the current study considers two particularly common experiences, specifically state anxiety and state dissociation. State anxiety is defined as a temporary feeling of fear, nervousness, and discomfort, as well as the arousal of the autonomic nervous system, which is induced by the perception of threats or danger (Spielberger, Gorsuch, & Lushene, 1970). State dissociation is broadly defined as "a disruption of and/or discontinuity in the

normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control, and behavior" (American Psychiatric Association, 2013, p. 291). State dissociation during exposure to a traumatic event (i.e., "peritraumatic dissociation") is one of the strongest predictors of chronic PTSD development (Ozer, Best, Lipsey, & Weiss, 2003; see also, Briere, Scott, & Weathers, 2005).

While numerous psychological theories of PTSD exist (see Brewin & Holmes, 2003), several prominent theories converge with respect to the proposal that the environmental antecedent of PTSD (i.e., an index traumatic event) not only causes stress during exposure (e.g., state anxiety and state dissociation), but also can continue to afflict the person through the indirect pathway of memory (Brewin et al., 1996; Ehlers & Clark, 2000; Foa, Steketee, & Rothbaum, 1989). A vast literature supports the idea that PTSD is a disorder of memory disturbance (Brewin, 2011, 2014). Memory disturbance in PTSD is often characterized as the coupled problems of (a) fragmented voluntary conceptual trauma memories and (b) easily-triggered involuntary perceptual trauma memories. The current study exclusively focuses on "fragmented" (or "disorganized") trauma memories, which are recollections of distressing experiences that have a general lack of narrative coherence characterized by an absence of important details or a confusing temporal order (Foa, Molnar, & Cashman, 1995; Huntjens, Wessel, Postma, van Wees-Cieraad, & de Jong, 2015; van der Kolk & Fisler, 1995). While memory fragmentation is documented as characteristic of PTSD (American Psychiatric Association, 2013; Jelinek, Randjbar, Seifert, Kellner, & Moritz, 2009), empirical findings are mixed (O'Kearney & Perrott, 2006), and little empirical evidence supports the premise that traumatic events are initially encoded in a particularly disjointed or fragmented manner (Segovia,

Strange, & Takarangi, 2016). Most research examining the etiology of memory fragmentation has investigated the role of peritraumatic dissociation (Buck, Kindt, & van den Hout, 2006; Kindt et al., 2005; Kindt & van den Hout, 2003). However, this literature has failed to demonstrate a causal link between peritraumatic dissociation and objectively measured memory fragmentation (Bedard-Gilligan & Zoellner, 2012).

## Psychological Theory of PTSD

As mentioned above, to explain the coupled problems of poor voluntary memory and strong involuntary memory of the traumatic event, cognitive theories of PTSD suggest the occurrence of some type of peritraumatic encoding disruption (PED) that results from extreme affective or dissociative responses (Brewin et al., 1996; Ehlers & Clark, 2000). Thus, understanding the development of PTSD may be contingent upon elucidating the roles of various memory processes, particularly encoding mechanisms. Although the current study primarily considers PED from the perspective of *dual representation theory* (DRT; Brewin et al., 1996, 2010), other closely related clinical models such as Ehlers and Clark's (2000) *cognitive theory* make similar predictions regarding the influence of encoding disruptions on memory disturbance (Holmes & Bourne, 2008).

As reviewed in Chapter 1 (Introduction), DRT assumes that typical encoding of everyday experiences involves the coordination of perceptual processing and conceptual processing, which, respectively, result in two types of encoded representations: (a) sensory-bound, perceptual representations and (b) contextual, conceptual representations (Brewin et al., 2010).

These two types of representation are typically integrated into a complete whole of perceptual, and conceptual, information. However, when experiencing extreme stress, DRT assumes that encoding is disrupted such that a "decoupling" occurs between perceptual processing and conceptual processing. Brewin and colleagues describe the decoupling processes as a down-regulation of the episodic memory system during the traumatic experience, which occurs in the service of enhancing the encoding of survival-related perceptual representations, particularly information related to external sensations and affective states. As a cost of this down-regulation, perceptual information will not be adequately elaborated or contextualized within one's autobiographical memory. The decoupling of these two processing streams results in the coupled problems of weak voluntary event memory (i.e., episodes that lack of sensory content) and strong involuntary perceptual event memory (i.e., sensory content that lacks conceptual context). The main clinical implication of DRT is that these memory problems will persist until a clinical intervention facilitates the integration of perceptual representations and conceptual representations.

## Evidence of Peritraumatic Encoding Disruption (PED) Hypothesis

To date, no empirical studies have assessed whether or not encoding processes as measured moment-to-moment are indeed disrupted during an analog stressful experience and if this disruption results in memory disturbance. However, many studies have investigated PED using indirect methods. Specifically, two major strands of research include (a) studies that use laboratory methods to induce encoding disruption and assess its effect on memory disturbance,

and (b) studies that measure peritraumatic dissociation as a proxy for encoding disruption and assess its effect on memory disturbance. Before reviewing each of these strands of research, the stressful film paradigm (SFP) will be reviewed because nearly all studies examining PED, including the current study, have used this analog approach.

## Stressful Film Paradigm

The SFP method involves exposing nonclinical samples to film clips with highly aversive content. Materials typically include aversive scenes from commercially produced film (e.g., sexual assault dramatization; Kindt, van den Hout, & Buck, 2005; Schaich, Watkins, & Ehring, 2013) or real world footage (e.g., a collage of motor vehicle accidents; Brewin & Saunders, 2001; Halligan, Clark, & Ehlers, 2002; Holmes et al., 2004). The methodological benefits of the SFP are (a) controlling the dose and nature of the index event and (b) allowing measurement of participant reactions both during exposure and prospectively. Recent reviews generally support its validity and utility (Holmes, 2004; Holmes & Bourne, 2008; Holmes & Steel, 2004; Weidmann, Conradi, Gröger, Fehm, & Fydrich, 2009).

Given that ethical standards encumber attempts to induce truly traumatic responses within the laboratory, ecological support of the SFP is provided by studies demonstrating that participants exhibit reactions that are likely to occur during real world traumatic experiences. Studies have successfully used the SFP to elicit a variety of stress reactions including changes in overall stress levels (Holmes et al., 2004), state anxiety levels (Halligan et al., 2002; Holmes et al., 2004), state dissociation levels (Holmes et al., 2004; Kindt et al., 2005), electrodermal

activity (Kindt & van den Hout, 2003; Kindt et al., 2005), and heart rate (Holmes et al., 2004). In addition, studies have successfully used the SFP to elicit intrusive memories (e.g., Davies & Clark, 1998; Holmes et al., 2004; Laposa & Alden, 2006), which many consider to be the hallmark symptom of PTSD (Foa et al., 1989; Steil & Ehlers, 2000). These PTSD-like reactions to the SFP tend to not last longer than several hours and the frequency of intrusive memories typically declines markedly within several days (Butler, Wells, & Dewick, 1995).

Laboratory-Induced Encoding Disruption

In recent years, over a dozen studies have used the SFP to investigate PED by comparing a laboratory-induced encoding disruption condition to a control condition. Encoding disruption is typically executed by introducing a concurrent cognitive task that consumes working memory resources, namely visuospatial or phonological processing load (Baddeley, 1986). The interruption of working memory processes during encoding of a stressful event is seen as a risk factor to develop PTSD (Brewin et al., 2010). It should be noted, however, that deficits in working memory abilities have also been identified as risk factors that operate after initial encoding. For instance, low working memory capacity has been linked to the inability to suppress intrusive memories (Brewin & Holmes, 2003). Therefore, manipulations to working memory within the lab may not fully account for the relationship between working memory and analog symptoms of PTSD.

Studies that induce encoding disruption have most frequently demonstrated significant findings for the PED hypothesis in the context of involuntary memory problems, not voluntary

memory problems (Brewin, 2014). The most frequently replicated finding is that a concurrent visuospatial task leads to a reduction in subsequent involuntary recollections of stressful stimuli relative to a control condition that does not involve a concurrent load task (Bourne et al., 2010, Experiment 1; Brewin & Saunders, 2001; Holmes et al., 2004, Experiments 1 and 2; Krans, Näring, Holmes, & Becker, 2010a, 2010b; Logan & O'Kearney, 2012; Stuart, Holmes, & Brewin, 2006). This effect has been replicated when visuospatial tasks (e.g., playing "Tetris") are administered after the initial encoding, with delays of 0 minutes (Deeprose et al., 2012, Experiment 1), 30 minutes (Deeprose et al., 2012, Experiment 2; Holmes, James, Coode-Bate, & Deeprose, 2009; Holmes, James, Kilford, & Deeprose, 2010, Experiment 1), and 240 minutes (Holmes et al., 2010, Experiment 2).

Findings related to the effects of a concurrent verbal task (e.g., counting backwards) have been less consistent. Specifically, this method has been shown to result in increases of intrusions (Bourne et al., 2010, Experiments 1 and 2; Deeprose, Zhang, DeJong, Dalgleish, & Holmes, 2012, Experiments 1 and 2; Holmes et al., 2004, Experiment 3), decreases in intrusions (Krans, Näring, & Becker, 2009; Logan & O'Kearney, 2012; Pearson & Sawyer, 2011), as well as no effect on intrusions (Krans, Langner, Reinecke, & Pearson, 2013). The source of unreliability may be the variability with which participants are able to successfully execute the counting backwards task, as better performance has been shown to positively predict intrusions (Bourne et al., 2010). However, mixed findings are also evident in other concurrent verbal tasks such as rehearsing a nine-digit number (Nixon, Cain, Nehmy, & Seymour, 2009a; Nixon, Nehmy, & Seymour, 2007), counting from one to six (Krans et al., 2010a), and the computer game "Pub Quiz" (Holmes et al., 2010, Experiments 1 and 2).

Most studies examining PED in the context of involuntary memory problems have also examined voluntary memory problems. However, the majority of tests on voluntary memory have produced non-significant results. When using a cued recall task (i.e., open-ended questions regarding the stimulus, such as, "How many people were put into coffins?"), most studies have found null findings (Brewin & Saunders, 2001; Holmes et al., 2004, Experiments 1, 2, and 3; Nixon et al., 2007, 2009a). However, some studies found significant decreases in voluntary recall if the participants counted backwards (Bourne et al., 2010, Experiment 1; Krans et al., 2009, 2010a) or, contrary to predictions, engaged in a spatial tapping task (Krans et al., 2010b). When using a sequencing recall task (i.e., ordering a list of verbally described events in the same sequence as the stimulus), one study found significant decreases in sequencing recall if rehearsing a nine-digit number (Nixon et al., 2007) and another found null results (Nixon et al., 2009a). When using a recognition task (i.e., closed-ended questions regarding the stimulus, such as, "The rapist kicks her twice [true/false]"), most studies found null results (Bourne et al., 2010, Experiment 1; Deeprose et al., 2012, Experiment 2; Holmes et al., 2004, Experiment 3, 2009; 2010, Experiments 1 and 2; Krans et al., 2009, 2010a, 2010b; Nixon et al., 2007, 2009a). However, some studies have found significant decreases in recognition performance if the participants counted backwards (Bourne et al., 2010, Experiment 2) or, contrary to predictions, engaged in a spatial tapping task (Holmes et al., 2004, Experiment 2).

In sum, studies that have investigated PED by incorporating laboratory-induced encoding disruption have found consistent support for the buffering effects of a visuospatial distractor on involuntary memory problems, but not voluntary memory problems. With respect to harmful effects of a verbal distractor, studies found inconsistent or null findings for both involuntary

memory problems and voluntary memory problems. The inconsistency of laboratory-induced encoding disruption may be attributed to poor ecological validity, as encoding disruption during real world stressful experiences seems to be more likely to occur organically through affective and dissociative responses. Specifically, the ecological validity is suspect given (a) the demand of concurrent tasks on overall cognitive load and (b) the misrepresentation of how encoding might actually be disrupted during stressful experiences (i.e., not counting backwards or tapping a complex pattern into a matrix). To better understand how memory disturbance may result from processes associated with initial encoding, new methods are needed that use relatively less demanding procedures to assess moment-to-moment encoding processes and allow the experimenter to assess ecologically plausible contributors to encoding disruption (e.g., state anxiety and state dissociation).

## Peritraumatic Dissociation as a Proxy for Encoding Disruption

Some studies have investigated the PED hypothesis by using theoretical proxies assumed to disrupt encoding processes, namely state dissociation (Buck, Kindt, & van den Hout, 2006; Kindt et al., 2005; Kindt & van den Hout, 2003). Rather than measure encoding processes directly, these studies assume that encoding disruption is the underlying mechanism of the relationship between affective or dissociative responses and subsequent memory disturbance. This assumption is problematic because the validity of the causal role of peritraumatic dissociation on trauma-related symptomatology is questionable (Bremner, 2010; Candel & Merckelbach, 2004; Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008, 2010). Dissociation as

a construct has been criticized as being too broad (e.g., Holmes et al., 2005), whereas to claim a person experienced peritraumatic dissociation seems to suggest little beyond some unspecified psychological dysfunction during exposure.

To date, the empirical findings linking peritraumatic dissociation to memory disturbance are mixed (Bedard-Gilligan & Zoellner, 2012). Cross-sectional studies using trauma-exposed samples have found higher levels of retrospectively reported peritraumatic dissociation to be related to higher ratings of memory fragmentation (Halligan, Michael, Clark, & Ehlers, 2003; Hardy, Young, & Holmes, 2009; Murray, Ehlers, & Mayou, 2002). However, these studies are limited in that only subjective perceptions of fragmentation were assessed (i.e., "meta-memory judgments"), which can be biased by (a) cues during recall and (b) one's history of recalling the memory, as well as (c) current psychological functioning. Consistent with this criticism, all laboratory studies that have attempted to use peritraumatic dissociation as a proxy for encoding disruption have found that it predicts subjectively measured memory quality (i.e., meta-memory), but not objectively measured memory quality (Buck et al., 2006; Kindt et al., 2005; Kindt & van den Hout, 2003). While peritraumatic dissociation may not be a useful proxy of encoding disruption, the empirical question remains if peritraumatic dissociation directly impacts encoding processes. Methodologies are needed to assess moment-to-moment encoding processes to examine the extent to which dissociative and affective responses do indeed disrupt encoding and if such a disruption results in a meaningful impact on memory outcomes.

## Summary

A defining characteristic of PTSD is memory disturbance, most notably strong involuntary trauma memories and weak voluntary trauma memories. Several theoretical accounts assume PTSD begins with some type of disruption during the initial encoding of the traumatic experience (i.e., the PED hypothesis). However, the empirical support for these theoretical accounts is limited by not assessing moment-to-moment behavioral data that can closely approximate actual encoding processes. The most adequate tests of the PED hypothesis should use methods that do not induce encoding disruption but rather measure moment-to-moment irregularities in encoding processes that occur organically. Cognitive science has recently provided one such method of moment-to-moment assessment that has shown high degrees of reliability and validity: event segmentation.

## Event Segmentation

The world we experience is a continuous stream of information falling upon our senses. Yet, we do not seem to perceive or remember the world as a continuous stream but rather a contiguous series of discrete events. An event is defined as "a segment of time at a given location that is conceived by an observer to have a beginning and an end" (Zacks & Tversky, 2001, p. 17). Although an event is a construct of the mind, its boundaries coincide with perceptible changes in the natural world (Tversky & Zacks, 2013). The moment-to-moment perception of experience as discrete units simplifies and streamlines our understanding of our

complex world as we move through it by condensing extended lengths of activity into single elements (Zacks & Tversky, 2001; Newtson, 1973). This facet of encoding seems to directly affect memory for our experiences (Sargent et al., 2013), as well as observational learning (Lozano, Hard, & Tversky, 2006). Specifically, the locations of boundaries between events affect how ongoing activity is remembered (Boltz, 1992; Ezzyat & Davachi, 2011; Schwan & Garsoffky, 2004; Schwan, Garsoffky, & Hesse, 2000; Swallow et al., 2011; Swallow, Zacks, & Abrams, 2009). A review of event segmentation is provided below, including its empirical evidence and potential applicability to the PED hypothesis.

## Psychological Theory of Event Segmentation

The human cognitive system has a variety of "chunking mechanisms" to enhance processing efficiency (Gobet et al., 2001; Miller, 1956; Newell & Simon, 1972). How and why do humans chunk ongoing experience into events? According to *event segmentation theory* (EST; Zacks et al., 2007), the parsing of incoming data is a result of a persistent anticipation of the immediate future. More specifically, event segmentation is a spontaneous concomitant (or "byproduct") of an ongoing perceptual processing system that transforms current sensory input into perceptual predictions that allow the organism to anticipate incoming future stimuli. As such, EST is one of many contemporary theories centered on the notion that cognitive systems (e.g., language comprehension and reinforcement learning) serve anticipatory functions (Zacks, Kurby, Eisenberg, & Haroutunian, 2011). To understand the EST perspective on how humans segment events and why this ability is important in daily functioning and memory, one must

consider event segmentation in the context of EST's proposed perceptual processing system (see Figure 1).

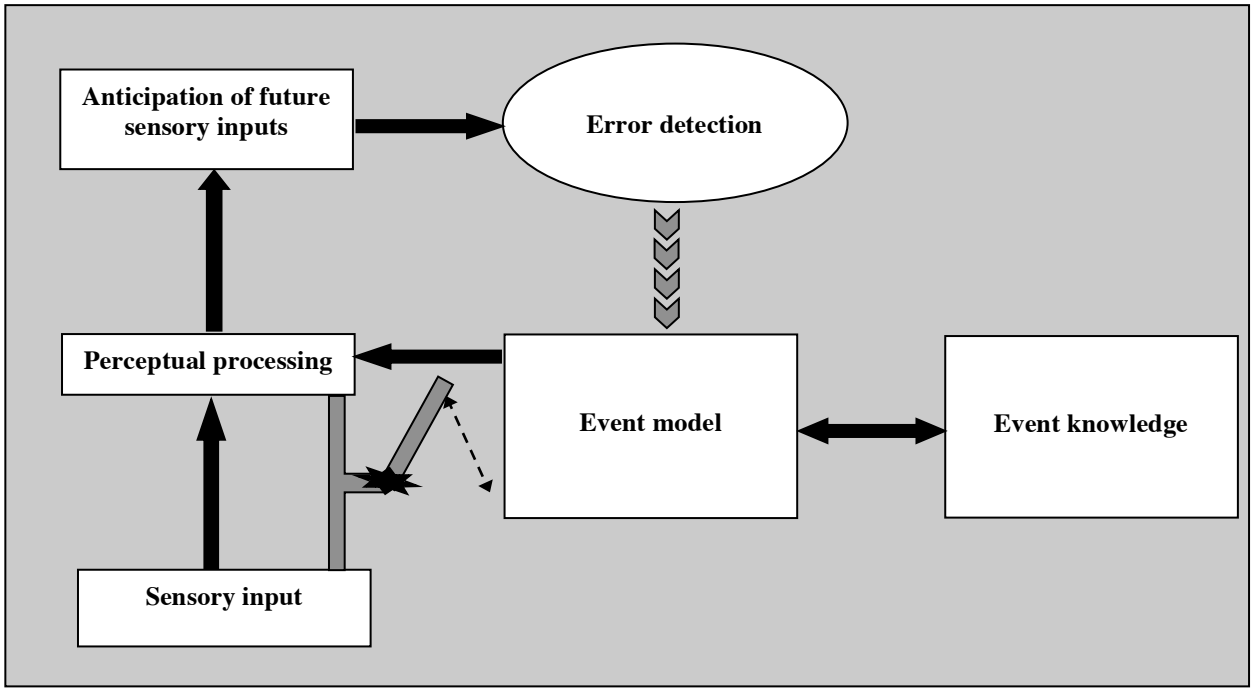


*Figure 1*. Schematic depiction of event segmentation theory (EST).

Components of Event Segmentation

According to the EST model proposed by Zacks et al. (2007), our experiences are understood in the context of *event models*, defined as representations maintained by working memory of what is happening in the moment. The content of the event models eventually gets incorporated into a long-term memory representation of the unfolding event. Event models are multimodal (e.g., visual, auditory, tactile) and are often accessible to consciousness. Importantly, in addition to receiving input from sensory and perceptual processes, event models

receive input in a top-down fashion (i.e., conceptual processing) based on *event knowledge* (or *event schemas*), defined as semantic memory representations of previously learned features of specific domains (e.g., using a vending machine) and generalized domains (e.g., activities of daily living). Event models can be stable for a period of time (ranging from a few seconds to tens of minutes) and not affected by transient changes or disruptions in the *sensory input* (see the "gated" arrow in Figure 1). Insensitivity to immediate sensory and perceptual input allows the event model to guide *perceptual processing*. Specifically, the current event model facilitates *anticipatory processes* by offering predictions for what might happen in the immediate future.

The accuracy of anticipatory processes is dependent upon how well the event model matches the actual state of affairs within the current environment, which is monitored by an *error detection mechanism* (neuroanatomical candidate: midbrain dopaminergic system; see Zacks et al., 2011). When the contents of an event model do not match the perceptual features of incoming stimuli (e.g., when the man suddenly stops walking down the hallway next to a vending machine), there is a transient increase in *prediction error signals* emitted by the error detection mechanism (see the segmented arrow in Figure 1). These prediction error signals activate a *gating mechanism* that allows new sensory and perceptual input to update the event model in a bottom-up fashion (i.e., perceptual processing; see the dashed black line in Figure 1). As the event model is updated and becomes stable (e.g., the man is putting coins into the vending machine), prediction error signals will reduce and the gating mechanism will be deactivated, thereby reducing the influence of sensory inputs on the event model. It is also at this time that the episodic memory for the larger event gets updated in long-term memory so that it now contains contents of the prior event model (e.g., the man walked down the hallway and then

made a purchase at the vending machine). Thus, the status of an event model perpetually alternates between periods of stability and change that are perceived as events and event boundaries, respectively.

To date, EST has been used primarily to explain how humans chunk everyday activities (e.g., taking out the garbage) into meaningful events. For example, when observing a person take out the garbage, EST predicts that observers will normatively segment and encode the following events: pulling out the trash bag from the kitchen's trash bin, carrying the trash bag to the garage, placing the trash bag within the large garbage can, dragging the garbage can to the street curb, and walking back to the house without the garbage can. Given that the current event model may not afford fully accurate visuospatial predictions (e.g., the first few steps into the garage), this ongoing activity will be segmented into events on a fine-grained scale due to changes in location and physical movement (e.g., walking in kitchen, walking in garage, walking in driveway). That is, prediction error signals will emit when incoming visuospatial information is not sufficiently anticipated by the current event model, causing the gating mechanism to open and thereby facilitate the construction of a new event model that can account for the new visuospatial information. However, perceptual predictions are based on multiple, hierarchical event models that are updated simultaneously on differently grained representational timescales that are tuned to detect particular characteristics of prediction error signals. Therefore, observers are also expected to segment the entire "taking out the garbage" sequence as a single, coarse-grained event because at a conceptual level all actions are highly predictable and based on the same superordinate goal (i.e., taking out the garage). While the fine-grained event will contain

more details from the stream of activity, the coarse-grained event will be more meaningful and more likely to be intentionally recalled.

## Perceptual Processes and Conceptual Processes

Event segmentation is predominantly constrained by perceptual, bottom-up processes (Zacks et al., 2007). Physical changes in the environment are expected to stimulate segmentation by increasing the potential for prediction error. For example, studies have shown that movement of physical objects correlates with the perception of event boundaries (Hard, Tversky, & Lang, 2006; Newtson, Engquist, & Bois, 1977), especially when the observer is motivated to detect fine-grained characteristics or when the physical objects move without intentionality (Zacks, 2004).

In comparison to bottom-up constraints to segmentation, less is currently known about top-down constraints. Intuition suggests that human observers leverage memory stores when making sense of their environment, rather than simply tracking changes in the environment like a motion-activated security camera (e.g., Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005). Thus, a case can be made that event knowledge (e.g., episodic memory, semantic knowledge, scripts, and schemas) can affect the identification of event boundaries. Specifically, event knowledge may influence the identification of event boundaries (or lack thereof) in an indirect fashion by constructing event models with situational features that have not yet been perceived. When event knowledge constructs an event model that closely mirrors the actual environment, perceptual predictions are accurate and, thus, the event model does not need to be

updated by additional sensory input. However, when event knowledge is inaccurate or insufficiently matches the current state of affairs, the observer's event model will need to be updated more frequently by sensory input in a bottom-up fashion. More frequent updating results in a greater number of identified event boundaries (Zacks, 2004). Also, in situations for which event knowledge does not adequately construct event models, the resulting memory representation may include perceptual information that is not integrated in a conceptually coherent manner, as event knowledge can inform how smaller events are arranged within a larger event (e.g., Zacks et al., 2007).

To date, the indirect role of event knowledge on segmentation (through the conduit of event model construction) is most clearly illustrated by studies investigating the top-down process of agent goal knowledge (Boggia & Ristic, 2015; Magliano, Taylor, & Kim, 2005; Speer, Zacks, & Reynolds, 2007; Zacks, 2004). For example, Magliano and Zacks (2011) showed that discontinuity edits in film, which by definition should be unpredictable, are more likely to be identified as event boundaries if the given edit depicts a discontinuation of goal-directed behavior rather than just visual information. However, evidence does not yet demonstrate an interaction between segmentation and individual differences in event knowledge (Sargent et al., 2013).

In addition to the potential influence of event knowledge on the segmentation system, another top-down determinant of segmentation may be the observer's own goals and attentional engagement (Zack & Swallow, 2007; Zacks et al., 2007). People approach experiences in widely differing manners. To list just a few examples, they may be motivated to learn, evaluate, avoid, ignore, or be entertained. Their own goals may impact how they regulate attention. In fact,

studies have shown that situational demands can influence a participant to change strategies during an event segmentation task (Zacks & Tversky, 2001). Although attentional engagement with an experience can vary across persons and situations, no studies have examined how event segmentation processes may change as a function of the emotionally evocative qualities of a situation. The current study takes the first steps in this direction by examining the extent to which affective responses influence event segmentation processes.

## Measurement of Event Segmentation

The primary method to assess event segmentation is the event segmentation task (Newtson, 1973). In this simple procedure, participants watch a film and press a button each time they consciously perceive a boundary between meaningful events. Task instructions vary between studies. Some iterations request the identification of the largest units of activity (i.e., course-grained), while other iterations request the identification of the smallest units of activity (i.e., fine-grained). The latter has been shown to be more reliable (Sargent et al., 2013).

With respect to reliability, the event segmentation task has strong inter-rater indices and test-retest indexes with respect to the identification of boundary locations and event durations (Newtson, 1976; Speer, Swallow, & Zacks, 2003; Zacks et al., 2006). With respect to predictive validity, recent studies have shown that the event segmentation task can identify predicted group differences (e.g., elderly vs. controls) in the segmentation of non-stressful events, as well as event memory in the predicted, positive direction during non-stressful events (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013; Zacks et al., 2006; Zacks, Kurby, Landazabal,

Krueger, & Grafman, 2016). Stimuli used in event segmentation research are carefully considered and no prior studies have used the event segmentation task in the context of a stressful experience. Differences in stimuli can elicit varied segmentation performances based on intrapersonal characteristics. For instance, studies have shown that, as predicted, previously established group differences (e.g., elderly vs. controls) in event segmentation performance in everyday experiences are not generalizable to narrative experiences (Kurby, Asiala, & Millis, 2013; Magliano, Kopp, McNerney, Radvansky, & Zacks, 2012).

With respect to ecological validity, evidence suggests this paradigm does not introduce task demands that substantially alter naturalistic perceptual processing. Specifically, Zacks et al. (2001) recorded brain activity using fMRI while participants passively watched films of everyday activities. Next, without fMRI measurement, participants identified event boundaries on the same films using the event segmentation task on two timescales (i.e., fine- and coarse-grained instructions). During the initial passive viewing, transient increases in activity of predicted brain areas (posterior and frontal cortex) coincided with event boundaries identified during the event segmentation tasks, especially for boundaries identified on the coarse-grained timescale. Specifically, brain activity (a) increased several seconds before each boundary and (b) peaked several seconds after each boundary. Due to the ordering of the study's procedures, changes in brain activity during passive viewing cannot be attributed to subsequent task demands. In addition to supporting the ecological validity of the event segmentation task, these findings provide evidence that event segmentation is a normal, spontaneous, and effortless perceptual process (see also, Speer et al., 2007).

While segmentation can be measured several ways on the event segmentation task, one approach is to calculate an agreement score, defined as the degree to which one indicates event boundaries that are consistent with an objective standard based on theoretically identified event boundaries (Kurby et al., 2013; Magliano et al., 2005, 2012). Although the process of event segmentation is inherently subjective and idiographic to the person-situation transaction, research has demonstrated that theoretically identified event boundaries are robust predictors of event segmentation (Kurby et al., 2013; Zacks et al., 2009). For example, people perceive event boundaries at the beginning and end of goal oriented action sequences (Magliano et al., 2005, 2012). Segmentation patterns that highly correlate with the pattern of theoretically identified event boundaries are considered to be "systematic." To exhibit unsystematic segmentation, one must locate event boundaries at idiosyncratic locations that are not meaningful with respect to a theoretically driven coding scheme. Thus, each button-press that deviates from the objective standard likely indicates some faulty or inapt process within the individual.

## Evidence of Event Segmentation Memory Effects

According to EST, the process of event segmentation directly affects event memory (Zacks et al., 2007). Specifically, each time an event model is updated, the previous event model is replaced by the new event model in working memory or short-term memory and subsequently encoded into long-term memory. These encoded units allow the individual to compress large spans of information into semantic chunks (e.g., walking through a hallway, putting coins into a vending machine, pushing a button, grabbing a soda, walking back through a hallway). Indeed,

strong empirical evidence supports the direct link between event segmentation and event memory (e.g., Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013).

The perception of event boundaries seems to be the key mechanism for what information is encoded and how the information is organized in memory (Ezzyat & Davachi, 2011; Radvansky, 2012). There is extensive research showing that details of events that occur around event boundaries are remembered better than those that occur within the boundaries (Boltz, 1992; Speer & Zacks, 2005; Schwan & Garsoffky, 2004; Schwan et al., 2000; Swallow et al., 2011; Swallow, et al., 2009; Zacks et al, 2006). Thus, identifying the "appropriate" event boundaries, which can be seen as "long-term memory anchors," can enhance encoding efficiency and the quality of a memory for a given experience (Kurby & Zacks, 2008; Zacks & Swallow, 2007). Event boundaries are considered appropriate if they cue the updating of the event model only when necessary. For example, when watching a man walk down a hallway to a vending machine, the cessation of his walking is a more appropriate event boundary than him passing underneath a fluorescent light bulb while still walking toward the vending machine.

## Event Segmentation and the PED Hypothesis

Given that the PED hypothesis assumes that an important antecedent to the development of PTSD is aberrant encoding caused by stressful responding (i.e., predominance of perceptual processing over conceptual processing), research is needed to examine the relationship between moment-to-moment encoding processes and relevant memory characteristics (e.g., weak voluntary memory). This research objective may profit from the emerging empirical literature

on event segmentation, given the assumption that any substantial disruption to peritraumatic encoding processes should be observable within the context of basic mechanisms of event perception. The event segmentation task can be incorporated into the SFP to provide a moment-to-moment marker of encoding, thereby permitting the examination of the theorized relationship between anxiety- and dissociation-impacted encoding and memory outcomes (e.g., reduced recall and recognition).

Three deterrents of systematicity in event segmentation during a stressful experience are anticipated. These deterrents may not be purely distinct but offer a framework to consider how "encoding disruption" may manifest in the context of an event segmentation task (i.e., low segmentation systematicity). First, the most obvious and plausible cause of low segmentation systematicity is diverting attentional focus away from aversive external sensations. This source of low segmentation systematicity will be called "overt attentional avoidance." If one does not visually track an unfolding activity, one loses useful information to construct event models and identify event boundaries. Second, given that insufficient prior event knowledge requires the event segmentation system to rely more heavily on perceptual information when updating event models (Zack, 2004), systematicity may diminish to the extent that the individual possesses little or inaccurate prior event knowledge of the stressful experience. This source of low segmentation systematicity will be called "insufficient prior event knowledge." Third, given that affective responses (e.g., state anxiety and state dissociation) have been shown to bias attention toward perceptual (bottom-up) processing and away from conceptual (top-down) processing (e.g., Brewin, Ma, & Colson, 2013; Brewin & Mersaditabari, 2013; Morgan, Doran, Steffian, Hazlett, & Southwick, 2006; Pacheco-Unguetti, Acosta, Callejas, & Lupiáñez, 2010; for theoretical

accounts, see Brewin et al., 2010; Ehlers & Clark, 2000; Metcalfe & Mischel, 1999; Eysenck, Derakshan, Santos, & Calvo, 2007), systematicity may diminish to the extent that an affect-related shift away from conceptual processing interferes with the potential of event knowledge to update event models. This source of low segmentation systematicity will be called "affect-related attentional interference."

Although not articulated by PTSD theories that support the PED hypothesis (Brewin et al., 1996; Ehlers & Clark, 2000), low segmentation systematicity (or simply, "unsystematic segmentation") during a stressful experience can be viewed as a type of encoding disruption. Given the three reasons stated above, event boundaries identified for a stressful experience, when compared to a non-stressful experiences, may be less conceptually driven and more perceptually driven. Since sensory information near event boundaries should be most salient in memory (Radvansky, 2012), the representation may be initially encoded as highly aversive snapshots and sound bites that are not meaningfully integrated together. This imbalance of perceptual information over conceptual information resonates with cognitive theories of PTSD (Brewin et al., 1996, 2010; Ehlers & Clark, 2000).

## Summary

In order to understand how individuals comprehend events, including traumatic events, one should consider the role of event segmentation, described as the coordination of perceptual processes and conceptual processes to chunk unfolding streams of information into a hierarchical structure of smaller units (Zacks et al., 2007). Given that memories of experiences are

influenced by how the experiences are segmented (Sargent et al., 2013), it is anticipated that segmenting an event unsystematically will lead to poor voluntary memory. In the context of traumatic experiences, there are several possible sources of unsystematic event segmentation, including overt attentional avoidance, insufficient prior event knowledge, and affect-related attentional interference. The event segmentation task (Newtson, 1973) provides an opportunity to measure event segmentation as a non-invasive, moment-to-moment marker of encoding disruption, which opens the possibility of examining the theoretical foundations of the PED hypothesis within a controlled laboratory setting.

# CHAPTER 3

# HYPOTHESES

## Overview of the Current Study

In this study, healthy participants engaged in the event segmentation task while viewing a non-stressful film and a stressful film. State anxiety and state dissociation were measured with self-report questionnaires before and after the stressful film. Ten minutes after the stressful film, event recall and then event recognition was assessed. Several variables were assessed as potential controls in regression analyses. One potential control was self-report of the extent to which the participant overtly avoided attentional engagement with the films (e.g., closing or covering eyes). Another potential statistical control was self-reported familiarity with the genre of the stressful stimulus (i.e., "torture porn"). Lastly, another potential statistical control was domain-specific event knowledge of the stressful experience (i.e., male-to-female rape), which was assessed by collecting "rape scripts" and coding for empirically identified "typical rape themes."

# Hypotheses

The overarching PED hypothesis makes four logically sequenced assumptions: (1) encoding disruption occurs during stressful experiences, (2) stress responses such as anxiety and dissociation predict encoding disruption, (3) encoding disruption predicts memory disturbance, and (4) encoding disruption is a mediating mechanism by which stress responses such as anxiety and dissociation cause memory disturbance. In the current study, these assumptions were viewed as four separate hypotheses. The a priori operationalization of encoding disruption was low segmentation agreement scores (i.e., "low segmentation systematicity").

## Hypothesis 1: Encoding Disruption Occurs During Stressful Experiences

It was hypothesized that encoding processes operate more unsystematically during stressful experiences than non-stressful experiences. The current study tested this hypothesis using event segmentation as a moment-to-moment indicator of one encoding process during a non-stressful experience (*Big Night*) and a potentially stressful experience (*Irréversible*).

H1: Event segmentation is less systematic during stressful events than non-stressful events.

*Prediction 1*: Segmentation agreement scores will be lower for the stressful film than the non-stressful film.

## Hypothesis 2: Stress Responses Predict Peritraumatic Encoding Disruption

It was hypothesized that reduced systematicity in encoding processes during stressful experiences is a direct result of stress responses (anxiety and dissociation). The current study tested this hypothesis using event segmentation as a moment-to-moment indicator of one encoding process during a potentially stressful experience (*Irréversible*).

H2: The more one experiences stress responses (anxiety and dissociation), the less systematic segmentation will be.

*Prediction 2*: Segmentation agreement scores for the stressful film will be negatively related to state anxiety and state dissociation (two separate tests).

## Hypothesis 3: Peritraumatic Encoding Disruption Predicts Event Memory Disturbance

It was hypothesized that encoding disruption during a stressful experience will negatively predict voluntary memory of the experience (recall and recognition). The current study tested this hypothesis using event segmentation as a moment-to-moment indicator of one encoding process during a potentially stressful experience (*Irréversible*).

H3: Unsystematic event segmentation during a stressful event results in poorer voluntary memory of the experience (recall and recognition).

*Prediction 3*. Segmentation agreement scores during the stressful film will positively predict voluntary recall and recognition (two separate tests).

## Hypothesis 4: Peritraumatic Encoding Disruption is a Mediating Mechanism by which Stress Responses Cause Event Memory Disturbance

It was hypothesized that poor voluntary memory for stressful experiences will occur to the extent that encoding processes are negatively influenced by stress responses (anxiety and dissociation). The current study tested this hypothesis using event segmentation as a moment-to-moment indicator of one encoding process during a potentially stressful experience (*Irréversible*).

H4: Unsystematic event segmentation is an encoding mechanism by which stress responses (anxiety and dissociation) leads to poor event recall and recognition. As such, stress responses (anxiety and dissociation) cause memory disturbance indirectly through unsystematic event segmentation.

*Prediction 4*. Segmentation agreement scores during the stressful film will mediate the negative relationship between anxiety and dissociation responses and voluntary recall and recognition (four separate tests).

# CHAPTER 4

# METHODOLOGY

## Participants

### Recruitment and Setting

Participants of all genders were recruited from PSYC 102 and compensated with course credit. Participation registration was executed using a secure online experiment management system (Sona Systems, Ltd.) where the study was advertised as "Understanding Stressful Experiences" (see Appendix A for IRB-approved recruitment materials). Participation lasted approximately 60 minutes. One trained research assistant guided each participant through nine phases (see Appendix B for an outline of procedures). Participants often participated simultaneously but in separate rooms within the same laboratory and without interacting. Each room contained a desk, computer, and headphones.

### Exclusionary Criteria

Exclusionary criteria included younger than 18 years of age, personal history of sexual assault victimization (any age), probable PTSD, and prior exposure to stimuli. Given that at least

71 participants were required to achieve adequate power to detect moderate effect sizes in the planned mediation analyses (Fritz & MacKinnon, 2007), participant recruitment continued until data were collected from at least 71 participants who completed all measures and met full inclusion criteria. In total, 177 participants were recruited. The final sample included 73 participants as 62 participants failed to meet inclusion criteria, 28 participants voluntarily stopped the stressful film, eight participants did not follow segmentation task directions, four participants could not complete the entire study due to scheduling conflicts, one participant voluntarily withdrew from the rape script task, and one participant did not complete all measures.

## Demographic Information

The final sample of 73 participants averaged 19.44 years of age (*SD* = 1.82) and were predominantly freshman (75.3%), averaging 24.34 credit hours (*SD* = 28.94). Slightly over half the participants identified as men (54.8%) with the remainder identifying as women. The vast majority identified as heterosexual (97.3%) with the remainder identifying as homosexual. The entire sample was fluent in English and 21.9% were multilingual. While the sample was racially diverse, the majority identified as either of European descent (49.3%) or African descent (30.1%). See Table 1 for a complete demographic summary.

Table 1

*Participant Demographics*

| Demographic Variable | Percentage | *n* | Description |
|---|---|---|---|
| **Age** | 31.5% | 23 | 18 |
| | 38.4% | 28 | 19 |
| | 13.7% | 10 | 20 |
| | 6.8% | 5 | 21 |
| | 2.7% | 2 | 22 |
| | 2.7% | 2 | 23 |
| | 0.0% | 0 | 24 |
| | 1.4% | 1 | 25 |
| | 1.4% | 1 | 26 |
| | 1.4% | 1 | 27 |
| **Class Standing** | 75.3% | 55 | Freshman (0 – 30 Credit Hours) |
| | 13.7% | 10 | Sophomore (31 – 60 Credit Hours) |
| | 5.5% | 4 | Junior (61 – 90 Credit Hours) |
| | 5.5% | 4 | Senior (91+ Credit Hours) |
| **Gender** | 54.8% | 40 | Male |
| | 45.2% | 33 | Female |
| **Sexual Orientation** | 97.3% | 71 | Heterosexual |
| | 2.7% | 2 | Homosexual |
| **Hispanic/Latino Heritage** | 79.5% | 58 | No |
| | 20.5% | 15 | Yes |
| **Race** | 49.3% | 36 | European |
| | 30.1% | 22 | African |
| | 5.5% | 4 | European and Indigenous American |
| | 4.1% | 3 | Indigenous American |
| | 2.7% | 2 | Asian |
| | 1.4% | 1 | African and Indigenous American |
| | 1.4% | 1 | European and Asian |
| | 1.4% | 1 | Middle Eastern |
| | 4.1% | 3 | No Response |
| **Languages Spoken** | 78.1% | 57 | English Only |
| | 11.0% | 8 | English and Spanish |
| | 4.1% | 3 | English and Tigrinya or Twi or Swahili |
| | 1.4% | 1 | English and Arabic |
| | 1.4% | 1 | English and Chinese |
| | 1.4% | 1 | English and Spanish and German |
| | 1.4% | 1 | English and Urdu |
| | 1.4% | 1 | English and Vietnamese |

# Materials

## Self-Report Measures

Before completing the script assessments, viewing and segmenting the films, and completing memory assessments, participants completed a survey packet that included several self-report measures. Later in the study, participants completed several pre- and post-film self-report measures. See Appendix C for all self-report measures.

Prior Film Exposure Questionnaire (PFEQ). Within the initial survey packet, prior exposure to two distinct film genres ("torture-porn" and "chick-flick") was assessed using the PFEQ, a 16-item self-report measure designed for the purposes of the current study. Torture-porn is a subgenre of horror films in which the central aspect of the plot is extreme violence against helpless victims, often including sexual violence but not necessarily (Edelstein, 2006). Chick-flick is a subgenre of comedy films and drama films that is explicitly marketed toward a stereotyped female audience and includes a plot depicting romantic themes in adult heterosexual relationships. The first 14 items of the PFEQ list seven representative films of each genre, resulting in two seven-item scales. Response options include 0 ("I have never heard of it"), 1 ("I have heard of it but I have never seen it"), 2 ("I have seen it only once"), and 3 ("I have seen it more than once"). Responses for each scale were averaged to form indices of "prior torture-porn exposure" (PFEQ-TP) and "prior chick-flick exposure" (PFEQ-CF). While the current study is most interested in the potential confounding role of prior torture-porn exposure, the inclusion of

a chick-flick scale was intended to mask the main purpose of the PFEQ and thereby reduce the likelihood of a socially desirable response set. The PFEQ-TP scale demonstrated good internal consistency ($\alpha = .74$). Scores ranged from 2 to 16 with a mean of 7.53 (*SD* = 3.20) and non-normal distribution with a positive skew of 0.62 (null skewness 95% CI [-0.55, 0.55]). Kurtosis did not significantly differ from zero (null kurtosis 95% CI [-1.10, 1.10]).

In addition to assessing prior exposure to film genres, the fifteenth and sixteenth items assessed prior exposure to the stressful stimuli (*Irréversible*; Chioua et al., 2002) and non-stressful stimuli (*Big Night*, Kirkpatrick et al., 1996), respectively. Participation discontinued if either of the final two items indicated at least one prior viewing. As mentioned above, four participants indicated a prior viewing of *Irréversible* and, thus, were excluded from continued participation. Only one participant indicated a prior viewing of *Big Night*; this participant had also previously seen *Irréversible*.

Life Events Checklist for DSM-5 (LEC-5). The initial survey packet also included the LEC-5 (Weathers, Blake, et al., 2013), a 17-item screener for potentially traumatic events that may have been experienced during the participant's lifetime. Specifically, 16 common antecedents of PTSD are listed, along with an additional item that assesses any other potentially traumatic event that was not already listed. In addition, nine follow-up questions assess which previously indicated event was the "worst," along with a variety of characteristics of the event (e.g., when it happened, if it reoccurred, and if injury or death was involved). Psychometric information is not currently available; however, given the minimal revisions from the psychometrically acceptable original version (Gray, Litz, Hsu, & Lombardo, 2004), the authors do not anticipate diminished reliability or validity. Participants were screened-out of the current

study using two items on the LEC-5 that assess lifetime history of sexual assault victimization or other unwanted sexual contact. With anticipation that the contents of the study's materials might remind some participants of previous traumatic experiences and result in especially high stress levels (Pfefferbaum, Pfefferbaum, North, & Neas, 2002), participants answering these two LEC-5 items as "happened to me," "witnessed it," or "not sure" were automatically advanced to debriefing after completing the survey packet. Forty-one of the 176 participants who completed the LEC-5 (23.3%) were excluded based on their responses (i.e., events involving sexual assault).

PTSD Checklist for DSM-5 (PCL-5). The initial survey packet then included the PCL-5 (Weathers, Litz, et al., 2013), a 20-item survey that assesses all representative PTSD symptoms included within *DSM-5* diagnostic criteria. The PCL-5 is intended to screen individuals for PTSD and provide provisional PTSD diagnoses. When completing the PCL-5, participants are instructed to respond to each item while keeping in mind the "worst event" specified on the LEC-5. Each item specifies a PTSD symptom and uses a five-point rating scale: *Not at all* (0), *A little bit* (1), *Moderately* (2), *Quite a bit* (3), and *Extremely* (4). Similar to the LEC-5, although psychometric information is not currently available, it is closely similar to psychometrically acceptable original version (Weathers, Litz, Herman, Huska, & Keane, 1993). Preliminary validation research suggests a cut-point of 38 to indicate probable PTSD, though the current study used a conservative cut-point of 30. As reported above, 37 of the 176 participants who completed the PCL-5 (21.0%) were excluded based on their responses. In the final sample, PCL-5 scores ranged from 0 to 28 with a mean of 9.37 (*SD* = 7.91) and the distribution was non-

normal with a positive skew of 0.64 (null skewness 95% CI [-0.55, 0.55]) and the minimum score (i.e., zero) as the modal response. Internal consistency was good (α = .84).

Demographic Questionnaire (DQ). Lastly, within the initial survey packet, demographic information was assessed using the DQ, a 7-item self-report measure that was created for the purposes of the current study. The DQ contains items assessing age, gender, Hispanic/Latino ethnicity, race, sexual orientation, credit hours, and languages spoken. Descriptive statistics are reported above (Table 1).

State Trait Anxiety Index – State, 6-Item Version (STAI-S6). Immediately before and after the stressful film, state anxiety was measured with the STAI-S6 (Marteau & Bekker, 1992), an abbreviated version of the original scale (Spielberger et al., 1970). The STAI-S6 has good internal reliability and construct validity (Marteau & Bekker, 1992; Tluczek, Henriques, & Brown, 2009). In the final sample, STAI-S6 Time One (T1) scores ranged from 6 to 15 with a mean of 8.52 (*SD* = 2.30). Internal consistency was acceptable (α = .67). The sample's STAI-S6 T1 scores did not approximate a normal distribution with a positive skew of 0.78 (null skewness 95% CI [-0.55, 0.55]). The STAI-S6 Time Two (T2) scores ranged from 6 to 24 with a mean of 16.16 (*SD* = 4.76) in a normal distribution. Internal consistency was good (α = .90).

Peritraumatic Dissociative Experience Questionnaire, 7-Item Version (PDEQ-7). Immediately before and after the stressful film, state dissociation was assessed using the PDEQ-7, a shortened version of the original 10-item self-report measure (Marmar, Weiss, & Metzler, 1997) used commonly by trauma analog studies (e.g., Kindt & van den Hout, 2003). Item content includes altered time perception, depersonalization, and derealization. Several items of the original version were removed due to being incompatible with trauma analog studies (e.g.,

"What was happening seemed unreal to me, like I was in a dream, or watching a movie or play"). The core measure consistently shows good internal reliability (Kindt & van den Hout, 2003; Marmar et al., 1994; Zoellner, Alvarez-Conrad, & Foa, 2002) and construct validity, as it positively predicts posttraumatic stress symptoms (Marmar et al., 1994), laboratory intrusions (Laposa & Rector, 2012), and subjective judgments of memory fragmentation (Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003; Hardy et al., 2009; Kindt & van den Hout, 2003; Kindt et al., 2005). During the pre-film state measurement, participants were asked to respond to the PDEQ-7 with regard to the previously viewed stimulus, which, depending on counterbalanced condition was either the practice film (i.e., building a toy boat using Legos) or *Big Night*. In the final sample, PDEQ-7 T1 scores ranged from 7 to 18 with a mean of 9.89 (*SD* = 2.64). Internal consistency was poor (α = .52). The sample's PDEQ-7 T1 scores were non-normally distributed with positive skewness of 0.89 (null skewness 95% CI [-0.55, 0.55]). The sample's PDEQ-7 Time 2 (T2) scores ranged from 7 to 23 with a mean of 10.62 (*SD* = 3.71). The sample's PDEQ-7 T2 scores were non-normally distributed with a positive skew of 1.21 (null skewness 95% CI [-0.55, 0.55]). Internal consistency was acceptable (α = .67).

Cognitive, Affective, and Visual Engagement Assessment Tests (CAVEAT). Immediately after both films, the CAVEAT was administered to assess a variety of facets (i.e., "caveats") related to viewer response. The CAVEAT is a 13-item measure made for the purposes of this study in order to assess a variety of possible between-film differences in viewer response. Part one, Cognitive Engagement, asked the participant to estimate the extent to which he or she paid attention to the film, experienced the perspective of the main character (omelet-maker in *Big Night* and victim in *Irréversible*), experienced empathy for the main character, and

identified with the main character. Part two, Affective Engagement, asked the participant to estimate the extent to which the film made him or her experience the five basic emotions of anger, joy, sadness, disgust, and fear (i.e., Ekman, 2003). Part three, Visual Engagement, included four items that asked the participant to estimate the number of times he or she looked away from the screen, deliberately closed his or her eyes (i.e., not simply blinking), deliberately covered his or her eyes, and the percentage of time he or she directly looked at the film. The estimated percentage of looking at the screen provides an index of "level of attentiveness" to the stressful film that could potentially be used as a statistical control. In *Irréversible*, slightly under half the participants (49.3%) indicated looking at the screen for 100% of the film's duration with a range of 50% to 100% and a mean of 94.16% (*SD* = 9.04%) in a non-normal distribution (skewness = -2.34, null skewness 95% CI [-0.55, 0.55]; kurtosis = 7.30, null kurtosis 95% CI [-1.10, 1.10]).

Scripts Assessments

Script writing procedures were used to assess generalized event knowledge for everyday experiences and domain-specific event knowledge for the stressful experience (i.e., sexual assault). Participants were asked to first produce scripts for three everyday events: getting ready for work, shopping for groceries, and going out to dinner. Three minutes were allowed for all three scripts (i.e., approximately one minute per script). Next, participants were asked to produce one script for a sexual assault within three minutes. The rape script assessment included more detailed and prescriptive instructions than the everyday event script assessment because

without some constraints the rape script assessment could produce widely heterogeneous responses. Following previous research (e.g., Davies, Walker, Archer, & Pollard, 2013; Littleton & Axsom, 2003; Ryan, 1988), participants were told to describe, in as much detail as possible, a specific but hypothetical rape of a female victim by a male perpetrator including the events leading up to the rape, during the rape, and after the rape, as well as characteristics of the victim and the perpetrator. Participants were told to use their own idea about what rape means. Each participant's rape script was scored for the degree to which it resembled a "typical rape" script. Also called a "real rape" script or a "blitz rape" script, a typical rape script is defined as a domain-specific knowledge structure that includes the following general narrative: a single male perpetrator derives sexual pleasure from unprotected penile penetration of an unknown, resisting, solitary, female victim within a public place and with an extensive amount of violence, often using a weapon (Ryan, 2011). See Appendix D for script assessment forms and scoring keys.

Stimuli

Participants segmented a 322-second non-stressful film (breakfast scene in *Big Night*; Kirkpatrick, Filly, Scott, & Tucci, 1996) and a 322-second stressful film (male-to-female rape scene in *Irréversible*; Chioua, Cassel, & Noé, 2002). Both films were commercially produced and include one continuous shot with minimal zooming and panning. In recent years, several studies have demonstrated the validity of the *Irréversible* rape scene as a stressful stimulus within the SFP (Nixon et al., 2007; Nixon et al., 2009a, 2009b; Qin et al., 2012; Schaich, Watkins, & Ehring, 2013). The empirical basis for using this scene is supported by a study that

directly compared the effectiveness of the *Irréversible* rape scene to other commonly used materials in the SFP (Weidmann et al., 2009). While most stressful stimuli are generally successful in eliciting self-reported stress and memory disturbance, with effects lasting up to three days, Weidmann and colleagues found the *Irréversible* rape scene to have the strongest and most consistent effects on heart rate, anger, disgust, stress, and intrusive memories.

In addition to the empirical basis, the *Irréversible* rape scene was selected because it satisfied several theoretically desirable qualities. First, in order to increase the likelihood that participants would interpret the materials as personally relatable and logically plausible, materials were sought that depicted commonly experienced traumatic events rather than unbelievable situations such as those common to the gore genre. Specifically, materials were sought that depicted adult sexual assault victimization because this type of experience presents the highest risk for developing PTSD (Kessler, Sonnega, Bromet, Hughes, & Nelson 1995). The *Irréversible* rape scene is realistic and depicts an interaction that fits any definition of violent sexual assault. Second, in order to increase the likelihood that participants would be engaged in the internal structure of the events, materials were sought that included a linear narrative rather than a compilation of unconnected scenes and images (e.g., the commonly used compilation of automobile accidents; Steil, 1996). The *Irréversible* rape scene has the following simple narrative structure: a woman walks into a dark tunnel, a male stranger physically intercepts the woman and threatens her with a knife, the man brutally assaults the woman (sexually and physically) while she attempts to escape without success. Third, in order to simulate the experience of witnessing a real life event, materials were sought that included long, continuous shots with head-high perspectives and minimal zooming. Similarly, materials were sought that

did not include many cinematic devices that aid segmentation such as fades, wipes, and changes in luminance (Cutting, Brunick, & Candan, 2012). The *Irréversible* rape scene includes only one shot with minimal camera movement. Fourth, in order to avoid the extent to which spoken dialog may influence segmentation, materials were sought that included minimal dialog and/or a non-English language. The *Irréversible* rape scene includes sporadic dialog in French without subtitles. Also important but not a requirement during stimulus selection, evidence suggests no gender differences with respect to reactions the *Irréversible* scene, which could reduce the likelihood of gender-based confounds (Weidmann et al., 2009).

For the same reasons why the *Irréversible* rape scene is an effective stimulus in trauma analog studies, some participants were expected to experience it as too distressing, even after screening out those indicating prior sexual assault victimization and/or probable PTSD. To mitigate this risk, participants were reminded that they could choose to stop the film at any time by pressing the "stop button." As reported above, of the 101 participants that started viewing the film and met all other inclusionary criteria, 28 chose to discontinue (27.72%).

To explore potential systematic biases in the decision to stop the film, a series of independent samples t-tests were conducted to compare participants who stopped the film to participants who watched the entire film. Specifically, participants were compared on age, prior exposure to "torture porn" films (PFEQ-TP), PTSD symptoms (PCL-5), script knowledge (everyday events and sexual assaults), post-film state anxiety (STAI-S6) and state dissociation (PDEQ-7), post-film emotions (anger, joy, sadness, disgust, and fear; CAVEAT), and level of attentiveness (CAVEAT). To reduce the likelihood of a Type 1 Error resulting from 13 simultaneous comparisons, a Bonferroni correction was used to adjust the conventional .05 *p*-

value to .004 (.05/13). Results indicate no statistically significant differences between groups (stoppers vs. non-stoppers). However, non-significant trends indicate that stoppers may have experienced greater state anxiety, anger, and disgust than non-stoppers and that non-stoppers may have had greater exposure to the torture-porn film genre. See Table 12 in Appendix E for results. In addition to these t-tests, chi-squared analyses indicate that participant gender did not predict stopping the film, $X^2$ (1, $N$ = 101) = 0.568, $p$ = .451, nor did racial identification as either European-American, $X^2$ (1, $N$ = 101) = 0.771, $p$ = .380, or African-American, $X^2$ (1, $N$ = 101) = 1.151, $p$ = .283, which represent the vast majority of participants. Taken together, there were no significant individual characteristic differences between non-stoppers and stoppers, though it is possible that some participants stopped the film if they were unfamiliar with its content and/or if they experienced the film as highly distressing (anxiety, anger, and disgust). While this possibility would suggest a systematic bias in the final sample, the lack of significant effects tempers this concern.

The order in which the stressful film and non-stressful film were presented was counterbalanced, namely to rule-out practice effects of the segmentation task. Prior to entering the lab, each participant was randomly assigned to either watch the stressful film first or the non-stressful film first. In the final sample, 38 participants (52.1%) saw the stressful film first and 35 saw the non-stressful film first (47.9%).

## Experimental Tasks

### Event Segmentation

Participants were oriented to a desk with a computer monitor, keyboard, and closed survey packet. Participants were introduced to the event segmentation task (Newtson, 1973) by completing a practice trial using a film of an actor engaging in an everyday activity (i.e., building a toy boat using Legos, 155 seconds; see Sargent et al., 2013). Participants did not receive details about the practice film (or the upcoming films) and were not told if the scenes were real or staged with actors. The film was presented on a 21-inch computer monitor placed two feet from the seated participant. To simulate the experience of witnessing a real life event, the film included one continuous shot from a fixed, head-high perspective with no change in lens zoom. Participants were asked to segment the film by pressing a spacebar to indicate each boundary between "meaningful units of activity." Specifically, participants were told to indicate the smallest units they found meaningful. If a given participant indicated fewer than six event boundaries, the experimenter repeated the film and asked the participant to indicate "a few more" (see Sargent et al., 2013). Prior to progressing to the next set of films, participants were reminded that participation was voluntary and, therefore, they could discontinue watching any of the films at any time without penalty. Participants were instructed that they could choose to stop the film by pressing a button clearly marked "stop." If a given participant pressed the button, he or she immediately continued to the next phase of the study. See Appendix F for the experimenter script for each administration of the event segmentation task.

## Memory Assessments

Event memory for the non-stressful and stressful films was assessed using a free recall task. Following Sargent et al. (2013), to assess event recall, participants were asked to handwrite for seven minutes everything that happened during each film in as much detail as possible and using the same sequential order of actions (See Appendix G). Scoring procedures are described in the Chapter 4 (Results) under the qualitative data coding section.

In addition, event memory for the stressful film was assessed using a recognition task. Following procedures used in prior event segmentation research (e.g., Sargent et al., 2013), the event recognition task included 20 trials in which the participant was asked to select one of two images that he or she believed was taken from the film. Target images were screenshots from the 322-second *Irréversible* clip and lure images were screenshots from other parts of *Irréversible* using the same actors but not included within the short clip. Performance on this task was scored through totaling the number of correctly recognized images. Higher scores indicated better recognition. In the final sample, the mean recognition score was 16.79 ($SD$ = 1.28) in a normal distribution ranging from 14 to 20. See Appendix H for recognition materials.

## Procedures

First, the experimenter closely reviewed the informed consent form (Appendix I) with each participant and responded to any questions and concerns. Second, participants completed a

series of self-report questionnaires while sitting alone at a desk (PFEQ, LEC-5, PCL-5, and DQ). Third, participants completed script assessment to generalized event knowledge for everyday experiences and domain-specific event knowledge for the stressful experience (i.e., sexual assault). Fourth, participants were oriented to the event segmentation task on a desktop computer using the practice film. Fifth, depending on counterbalanced condition, participants viewed and segmented either the non-stressful film or stressful film. Sixth, participants viewed the remaining film (i.e., stressful film if non-stressful film viewed first or vice versa). Before and after the stressful film, pre- and post-film self-report measures were administered (STAI-S6 and PDEQ-7). After both films, the CAVEAT was administered. Seventh and eighth, participants completed memory assessments for each film in the same order as viewed. Ninth, and lastly, the experimenter conducted a positive mood induction procedure (Appendix J) and provided a debriefing form (Appendix K) and a list of mental health counseling agencies (Appendix L).

## Qualitative Data Coding

### Everyday Event Script Assessment

Following Sargent et al. (2013), everyday event knowledge was assessed by totaling the number of steps that correspond to one of the 18 norm-identified steps for that activity (Rosen, Caplan, Sheesley, Rodriguez, & Grafman, 2003). The operationalized index of everyday event knowledge ranges from 0 to 54 (i.e., 18 points for each of three everyday event scripts) with high scores reflecting highly elaborated and accessible everyday event knowledge. Three

undergraduate research assistants coded all everyday event scripts. Prior to coding, the principal investigator trained the group of research assistants over three meetings. Training was completed after the research assistants, as a group, produced codes for ten scripts that aligned with over 90% of codes produced by the principal investigator. After training, research assistants coded independently. The final codes were selected from the coding pair that established the highest reliability across all three everyday event scripts, which was determined by Cohen's kappa. Codes from the third research assistant were used to resolve coding discrepancies within the most reliable coding pair. Given that all 18 steps of each everyday event was coded dichotomously as present ("1") or absent ("0"), a group majority among three coders emerged for all steps. In total, 116 participants completed the everyday event script task. Given 18 steps to be coded per each of three everyday event scripts, each research assistant made 6,264 codes. The most reliable coding pair agreed on 95.7% of codes with a Cohen's kappa of .89. Reliability was comparable for the second coding pair ($\kappa$ = .88; raw agreement = 95.4%) and third coding pair ($\kappa$ = .88; raw agreement = 95.3%). As anticipated, codes from the third research assistant resolved all 273 disagreements within the most reliable coding pair. In the final sample, everyday event script scores ranged from 3 to 22 with a mean of 12.45 (*SD* = 4.10) and approximated a normal distribution.

Rape Script Assessment

Rape scripts were coded for resemblance to a typical rape script using a scoring key (see Appendix D) that was constructed by the principal investigator for the purposes of this study

based on a review of quantitative and qualitative findings on rape scripts (e.g., Davies et al, 2013; Krahé, Bieneck, & Scheinberger-Olwig, 2007; Littleton & Axsom, 2003; Littleton, Breitkopf, & Berenson, 2007; Littleton, Tabernik, Canales, & Backstrom, 2009; Ryan, 1988). The scoring key included 17 themes covering characteristics of the setting, perpetrator, and victim. Each theme was coded for typical rape (score: +1), atypical rape (score: -1), and not applicable or not included (score: 0). Thus, operationalization of "typical rape" event knowledge was achieved by totaling the coded values of all themes, resulting in a potential range of -17 to +17 with higher scores reflecting event knowledge that closely resembles a so-called typical rape script. Importantly, all 17 typical rape themes were consistent with content of the stressful stimulus (i.e., *Irréversible*; Chioua et al., 2002). Similar to the everyday event script coding, the principal investigator trained the group of three research assistants over the course of three meetings. After the group agreed with at least 90% of codes produced by the principal investigator on ten scripts, research assistants independently coded the remainder of the dataset. The final codes were selected from the most reliable coding pair as determined by Cohen's kappa. Coding discrepancies within the most reliable coding pair were resolved using codes from the third research assistant. If no majority for a given theme of a given case emerged between the three research assistants, a score of zero (i.e., "not applicable") was coded. In total, 115 participants completed the rape script task. Given the 17 themes to be coded per rape script, each research assistant made 1,955 codes. The most reliable coding pair agreed on 90.6% of codes ($\kappa = .757$). Reliability was comparable for the second coding pair ($\kappa = .749$; raw agreement = 91.2%) and third coding pair ($\kappa = .730$; raw agreement = 90.1%). Of the 183 disagreements within the most reliable coding pair, the third research assistant resolved 180

discrepancies (98.4%). Thus, only three codes were overwritten with a zero (0.2% of data). In the final sample, rape script scores ranged from -1 to 7 with a mean of 2.45 (*SD* = 1.91) and approximated a normal distribution.

Non-Stressful Event Recall

Event memory of the non-stressful film (*Big Night*) was assessed to provide a baseline index of event memory ability that may be used as a statistical control. Following Sargent et al. (2013), to assess event recall, participants were asked to handwrite for seven minutes everything that happened during the film in as much detail as possible and using the same sequential order of actions (see Appendix G). Before coding recall data, each recall protocol was parsed into "idea units." An idea unit is defined as a clause that includes a stated (or inferable) subject and a stated predicate in the form of a verb phase (e.g., a verb and an object). Any statement with two or more subjects engaging in the same activity (e.g., "*The two guests* ate eggs") was coded as two or more idea units. In these instances, the idea unit was doubled within the dataset to facilitate the coding of two different idea units (e.g., "The two guests eat eggs [Egg Eater #1]" and "The two men ate eggs [Egg Eater #2]"). Two coders jointly parsed each protocol: the principal investigator and one undergraduate research assistant. Parsing disagreements between the coders were not systematically tracked but were estimated as infrequent (i.e., less than 10% of data). The principal investigator resolved each parsing disagreement.

Event recall was operationalized as the total number of correctly recalled "accurate explicit events," with one point given to each unique event (i.e., multiple points were not given

to multiple references to the same event). An accurate explicit event was defined as any goal-directed behavior committed by any agent within the film. The principal investigator coded *Big Night* for 44 explicit events (23 committed by Stanley Tucci's character ["Egg Cooker"], 15 committed by Marc Anthony's character ["Egg Eater #1"], and six committed by Tony Shalhoub's character ["Egg Eater #2"]). See Appendix L for description of each explicit event.

If an idea unit was not coded as an accurate explicit event, it was coded as one of seven dimensions that capture recall processes that are not relevant to the current study. These seven dimensions will be briefly defined but not further analyzed. First, a "macro-statement" is a general statement of two or more accurate explicit events (e.g., "The chef made breakfast"). Second, an "inaccurate explicit events" is an event statement that is not depicted in the film (e.g., "He drank something"). Third, an "explicit characteristic" is a depicted trait or feature of the setting or characters within the film (e.g., "It was a commercial kitchen"). Fourth, an "inference" is an internal state of an agent, non-depicted causal link, or non-depicted characteristic of the setting or characters (e.g., "The chef was hungry"). Fifth, an "affective response" is the participant's affective reaction to film (e.g., "This made me depressed"). Sixth, a "meta-cognition" is a reference to participant's memory or behavior (e.g., "I was bored"). Seventh, an "other" dimension is used to capture idea units that do not fit into any other dimension.

Each idea unit was coded for either one accurate explicit event or one of the seven dimensions described above. When coded as an accurate explicit event, the coders specified which of the 44 different explicit events the idea unit referenced. If a single idea unit appeared to be applicable as an accurate explicit event and one of the seven dimensions (e.g., "I remember the man cracking eggs" could be both a meta-cognition ["I remember …"] and an explicit event

["man cracking eggs"]), the idea unit would be coded for the accurate explicit event. For the purposes of the current study, all seven of these dimensions were collapsed into one "null category" that captures an amalgamation of recall processes that do not include retrieval of non-macro, explicit events. Thus, each idea unit was coded for one of the 44 accurate explicit events or the null category, totaling 45 potential codes for each idea unit.

Three research assistants were trained as a group by the principal investigator before they began to code all parsed idea units with the 44 accurate explicit events and seven dimensions that form the null category. After training, the research assistants were required to establish strong inter-rater reliability using a subset of the data. Cohen's kappa of .750 between all three coding pairs was used as the threshold to confirm adequate reliability. For the reliability trial of the non-stressful event recall task, each research assistant was assigned 17 cases (15.6% of dataset) to code. All three coding pairs exceeded the reliability threshold (pair #1: $\kappa = .89$, raw agreement = 89.5%; pair #2: $\kappa = .88$, raw agreement = 88.5%; pair #3; $\kappa = .85$, raw agreement = 85.5%). Given that the 109 participants that completed the task averaged 26.06 idea units, each research assistant was required to code 2,840 idea units. After establishing reliability, the research assistants coded the remaining 92 cases (84.4% of dataset).

The final codes were selected from the most reliable coding pair on the entire dataset as determined by Cohen's kappa. Coding discrepancies within the most reliable coding pair were resolved using codes from the third research assistant. If no majority for a given idea unit of a given case emerged between the three research assistants, the principal investigator would pick one of the three suggested codes. The most reliable coding pair agreed on 88.0% of codes ($\kappa = .874$), which was comparable for the next most reliable coding pair ($\kappa = .85$; raw agreement =

85.3%) and the least reliable coding pair (κ = .84; raw agreement = 84.5%). Of the 340 disagreements within the most reliable coding pair, the third research assistant resolved 283 discrepancies (83.2%). Thus, only 57 idea units had a three-way disagreement (2.0% of the entire dataset). Of the 57 three-way agreements, the principal investigator chose one of the three codes selected by the research assistants. The number of unique explicit events produced by each participant was totaled. All but one participant in the final sample completed the task ($N$ = 72). Non-stressful event recall ranged from 8 to 29 with a mean of 17.81 ($SD$ = 4.70) and approximated a normal distribution.

Stressful Event Recall

Similar to the non-stressful event memory assessment, event memory for the stressful film was assessed with an event recall task. All procedures were identical: handwritten recall responses within seven minutes, parsing protocols for idea units, creating scoring key based on explicit events in film and other recall dimensions, training research assistants, completing the reliability trial, tabulating final codes, and totaling number of accurate explicit events. The main difference is that the scoring keys differed to accommodate differences in the content between films. To construct the scoring key for *Irréversible*, the principal investigator coded 44 explicit events (24 committed by Jo Prestia's character ["Perpetrator"], 12 committed by Monica Bellucci's character ["Main Victim"], five committed by Jara Millo's character ["Escaped Victim"], and three committed by the Unaccredited Actor's character ["Bystander"]). See Appendix N for description of each explicit event. Again, research assistants coded each idea

unit for either one of the 44 accurate explicit events or one of the seven dimensions that were then collapsed into the null category.

Similar to the non-stressful event recall task, prior to coding the entire dataset, three research assistants were trained over the course of three meetings and then were required to establish reliability (threshold: Cohen's kappa of .75 between all three coding pairs). For the reliability trial, each research assistant was assigned 17 cases (15.5% of dataset) to code. All three coding pairs exceeded the reliability threshold (pair #1: $\kappa = .87$, raw agreement = 88.2%; pair #2: $\kappa = .84$, raw agreement = 85.8%; pair #3; $\kappa = .81$, raw agreement = 82.9%). Given that the 110 participants who completed the task averaged 23.15 idea units, each research assistant was required to code 2,547 idea units. After establishing reliability, the research assistants coded the remaining 93 cases (84.5% of dataset). The final codes were selected from the most reliable coding pair on the entire dataset as determined by Cohen's kappa with discrepancies resolved using the third research assistant's codes. Given a lack of group majority, the principal investigator would pick one of the three suggested codes. The most reliable coding pair agreed on 89.0% of codes ($\kappa = .88$), which was comparable for the next most reliable coding pair ($\kappa = .86$; raw agreement = 86.7%) and the least reliable coding pair ($\kappa = .85$; raw agreement = 86.1%). Of the 279 disagreements within the most reliable coding pair, the third research assistant resolved 244 discrepancies (87.5%). Thus, only 35 idea units had a three-way disagreement (1.4% of the entire dataset). Of the 35 three-way agreements, the principal investigator, at his own discretion, chose one of the three codes selected by the research assistants. The number of unique explicit events produced by each participant was totaled. In

the final sample, stressful event recall ranged from 8 to 23 with a mean of 15.36 (*SD* = 3.51) and approximated a normal distribution.

## Segmentation Agreement Coding

### Event Segmentation of Non-Stressful Event

During the non-stressful film, participants averaged 22.53 button presses (*SD* = 22.26) with frequencies ranging from 2 to 162 in a non-normal distribution as skew was positive at 3.91 (null skewness 95% CI [-0.55, 0.55]) and kurtosis was positive at 21.55 (null kurtosis 95% CI [-1.10, 1.10]). At the average rate of button presses, the mean duration of units was 13.68 seconds. Although considerable variance existed in the number of button presses, which suggests slightly different grain sizes across participants, the operationalization of segmentation performance adjusted for individual differences in grain size (see below).

Segmentation performance was operationalized by *agreement score*, defined as the extent to which one indicates the same event boundaries as an objective standard (e.g., Magliano et al., 2005, 2012). The objective standard for each film was constructed following the precedent set by Magliano and colleagues (Magliano et al., 2005, 2012). Specifically, Magliano and colleagues identified the goal episodes of characters and when they temporally started and stopped. Segmentation judgments were correlated with the boundaries of the goal episodes (Magliano et al., 2005; 2012). In the present study, each 322-second film was parsed into 322 one-second bins and then coded (per bin) for the occurrence of a theoretically identified event

boundary. Specifically, the primary investigator (AMS) and co-director (JPM) coded each film event boundaries defined as the beginning and end of goal-directed behaviors committed by each character. Expectedly, there was variability in temporality of the beginnings and ends of goal sequences (range: one to four seconds). That is, some behaviors had a clear and quick onset (e.g., perpetrator starting to enter hallway takes less than one second) and some behaviors had ambiguous and slow onsets (e.g., perpetrator starting to pull victim toward ground takes about four seconds). Additionally, all beginnings and ends of goal sequences were coded for one additional bin in order to account for "lag effects" (i.e., some participants might exhibit a slight delay between noticing an event boundary and then pressing the button). As a coding rule, all beginnings and ends of goal sequences were coded for at least two bins (i.e., two seconds). Thus, for example, although it takes less than one second for the perpetrator to enter the hallway, this action was coded for two one-second bins. Bins with no boundaries were coded as "0" and bins with one or more boundaries were coded with a whole integer indicating the number of boundaries within the bin.

Segmentation agreement scores were computed following the precedent set by Kurby and colleagues (Kurby et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). Each participant's segmentation pattern was coded into the same one-second bin ("1" indicates at least event boundary and "0" indicates no event boundary). Next, point-biserial correlational coefficients were calculated between each participant's segmentation pattern (i.e., binary data across 322 bins) and the objective standard (i.e., number of theoretically identified boundaries in each of 322 bins). The resulting coefficients (called "raw correlations") are agreement scores; however, further computations (called "scaled correlations") can correct for between-subjects differences

in inherently chosen grain sizes. To compute scaled correlations, each participant's raw correlation ($r_{raw}$) was scaled based on the highest possible correlation ($r_{max}$) and the lowest possible correlation ($r_{min}$) given the number of boundaries the participant identified. Specifically, scaling was accomplished using this formula: $(r_{raw} - r_{min})/(r_{max} - r_{min})$. Thus, using the scaled correlation approach, the agreement scores have a potential range of zero to one and remain independent of the total event boundaries identified (i.e., the particular grain size strategy chosen by the participant). In the final sample, the mean agreement score for *Big Night* was 0.40 (*SD* = 0.09) with a normal distribution ranging from 0.13 to 0.62.

Event Segmentation of Stressful Event

During the stressful film, participants averaged 36.25 spacebar presses (*SD* = 41.07) with frequencies ranging from 1 to 275 in a non-normal distribution as skew was positive at 3.44 (null skewness 95% CI [-0.55, 0.55]) and kurtosis was positive at 16.04 (null kurtosis 95% CI [-1.10, 1.10]). At the average rate of button presses, the mean duration of units was 8.86 seconds. Following the same approach as *Big Night*, the principal investigator (AMS) and co-chair (JPM) constructed an objective standard for *Irréversible*. Likewise, segmentation agreement scores were calculated as described above. The mean agreement score for *Irréversible* was 0.38 (*SD* = 0.10) with scores ranging from 0.00 to 0.57 in a non-normal distribution as skew was negative at -1.01 (null skewness 95% CI [-0.55, 0.55]) and kurtosis was positive at 1.90 (null kurtosis 95% CI [-1.10, 1.10]).

# CHAPTER 5

# RESULTS

## Preliminary Analyses

### Data Screening

All variables were screened for missing data, out-of-range values, violations of normality, and outliers. Frequency tables revealed no missing data or out-of-range values. As described in Chapter 4 (Methods), the following variables did not approximate a normal distribution: prior torture-porn exposure (PFEQ-TP), stressful film segmentation agreement, post-film state dissociation (PDEQ-7), and percentage of time looking at the stressful film (CAVEAT). No raw data transformations or outlier modifications were used for any of these variables because none of these normality corrections meaningfully impacted the results of the planned analyses.

### Objective Standard Coding Check

EST (Zacks et al., 2006) predicts that segmentation behavior will correlate positively with a theoretically driven model of the event's narrative structure (i.e., the "objective standard"). This assumption has been received empirical support (Magliano, Taylor, & Kim,

2005; Magliano, Kopp et al., 2012; Zacks et al., 2009). The primary investigator (AMS) and co-director (JPM) coded each film (*Big Night* and *Irréversible*) for the beginning and ending of goal-directed behaviors committed by each character. For *Big Night*, participants averaged a raw correlation of $r = .09$ between the objective standard and their segmentation behavior, which was significantly greater than zero in a one-sample t-test, $t(72) = 12.04$, $p < .001$. For *Irréversible*, participants averaged a raw correlation of $r = .11$ between the objective standard and their segmentation behavior, which was significantly greater than zero in a one-sample t-test, $t(72) = 12.54$, $p < .001$. Thus, overall, participants' segmentation behavior for each film appeared to conform to the objective standard, which supports the basic assumptions of EST (Zacks et al., 2006).[1]

Manipulation Check

To confirm that *Irréversible* functioned as a stressful stimulus, state anxiety (STAI-S6) and state dissociation (PDEQ-7) were measured before (T1) and after (T2) participants watched the clip. As anticipated, STAI-S6 T2 scores ($M = 16.16$, $SD = 4.76$) were significantly greater than STAI-S6 T1 scores ($M = 8.52$, $SD = 2.30$) in a paired-samples t-test, $t(72) = 14.09$, $p < .001$. Contrary to anticipation, PDEQ-7 T2 scores ($M = 10.62$, $SD = 3.71$) were not significantly greater than PDEQ-7 T1 scores ($M = 9.89$, $SD = 2.64$), though a paired-samples t-test, $t(72) =$

[1] In addition to using an objective standard to compute agreement scores, an alternative approach called "normative agreement" compares each participant's segmentation pattern to the entire sample's aggregated segmentation pattern (Kurby et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). In the current project, normative agreement scores were computed for all participants for both films. For exploratory purposes, all planned analyses were conducted using the normative agreement scores. The results using normative agreement scores largely converged with results using the objective standard agreement scores. As described in the method section, results will be presented using

1.85, $p = .069$, showed a trend toward significance in the anticipated direction. Together, these pre- and post-manipulation comparisons suggest the *Irréversible* clip had a robust effect on increasing state anxiety and a marginal effect on increasing state dissociation.

Next, the number of unit boundaries identified by participants (i.e., button presses) during the segmentation task was compared between films. Based on the difference in the number of coded action units between the objective standard of each film (*Irréversible* = 93, *Big Night* = 52), it was anticipated that participants would detect more units in *Irréversible* than *Big Night*. Consistent with expectations, the number of identified unit boundaries was significantly higher for the stressful film ($M = 36.25$, $SD = 41.07$) than the non-stressful film ($M = 22.73$, $SD = 22.17$) using a paired-samples t-test, $t(72) = 4.00$, $p < .001$.

To demonstrate viewer response differences across films, paired samples t-tests were conducted for each of the 13 CAVEAT items (see Table 2). To reduce the likelihood of a Type 1 Error resulting from 13 simultaneous comparisons, a Bonferroni correction was used to adjust the conventional .05 *p*-value to .004 (.05/13). Participants reported that they did not pay greater attention to either film, though a non-significant trend suggested more attention was paid to *Irréversible* than *Big Night*. Participants reported greater empathy for the victim in *Irréversible* than the omelet maker in *Big Night*, but not greater identification or perspective. All emotional responses were significantly different and in expected directions (compared to *Big Night*, *Irréversible* elicited greater anger, sadness, disgust and fear and less joy). Lastly, participants looked at the screen for a greater percentage of time in *Big Night* than *Irréversible* but not a greater number of instances of covering eyes, closing eyes, or looking away from the screen.

Again, the estimated percentage of looking at the screen provides an index of "level of attentiveness" to the stressful film that could potentially be used as a statistical control.

Table 2

*Differences in Viewer Response (CAVEAT) Across Films*

| Variable | | Group Statistics | | | | *t*-test for Equality of Means | | |
|---|---|---|---|---|---|---|---|---|
| | | Group | *n* | *M* | *SD* | *t* | *df* | *p* |
| **I-1** | I paid close ***attention*** to the film. | *Big Night* | 73 | 3.47 | 0.77 | -2.02 | 72 | *.047* |
| | | *Irréversible* | 73 | 3.66 | 0.61 | | | |
| **I-2** | I shared the ***perspective*** of the *victim* (or, *omelet-maker*). | *Big Night* | 73 | 1.88 | 1.31 | -1.50 | 72 | .139 |
| | | *Irréversible* | 73 | 2.21 | 1.50 | | | |
| **I-3** | I felt ***empathy*** for the *victim* (or, *omelet-maker*). | *Big Night* | 73 | 1.47 | 1.26 | -12.43 | 72 | **< .001** |
| | | *Irréversible* | 73 | 3.62 | 0.83 | | | |
| **I-4** | I ***identified*** with the *victim* (or, *omelet-maker*). | *Big Night* | 73 | 1.60 | 1.33 | 1.53 | 72 | .130 |
| | | *Irréversible* | 73 | 1.32 | 1.45 | | | |
| **II-1** | I experienced **anger.** | *Big Night* | 73 | 0.19 | 0.54 | -14.96 | 72 | **< .001** |
| | | *Irréversible* | 73 | 2.77 | 1.34 | | | |
| **II-2** | I experienced **joy.** | *Big Night* | 73 | 0.75 | 1.01 | 5.18 | 72 | **< .001** |
| | | *Irréversible* | 73 | 0.08 | 0.43 | | | |
| **II-3** | I experienced **sadness.** | *Big Night* | 73 | 1.08 | 1.39 | -8.17 | 72 | **< .001** |
| | | *Irréversible* | 73 | 2.74 | 1.23 | | | |
| **II-4** | I experienced **disgust.** | *Big Night* | 73 | 0.26 | 0.67 | -28.42 | 72 | **< .001** |
| | | *Irréversible* | 73 | 3.59 | 0.76 | | | |
| **II-5** | I experienced **fear.** | *Big Night* | 73 | 0.15 | 0.49 | -8.82 | 72 | **< .001** |
| | | *Irréversible* | 73 | 1.79 | 1.43 | | | |
| **III-1** | Estimate the ***number*** of times you ***looked away*** from the screen. | *Big Night* | 73 | 0.38 | 0.89 | -1.91 | 72 | *.061* |
| | | *Irréversible* | 73 | 0.84 | 1.72 | | | |
| **III-2** | Estimate the ***number*** of times you ***closed your eyes*** for an extended period of time. | *Big Night* | 73 | 0.08 | 0.40 | -2.92 | 72 | *.005* |
| | | *Irréversible* | 73 | 0.56 | 1.55 | | | |
| **III-3** | Estimate the ***number*** of times you ***covered your eyes*** with your clothes, hands, or other body parts. | *Big Night* | 73 | 0.01 | 0.12 | -2.18 | 72 | *.033* |
| | | *Irréversible* | 73 | 0.18 | 0.67 | | | |
| **III-4** | Estimate the ***total percentage*** of time (range: 0% to 100%) that you were ***looking directly*** at the screen. | *Big Night* | 73 | 98.71 | 2.53 | 4.39 | 72 | **< .001** |
| | | *Irréversible* | 73 | 94.16 | 9.04 | | | |

Correlations

Next, correlation analyses were conducted to examine the relations between segmentation agreement scores (both films), self-reported stress responses (state anxiety and state dissociation), memory assessments (event recall and event recognition), and potential control variables (time looking at screen, domain-specific and generic event knowledge, torture-porn exposure, and gender). See correlation matrix in Table 3.

Table 3

*Correlation Table*

| Category | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Segmentation Performance* | **1 Stressful Segmentation Agreement** | — | | | | | | | | | | |
| | **2 Non-Stressful Segmentation Agreement** | .26* | — | | | | | | | | | |
| *Self-Reported Stress Response* | **3 State Anxiety** (STAI-S6) | .22† | -.13 | — | | | | | | | | |
| | **4 State Dissociation** (PDEQ-7) | .25* | -.01 | .54*** | — | | | | | | | |
| *Event Memory* | **5 Stressful Event Recall** (Unique Units) | -.11 | .09 | .27* | .22† | — | | | | | | |
| | **6 Stressful Event Recognition** | -.28* | -.02 | .00 | -.19 | .18 | — | | | | | |
| | **7 Non-Stressful Event Recall** (Unique Units) | .08 | .34** | -.01 | .17 | .47*** | -.12 | — | | | | |
| *Potential Statistical Controls* | **8 Time Looking at Screen** (Self-Report %) | -.08 | -.02 | -.26* | .01 | -.09 | .08 | -.02 | — | | | |
| | **9 Typical Rape Script** (Domain Knowledge) | .18 | .09 | .19 | .26* | .27* | -.25* | -.03 | .01 | — | | |
| | **10 Everyday Event Script** (Generic Knowledge) | .15 | -.01 | .19 | .06 | .23* | .08 | .19 | -.08 | .11 | — | |
| | **11 Torture-Porn Exposure** (PFEQ-TF) | -.06 | -.05 | -.17 | -.10 | -.10 | .14 | .04 | .26* | -.12 | .03 | — |
| | **12 Gender** (0 = Male; 1 = Female) | -.05 | .17 | .21† | .16 | .22† | -.14 | .21† | -.26* | .13 | .31** | -.16 |

*Notes.* † = $p < .10$; * = $p < .05$; ** = $p < .01$; *** = $p < .001$.

Significant correlations worth noting are briefly discussed. As can be seen in the first column, a significant positive correlation was found between segmentation agreement scores of the non-stressful film and the stressful film, which suggests factors outside of anxiety and dissociation (e.g., underlying general abilities) contribute to the segmentation of the stressful film. As expected, significant positive correlations were found between both self-report markers of typical peritraumatic responses (i.e., state anxiety and state dissociation). Contrary to expectations, stressful film segmentation agreement was positively correlated with state dissociation and approached a significant positive correlation with state anxiety.

Other significant correlations worth noting are in regard to event memory. To begin, non-stressful segmentation was positively correlated with non-stressful event recall, which is consistent with prior research and thus provides empirical support for the project's administration and scoring of the event segmentation task and event recall task (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). In comparison, stressful segmentation was not directly related to stressful event recall. Further, stressful segmentation was negatively correlated with stressful event recognition. Thus, the positive link between segmentation and memory demonstrated in prior research may be altered in the context of stressful events. With regard to stress responses, stressful event recall was positively correlated with state anxiety and showed a trend toward a significant positive relationship with state dissociation, which suggests a general, facilitative effect of stressful responding on memory. Lastly, stressful event recall was positively correlated with potential control variables of non-stressful event recall and domain-specific event knowledge (i.e., typical rape script score). Thus, several factors appear to positively influence stressful event recall including the anxiety and dissociation, event

knowledge, and general recall abilities. In comparison, stressful event recognition was not directly related to anxiety or dissociation and was negatively correlated with domain-specific event knowledge, suggesting that event knowledge may differentially impact recall and recognition.

Control Variables

Prior to conducting planned analyses, group differences were assessed between counterbalanced conditions and participant gender. Independent samples t-tests comparing randomly assigned counterbalanced conditions (*Big Night* first vs. *Irréversible* first) were conducted on all the variables listed in the correlation matrix in Table 3. Bonferroni correction was used to adjust the *p*-value to .004 (.05/12). No significant differences were found (all *p*-values > .22), indicating that the order of films did not meaningfully impact any of the study's variables. Second, independent samples t-tests comparing genders were conducted on the same variables. Bonferroni correction was used to adjust the *p*-value to .005 (.05/11). No significant gender differences were found, though several tests approached statistical significance (see Table 4). Specifically, when compared to men, women exhibited trends toward higher everyday event script scores, lower time looking at the screen during *Irréversible* (i.e., level of attentiveness), greater state anxiety, greater stressful event recall, and greater non-stressful event recall.

Table 4

*Significant Gender Differences*

| Variable | Group Statistics | | | | *t*-test for Equality of Means | | |
|---|---|---|---|---|---|---|---|
| | Group | *n* | *M* | *SD* | *t* | *df* | *p* |
| **Everyday Event Script** (Generic Knowledge) | Men | 40 | 11.30 | 3.78 | -2.76 | 71 | *.007* |
| | Women | 33 | 13.85 | 4.09 | | | |
| **Time Looking at Screen** (Self-Report %)* | Men | 40 | 96.30 | 6.78 | 2.27 | 71 | *.025* |
| | Women | 33 | 91.58 | 10.74 | | | |
| **Stressful Event Recall** (Unique Units) | Men | 40 | 14.65 | 3.45 | -1.93 | 71 | *.058* |
| | Women | 33 | 16.21 | 3.44 | | | |
| **Non-Stressful Event Recall** (Unique Units) | Men | 39 | 16.90 | 4.73 | -1.81 | 70 | *.074* |
| | Women | 33 | 18.88 | 4.49 | | | |
| **STAI-S6** (State Anxiety) | Men | 40 | 15.28 | 4.64 | -1.79 | 71 | *.078* |
| | Women | 33 | 17.24 | 4.74 | | | |

*Notes*. Before conducting each independent samples *t*-test, a Levene's test was conducted to test at the 0.05 level the null hypothesis that that the variances of the two populations from which the samples were drawn are equal. The null was rejected only for time looking at the screen, $F(1, 71) = 4.72$, $p = .033$, which was likely due to ceiling effects among male participants.

The correlation analyses and tests for group differences (gender and counterbalance conditions) informed which variables would be the most useful statistical controls in the planned analyses. Depending on the analysis, up to four variables were used as control variables. First, given the gender differences noted above, gender was statistically controlled. Second, given the moderate correlation between non-stressful event segmentation and stressful event segmentation, non-stressful event segmentation was used to statistically control for segmentation ability during non-stressful experiences (see Sargent et al., 2013). Rather than using several clips depicting everyday activities to establish a control for segmentation ability (see Sargent et al., 2013), *Big Night* could be used for this purpose due to the highly objective manner in which it was shot (i.e., the scene resembled an everyday activity). Third, given the moderate correlation between non-

stressful event recall and stressful event recall, non-stressful event recall was used to statistically control for recall ability of non-stressful experiences. While recall ability can be assessed by collecting recall protocols for several clips of everyday experiences, which would provide a stable measure of skill, recall of the objectively shot *Big Night* scene may approximate a more generalized recall ability. Fourth, given the moderate correlations between domain-specific event knowledge (i.e., typical rape script score) and both stressful event memory variables (recall and recognition), domain-specific event knowledge was used as a statistical control.

## Hypothesis Testing

### Hypothesis 1

The first hypothesis was that encoding disruption occurs during stressful experiences. Following this hypothesis, it was predicted that stressful film agreement scores would be lower than non-stressful film agreement scores. Hypothesis 1 was tested using a paired-samples t-test. In direct contrast to predictions, raw segmentation agreement scores were significantly higher for the stressful film ($M$ = .112, $SD$ = .076) than the non-stressful film ($M$ = .086, $SD$ = .061), $t(72)$ = 2.20, $p$ = .031, Cohen's $d$ = 0.26.[2]

[2] To rule-out the possibility that the number of units identified for each film artificially increased agreement scores, a similar analysis was conducted that controls for number of units in each film. Specifically, a repeated measures linear regression was used with segmentation agreement of each film as the within-subjects variable and number of units for each film as covariates. Results indicate a significant difference between films in agreement scores, $F(1, 70) = 14.62$, $p < .001$. Thus, the number of units identified did not appear to artificially enhance segmentation scores.

Hypothesis 2

Hypothesis 2 assumes that anxiety and dissociation predict peritraumatic encoding disruption. Following this hypothesis, it was predicted that agreement scores for the stressful film would be negatively related to state anxiety and state dissociation. As planned, two separate multiple regression analyses using forced entry were conducted to predict agreement score, each with a different IV representing either state anxiety (STAI-S6) or state dissociation (PDEQ-7). Additionally, domain-specific event knowledge, non-stressful film agreement score, and gender were included as control variables in both regression analyses (Table 5).

Table 5

*Hypothesis 2 Multiple Regression Models Predicting Agreement Segmentation in Stressful Film*

| | **Variables** | | | | | **Model** | | |
|---|---|---|---|---|---|---|---|---|
| | ***b*** | ***SE*** | **β** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Anxiety → Segmentation** | — | — | — | — | — | .173 | 3.55 | **.011** |
| Constant | 0.19 | 0.07 | | 2.87 | .006 | — | — | — |
| Gender | -0.03 | 0.02 | -.174 | -1.51 | .137 | — | — | — |
| Non-Stressful Segmentation | 0.33 | 0.12 | .313 | 2.74 | **.008** | — | — | — |
| Typical Rape Knowledge | 0.01 | 0.01 | .126 | 1.11 | .270 | — | — | — |
| State Anxiety | 0.01 | 0.00 | .274 | 2.35 | **.022** | — | — | — |
| | | | | | | | | |
| **Dissociation → Segmentation** | — | — | — | — | — | .163 | 3.31 | **.015** |
| Constant | 0.22 | 0.06 | | 3.61 | .001 | — | — | — |
| Gender | -0.03 | 0.02 | -.150 | -1.31 | .194 | — | — | — |
| Non-Stressful Segmentation | 0.29 | 0.12 | .278 | 2.46 | **.016** | — | — | — |
| Typical Rape Knowledge | 0.01 | 0.01 | .111 | 0.96 | .341 | — | — | — |
| State Dissociation | 0.01 | 0.00 | .252 | 2.17 | **.034** | — | — | — |

First, the multiple regression model including state anxiety was significant, $R^2 = .173$, $F(4, 68) = 3.55$, $p = .011$. However, in the opposite direction to expectations, state anxiety significantly and positively predicted the objective segmentation agreement scores, $\beta = .274$, $t(68) = 2.35$, $p = .022$. Non-stressful event segmentation was the only control variable that significantly predicted stressful event segmentation, $\beta = .313$, $t(68) = 2.74$, $p = .008$.

Second, the multiple regression model including state dissociation was significant, $R^2 = .163$, $F(4, 68) = 3.31$, $p = .015$. However, again in the opposite direction to expectations, state dissociation significantly and positively predicted objective segmentation agreement scores, $\beta = .252$, $t(68) = 2.17$, $p = .034$. Non-stressful event segmentation was the only control variable that significantly predicted stressful event segmentation, $\beta = .278$, $t(68) = 2.46$, $p = .016$.

Hypothesis 3

Hypothesis 3 assumes that peritraumatic encoding disruption predicts event memory disturbance. Following this hypothesis, it was predicted that agreement scores would positively predict event recall and recognition for the stressful film. As planned, two separate multiple regression analyses using forced entry was conducted using agreement score as the IV and either recall score or recognition scores as the DV. Control variables included gender, domain-specific event knowledge, and non-stressful event agreement score. The recall model also included non-stressful event recall as a control. Table 6 shows the results of the regression analyses.

Table 6

*Hypothesis 3 Multiple Regression Models Predicting Recall and Recognition of Stressful Film*

| | Variables | | | | | Model | | |
|---|---|---|---|---|---|---|---|---|
| | ***b*** | ***SE*** | **β** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Segmentation → Recall** | — | — | — | — | — | .333 | 6.59 | **< .001** |
| Constant | 10.01 | 2.14 | — | 4.69 | < .001 | — | — | — |
| Gender | 0.47 | 0.72 | .068 | 0.65 | .517 | — | — | — |
| Segmentation (Non-Stress) | -2.86 | 4.11 | -.078 | -0.70 | .489 | — | — | — |
| Typical Rape Knowledge | 0.55 | 0.19 | .308 | 2.97 | **.004** | — | — | — |
| Non-Stressful Recall | 0.37 | 0.08 | .499 | 4.58 | **< .001** | — | — | — |
| Segmentation (Stress) | -5.31 | 3.75 | -.150 | -1.41 | .162 | — | — | — |
| | | | | | | | | |
| **Segmentation → Recognition** | — | — | — | — | — | .140 | 2.77 | **.034** |
| Constant | 18.46 | 0.84 | — | 22.08 | < .001 | — | — | — |
| Gender | -0.35 | 0.30 | -.138 | -1.19 | .238 | — | — | — |
| Segmentation (Non-Stress) | 1.27 | 1.63 | .092 | 0.78 | .440 | — | — | — |
| Typical Rape Knowledge | -0.13 | 0.08 | -.192 | -1.66 | .101 | — | — | — |
| Segmentation (Stress) | -3.54 | 1.55 | -.272 | -2.29 | **.025** | — | — | — |

First, the multiple regression model investigating stressful event recall was significant, $R^2 = .333$, $F(5, 66) = 6.59$, $p < .001$. However, despite expectations, segmentation agreement scores were not related to stressful event recall, $\beta = -.150$, $t(66) = -1.41$, $p = .162$. Rather, stressful event recall was significantly and positively predicted by domain-specific event knowledge, $\beta = .308$, $t(66) = 2.97$, $p = .004$, and non-stressful event recall, $\beta = .499$, $t(66) = 4.58$, $p < .001$.

Second, the multiple regression model investigating stressful event recognition was significant, $R^2 = .140$, $F(4, 68) = 2.77$, $p = .034$. However, in the opposite direction of predictions, segmentation agreement scores significantly and negatively predicted stressful event recognition, $\beta = -.272$, $t(68) = -2.29$, $p = .025$. No control variables were significant.

Hypothesis 4

Hypothesis 4 assumes that encoding disruption is a mediating mechanism by which anxiety and dissociation cause event memory disturbance (i.e., the full version of the "PED Hypothesis"). Following this hypothesis, it was predicted that affective and dissociative responses would negatively predict recall and recognition indirectly through unsystematic event segmentation. As planned, four separate mediational analyses were conducted, each with either state anxiety (STAI-S6) or state dissociation (PDEQ-7) as the independent variable, all with agreement score in the stressful film as the mediator, and each with either recall score or recognition score as the dependent variable. The controls were gender, agreement score in the non-stressful film, and domain-specific event knowledge. The recall models also included event recall of the non-stressful film as a control. In each of the four mediation analyses, the indirect effect was tested using confidence intervals (CIs) derived from bias-corrected bootstrapping (Hayes, 2013; Shrout & Bolger, 2002). This procedure, executed using the PROCESS macro of SPSS (Hayes, 2013), treats the sample as a "miniature representation" of the population by repeatedly resampling (with replacement) the original dataset (recommended iterations: 10,000; Mallinckrodt, Abraham, Wei, & Russell, 2006). A significant indirect effect is evidenced by a 95% CI that does not span zero, which suggests the indirect effect is significantly different than zero. According to Hayes (2013), the best method to illustrate the size of the indirect effect using the current analyses is a completely standardized effect ($ab_{cs}$), which is interpreted as the number of *SD* changes in *Y* (i.e., state anxiety of state dissociation) due to one *SD* increase in *X* (i.e., recall or recognition) as it operates through *M* (i.e., stressful film segmentation score).

Additionally, Hayes (2013) suggests reporting the ratio of the size of the indirect effect compared to the direct effect. See Figure 2 for the statistical model being used.

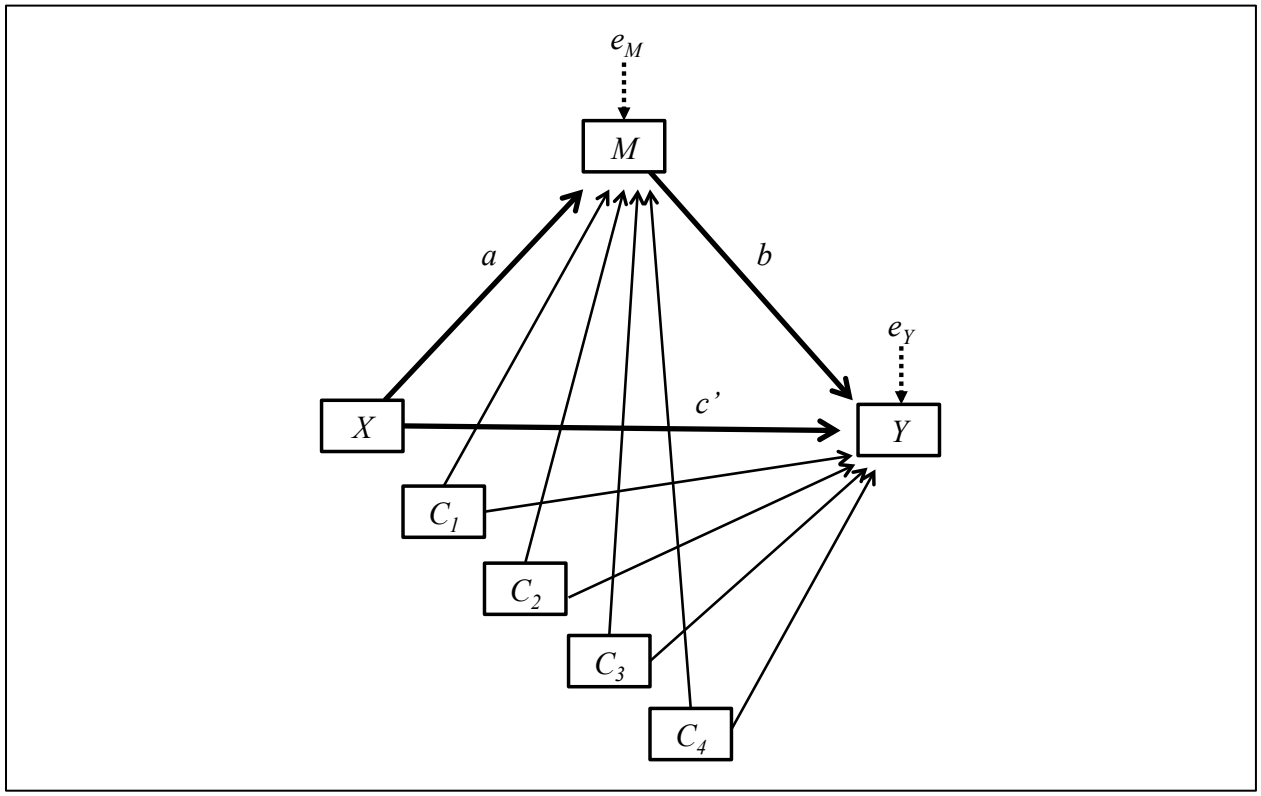


*Figure 2*. A measurement model for mediation analyses that tested predictions based on Hypothesis 4. Statistically, two linear models were tested. First, the mediator ($M$) is equal to $i_1 + aX + f_1C_1 + f_2C_2 + f_3C_3 + f_4C_4 + e_M$, where $i_1$ is the regression intercept, $e_M$ is the error in the estimation of $M$, $a$ is the regression coefficients of the predictor ($X$), and $f_i$ is the regression coefficient of each control variable ($C_i$). Second, the dependent variable ($Y$) is equal to $i_2 + c'X + bM + + g_1C_1 + g_2C_2 + g_3C_3 + g_4C_4 + e_Y$, where $i_2$ is the regression intercept, $e_Y$ is the error in the estimation of $Y$, $c'$ is the regression coefficients of the predictor ($X$), and $b$ is the regression coefficient for $M$.

First, the indirect effect of state anxiety on stressful event recall through stressful segmentation was statistically significant, though in the opposite direction as predicted (Table 7). Specifically, the mediational analysis found that state anxiety was positivity related to stressful segmentation ($a$ = 0.01, $p$ = .023), which negatively predicted stressful recall ($b$ = -7.61, $p$ = .037). The indirect link was significant, $ab$ = -0.04, 95% bias-corrected CI [-0.12, -0.01] ($ab_{cs}$ = -0.07; 95% bias-corrected CI [-0.19, -0.01]). Further, the direct link between state anxiety and stressful recall was significant ($c'$ = 0.20, $p$ = .011). The indirect effect was only 22% the size of the significant direct positive effect of state anxiety on recall. Thus, state anxiety appears to have a positive direct effect on recall, which is consistent with basic memory research (e.g., Henckens, Hermans, Pu, Joëls, & Fernández, 2009; Porter & Peace, 2007). In addition to the positive direct effect, state anxiety appears to have a negative indirect effect on recall through segmentation, which is opposite to expectations based on Hypothesis 4. These findings suggest that state anxiety might have an overall facilitative effect on recall, yet recall diminishes to the extent that state anxiety increases segmentation systematicity. It is theoretically reasonable that within one statistical model a negative conduit can exist within the total positive effect of a predictor (Hayes, 2013). Memory systems beyond cognitive encoding mechanisms, and specifically event segmentation, can account for the positive relationship between recall and anxiety or dissociation. Memory systems that are enhanced by stressful responding include evaluated cortisol levels (Buchanan & Lovallo, 2001; Schwabe et al., 2012), noradrenergic activation (Schwabe et al., 2009; Wiemers, Sauvage, Schoofs, Hamacher-Dang, & Wolf, 2013), and activation of the left inferior frontal gyrus and middle temporal gyrus (Bourne, Mackay, & Holmes, 2013; Clark, Holmes, Woolrich, & Mackay, 2016).

Table 7

*Indirect Effect of State Anxiety on Stressful Recall through Stressful Segmentation*

| | Variables | | | | Path | | |
|---|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Mediator: Stressful Segmentation** | — | — | — | — | .172 | 2.75 | **.026** |
| Constant | 0.18 | 0.07 | 2.61 | **.011** | — | — | — |
| Gender ($C_1$) | -0.03 | 0.02 | -1.36 | .180 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.01 | 0.01 | 1.13 | .262 | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 0.33 | 0.13 | 2.55 | **.013** | — | — | — |
| Non-Stressful Recall ($C_4$) | 0.00 | 0.00 | 0.07 | .944 | — | — | — |
| State Anxiety ($X$) | 0.01 | 0.00 | 2.28 | **.023** | — | — | — |
| | | | | | | | |
| **Outcome: Stressful Recall** | — | — | — | — | .397 | 7.14 | **< .001** |
| Constant | 7.61 | 2.24 | 3.40 | **.001** | — | — | — |
| Gender ($C_1$) | 0.00 | 0.71 | 0.01 | .995 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.49 | 0.18 | 2.72 | **.009** | — | — | — |
| Non-Stressful Segmentation ($C_3$) | -0.25 | 4.06 | -0.06 | .952 | — | — | — |
| Non-Stressful Recall ($C_4$) | 0.36 | 0.08 | 4.75 | **< .001** | — | — | — |
| State Anxiety ($X$) | 0.20 | 0.08 | 2.63 | **.011** | — | — | — |
| Stressful Segmentation ($M$) | -7.61 | 3.72 | -2.13 | **.037** | — | — | — |

| | Direct and Indirect Effects | | | | 95% CI | |
|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | **Lower** | **Upper** |
| **Direct Effect (*c*')** | — | — | — | — | — | — |
| State Anxiety ($X$) → Stressful Event Recall ($Y$) | 0.20 | 0.08 | 2.63 | **.011** | **0.048** | **0.352** |
| **Indirect Effect (*ab*)** | — | — | — | — | — | — |
| State Anxiety ($X$) → Stressful Event Segmentation ($M$) → Stressful Event Recall ($Y$) | -0.04 | 0.03 | — | — | **-0.121** | **-0.005** |

*Notes*. Significant *p*-values and CIs are in bolded. See Figure 2 for an illustration of the statistical model.

Second, the indirect effect of state dissociation on stressful recall through stressful segmentation was not statistically significant (see Table 8). Specifically, the mediational analysis found that state dissociation was positivity related to stressful segmentation ($a$ = 0.01, $p$ = .037), which was not significantly related to stressful recall ($b$ = -6.24, $p$ = .113). When using a 95% CI, the indirect link was not significant, $ab$ = -0.04, 95% bias-corrected CI [-0.13, 0.00], ($ab_{cs}$ = -0.05; 95% bias-corrected CI [-0.16, 0.00]). However, the mediation effect was trending toward significance in the opposite direction of predictions when using a 90% bias-corrected CI (-0.11, -0.00). Lastly, the direct link between state anxiety and stressful recall was not significant ($c'$ = 0.10, $p$ = .348). The indirect effect was only 43% the size of the non-significant direct positive effect of state dissociation on recall. These null findings do not support predictions.

Table 8

*Indirect Effect of State Dissociation on Stressful Recall through Stressful Segmentation*

| | Variables | | | | Path | | |
|---|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Mediator: Stressful Segmentation** | — | — | — | — | .165 | 2.60 | **.033** |
| Constant | 0.22 | 0.06 | 3.44 | **.001** | — | — | — |
| Gender ($C_1$) | -0.03 | 0.02 | -1.12 | .268 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.01 | 0.01 | 0.93 | .353 | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 0.31 | 0.13 | 2.40 | **.019** | — | — | — |
| Non-Stressful Recall ($C_4$) | 0.00 | 0.00 | -0.29 | .770 | — | — | — |
| State Dissociation ($X$) | 0.01 | 0.00 | 2.12 | **.037** | — | — | — |
| | | | | | | | |
| **Outcome: Stressful Recall** | — | — | — | — | .342 | 5.64 | **< .001** |
| Constant | 9.55 | 2.19 | 4.35 | **< .001** | — | — | — |
| Gender ($C_1$) | 0.37 | 0.73 | 0.51 | .612 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.51 | 0.19 | 2.67 | **.010** | — | — | — |
| Non-Stressful Segmentation ($C_3$) | -2.14 | 4.18 | -0.51 | .611 | — | — | — |
| Non-Stressful Recall ($C_4$) | 0.35 | 0.08 | 4.32 | **< .001** | — | — | — |
| State Dissociation ($X$) | 0.10 | 0.10 | 0.95 | .348 | — | — | — |
| Stressful Segmentation ($M$) | -6.24 | 3.88 | -1.61 | .113 | — | — | — |

| | Direct and Indirect Effects | | | | 95% CI | |
|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | **Lower** | **Upper** |
| **Direct Effect (*c*')** | — | — | — | — | — | — |
| State Dissociation ($X$) → Stressful Event Recall ($Y$) | 0.10 | 0.10 | 0.95 | .348 | -0.108 | 0.302 |
| **Indirect Effect (*ab*)** | — | — | — | — | — | — |
| State Dissociation ($X$) → Stressful Event Segmentation ($M$) → Stressful Event Recall ($Y$) | -0.04 | 0.03 | — | — | *-0.132* | *0.004* |

*Notes*. When using a bias-corrected 90% CI, the indirect effect is significant (lower CI = -0.113, upper CI = -0.003). Significant *p*-values and CIs are in bolded. Marginal *p*-values and CIs are in italicized. See Figure 2 for an illustration of the statistical model.

Third, the indirect effect of state anxiety on stressful event recognition through stressful event segmentation was statistically significant, though in the opposite direction as predicted (Table 9). Specifically, the mediational analysis found that state anxiety was positivity related to stressful event segmentation ($a$ = 0.01, $p$ = .022), which negatively predicted stressful event recognition ($b$ = -4.11, $p$ = .013). The indirect link was significant, $ab$ = -0.02, 95% bias-corrected CI [-0.06, -0.01], ($ab_{cs}$ = -0.09; 95% bias-corrected CI [-0.20, -0.02]). Further, the direct link between state anxiety and stressful recognition was not significant ($c'$ = 0.04, $p$ = .198). The indirect effect was only 54% the size of the non-significant direct positive effect of state anxiety on recognition. Thus, findings suggest a mediating effect of segmentation on the negative impact of state anxiety on recognition, which is opposite to predictions based on Hypothesis 4.

Table 9

*Indirect Effect of State Anxiety on Stressful Recognition through Stressful Segmentation*

| | Variables | | | | Path | | |
|---|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Mediator: Stressful Segmentation** | — | — | — | — | .173 | 3.55 | **.011** |
| Constant | 0.19 | 0.07 | 2.86 | **.006** | — | — | — |
| Gender ($C_1$) | -0.03 | 0.02 | -1.51 | .137 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.01 | 0.01 | 1.11 | .271 | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 0.33 | 0.12 | 2.74 | **.008** | — | — | — |
| State Anxiety ($X$) | 0.01 | 0.00 | 2.35 | **.022** | — | — | — |
| | | | | | | | |
| **Outcome: Stressful Recognition** | — | — | — | — | .161 | 2.58 | **.034** |
| Constant | 17.94 | 0.92 | 19.44 | **< .001** | — | — | — |
| Gender ($C_1$) | -0.45 | 0.30 | -1.49 | .142 | — | — | — |
| Typical Rape Knowledge ($C_2$) | -0.14 | 0.08 | -1.83 | *.072* | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 1.82 | 1.68 | 1.08 | .282 | — | — | — |
| State Anxiety ($X$) | 0.04 | 0.03 | 1.30 | .198 | — | — | — |
| Stressful Segmentation ($M$) | -4.11 | 1.60 | -2.56 | **.013** | — | — | — |

| | Direct and Indirect Effects | | | | 95% CI | |
|---|---|---|---|---|---|---|
| | **coeff** | ***SE*** | ***t*** | ***p*** | **Lower** | **Upper** |
| **Direct Effect (*c'*)** | — | — | — | — | — | — |
| State Anxiety ($X$) → Stressful Event Recognition ($Y$) | 0.04 | 0.03 | 1.30 | .198 | -0.023 | 0.109 |
| **Indirect Effect (*ab*)** | — | — | — | — | — | — |
| State Anxiety ($X$) → Stressful Event Segmentation ($M$) → Stressful Event Recognition ($Y$) | -0.02 | 0.01 | — | — | **-0.055** | **-0.005** |

*Notes*. Significant *p*-values and CIs are in bolded. Marginal *p*-values and CIs are in italicized. See Figure 2 for an illustration of the statistical model.

Fourth, the indirect effect of state dissociation on stressful event recognition through stressful event segmentation was statistically significant, though in the opposite direction as predicted (Table 10). Specifically, the mediational analysis found that state dissociation was positivity related to stressful event segmentation ($a$ = 0.01, $p$ = .034), which was negatively related to stressful event recognition ($b$ = -3.37, $p$ = .041). The indirect link was significant, $ab$ = -0.02, 95% bias-corrected CI [-0.06, -0.00] ($ab_{cs}$ = -0.06; 95% bias-corrected CI [-0.16, -0.01]). Further, the direct link between state dissociation and stressful recognition was not significant ($c'$ = -0.02, $p$ = .672). The indirect effect was 25% larger than the size of the non-significant direct negative effect of state dissociation on recognition. Thus, findings suggest a mediating effect of segmentation on the negative impact of state dissociation on event recognition, which is opposite to predictions based on Hypothesis 4.

Table 10

*Indirect Effect of State Dissociation on Stressful Recognition through Stressful Segmentation*

| | Variables | | | | Path | | |
|---|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | $R^2$ | ***F*** | ***p*** |
| **Mediator: Stressful Segmentation** | — | — | — | — | .163 | 3.31 | **.015** |
| Constant | 0.22 | 0.06 | 3.61 | **< .001** | — | — | — |
| Gender ($C_1$) | -0.03 | 0.02 | -1.31 | .194 | — | — | — |
| Typical Rape Knowledge ($C_2$) | 0.01 | 0.01 | 0.96 | .341 | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 0.29 | 0.12 | 2.46 | **.016** | — | — | — |
| State Dissociation ($X$) | 0.01 | 0.00 | 2.17 | **.034** | — | — | — |
| | | | | | | | |
| **Outcome: Stressful Recognition** | — | — | — | — | .143 | 2.23 | *.062* |
| Constant | 18.57 | 0.88 | 21.09 | **< .001** | — | — | — |
| Gender ($C_1$) | -0.33 | 0.30 | -1.09 | .279 | — | — | — |
| Typical Rape Knowledge ($C_2$) | -0.12 | 0.08 | -1.53 | .131 | — | — | — |
| Non-Stressful Segmentation ($C_3$) | 1.17 | 1.65 | 0.71 | .480 | — | — | — |
| State Dissociation ($X$) | -0.02 | 0.04 | -0.43 | .672 | — | — | — |
| Stressful Segmentation ($M$) | -3.37 | 1.61 | -2.09 | **.041** | — | — | — |

| | Direct and Indirect Effects | | | | 95% CI | |
|---|---|---|---|---|---|---|
| | **coeff.** | ***SE*** | ***t*** | ***p*** | **Lower** | **Upper** |
| **Direct Effect (*c'*)** | — | — | — | — | — | — |
| State Dissociation ($X$) → Stressful Event Recognition ($Y$) | -0.02 | 0.04 | -0.43 | .672 | -0.102 | 0.066 |
| **Indirect Effect (*ab*)** | — | — | — | — | — | — |
| State Dissociation ($X$) → Stressful Event Segmentation ($M$) → Stressful Event Recognition ($Y$) | -0.02 | 0.01 | — | — | **-0.058** | **-0.003** |

*Notes*. Significant *p*-values and CIs are in bolded. Marginal *p*-values and CIs are in italicized. See Figure 2 for an illustration of the statistical model.

# CHAPTER 6

# DISCUSSION

The goal of this dissertation was to execute an analog laboratory design using a moment-to-moment measure of one encoding process to test the peritraumatic encoding disruption (PED) hypothesis. This dissertation addressed a significant gap in the literature, specifically, understanding the extent to which one encoding process, as measured moment-to-moment, is impacted by stressful experiences. Cognitive theories of PTSD (Brewin et al., 1996; Ehlers & Clark, 2000) argue that increases in affect and dissociation during a stressful experience will disrupt standard encoding processes, namely with an attentional bias toward perceptual information and away from conceptual information. Further, these theories assume that stress-induced encoding disruption forms event memory representations that are neither cohesive nor elaborated effectively within one's autobiography. According to PTSD theories, the content of trauma memory representations remain disjointed and difficult to retrieve voluntarily while, at the same time, the memory content is easily triggered by environmental cues. The PED hypothesis has received empirical support from retrospective self-report studies and trauma analog studies that use cognitive distractor tasks to simulate the phenomenon of encoding disruption. To add to the literature by providing a test of the PED hypothesis using a moment-to-moment measure of one encoding process during a stressful experience, this dissertation

introduced a new paradigm in which the event segmentation task is inserted into the stressful film paradigm (SFP).

Given that multiple assumptions are embedded within the PED hypothesis, this dissertation deconstructed the PED hypothesis into four smaller hypotheses. First, the PED hypothesis assumes the encoding of stressful experiences becomes atypical when compared against the encoding of everyday, non-stressful experiences (Hypothesis 1). Second, the PED hypothesis assumes that affective and dissociative responses within stressful experiences result in this reduced systematicity of encoding processes (Hypothesis 2). Third, the PED hypothesis assumes that reduced systematicity of encoding processes results in poor voluntary memory (Hypothesis 3). Fourth, the PED hypothesis assumes that reduced systematicity of encoding processes is a conduit (i.e., mediator) through which affective and dissociative responses have a negative effect on voluntary memory.

## Summary of Results

None of the predictions based on the four hypotheses were supported (see Table 11). However, data analyses revealed many significant effects. Each significant effect was in the opposite direction of predictions. The most important findings will be highlighted in this section and interpretations will be discussed in the next section.

Table 11

*Summary of Hypotheses, Predictions, and Results*

| Hypo-theses | Predictions | | | | Results | |
|---|---|---|---|---|---|---|
| | Statements | IV | Mediator | DV | Sig. | Direction |
| **H1** | • Segmentation agreement scores will be lower for the stressful film than the non-stressful film | Stressful film vs. non-stressful film | N/A | Agreement scores | Yes | Opposite of prediction |
| **H2** | 1. Segmentation agreement scores for the stressful film will be negatively related to state anxiety. | Agreement score for stressful film | N/A | Post-film state anxiety | Yes | Opposite of prediction |
| | 2. Segmentation agreement scores for the stressful film will be negatively related to state dissociation. | Agreement score for stressful film | N/A | Post-film state dissociation | Yes | Opposite of prediction |
| **H3** | 1. Segmentation agreement scores during the stressful film will positively predict recall. | Agreement score for stressful film | N/A | Recall score for stressful film | No | N/A |
| | 2. Segmentation agreement scores for the stressful film will positively predict recognition. | Agreement score for stressful film | N/A | Recognition score for stressful film | Yes | Opposite of prediction |
| **H4** | 1. Segmentation agreement scores during the stressful film will mediate the negative relationship between state anxiety and recall. | Post-film state anxiety | Agreement score for stressful film | Recall score for stressful film | Yes | Opposite of prediction |
| | 2. Segmentation agreement scores during the stressful film will mediate the negative relationship between state dissociation and recall. | Post-film state dissociation | Agreement score for stressful film | Recall score for stressful film | No | N/A (Trending in opposite direction of predictions) |
| | 3. Segmentation agreement scores during the stressful film will mediate the negative relationship between state anxiety and recognition. | Post-film state anxiety | Agreement score for stressful film | Recognition score for stressful film | Yes | Opposite of prediction |
| | 4. Segmentation agreement scores during the stressful film will mediate the negative relationship between state dissociation and recognition. | Post-film state dissociation | Agreement score for stressful film | Recognition score for stressful film | Yes | Opposite of prediction |

First, the stressful film resulted in higher segmentation agreement scores than the non-stressful film, which was in the opposite direction of the effect predicted in Hypothesis 1. Given that the remaining hypotheses assumed stressful experiences would diminish segmentation agreement, it was then not surprising to discover that the remaining analyses produced results that trended (often significantly) in the opposite direction of predictions.

Second, anxiety and dissociation during the stressful experience appeared to increase segmentation agreement, not decease segmentation as predicted in Hypothesis 2. This positive link between the stress responses (anxiety and dissociation) and segmentation performance is consistent with the finding that segmentation agreement scores were significantly higher in the stressful film when compared to the non-stressful film. It is possible that anxiety and dissociation enhanced segmentation agreement.

Third, there were mixed findings for predictions based on Hypothesis 3, which assumed that low segmentation agreement scores during the stressful experience would result in low memory performance. Opposite to this prediction, there was a negative effect of segmentation agreement on recognition. This finding is particularly notable because no previous study using non-stressful materials has shown that high segmentation agreement predicts low memory performance (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). Alongside the significant negative effect of segmentation on recognition, there was no effect of segmentation agreement on recall of the stressful film. And, while segmentation did not appear to affect recall of the stressful film, there was a positive relationship between segmentation and recall of the non-stressful film. The positive link between segmentation and memory for the non-stressful film is consistent with other studies (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al.,

2013). The unexpected finding that, during stressful experiences, segmentation does not impact recall and has a negative impact on recognition may indicate that the relationship between segmentation and memory systems may be different for stressful experiences than non-stressful experiences. Interpretations of this pattern of results are discussed in the next section.

Fourth, in a consistent pattern of significant and marginal effects, results indicate that affective and dissociative responses to the stressful film had an indirect and negative effect on voluntary memory through high segmentation agreement, not low segmentation agreement as predicted based on Hypothesis 4. While this evidence is consistent with the assumption that event segmentation is a conduit through which the stress responses negatively impact memory (Hypothesis 4), it was predicted that the indirect effect would be mediated by low segmentation agreement, not high segmentation agreement. Thus, it appears that anxiety and dissociation enhanced segmentation, yet this enhancement does not translate to stronger memory performance.

In sum, although none of the hypotheses were supported, results indicated a pattern of significant results that were consistently in the opposite direction as predicted. Although the hypotheses were not supported, the significant results warrant cautious interpretation. All post-hoc interpretations are exploratory in nature and will benefit from replication.

## Interpretations of Findings

### General Support for Event Segmentation Theory (EST)

This dissertation is not a test of EST; however, the results are largely consistent with EST. First, for both films, there was a significant correlation between participants' segmentation behavior and the objective standard (i.e., the goal structure of each film's narrative). The correspondence between theoretically defined event boundaries and participant-identified event boundaries is consistent with other studies (Magliano et al., 2005; Magliano, Kopp et al., 2012; Zacks et al., 2009) and provides credence to EST's assumption that perceived event boundaries can be predicted based on a theoretically driven codification of character actions. Second, for the stressful film, conceptual knowledge (typical rape scripts) was not significantly related to segmentation but was significantly related to event memory (recall and recognition). Consistent with these findings, EST predicts the top-down influence of conceptual knowledge does not directly influence segmentation but may contribute to the updating of event models, which are then encoded into memory. Third, for the non-stressful film, the finding that segmentation agreement and recall were significantly positively correlated is consistent with EST's assumption that segmentation performance facilitates memory (Zacks et al., 2006), which has been demonstrated by other studies using non-stressful stimuli (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). Thus, at least for the non-stressful film, the basic assumptions of EST were supported. Further, given that the positive effect of segmentation on non-stressful film

recall was replicated successfully, these results indicate accuracy and fidelity in the administration and scoring of (a) the event segmentation task and (b) the recall task.

Greater Segmentation Agreement in Stressful Film than Non-Stressful Film

All significant effects that emerged in the opposite direction of predictions are rooted in the same unexpected phenomenon: anxiety and dissociation appeared to enhance the systematicity with which segmentation processes operate. Three possibilities will be introduced to explain why segmentation agreement was higher in the stressful film than the non-stressful film. The first two possibilities argue that this finding is not due to anxiety and dissociation per se but differences in the films used in the current study. The third possibility argues that anxiety and dissociation may indeed facilitate segmentation processes.

Possibility #1: Confound of film devices. The differences in segmentation agreement between the stressful film and non-stressful film may be the result of differences in the way the films were shot. Commercially produced films, including *Irréversible* and *Big Night*, are typically shot using techniques to capture attentional processes and direct them to certain narrative events (Smith, 2012; Loschky et al., 2015). These techniques are used selectively to narrow or broaden attentional focus, as well as maintain or disrupt gaze duration. Although an effort was made in the current project to closely match pre-existing film clips on cinematic techniques, the stressful film may have a meaningfully greater number of these features than the non-stressful film. The stressful film (*Irréversible*) used several nuanced techniques that changed across the duration of the scene such as alterations to lighting, camera movement, actor

choreography, and sound editing. In comparison, the non-stressful film (*Big Night*) used a more static camera and the choreography was less of a salient force to direct attention – as a result, the viewer's eye in *Big Night* may have been more free to wander across the scene. If *Irréversible* was more successful in modulating the viewer's attention than *Big Night*, then more consistent agreement with the objective standard would be expected. This possibility highlights the need for future studies to control for material content. Materials are needed that simulate real life events and contain few constraints on attention. It should be noted, however, that while film devices can potentially explain differences in segmentation agreement across films, film devices cannot readily explain why segmentation of the stressful film was positively related to anxiety and dissociation and negatively related to memory performance.

Possibility #2: Confound of action units. Another confound is a different number of actions units between films. Although both films were the same length (322 seconds) and had approximately 44 distinct agent goals (see Appendices L and M), the agent goals in *Irréversible* were repeated many times (e.g., multiple attempts of perpetrator to remove victim's clothes). *Irréversible* depicted a hectic narrative structure (albeit "stereotypical" when compared to other assault scenarios), whereas the narrative structure of *Big Night* followed the benign and familiar procedure of making breakfast. Thus, there were more action units in the stressful film (93) than the non-stressful film (52). With a greater number of action units comes the opportunity for a greater number of segmentation behaviors. Indeed, the results indicated that participants indicated significantly more event boundaries in *Irréversible* than *Big Night*. From a purely statistical perspective, with a greater number of action units and segmentation behaviors comes a greater chance for more stable correlations between the two variables. Similar to the first

possibility, this possibility calls for future research to control for material content. And again, it should be noted that although differences in total action units can potentially account for variability in segmentation across films, the number of action units cannot readily explain why segmentation of the stressful film was positively related to anxiety and dissociation and negatively related to memory performance.

Possibility #3: Stress enhances detection of perceptual changes. Until this dissertation, no prior study had investigated the role of anxiety or dissociation in the segmentation system. It was originally assumed that the primary impact of anxiety and dissociation would be to diminish top-down conceptual processing, thus reducing segmentation systematicity because event knowledge would have a diminished influence during the updating of event models (Zacks et al., 2006). However, the primary impact of anxiety and dissociation may be to enhance bottom-up perceptual processing. It is important to note that EST assumes that perceptual processes are largely responsible for the identification of event boundaries (Kurby & Zacks, 2008; Zacks et al., 2006). The segmentation system is set up to expect perceptual continuity of action and it is when there is an error in that expectation that people perceive an event boundary. The increase in segmentation agreement resulting from anxiety or dissociation could be interpreted as being consistent with cognitive theories of PTSD (Brewin et al., 1996, 2010; Ehlers & Clark, 2000), but not in the manner that was assumed at the outset of the design of this study. If stressful experiences engender greater attention to perceptual processing (Brewin et al., 2013; Brewin & Mersaditabari, 2013; Morgan et al., 2006; Pacheco-Unguetti et al., 2010), then it is reasonable to expect that under stress, one could be more sensitive to perceptual change. According to EST, this would increase the likelihood of perceiving event boundaries. While the two confounds

raised above are important to consider, the fact that segmentation agreement under stress (i.e., anxiety and dissociation) was negatively correlated with memory performance lends credence to the possibility that the results are consistent with the assumption of cognitive theories of PTSD that oversensitivity to perceptual processing under stress may be an underlying mechanism for poor event memory.

## Implications for Theory

### Does Stress Increase Segmentation Systematicity?

Following *Possibility #3* (raised above), this dissertation's results suggest that anxiety and dissociation might increase attention to low-level perceptual cues, thus increasing the systematicity of event segmentation because detecting perceptual change largely drives the segmentation system. This interpretation is more parsimonious than the dissertation's a priori arguments because it does not invoke an explanation for how anxiety and dissociation might impact top-down processes (e.g., the influence of event knowledge during updating). The view that anxiety and dissociation increases systematicity via enhanced attention to perceptual change is consistent with recent evidence indicating that the anxiety characteristic of "checking proneness" predicts event segmentation behavior based on low-level perceptual cues (Belayachi & Van der Linden, 2015). Thus, one general function of anxiety and dissociation may be to enhance the detection of changes to perceptual stimulation, which can then increase systematicity. To further investigate this possibility, other segmentation scoring strategies may

be developed that can produce an objective standard that more strictly corresponds to changes in sensory stimulation. For example, an objective standard can be constructed based on concrete sensory alterations such as changes in sound volume, pixel color, or picture brightness.

Does Stress-Enhanced Segmentation Diminish Memory?

While high segmentation agreement scores typically predict high memory performance (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013), anxiety- and dissociation-enhanced segmentation may represent the type of data-driven, perceptually hypervigilant encoding that PTSD theories argue is a maladaptive process that leads to trauma-related memory problems (Brewin et al., 1996; Ehlers & Clark, 2000). What is very interesting (and unexpected) about the possibility of a facilitative effect of anxiety and dissociation on segmentation is that the current results indicate that high segmentation agreement had a negative impact on recognition of the stressful film. This suggests that anxiety and dissociation may interfere with some fundamental memory processes (encoding, storage, and retrieval). Although recall of the stressful film was insignificantly related to segmentation agreement, the relationship also trended in the negative direction. Recall and recognition tasks operate on similar cognitive processes but recognition tasks use more retrieval cues than recall tasks (Kintsch, 1970). Given that some participants may have been unwilling to engage in effortful retrieval of aversive content during the recall task, the use of salient retrieval cues in the recognition task may have more reliably assessed voluntary memory.

Given that segmentation of stressful experiences had not been investigated until this project, there is little precedent to suggest whether or not segmentation systematicity during stressful events is an adaptive process. Rather, the current state of the literature suggests systematicity within event segmentation simply refers to the extent to which one's segmentation behavior is consistent with an objective standard.

To understand the costs and benefits of segmentation systematicity, it is important to understand the nature and implications of the objective standard. In the event segmentation literature, the objective standard is typically based on narrative elements of a story (e.g., agent goal states and interactions between agents and objects; Magliano, Miller, & Zwaan, 2001; Zacks et al., 2009; Zwaan, Magliano, & Graesser, 1995). Studies on the segmentation of narratives often view systematicity as an adaptive ability to reliably identify event boundaries only when the current event model needs to be updated (e.g., when there is a break in narrative comprehension). It is considered adaptive because it appears to enhance encoding efficiency and the quality of the memory (Kurby & Zacks, 2008; Zacks & Swallow, 2007). However, in comparison to typical objective standards used in studies on narrative comprehension, the nature and implications of the *Irréversible* objective standard might be quite different. The *Irréversible* objective standard not only represents a narrative structure but also a codification of aversive content that unfolds in an iterative fashion (e.g., seven counts of perpetrator restraining victim's arm, four counts of perpetrator groping victim, three counts of perpetrator penetrating victim). Systematically identifying the beginning and end of each violent action might not lead to a more complete understanding or memory of the experience.

Is it possible that segmentation systematicity during a stressful experience might negatively impact voluntary memory? Although the current results suggest that anxiety- and dissociation-enhanced segmentation may have diminished voluntary memory, these unexpected results require replication prior to making strong claims about adaptation. Future research can explore the possibility that high systematicity during stressful experiences is the result of an anxiety- or dissociation-related shift in the allocation of attentional resources. Specifically, stressful responding may cue executive control (i.e., Engle 2022; Cowan, 1988) to shift from understanding the narrative and toward detecting perceptual changes, which may manifest as enhanced segmentation systematicity.

Can Stress-Enhanced Segmentation be Viewed as "Encoding Disruption?"

One theoretical account of encoding disruption is Ehlers and Clark's (2000) idea of "data-driven processing," meaning the stress-enhanced processing of sensory impressions and perceptual characteristics rather than processing the event's underlying meaning in an organized way. Given the possibility that stress responses such as anxiety and dissociation might increase one's sensitivity to detect perceptual change and thus increase segmentation systematicity, stress-enhanced segmentation can be viewed as a form of data-driven processing. Ehlers and Clark argue that to the extent that an individual engages in data-driven processing, the resulting memory representation is believed to contain rich perceptual information that has a weak internal structure (i.e., disorganized and incoherent information) and is not adequately integrated into autobiographical memory, which makes it difficult for one to voluntarily search and retrieve

information (for similar arguments, see Brewin et al., 1996). Consistent with this view, basic memory research has shown that attending to sensory impressions of experimental stimuli results in weaker memory performance than attending to the conceptual meaning of experimental stimuli (García-Bajos, Migueles, & Aizpurua, 2014; Jacoby, 1983; Morris, Bransford, & Franks, 1977; Roediger, 1990). In the context of stressful experiences, studies using a self-report measure of data-driven processing support the prediction that data-driven processing results in trauma-related memory disturbance (Halligan et al., 2002, 2003; Laposa & Rector, 2012; Murray et al., 2002; Regambal & Alden, 2009; Sündermann, Hauschildt, & Ehlers, 2013). If stress-enhanced segmentation is viewed as a form of data-driven processing, these findings are consistent with the current result that stress-enhanced segmentation negatively impacted voluntary memory.

Implications Summary

Most of the planned analyses indicated significant effects in the opposite predicted direction. When viewing *high* segmentation as a disrupted encoding characteristic during stressful experiences (i.e., data-driven processing), then one would anticipate that (a) segmentation agreement would be higher in the stressful film than the non-stressful film, (b) anxiety and dissociation would increase segmentation agreement, (c) segmentation agreement would negatively predict voluntary memory, and (d) anxiety and dissociation would reduce voluntary memory indirectly through stress-enhanced segmentation agreement. Indeed, these are the unpredicted yet significant results of the dissertation. These unpredicted statistically

significant effects warrant follow-up examination and suggest that the use of event segmentation as a moment-to-moment marker of encoding disruption (or more specifically, data-driven processing) may be theoretically and empirically viable. Further, these data suggest some merit to the hybrid design that combines the SFP and the event segmentation task. This design may serve as a valuable research tool to investigate a wealth of empirical questions regarding the antecedents and consequences of peritraumatic processes.

## Limitations

The major methodological limitations are the problematic stimuli (discussed earlier) and problems that emerged from combining the SFP with the event segmentation task. Even without the additional complications related to the event segmentation task, SFP research has demonstrated a major limitation that the SFP may not reliably induce anxiety and dissociation and elicit analog levels of trauma-related memory disturbance, especially voluntary memory problems (Brewin, 2014). Contributing to the unreliability of the SFP is that the stressfulness of the stimuli (e.g., *Irréversible* rape scene) is rarely standardized, which makes it difficult to assess the "dose" of the stress induction.

Using unstandardized stress inducers is important when considering that many performance tasks are affected by stress in a curvilinear fashion (e.g., Yerkes & Dodson, 1908). Segmentation behavior may be facilitated by *moderate* levels of stress but then diminish markedly at *extreme* levels of stress. If so, the *Big Night* scene may have been under-stimulating for the event segmentation task while the *Irréversible* scene may have been stimulating enough

to elicit peak performance. In support of this possibility, current findings suggest that greater levels of anxiety and dissociation predicted higher segmentation agreement. However, since there was no condition resembling "extreme" anxiety and dissociation levels often experienced in actual traumatic experiences, the current data cannot test if segmentation is affected by stress in a curvilinear fashion. If a curvilinear effect does exist, the current use of the SFP may have been insufficient to elicit enough stress to decrease performance on the event segmentation task, thus precluding the opportunity to test the PED hypothesis. To better control the dose of stress, and to control problems emerging from differences in stressful vs. non-stressful materials, future research can investigate the impact of stress on segmentation by administering substances such as hydrocortisone to elevate participants' cortisol to levels (e.g. Van Ast, Cornelisse, Meeter, Joëls, & Kindt, 2013) while watching an inherently non-stressful film.

Yet another limitation of the STP is that the option for participants to voluntarily stop the film could create a systematic bias in the final sample (i.e., those who watched the complete film). Stopping the film early could indicate several characteristics including extreme distress, a moral decision to not watch a reprehensible film, or even a general lack of engagement. To temper this concern in the current project, independent-samples t-tests comparing stoppers to non-stoppers indicated no statistically significant group differences (Table 12 in Appendix E). However, non-significant trends suggest participants may have been more likely to stop the film if they were unfamiliar with its "torture-porn" content and/or if they experienced the film as highly distressing (anxiety, anger, and disgust). This potential systematic bias draws attention to the need of future research to consider using means other than aversive film content to elicit stress responses.

If the SFP is unreliable, than task demands from the addition of the event segmentation task may have further complicated matters. One possibility is that the event segmentation task may have consumed working memory resources, which previous studies have shown can diminish voluntary memory of stressful experiences (Bourne et al., 2010; Holmes et al., 2004; Krans et al., 2009, 2010a, 2010b; Nixon et al., 2007). Participants who were highly motivated to engage with the task during the stressful film may have experienced a strong cognitive load that negatively impacted recall and recognition. Thus, one possible explanation of the unpredicted findings is that participants varied in the extent to which they engaged in the segmentation task, as level of engagement can explain (a) high segmentation scores due to enhanced attention and (b) diminished voluntary memory due to reduced working memory during encoding. Although some evidence suggests the event segmentation task does not introduce substantial task demands (Zacks et al., 2001), more research is needed to understand how the event segmentation task consumes working memory resources.

While the event segmentation task has strong inter-rater indices and test-retest indexes (Newtson, 1976; Speer et al., 2003; Zacks et al., 2006) and is able to detect expected group differences (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013; Zacks et al., 2006), no prior studies have validated the event segmentation task in the context of a stressful experience. While the current study predicted that strong affective responses might impact event segmentation as an *encoding system*, strong affective responses might have also interfered with behavioral compliance of event segmentation as a *laboratory task*. Participants could have been so surprised or shocked by the stressful film that they forgot to regularly continue pressing the spacebar. Or, participants may have prioritized their own well being (e.g., engaging in self-

soothing or temporarily choosing to discontinue) over complying with experimental instructions. If participants did not engage in the segmentation task due to forgetting or prioritizing other needs, than the cognitive system of event segmentation was not assessed adequately. The actual manifestation of this limitation is difficult to assess. Future studies should consider including procedural compliance checks to rule-out the possibility that poor segmentation results from disengagement from the task.

Lastly, an important limitation to Magliano and colleagues' (2005, 2013) approach to constructing the objective standards is that it pre-sets the grain of segmentation units. Pre-setting the theoretical grain size requires the current results to be interpreted with awareness of the theoretical unit grain size to which participant responses were compared. The instructions used for the event segmentation task was, "We want you to indicate the smallest units that you find meaningful" (see Appendix F). This instruction could be interpreted by participants as segmenting at a finer grain size than the objective standards. Thus, it is difficult to rule-out the possibility that the current analyses did not reliably assess a fine-grained segmentation strategy. However, given that results using objective agreement scores largely converged with normative agreement scores, which do not pre-set grain sizes, the objective standards' pre-set grain size does not appear to be substantially problematic.

## Conclusion

This dissertation executed a novel analog laboratory design to test the PED hypothesis that stress responses such as anxiety and dissociation negatively affect encoding processes,

which then results in memory disturbance (Brewin et al., 1996; Ehlers & Clark, 2000). This dissertation introduced event segmentation as a potentially useful moment-to-moment marker of encoding processes during a stressful experience. Although none of this dissertation's hypotheses were supported, significant results were found consistently in the opposite direction of predictions. One possible interpretation of the results is that stress-enhanced segmentation systematicity is due to the empirically established phenomenon of stress-enhanced attention to low-level perceptual cues. This post-hoc interpretation should be reassessed in replication efforts.

Interestingly, stress-enhanced segmentation appeared to diminish voluntary memory. The negative relationship between segmentation of a stressful experience and memory performance is drastically different from the effects found for non-stressful experiences, which typically demonstrate a positive relationship (Bailey et al., 2013; Kurby & Zacks, 2011; Sargent et al., 2013). These findings are consistent with theory that data-driven, perceptually hypervigilant processing interferes with effective memory storage, thus resulting in weak voluntary memory (Ehlers & Clark, 2000). Replications and extensions of the current study can further assess this theoretical perspective.

The dissertation's evidence that the nature and function of event segmentation changes in the context of stressful experiences can provide important insights for how and why peritraumatic encoding might contribute to subsequent pathology. This evidence also has implications for EST (Zacks et al., 2006), which can potentially account for a role of affect within the segmentation system. Continued work in this area is encouraged to refine and calibrate the current study's methodological strategy. Although the significant findings were

unexpected, the results suggest stress-induced changes to one typical encoding process (event segmentation) can be measured within current paradigm. This is the first known study to demonstrate that an encoding process during an analog traumatic event can be measured moment-to-moment. Future researchers are encouraged to use and expand upon this novel paradigm to replicate the current findings and gain a better understanding of the etiology of trauma-related memory disturbance.

REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Baddeley, A. D. (1986). *Working memory*. Oxford, England: Clarendon.

Bailey, H. R., Zacks, J. M., Hambrick, D. Z., Zacks, R. T., Head, D., Kurby, C. A., & Sargent, J. Q. (2013). Medial temporal lobe volume predicts elders' everyday memory. *Psychological Science, 24*, 1113-1122. doi:10.1177/0956797612466676

Bedard-Gilligan, M., & Zoellner, L. A. (2012). Dissociation and memory fragmentation in post-traumatic stress disorder: An evaluation of the dissociative encoding hypothesis. *Memory, 20*, 277-299. doi:10.1080/09658211.2012.655747

Belayachi, S., & Van der Linden, M. (2015). Exploring the parsing of dynamic action in checking proneness. *Behaviour Change, 32*, 93-103. doi:10.1017/bec.2015.2

Berntsen, D., & Rubin, D. C. (2006). The Centrality of Event Scale: A measure of integrating a trauma into one's identity and its relation to post-traumatic stress disorder symptoms. *Behaviour Research and Therapy, 44*, 219-231. doi:10.1016/j.brat.2005.01.009

Berntsen, D., & Rubin, D. C. (2014). Involuntary memories and dissociative amnesia assessing key assumptions in posttraumatic stress disorder research. *Clinical Psychological Science, 2*, 174-186. doi:10.1177/2167702613496241

Boggia, J., & Ristic, J. (2015). Social event segmentation. *The Quarterly Journal of Experimental Psychology, 68*, 731-744. doi:10.1080/17470218.2014.964738

Boltz, M. (1992). Temporal accent structure and the remembering of filmed narratives. *Journal of Experimental Psychology: Human Perception and Performance, 18,* 90-105. doi:10.1037/0096-1523.18.1.90

Bourne, C., Frasquilho, F., Roth, A. D., & Holmes, E. A. (2010). Is it mere distraction? Peri-traumatic verbal tasks can increase analogue flashbacks but reduce voluntary memory performance. *Journal of Behavior Therapy and Experimental Psychiatry, 41*, 316-324. doi:10.1016/j.jbtep.2010.03.001

Bourne, C., Mackay, C. E., & Holmes, E. A. (2013). The neural basis of flashback formation: the impact of viewing trauma. *Psychological Medicine, 43*, 1521-1532. doi:10.1017/S0033291712002358

Bremner, J. D. (2010). Cognitive processes in dissociation: Comment on Giesbrecht et al. (2008). *Psychological Bulletin, 136*, 1-6. doi:10.1037/a0018021

Brewin, C. R. (2007). Remembering and forgetting. In M. J. Friedman, T. M. Keane, & P. A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 116-134). New York: Guilford.

Brewin, C. R. (2011). The nature and significance of memory disturbance in posttraumatic stress disorder. *Annual Review of Clinical Psychology, 7*, 203-227. doi:10.1146/annurev-clinpsy-032210-104544

Brewin, C. R. (2014). Episodic memory, perceptual memory, and their interaction: Foundations for a theory of posttraumatic stress disorder. *Psychological Bulletin, 140*, 69-97. doi:10.1037/a0033722

Brewin C. R., Andrews, B., & Rose, S. (2000). Fear, helplessness, and horror in posttraumatic stress disorder: Investigating DSM-IV criterion A2 in victims of violent crime. *Journal of Traumatic Stress, 13*, 499-509. doi:10.1023/A:1007741526169

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology, 68*, 748-766. doi:10.1037/0022-006X.68.5.748

Brewin, C. R., & Burgess, N. (2014). Contextualisation in the Revised Dual Representation Theory of PTSD: A response to Pearson and colleagues. *Journal of Behavior Therapy and Experimental Psychiatry, 45*, 217-219. doi:10.1016/j.jbtep.2013.07.011

Brewin, C. R., Dalgleish, T., & Joseph, S. (1996). A dual representation theory of posttraumatic stress disorder. *Psychological Review, 103*, 670-686. doi:10.1037/0033-295X.103.4.670

Brewin, C. R., Gregory, J. D., Lipton, M., & Burgess, N. (2010). Intrusive images in psychological disorders: Characteristics, neural mechanisms, and treatment implications. *Psychological Review, 117*, 210-232. doi:10.1037/a0018113

Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of post-traumatic stress disorder. *Clinical Psychology Review, 23*, 339-376. doi:10.1016/S0272-7358(03)00033-3

Brewin, C. R., Ma, B. Y., & Colson, J. (2013). Effects of experimentally induced dissociation on attention and memory. *Consciousness and Cognition, 22*, 315-323. doi:10.1016/j.concog.2012.08.005

Brewin, C. R., & Mersaditabari, N. (2013). Experimentally-induced dissociation impairs visual memory. *Consciousness and Cognition, 22*, 1189-1194. doi:10.1016/j.concog.2013.07.007

Brewin, C. R., & Saunders, J. (2001). The effect of dissociation at encoding on intrusive memories for a stressful film. *British Journal of Medical Psychology, 74*, 467-472. doi:10.1348/000711201161118

Briere, J., Scott, C., & Weathers, F. (2005). Peritraumatic and persistent dissociation in the presumed etiology of PTSD. *American Journal of Psychiatry, 162*, 2295-2301. doi:10.1176/appi.ajp.162.12.2295

Buchanan, T. W., & Lovallo, W. R. (2001). Enhanced memory for emotional material following stress-level cortisol treatment in humans. *Psychoneuroendocrinology, 26*, 307-317. doi:10.1016/S0306-4530(00)00058-5

Buck, N., Kindt, M., & van den Hout, M. (2006). Effects of state dissociation on objectively and subjectively assessed memory disturbances. *Behavioural and Cognitive Psychotherapy, 34*, 319-331. doi:10.1017/S1352465806002827

Butler, G., Wells, A., & Dewick, H. (1995). Differential effects of worry and imagery after exposure to a stressful stimulus: A pilot study. *Behavioural and Cognitive Psychotherapy, 23*, 45-56. doi:10.1017/S1352465800017628

Calvo-Merino, B., Glaser, D. E., Grèzes, J., Passingham, R. E., & Haggard, P. (2005). Action observation and acquired motor skills: An FMRI study with expert dancers. *Cerebral Cortex, 15*, 1243-1249. doi:10.1093/cercor/bhi007

Candel, I., & Merckelbach, H. (2004). Peritraumatic dissociation as a predictor of post-traumatic stress disorder: A critical review. *Comprehensive Psychiatry, 45*, 44-50. doi:10.1016/j.comppsych.2003.09.012

Chioua, B. (Producer), Cassel, V. (Producer), & Noé, G. (Director). (2002). *Irréversible* [Motion picture]. France: StudioCanal.

Clark, I. A., Holmes, E. A., Woolrich, M. W., & Mackay, C. E. (2016). Intrusive memories to traumatic footage: The neural basis of their encoding and involuntary recall. *Psychological Medicine, 46*, 505-518. doi:10.1017/S0033291715002007

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review, 107*, 261-268. doi:10.1037/0033-295X.107.2.261

Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information-processing system. *Psychological Bulletin, 104*, 163-191. doi:10.1037/0033-2909.104.2.163

Cutting, J. E., Brunick, K. L., & Candan, A. (2012). Perceiving event dynamics and parsing Hollywood films. *Journal of Experimental Psychology: Human Perception and Performance, 38*, 1476-1490. doi:10.1037/a0027737

Davies, M. I., & Clark, D. M. (1998). Thought suppression produces a rebound effect with analogue post-traumatic intrusions. *Behaviour Research and Therapy, 36*, 571-582. doi:10.1016/S0005-7967(98)00051-5

Davies, M., Walker, J., Archer, J., & Pollard, P. (2013). The scripting of male and female rape. *Journal of Aggression, Conflict and Peace Research, 5*, 68-76. doi:10.1108/17596591311313663

Deeprose, C., Zhang, S., DeJong, H., Dalgleish, T., & Holmes, E. A. (2012). Imagery in the aftermath of viewing a traumatic film: Using cognitive tasks to modulate the development of involuntary memory. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 758-764. doi:10.1016/j.jbtep.2011.10.008

Edelstein, D. (February 6, 2006). "Now Playing at Your Local Multiplex: Torture Porn". *New York Magazine*. Retrieved from: http://nymag.com/movies/features/15622/

Ehlers, A. (2010). Understanding and treating unwanted trauma memories in posttraumatic stress disorder. *Zeitschrift für Psychologie/Journal of Psychology, 218*, 141-145. doi:10.1027/0044-3409/a000021

Ehlers, A., & Clark, D. M. (2000). A cognitive model of post-traumatic stress disorder. *Behaviour Research and Therapy, 38*, 219-245. doi:10.1016/S0005-7967(99)00123-0

Ehlers, A., Hackmann, A., & Michael, T. (2004). Intrusive re-experiencing in post-traumatic stress disorder: Phenomenology, theory, and therapy. *Memory, 12*, 403-415. doi:10.1080/09658210444000025

Ehring, T., Ehlers, A., & Glucksman, E. (2008). Do cognitive models help in predicting the severity of posttraumatic stress disorder, phobia, and depression after motor vehicle accidents? A prospective longitudinal study. *Journal of Consulting and Clinical Psychology, 76*, 219-230. doi:10.1037/0022-006X.76.2.219

Ekman, P. (2003). *Emotions revealed: Recognizing faces and feelings to improve communication and emotional life*. New York, NY: Holt & Co.

Elzinga, B. M., & Bremner, J. D. (2002). Are the neural substrates of memory the final common pathway in posttraumatic stress disorder (PTSD)? *Journal of Affective Disorders, 70*, 1-17. doi:10.1016/S0165-0327(01)00351-2

Engelhard, I. M., van den Hout, M. A., Kindt, M., Arntz, A., & Schouten, E. (2003). Peritraumatic dissociation and post-traumatic stress after pregnancy loss: A prospective study. *Behavior Research and Therapy, 41*, 67-78. doi:10.1016/S0005-7967(01)00130-9

Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science, 11*, 19-23. doi:10.1111/1467-8721.00160

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*, 336-353. doi:10.1037/1528-3542.7.2.336

Ezzyat, Y., & Davachi, L. (2011). What constitutes an episode in episodic memory? *Psychological Science, 22*, 243-252. doi:10.1177/0956797610393742

Foa, E. B., Molnar, C., & Cashman, L. (1995). Change in rape narratives during exposure therapy for posttraumatic stress disorder. *Journal of Traumatic Stress, 8*, 675-690. doi:10.1002/jts.2490080409

Foa, E. B., & Rothbaum, B. O. (1998). *Treating the trauma of rape: Cognitive-behavioral therapy for PTSD*. New York, NY: Guilford Press.

Foa, E. B., Steketee, G., & Rothbaum, B. (1989). Behavioral/cognitive conceptualizations of post-traumatic stress disorder. *Behavior Therapy, 20*, 155-176. doi:10.1016/S0005-7894(89)80067-X

Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*, 233-239. doi:10.1111/j.1467-9280.2007.01882.x

García-Bajos, E., Migueles, M., & Aizpurua, A. (2014). Conceptual and perceptual encoding instructions differently affect event recall. *Cognitive Processing, 15*, 535-541. doi:10.1007/s10339-014-0615-3

Giesbrecht, T., Lynn, S. J., Lilienfeld, S. O., & Merckelbach, H. (2008). Cognitive processes in dissociation: An analysis of core theoretical assumptions. *Psychological Bulletin, 134*, 617-647. doi:10.1037/0033-2909.134.5.617

Giesbrecht, T., Lynn, S. J., Lilienfeld, S. O., & Merckelbach, H. (2010). Cognitive processes, trauma, and dissociation—Misconceptions and misrepresentations: Reply to Bremner (2010). *Psychological Bulletin, 136*, 7-11. doi:10.1037/a0018068

Gobet, F., Lane, P. C. R., Croker, S., Cheng, P. C. H., Jones, G., Oliver, I., & Pine, J. M. (2001). Chunking mechanisms in human learning. *Trends in Cognitive Sciences, 5*, 236-243. doi:10.1016/S1364-6613(00)01662-4

Gray, M., Litz, B., Hsu, J., & Lombardo, T. (2004). Psychometric properties of the Life Events Checklist. *Assessment, 11*, 330-341. doi:10.1177/1073191104269954

Hackmann, A., Ehlers, A., Speckens, A., & Clark, D.M. (2004). Characteristics and content of intrusive memories in PTSD and their changes with treatment. *Journal of Traumatic Stress, 17*, 231-240. doi:10.1023/B:JOTS.0000029266.88369.fd

Halligan, S. L., Clark, D. M., & Ehlers, A. (2002). Cognitive processing, memory, and the development of PTSD symptoms: Two experimental analogue studies. *Journal of Behavior Therapy and Experimental Psychiatry, 33*, 73-89. doi:10.1016/S0005-7916(02)00014-9

Halligan, S. A., Michael, T., Clark, D. M., & Ehlers, A. (2003). Post-traumatic stress disorder following assault: The role of cognitive processing, trauma memory, and appraisals. *Journal of Consulting and Clinical Psychology, 71*, 419-431. doi:10.1037/0022-006X.71.3.419

Hard, B. M., Tversky, B., & Lang, D. (2006). Making sense of abstract events: Building event schemas. *Memory & Cognition, 34*, 1221-1235. doi:10.3758/BF03193267

Hardy, A., Young, K., & Holmes, E.A. (2009). Does trauma memory play a role in the experience of reporting sexual assault during police interviews? An exploratory study. *Memory, 17*, 783-788. doi:10.1080/09658210903081835

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Henckens, M. J., Hermans, E. J., Pu, Z., Joëls, M., & Fernández, G. (2009). Stressed memories: how acute stress affects memory formation in humans. *The Journal of Neuroscience, 29*, 10111-10119. doi:10.1523/jneurosci.1184-09.2009

Holmes, E. A. (2004). Intrusive, emotional mental imagery and trauma: Experimental and clinical clues. *Imagination, Cognition and Personality, 23*, 147-154. doi:10.2190/HJG1-7UPH-B3K0-P9H5

Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. *Acta Psychologica, 127*, 553-566. doi:10.1016/j.actpsy.2007.11.002

Holmes, E. A., Brewin, C. R., & Hennessy, R. G. (2004). Trauma films, information processing, and intrusive memory development. *Journal of Experimental Psychology-General, 133*, 3-22. doi:10.1037/0096-3445.133.1.3

Holmes, E. A., Brown, R. J., Mansell, W., Fearon, R., Hunter, E., Frasquilho, F., & Oakley, D. A. (2005). Are there two qualitatively distinct forms of dissociation? A review and some clinical implications. *Clinical Psychology Review, 25*, 1-23. doi:10.1016/j.cpr.2004.08.006

Holmes, E. A., Grey, N., & Young, K. A. D. (2005). Intrusive images and ‘‘hotspots” of trauma memories in Posttraumatic stress disorder: An exploratory investigation of emotion and cognitive themes. *Journal of Behaviour Therapy and Experimental Psychology, 36*, 3-17. doi:10.1016/j.jbtep.2004.11.002

Holmes, E. A., James, E. L., Coode-Bate, T., & Deeprose, C. (2009). Can playing the computer game ‘Tetris’ reduce the build-up of flashbacks for trauma? A proposal from cognitive science. *PLoS ONE, 4*, e4153. doi:10.1371/journal.pone.0004153

Holmes, E. A., James, E. L., Kilford, E. J., & Deeprose, C. (2010). Key steps in developing a cognitive vaccine against traumatic flashbacks: Visuospatial Tetris versus verbal Pub Quiz. *PLoS ONE, 5*, e13706. doi:10.1371/journal.pone.0013706

Holmes, E. A., & Steel, C. (2004). Schizotypy: A vulnerability factor for traumatic intrusions. *Journal of Nervous and Mental Disease, 192*, 28-34. doi:10.1097/01.nmd.0000105997.28152.4b

Huntjens, R. J., Wessel, I., Postma, A., van Wees-Cieraad, R., & de Jong, P. J. (2015). Binding temporal context in memory: Impact of emotional arousal as a function of state anxiety and state dissociation. *The Journal of Nervous and Mental Disease, 203*, 545-550. doi:10.1097/NMD.0000000000000325

Jacoby, L. L. (1983). Perceptual enhancement: Persistent effects of an experience. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9*, 21-38. doi:10.1037/0278-7393.9.1.21

Jelinek, L., Randjbar, S., Seifert, D., Kellner, M., & Moritz, S. (2009). The organization of autobiographical and nonautobiographical memory in posttraumatic stress disorder (PTSD). *Journal of Abnormal Psychology, 118*, 288-298. doi:10.1037/a0015633

Kessler, R.C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C.B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry, 52*, 1048-1060. doi:10.1001/archpsyc.1995.03950240066012

Kindt, M., & van den Hout, M. (2003). Dissociation and memory fragmentation: Experimental effects on meta-memory but not on actual memory performance. *Behavior Research and Therapy, 41*, 167-178. doi:10.1016/S0005-7967(01)00135-8

Kindt, M., van den Hout, M., Artnz, A., & Drost, J. (2008). The influence of data-driven versus conceptually-driven processing on the development of PTSD-like symptoms. *Journal of Behavior Therapy and Experimental Psychiatry, 39*, 546-557. doi:10.1016/j.jbtep.2007.12.003

Kindt, M., van den Hout, M., & Buck, N. (2005). Dissociation related to subjective memory fragmentation and intrusions but not to objective memory disturbances. *Journal of Behavior Therapy and Experimental Psychiatry, 36*, 43-59. doi:10.1016/j.jbtep.2004.11.005

Kintsch, W. (1970). Models for free recall and recognition. In: D. A. Norman (Ed.), *Models of Human Memory* (pp. 331-373). New York: Academic Press. 331-373.

Kirkpatrick, D. (Producer), Filley, J. (Producer), Scott, C. (Director), & Tucci, S. (Director). (1996). *Big night* [Motion picture]. USA: The Samuel Goldwyn Company.

Krahé, B., Bieneck, S., & Scheinberger-Olwig, R. (2007). Adolescents' sexual scripts: Schematic representations of consensual and non-consensual heterosexual interactions. *Journal of Sex Research, 4*, 316-327. doi:10.1080/00224490701580923

Krans, J., Langner, O., Reinecke, A., & Pearson, D. G. (2013). Intrusive images and voluntary memory for affective pictures: Contextualization and dual-task interference. *Journal of Behavior Therapy and Experimental Psychiatry, 44*, 418-425. doi:10.1016/j.jbtep.2013.05.001

Krans, J., Näring, G., & Becker, E. S. (2009). Count out your intrusions: Effects of verbal encoding on intrusive memories. *Memory, 17*, 809-815. doi:10.1080/09658210903130780

Krans, J., Näring, G., Holmes, E. A., & Becker, E. S. (2010a). "I see what you're saying": Intrusive images from listening to a traumatic verbal report. *Journal of Anxiety Disorders, 24*, 134-140. doi:10.1016/j.janxdis.2009.09.009

Krans, J., Näring, G., Holmes, E. A., & Becker, E. S. (2010b). Motion effects on intrusion development. *Journal of Trauma & Dissociation, 11*, 73-82. doi:10.1080/15299730903318483

Kurby, C. A., Asiala, L. K., & Mills, S. R. (2013). Aging and the segmentation of narrative film. *Aging, Neuropsychology, and Cognition, 21*, 444-463. doi:10.1080/13825585.2013.832138

Kurby, C. A., & Zacks, J. M. (2008). Segmentation in the perception and memory of events. *Trends in Cognitive Sciences, 12*, 72-79. doi:10.1016/j.tics.2007.11.004

Kurby, C. A., & Zacks, J. M. (2011). Age differences in the perception of hierarchical structure in events. *Memory & Cognition, 39*, 75-91. doi:10.3758/s13421-010-0027-2

Laposa, J. M., & Alden, L. E. (2006). An analogue study of intrusion. *Behaviour Research and Therapy, 44*, 925-946. doi:10.1016/j.brat.2005.07.003

Laposa, J. M., & Rector, N. A. (2012). The prediction of intrusions following an analogue traumatic event: Peritraumatic cognitive processes and anxiety-focused rumination versus rumination in response to intrusions. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 877-883. doi:10.1016/j.jbtep.2011.12.007

Littleton, H. L., & Axsom, D. (2003). Rape and seduction scripts of university students: Implications for rape attributions and unacknowledged rape. *Sex Roles, 49*, 465-475. doi:10.1023/A:1025824505185

Littleton, H., Breitkopf, C. R., & Berenson, A. B. (2007). Rape scripts of low-income European American and Latina women. *Sex Roles, 56*, 509-516. doi:10.1007/s/11199-007-9189-1

Littleton, H., Tabernik, H., Canales, E. J., & Backstrom, T. (2009). Risky situation or harmless fun? A qualitative examination of college women's bad hook-up and rape scripts. *Sex Roles, 60*, 793-804. doi:10.1007/s1199-009-9586-8

Logan, S., & O'Kearney, R. (2012). Individual differences in emotionality and peri-traumatic processing. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 815-822. doi:10.1016/j.jbtep.2011.12.003

Loschky, L. C., Larson, A. M., Magliano, J. P., & Smith, T. J. (2015). What would Jaws do? The tyranny of film and the relationship between gaze and higher-level narrative film comprehension. *PLOS ONE, 10*, e0142474. doi:10.1371/journal.pone.0142474

Lozano, S. C., Hard, B. M., & Tversky, B. (2006). Perspective taking promotes action understanding and learning. *Journal of Experimental Psychology: Human Perception and Performance, 32*, 1405-1421. doi:10.1037/0096-1523.32.6.1405

Magliano, J., Kopp, K., McNerney, M. W., Radvansky, G. A., & Zacks, J. M. (2012). Aging and perceived event structure as a function of modality. *Aging, Neuropsychology, and Cognition, 19*, 264-282. doi:10.1080/13825585.2011.633159

Magliano, J. P., & Radvansky, G. A. (2001). Goal coordination in narrative comprehension. *Psychonomic Bulletin & Review, 8*, 372-376.

Magliano, J. P., Taylor, H. A., & Kim, H. J. J. (2005). When goals collide: Monitoring the goals of multiple characters. *Memory & Cognition, 33*, 1357-1367. doi:10.3758/BF03193368

Magliano, J. P., & Zacks, J. M. (2011). The impact of continuity editing in narrative film on event segmentation. *Cognitive Science, 35*, 1489-1517. doi:10.1111/j.1551-6709.2011.01202.x

Mallinckrodt, B., Abraham, W. T., Wei, M., & Russell, D. W. (2006). Advances in testing the statistical significance of mediation effects. *Journal of Counseling Psychology, 53*, 372-378. doi:10.1037/0022-0167.53.3.372

Marmar, C. R., Weiss, D. S. and Metzler, M. A. (1997). The peritraumatic dissociative experiences questionnaire. In: J. P. Wilson and T. M. Keane (Eds.), *Assessing Psychological Trauma and PTSD: A practitioners' handbook*. New York: Guilford Press.

Marmar, C. R., Weiss, D. S., Schlenger, W. E., Fairbank, J. A., Jordan, B. K., Kulka, R. A., & Hough, R. L. (1994). Peritraumatic dissociation and posttraumatic stress in male Vietnam theater veterans. *American Journal of Psychiatry, 151*, 902-907. Retrieved from http://ajp.psychiatryonline.org/

Marteau, T., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *British Journal of Psychology, 31*, 301-306. doi:10.1111/j.2044-8260.1992.tb00997.x

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106*, 3-19. doi:10.1037/0033-295X.106.1.3

Miller, G. A. (1956) The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review, 63*, 81-97. doi:10.1037/h0043158

Morgan, C. A., Doran, A., Steffian, G., Hazlett, G., & Southwick, S. M. (2006). Stress-induced deficits in working memory and visuo-constructive abilities in special operations soldiers. *Biological Psychiatry, 60*, 722-729. doi:10.1016/j.biopsych.2006.04.021

Morris, C. D., Bransford, J. D., & Franks, J. J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning & Verbal Behavior, 16*, 519-533. doi:10.1016/S0022-5371(77)80016-9

Murray, J., Ehlers, A., & Mayou, R. A. (2002). Dissociation and post-traumatic stress disorder: Two prospective studies of road traffic accident survivors. *British Journal of Psychiatry, 180*, 363-368. doi:10.1192/bjp.180.4.363

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

Newtson, D. (1973). Attribution and the unit of perception of ongoing behavior. *Journal of Personality and Social Psychology, 28*, 28-38. doi:10.1037/h0035584

Newtson, D. (1976). Foundations of attributions: The perception of ongoing behavior. In J. Harvey, W. Ickes, & R. Kidd (Eds.), *New directions in attribution research*. Hillsdale, NJ: Erlbaum.

Newtson, D., Engquist, G., & Bois, J. (1977). The objective basis of behavior units. *Journal of Personality and Social Psychology, 35*, 847-862. doi:10.1037/0022-3514.35.12.847

Nixon, R. D., Cain, N., Nehmy, T., & Seymour, M. (2009a). Does post-event cognitive load undermine thought suppression and increase intrusive memories after exposure to an analogue stressor? *Memory, 17*, 245-255. doi:10.1080/09658210802592353

Nixon, R. D., Cain, N., Nehmy, T., & Seymour, M. (2009b). The influence of thought suppression and cognitive load on intrusions and memory processes following an analogue stressor. *Behavior Therapy, 40*, 368-379. doi:10.1016/j.beth.2008.10.004

Nixon, R. D. V., Nehmy, T., & Seymour, M. (2007). The effect of cognitive load and hyperarousal on negative intrusive memories. *Behaviour Research and Therapy, 45*, 2652-2663. doi:10.1016/j.brat.2007.06.010

O'Kearney, R., & Perrott, K. (2006). Trauma narratives in posttraumatic stress disorder: A review. *Journal of Traumatic Stress, 19*, 81-93. doi:10.1002/jts.20099.

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of post-traumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin, 129*, 52-73. doi:10.1037/1942-9681.S.1.3

Pacheco-Unguetti, A. P., Acosta, A., Callejas, A., & Lupiáñez, J. (2010). Attention and anxiety: Different attentional functioning under state and trait anxiety. *Psychological Science, 21*, 298-304. doi:10.1177/0956797609359624

Payne, J. D., Jackson, E. D., Ryan, L., Hoscheidt, S., Jacobs, W. J., & Nadel, L. (2006). The impact of stress on neutral and emotional aspects of episodic memory. *Memory, 14*, 1-16. doi:10.1080/09658210500139176

Peace, K. A., Porter, S., & ten Brinke, L. (2008). Are memories for sexually traumatic events ''special''? A with-in subjects investigation of trauma and memory in a clinical sample. *Memory, 16*, 10-21. doi:10.1080/09658210701363583

Pearson, D. G. (2014). Are C-reps contextual representations? A reply to Brewin and Burgess. *Journal of Behavior Therapy and Experimental Psychiatry, 45*, 220-222. doi:10.1016/j.jbtep.2013.07.010

Pearson, D. G., & Sawyer, T. (2011). Effects of dual task interference on memory intrusions for affective images. *International Journal of Cognitive Therapy, 4*, 122-133. doi:10.1521/ijct.2011.4.2.122

Porter, S., & Birt, A. R. (2001). Is traumatic memory special? A comparison of traumatic memory characteristics with memory for other emotional life experiences. *Applied Cognitive Psychology, 15*, S101-S117. doi:10.1002/acp.766

Porter, S., & Peace, K. A. (2007). The scars of memory: A prospective, longitudinal investigation of the consistency of traumatic and positive emotional memories in adulthood. *Psychological Science, 18*, 435-441. doi:10.1111/j.1467-9280.2007.01918.x

Qin, S., Cousijn, H., Rijpkema, M., Luo, J., Franke, B., Hermans, E. J., & Fernández, G. (2012). The effect of moderate acute psychological stress on working memory-related neural activity is modulated by a genetic variation in catecholaminergic function in humans. *Frontiers in Integrative Neuroscience, 6*, Article 16. doi:10.3389/fnint.2012.00016

Radvansky, G. A. (2012). Across the event horizon. *Current Directions in Psychological Science, 21*, 269-272. doi:10.1177/0963721412451274

Regambal, M. J., & Alden, L. E. (2009). Pathways to intrusive memories in a trauma analogue paradigm: A structural equation model. *Depression and Anxiety, 26*, 155-166. doi:10.1002/da.20483

Rizvi, S. L., Kaysen, D. L., Gutner, C. A., Griffen, M. G., & Resick, P. A. (2008). Beyond fear: The role of peritraumatic responses in posttraumatic and depressive symptoms among female crime victims. *Journal of Interpersonal Violence, 23*, 853-868. doi:10.1177/0886260508314851

Roediger, H. L. (1990). Implicit memory: retention without remembering. *American Psychologist, 45*, 1043-1056. doi:10.1037/0003-066X.45.9.1043

Roediger, H. L. (2008). Relativity of remembering: Why the laws of memory vanished. *Annual Review of Psychology, 59*, 225-254. doi:10.1146/annurev.psych.57.102904. 190139

Rosen, V. M., Caplan, L., Sheesley, L., Rodriguez, R., & Grafman, J. (2003). An examination of daily activities and their scripts across the adult lifespan. *Behavior Research Methods, Instruments, & Computers, 35*, 32-48. doi:10.3758/BF03195495

Rubin, D. C., Berntsen, D., & Bohni, M. K. (2008). Memory-based model of posttraumatic stress disorder: Evaluating basic assumptions underlying the PTSD diagnosis. *Psychological Review, 115*, 985-1011. doi:10.1037/a0013397

Rubin, D. C., Boals, A., & Berntsen, D. (2008). Memory in posttraumatic stress disorder: Properties of voluntary and involuntary, traumatic and nontraumatic autobiographical memories in people with and without posttraumatic stress disorder symptoms. *Journal of Experimental Psychology: General, 137*, 591-614. doi:10.1037/a0013165

Ryan, K. (1988). Rape and seduction scripts. *Psychology of Women Quarterly, 12*, 237-245. doi:10.1111/j.1471-6402.1988.tb00939.x.

Ryan, K. M. (2011). The relationship between rape myths and sexual scripts: The social construction of rape. *Sex Roles, 65*, 774-782. doi:10.1007/s11199-011-0033-2

Sargent, J. Q., Zacks, J. M., Hambrick, D. Z., Zacks, R. T., Kurby, C. A., Bailey, H. R., Eisenberg, M. L., & Beck, T. M. (2013). Event segmentation ability uniquely predicts event memory. *Cognition, 129*, 241-255. doi:10.1016/j.cognition.2013.07.002

Schaich, A., Watkins, E. R., & Ehring, T. (2013). Can concreteness training buffer against the negative effects of rumination on PTSD? An experimental analogue study. *Journal of Behavior Therapy and Experimental Psychiatry, 44*, 396-403. doi:10.1016/j.jbtep.2013.03.006

Schwabe, L., Römer, S., Richter, S., Dockendorf, S., Bilak, B., & Schächinger, H. (2009). Stress effects on declarative memory retrieval are blocked by a β-adrenoceptor antagonist in humans. *Psychoneuroendocrinology, 34*, 446-454. doi:10.1016/j.psyneuen.2008.10.009

Schwabe, L., Joëls, M., Roozendaal, B., Wolf, O. T., & Oitzl, M. S. (2012). Stress effects on memory: an update and integration. *Neuroscience & Biobehavioral Reviews, 36*, 1740-1749. doi:10.1016/j.neubiorev.2011.07.002

Schwan, S., & Garsoffky, B. (2004). The cognitive representation of filmic event summaries. *Applied Cognitive Psychology, 18*, 37-55. doi:10.1002/acp.940

Schwan, S., Garsoffky, B., & Hesse, F. W. (2000). Do film cuts facilitate the perceptual and cognitive organization of activity sequences? *Memory and Cognition, 28*, 214-223. doi:10.3758/BF03213801

Segovia, D. A., Strange, D., & Takarangi, M. K. (2016). Encoding disorganized memories for an analogue trauma does not increase memory distortion or analogue symptoms of PTSD. *Journal of Behavior Therapy and Experimental Psychiatry, 50*, 127-134. doi:10.1016/j.jbtep.2015.07.003

Shobe, K. K., & Kihlstrom, J. F. (1997). Is traumatic memory special? *Current Directions in Psychological Science, 6*, 70-74. doi:10.1111/1467-8721.ep11512658

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychological Methods, 7*, 422-445. doi:10.1037/1082-989X.7.4.422

Smith, T. J. (2012). Extending AToCC: A reply. *Projections, 6*, 71-78. doi:10.3167/proj.2012.060102a

Speer, N. K., Swallow, K. M., & Zacks, J. M. (2003). Activation of human motion processing areas during event perception. *Cognitive, Affective, & Behavioral Neuroscience, 3*, 335-345. doi:10.3758/CABN.3.4.335

Speer, N. K. & Zacks, J. M. (2005). Temporal changes as event boundaries: Processing and memory consequences of narrative time shifts. *Journal of Memory and Language, 53*, 125-140. doi:10.1016/j.jml.2005.02.009

Speer, N. K., Zacks, J. M., & Reynolds, J. R. (2007). Human brain activity time-locked to narrative event boundaries. *Psychological Science, 18*, 449-455. doi:10.1111/j.1467-9280.2007.01920.x

Steil, R. I. (1996). *Posttraumatische intrusionen nach verkehrsunfällen. [Posttraumatic intrusions after road traffic accidents]*. Frankfurt, Germany: Peter Lang.

Steil, R., & Ehlers, A. (2000). Dysfunctional meaning of posttraumatic intrusions in chronic PTSD. *Behaviour Research and Therapy, 38*, 537-558. doi:10.1016/S0005-7967(99)00069-8

Stuart, A. D. P., Holmes, E. A., & Brewin, C. R. (2006). The influence of a visuospatial grounding task on intrusive images of a traumatic film. *Behaviour Research and Therapy, 44*, 611-619. doi:10.1016/j.brat.2005.04.004

Sündermann, O., Hauschildt, M., & Ehlers, A. (2013). Perceptual processing during trauma, priming and the development of intrusive memories. *Journal of Behavior Therapy and Experimental Psychiatry, 44*, 213-220. doi:10.1016/j.jbtep.2012.10.001

Swallow, K. M., Barch, D. M., Head, D., Maley, C. J., Holder, D., & Zacks, J. M. (2011). Changes in events alter how people remember recent information. *Journal of Cognitive Neuroscience, 23*, 1052-1064. doi:10.1162/jocn.2010.21524

Swallow, K. M., Zacks, J. M., & Abrams, R. A. (2009). Event boundaries in perception affect memory encoding and updating. *Journal of Experimental Psychology: General, 138*, 236-257. doi:10.1037/a0015631

Tluczek, A., Henriques, J. B., & Brown, R. L. (2009). Support for the reliability and validity of a six-item state anxiety scale derived from the State-Trait Anxiety Inventory. *Journal of Nursing Measurement, 17*, 19-28. doi:10.1891/1061-3749.17.1.19

Tulving, E. (2001). Does memory encoding exist? (pp. 6-27). In M. Naveh-Benjamin, M. Moscovitch, & H. L. Roediger (Eds.), *Perspectives on Human Memory and Cognitive Aging: Essays in Honor of Fergus Craik*. New York, NY: Psychology Press.

Tversky, B., & Zacks, J. M. (2013). Event perception (pp. 83-94). In D. Reisberg (Ed.), *The Oxford Handbook of Cognitive Psychology.* New York, NY: Oxford University Press.

Van Ast, V. A., Cornelisse, S., Meeter, M., Joëls, M., & Kindt, M. (2013). Time-dependent effects of cortisol on the contextualization of emotional memories. *Biological Psychiatry, 74*(11), 809-816. doi:10.1016/j.biopsych.2013.06.022

van der Kolk, B. A., & Fisler, R. (1995). Dissociation and the fragmentary nature of traumatic memories: Overview and exploratory study. *Journal of Traumatic Stress,* 8, 505-525. doi:10.1002/jts.2490080402

Vyas, A., Mitra, R., Rao, B. S. S., & Chattarji, S. (2002). Chronic stress induces contrasting patterns of dendritic remodeling in hippocampal and amygdaloid neurons. *Journal of Neuroscience, 22*, 6810-6818. Retrieved from http://www.jneurosci.org

Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P., & Keane, T. M. (2013). *The Life Events Checklist for DSM-5 (LEC-5)*. Instrument available from the National Center for PTSD at www.ptsd.va.gov

Weathers, F., Litz, B., Herman, D., Huska, J., & Keane, T. (1993, October). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Paper presented at the Annual Convention of the International Society for Traumatic Stress Studies in San Antonio, TX.

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). *The PTSD Checklist for DSM-5 (PCL-5)*. Scale available from the National Center for PTSD at www.ptsd.va.gov

Weidmann, A., Conradi, A., Gröger, K., Fehm, L., & Fydrich, T. (2009). Using stressful films to analyze risk factors for PTSD in analogue experimental studies: Which film works best? *Anxiety, Stress and Coping, 22*, 549-569. doi:10.1080/10615800802541986

Wiemers, U. S., Sauvage, M. M., Schoofs, D., Hamacher-Dang, T. C., & Wolf, O. T. (2013). What we remember from a stressful episode. *Psychoneuroendocrinology, 38*, 2268-2277. doi:10.1016/j.psyneuen.2013.04.015

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology, 18*, 459-482. doi:10.1002/cne.920180503

Zacks, J. M. (2004). Using movement and intentions to understand simple events. *Cognitive Science, 28*, 979-1008. doi:10.1016/j.cogsci.2004.06.003

Zacks, J. M. (2008). Event perception. *Scholarpedia, 3*(10):3837. doi:10.4249/scholarpedia.3837

Zacks, J. M., Braver, T. S., Sheridan, M. A., Donaldson, D. I., Snyder, A. Z., Ollinger, J. M., Buckner, R. L., & Raichle, M. E. (2001). Human brain activity time-locked to perceptual event boundaries. *Nature Neuroscience, 4*, 651-655. doi:10.1038/88486

Zacks, J. M., Kurby, C. A., Eisenberg, M. L., & Haroutunian, N. (2011). Prediction error associated with the perceptual segmentation of naturalistic events. *Journal of Cognitive Neuroscience, 23*, 4057-4066. doi:10.1162/jocn_a_00078

Zacks, J. M., Kurby, C. A., Landazabal, C. S., Krueger, F., & Grafman, J. (2016). Effects of penetrating traumatic brain injury on event segmentation and memory. *Cortex, 74*, 233-246. doi:10.1016/j.cortex.2015.11.002

Zacks, J. M., & Sargent, J. Q. (2010). Event perception: A theory and its application to clinical neuroscience. *The Psychology of Learning and Motivation, 53*, 253-299. doi:10.1016/S0079-7421(10)53007-X

Zacks, J. M., Speer, N. K., Swallow, K. M., Braver, T. S., & Reynolds, J. R. (2007). Event Perception: A mind-brain perspective. *Psychological Bulletin, 133*, 273- 293. doi:10.1037/0033-2909.133.2.273

Zacks, J. M., Speer, N. K., Vettel, J. M., & Jacoby, L. L. (2006). Event understanding and memory in healthy aging and dementia of the Alzheimer type. *Psychology and Aging, 21*, 466-482. doi:10.1037/0882-7974.21.3.466

Zacks, J. M., & Tversky, B. (2001). Event structure in perception and conception. *Psychological Bulletin, 127*, 3-21. doi:10.1037/0033-2909.127.1.3

Zoellner, L. A., Alvarez-Conrad, J., & Foa, E. B. (2002). Peritraumatic dissociative experiences, trauma narratives and trauma pathology. *Journal of Traumatic Stress, 15*, 49-57. doi:10.1023/A:1014383228149

Zoellner, L. A., Sacks, M. B., & Foa, E. B. (2001). Stability of emotions for traumatic memories in acute and chronic PTSD. *Behavior Research and Therapy, 39*, 697-711. doi:10.1016/S0005-7967(00)00050-4

# APPENDIX A

# RECRUITMENT MATERIALS FOR IRB

## Recruitment Materials for IRB

Participants will be recruited from the PSYC 102 participant pool. These participants sign up for studies using a secure online experiment management system developed by Sona Systems, Ltd. The URL is http://niu.sona-systems.com/. The proposed study will be listed on the website as "Understanding Stressful Experiences." The study will not be available for participants under 18 years old. The following statement will be used to recruit participants:

> The purpose of this study is to better understand how individuals process and remember non-stressful experiences and stressful experiences. First, participants will fill out a series of questionnaires. Second, participants will watch a non-stressful film and a stressful film. While watching the films, participants will engage in a task that measures cognitive processes. Third, participants will complete a memory test for the films. Participation may take up to two hours. The study is being conducted in the Psychology Building.

# APPENDIX B

# OUTLINE OF STUDY PROCEDURES

**Outline of Study Procedures**

***Phase One*:** Informed Consent

***Phase Two*:** Survey Packet
1. Life Events Checklist for *DSM-5* (LEC-5)
2. PTSD Checklist for *DSM-5* (PCL-5)
3. Prior Film Exposure Questionnaire (PFEQ)
4. Demographics Questionnaire (DQ)

***Phase Three:*** Script Assessment
1. Everyday event scripts
    a. Getting ready for work
    b. Shopping for groceries
    c. Going out to dinner
2. Rape script

***Phase Four*:** Orientation to Event Segmentation Task

***Phase Five or Six (Counterbalanced)*:** Non-Stressful Event Segmentation
1. Event segmentation task (stimuli: Breakfast scene from *Big Night*)
2. Cognitive, Affective, and Visual Engagement Assessment Tests (CAVEAT)

***Phase Six or Five (Counterbalanced)*:** Stressful Event Segmentation
1. State measurement questionnaires (Time One):
    a. State/Trait Anxiety Index (STAI-S6)
    b. Peritraumatic Dissociative Experiences Scale (PDEQ-7)
2. Event segmentation task (stimuli: Rape scene from *Irréversible*)
3. State measurement questionnaires (Time Two):
    a. State/Trait Anxiety Index (STAI-S6)
    b. Peritraumatic Dissociative Experiences Scale (PDEQ-7)
4. Cognitive, Affective, and Visual Engagement Assessment Tests (CAVEAT)

***Phase Seven or Eight (Counterbalanced)*:** Non-Stressful Event Recall Assessment

***Phase Eight or Seven (Counterbalanced)*:** Stressful Event Recall and Recognition Assessment
1. Event recall
2. Event recognition

***Phase Nine*:** Positive Mood Induction and Debriefing
1. Positive mood induction
2. Debriefing

# APPENDIX C

# SELF-REPORT QUESTIONNAIRES

## Prior Film Exposure Questionnaire (PFEQ)

**Directions:**
Please indicate how many times you have seen the following films using the following scale:

**?** = "I have never heard of it."
**0** = "I have heard of it but I have never seen it."
**1** = "I have seen it only once."
**>1** = "I have seen it more than once."

| Film | | Seen It? | | | |
|---|---|---|---|---|---|
| **1** $_{CF}$ | ***The Notebook*** [2004; Director: Nick Cassavetes; Lead: Ryan Gosling] | ? | 0 | 1 | >1 |
| **2** $_{TP}$ | ***Saw*** [2004; Director: James Wan; Lead: Cary Elwes] | ? | 0 | 1 | >1 |
| **3** $_{CF}$ | ***Ghost*** [1990; Director: Jerry Zucker; Lead: Patrick Swayze] | ? | 0 | 1 | >1 |
| **4** $_{TP}$ | ***A Serbian Film*** [2010; Director: Srđan Spasojević; Lead: Sergej Trifunović] | ? | 0 | 1 | >1 |
| **5** $_{TP}$ | ***The Devil's Rejects*** [2005; Director: Rob Zombie; Lead: Sid Haig] | ? | 0 | 1 | >1 |
| **6** $_{CF}$ | ***27 Dresses*** [2008; Director: Anne Fletcher; Lead: Katherine Heigl] | ? | 0 | 1 | >1 |
| **7** $_{TP}$ | ***I Spit on Your Grave*** [2010; Director: Steven Monroe; Lead: Sarah Butler] | ? | 0 | 1 | >1 |
| **8** $_{CF}$ | ***Steel Magnolias*** [1989; Director: Herbert Ross; Lead: Sally Field] | ? | 0 | 1 | >1 |
| **9** $_{CF}$ | ***Beaches*** [1988; Director: Garry Marshall; Lead: Bette Midler] | ? | 0 | 1 | >1 |
| **10** $_{TP}$ | ***The Human Centipede*** [2009; Director: Tom Six; Lead: Dieter Laser] | ? | 0 | 1 | >1 |
| **11** $_{TP}$ | ***Final Destination*** [2000; Director: James Wong; Lead: Devon Sawa] | ? | 0 | 1 | >1 |
| **12** $_{CF}$ | ***Notting Hill*** [1999; Director: Roger Michell; Lead: Julia Roberts] | ? | 0 | 1 | >1 |
| **13** $_{CF}$ | ***Dear John*** [2010; Director: Lasse Hallström; Lead: Channing Tatum] | ? | 0 | 1 | >1 |
| **14** $_{TP}$ | ***Hostel*** [2005; Director: Eli Roth; Lead: Jay Hernandez] | ? | 0 | 1 | >1 |
| **15** $_{EX}$ | ***Irréversible*** [2002; Director: Gaspar Noé; Lead: Monica Bellucci] | ? | 0 | 1 | >1 |
| **16** $_{EX}$ | ***Big Night*** [1996; Directors: Campbell Scott; Lead: Stanley Tucci] | ? | 0 | 1 | >1 |

*Exclusionary instructions*: The participant must discontinue the study if items $15_{EX}$ and/or $16_{EX}$ indicates one or more viewings of the study's stimuli (*Irréversible* and *Big Night*).

*Scoring instructions*: First, recode original responses [?, 0, 1, >1] into exposure scale [0, 1, 2, 3]. Second, average all items labeled "CF" for "chick-flick exposure" and all items labeled "TP" for "torture-porn exposure." (When given to participants, the PFEQ will not include item notations [i.e., EX, CF, and TP].)

## LEC-5/PCL-5: Part One

**Directions:**
Listed below are a number of difficult or stressful things that sometimes happen to people. For each event check one or more of the boxes to the right to indicate that: (a) it *happened to you* personally; (b) you *witnessed it* happen to someone else; (c) you *learned about it* happening to a close family member or close friend; (d) you were exposed to it as *part of your job* (for example, paramedic, police, military, or other first responder); or (e) you're *not sure* if it fits.

Be sure to consider your *entire life* (growing up as well as adulthood) as you go through the list of events.

| Event | | Happened to me | Witnessed it | Learned about it | Part of my job | Not sure |
|---|---|---|---|---|---|---|
| **1** | Natural disaster (for example, flood, hurricane, tornado, earthquake) | | | | | |
| **2** | Fire or explosion | | | | | |
| **3** | Transportation accident (for example, car accident, boat accident, train wreck, plane crash) | | | | | |
| **4** | Serious accident at work, home, or during recreational activity | | | | | |
| **5** | Exposure to toxic substance (for example, dangerous chemicals, radiation) | | | | | |
| **6** | Physical assault (for example, being attacked, hit, slapped, kicked, beaten up) | | | | | |
| **7** | Assault with a weapon (for example, being shot, stabbed, threatened with a knife, gun, bomb) | | | | | |
| **8** | Sexual assault (rape, attempted rape, made to perform any type of sexual act through force or threat of harm) | | | | | |
| **9** | Other unwanted or uncomfortable sexual experience | | | | | |
| **10** | Combat or exposure to a war-zone (in the military or as a civilian) | | | | | |
| **11** | Captivity (for example, being kidnapped, abducted, held hostage, prisoner of war) | | | | | |
| **12** | Life-threatening illness or injury | | | | | |
| **13** | Severe human suffering | | | | | |
| **14** | Sudden violent death (for example, homicide, suicide) | | | | | |
| **15** | Sudden accidental death | | | | | |
| **16** | Serious injury, harm, or death you caused to someone else | | | | | |
| **17** | Any other very stressful event or experience | | | | | |

## LEC-5/PCL-5: Part Two

**A.** If you checked anything for **#17** in **PART ONE**, briefly identify the event you were thinking of:

_____

**B.** If you have experienced *more than one* of the events in **PART ONE**, think about the event you consider the *worst event*, which for this questionnaire means the event that currently bothers you the most. If you have experienced only one of the events in **PART ONE**, use that one as the worst event. Please answer the following questions about the *worst event* (check all options that apply):

| | |
|---|---|
| **1** | Briefly describe the **worst event** (*for example, what happened, who was involved, etc.*):<br><br>_____<br><br>_____ |
| **2** | How long ago did it happen?<br>_____ (*please estimate if you are not sure*) |
| **3** | How did you experience it?<br>____ *It happened to me directly*<br>____ *I witnessed it*<br>____ *I learned about it happening to a close family member or close friend*<br>____ *I was repeatedly exposed to details about it as part of my job (for example, paramedic, police, military, or other first responder)*<br>____ *Other, please describe:* _____ |
| **4** | Was someone's life in danger?<br>____ *Yes, my life*<br>____ *Yes, someone else's life*<br>____ *No* |
| **5** | Was someone seriously injured or killed?<br>____ *Yes, I was seriously injured*<br>____ *Yes, someone else was seriously injured or killed*<br>____ *No* |
| **6** | Did it involve sexual violence? ____ *Yes* ____ *No* |
| **7** | If the event involved the death of a close family member or close friend, was it due to some kind of accident or violence, or was it due to natural causes?<br>____ *Accident or violence*<br>____ *Natural causes*<br>____ *Not applicable (The event did not involve the death of a close family member or close friend)* |
| **8** | How many times altogether have you experienced a similar event as stressful or nearly as stressful as the worst event?<br>____ *Just once*<br>____ *More than once (please specify or estimate the total # of times you have had this experience _____)* |

## LEC-5/PCL-5: Part Three

**Directions:**
Below is a list of problems that people sometimes have in response to a very stressful experience. Keeping your worst event in mind (**Part Two**), please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

| | ***In the past month, how much were you bothered by:*** | **Not at all** | **A little bit** | **Moderately** | **Quite a bit** | **Extremely** |
|---|---|---|---|---|---|---|
| **1** | Repeated, disturbing, and unwanted memories of the stressful experience? | 0 | 1 | 2 | 3 | 4 |
| **2** | Repeated, disturbing, and unwanted memories of the stressful experience? | 0 | 1 | 2 | 3 | 4 |
| **3** | Suddenly feeling or acting as if the stressful experience were actually happening again (*as if you were actually back there reliving it*)? | 0 | 1 | 2 | 3 | 4 |
| **4** | Feeling very upset when something reminded you of the stressful experience? | 0 | 1 | 2 | 3 | 4 |
| **5** | Having strong physical reactions when something reminded you of the stressful experience *(e.g., heart pounding, trouble breathing, sweating*)? | 0 | 1 | 2 | 3 | 4 |
| **6** | Avoiding memories, thoughts, or feelings related to the stressful experience? | 0 | 1 | 2 | 3 | 4 |
| **7** | Avoiding external reminders of the stressful experience (*e.g., people, places, conversations, activities, objects, or situations*)? | 0 | 1 | 2 | 3 | 4 |
| **8** | Trouble remembering important parts of the stressful experience? | 0 | 1 | 2 | 3 | 4 |
| **9** | Having strong negative beliefs about yourself, other people, or the world (*e.g., having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous*)? | 0 | 1 | 2 | 3 | 4 |
| **10** | Blaming yourself or someone else for the stressful experience or what happened after it? | 0 | 1 | 2 | 3 | 4 |
| **11** | Having strong negative feelings such as fear, horror, anger, guilt, or shame? | 0 | 1 | 2 | 3 | 4 |
| **12** | Loss of interest in activities that you used to enjoy? | 0 | 1 | 2 | 3 | 4 |
| **13** | Feeling distant or cut off from other people? | 0 | 1 | 2 | 3 | 4 |
| **14** | Trouble experiencing positive feelings (*e.g., being unable to feel happiness or have loving feelings for people close to you*)? | 0 | 1 | 2 | 3 | 4 |
| **15** | Irritable behavior, angry outbursts, or acting aggressively? | 0 | 1 | 2 | 3 | 4 |
| **16** | Taking too many risks or doing things that could cause you harm? | 0 | 1 | 2 | 3 | 4 |
| **17** | Being “superalert” or watchful or on guard? | 0 | 1 | 2 | 3 | 4 |
| **18** | Feeling jumpy or easily startled? | 0 | 1 | 2 | 3 | 4 |
| **19** | Having difficulty concentrating? | 0 | 1 | 2 | 3 | 4 |
| **20** | Trouble falling or staying asleep? | 0 | 1 | 2 | 3 | 4 |

| Demographics Questionnaire (DQ) | |
|---|---|
| **Instructions:** Below is a list of questions about your identity and life circumstances. Please answer each question to the best of your ability. | |
| **1** | Age: _____ |
| **2** | Gender (circle one): MALE FEMALE OTHER: _____ |
| **3** | Hispanic/Latino(a) ethnicity (circle one): YES NO |
| **4** | Race (circle all that apply):<br>1. Asian or Asian-American<br>2. Black or African-American<br>3. Indigenous American (North, Central, or South American, Pacific Islander)<br>4. White or European-American<br>5. Other: _____ |
| **5** | How would you describe your sexual orientation?<br>1. Heterosexual<br>2. Homosexual<br>3. Other: _____ |
| **6** | How many credit hours of college have you completed? _____ |
| **7** | What languages do you speak? _____ |
| | |

## Cognitive, Affective, and Visual Engagement Assessment Tests (CAVEAT)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **I** | **Instructions:** Mark the choice that best describes your experiences and reactions *during the film*. | | **Not at all** | **Barely** | **Somewhat** | **Mostly** | **Completely** |
| | | | **0** | **1** | **2** | **3** | **4** |
| | **1** | I paid close ***attention*** to the film. | | | | | |
| | **2** | I shared the ***perspective*** of the *victim* (or, *omelet-maker*). | | | | | |
| | **3** | I felt ***empathy*** for the *victim* (or, *omelet-maker*). | | | | | |
| | **4** | I ***identified*** with the *victim* (or, *omelet-maker*). | | | | | |
| **II** | **Instructions:** Mark the choice that best describes your experiences and reactions *during the film*. | | **Not at all** | **Barely** | **Somewhat** | **Mostly** | **Completely** |
| | | | **0** | **1** | **2** | **3** | **4** |
| | **1** | I experienced ***anger***. | | | | | |
| | **2** | I experienced ***joy***. | | | | | |
| | **3** | I experienced ***sadness***. | | | | | |
| | **4** | I experienced ***disgust***. | | | | | |
| | **5** | I experienced ***fear***. | | | | | |

| | | | |
|---|---|---|---|
| **III** | **Instructions:** Mark the choice that best describes your experiences and reactions *during the film*. | | **Answer** |
| | **1** | Estimate the ***number*** of times you ***looked away*** from the screen. If you never looked away, write *zero* (0). | _____ Times |
| | **2** | Estimate the ***number*** of times you ***closed your eyes*** for an extended period of time. If you never closed your eyes, write *zero* (0).<br>***Note:*** Don't include normal eye blinks. | _____ Times |
| | **3** | Estimate the ***number*** of times you ***covered your eyes*** with your clothes, hands, or other body parts. If you never covered your eyes, write *zero* (0). | _____ Times |
| | **4** | Estimate the ***total percentage*** of time (range: 0% to 100%) that you were ***looking directly*** at the screen. | _____ % |

## State/Trait Anxiety Inventory (STAI-S6; Marteau & Bekker, 1992)

**Instructions:** A number of statements which people have used to describe themselves are given below. Read each statement and then mark the most appropriate number to the right of the statement to indicate how you feel *right now, at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

| | | Not at All | Somewhat | Moderately | Very Much |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| **1** | I feel calm | | | | |
| **2** | I am tense | | | | |
| **3** | I feel upset | | | | |
| **4** | I am relaxed | | | | |
| **5** | I feel content | | | | |
| **6** | I am worried | | | | |

*Please make sure that you have answered all the questions.*

| Peritraumatic Dissociative Experience Q. (PDEQ-7; Marmar et al., 1997) | | | | | | |
|---|---|---|---|---|---|---|
| **Instructions:** Please complete the items below by marking the choice that best describes your experiences and reactions *during the film and immediately afterward*. If an item does not apply to your experience, please mark "Not at all true." | | **Not at all true** | **Slightly true** | **Some-what true** | **Very true** | **Extremely true** |
| | | **1** | **2** | **3** | **4** | **5** |
| **1** | I had moments of losing track of what was going on — I "blanked out" or "spaced out" or in some way felt that I was not part of what was going on. | | | | | |
| **2** | My sense of time changed — things seemed to be happening in slow motion. | | | | | |
| **3** | I felt as though I were spectator watching what was happening to me, as if I were floating above the scene or observing it as an outsider. | | | | | |
| **4** | There were moments when my sense of my own body seemed distorted or changed. I felt disconnected from my own body, or it was unusually large or small. | | | | | |
| **5** | I felt as though things that were actually happening to others were happening to me — like I was being trapped when I really wasn't. | | | | | |
| **6** | I felt confused; that is, there were moments when I had difficulty making sense of what was happening. | | | | | |
| **7** | I felt disoriented; that is, there were moments when I felt uncertain about where I was or what time it was. | | | | | |

*Removed items*: The original PDEQ includes 10 items. However, three items were not appropriate due to the laboratory context. These items include:

- I found that I was on "automatic pilot" — I ended up doing things that I later realized I hadn't actively decided to do.
- What was happening seemed unreal to me, like I was in a dream, or watching a movie or play.
- I was surprised to find afterwards that a lot of things happened at the time that I was not aware of, especially things I ordinarily would have noticed.

# APPENDIX D

# SCRIPT ASSESSMENT FORMS AND SCORING KEYS

## Script Assessment (Part 1)

**Instructions:**
Your task is to write ***all*** the steps involved in ***three experiences*** that some people have. You will be given a total of ***three minutes*** to complete this task. Please write in as much detail as possible and include every step from the beginning of each experience to the end of each experience.

The experiences you will write about are (1) ***getting ready for work***, (2) ***shopping for groceries***, and (3) ***going out to dinner***.

| **Topic:** | **Answer:** |
|---|---|
| ***Getting ready for work*** | |
| ***Shopping for groceries*** | |
| ***Going out to dinner*** | |

| Everyday Event Script Scoring Key (Rosen et al., 2003) | | | |
|---|---|---|---|
| | Scripts | | |
| Step | Getting Ready for Work | Shopping for Groceries | Going Out to Dinner |
| 1 | Turn off alarm | Determine items needed | Decide on restaurant |
| 2 | Wake up | Make grocery list | Call and make reservation |
| 3 | Get out of bed | Cut/gather coupons | Take a shower |
| 4 | Go to bathroom | Get in car to go shopping | Get dressed |
| 5 | Brush teeth | Drive/go to store | Get in car |
| 6 | Take a shower | Park car at store | Drive/go to restaurant |
| 7 | Shave | Get shopping cart | Enter restaurant |
| 8 | Get dressed | Enter store | Give name to host/hostess |
| 9 | Style/fix hair | Go down aisles | Wait to be seated |
| 10 | Put on makeup | Shop for groceries | Be seated/go to table |
| 11 | Prepare breakfast | Go to checkout area | Look at dinner menu |
| 12 | Eat breakfast | Put groceries on belt | Order drinks/wine |
| 13 | Read newspaper | Pay cashier | Order dinner/meal |
| 14 | Pack lunch/snacks | Bring bags to car | Make conversation |
| 15 | Gather belongings/keys | Put groceries in car | Eat dinner |
| 16 | Leave house | Drive/go home | Ask for/wait for/get check |
| 17 | Get in car | Unload car | Pay check |
| 18 | Drive/go to work | Put groceries away | Drive/go home |

## Script Assessment (Part 2)

**Instructions:**
Your task is to write ***all*** the steps involved in ***one experience*** that some people have. You will be given a total of ***three minutes*** to complete this task. Please write in as much detail as possible and include every step from the beginning of the experience to the end of the experience.

The experience you will write about is ***male-to-female rape***.

***Important:*** Use your own idea about what "rape" means but describe the steps involved in ***male-to-female*** rape. That is, write about a ***specific but hypothetical*** rape of a female victim by a male perpetrator. Include all the events leading up to the rape, during the rape, and after the rape. Also, include ***characteristics*** of the victim and the perpetrator.

| **Topic:** | **Answer:** |
|---|---|
| ***Male-to-Female Rape*** | |

| Typical Rape Script Scoring Key | | | |
|---|---|---|---|
| **Theme** | **Typical Rape**<br>*Score*: +1 | **N/A**<br>*Score*: 0 | **Atypical Rape**<br>*Score*: -1 |
| **Setting characteristics** | | | |
| Relationship between victim and perpetrator | Stranger (e.g., met that night) | N/A (i.e., no mention of relationship) | Non-stranger (e.g., known previously) |
| Number of perpetrators | One (i.e., use of singular nouns) | N/A (i.e., mixture or singular/plural) | >1 perpetrator or accomplice |
| Location | Public (e.g., parties, school, parks) | N/A (i.e., no mention of location) | Private (e.g., victim knows owner/renter) |
| Barrier contraceptive used | No (i.e., must be explicitly absent) | N/A (i.e., no mention of contraceptive) | Yes (e.g., diaphragm, male/female condom) |
| **Perpetrator characteristics** | | | |
| Physical assault *before* sexual assault | Yes (e.g., attack, push, grab, constrain) | N/A (e.g., rape, inappropriate) | No (i.e., must be explicitly absent) |
| Physical assault *during* sexual assault | Yes (e.g., attack, push, grab, constrain) | N/A (e.g., rape, inappropriate) | No (i.e., must be explicitly absent) |
| Threats of physical assault (anytime) | Yes (e.g., "don't scream or I'll…") | N/A (e.g., coercive or "slimy" talk) | No (i.e., must be explicitly absent) |
| Possession of weapon | Yes (e.g., knife or gun) | N/A (e.g., sedatives) | No (i.e., must be explicitly absent) |
| Yelling or derogatory language | Yes (e.g., says shut up, calls victim a slut) | N/A (e.g., coercive "slimy" talk) | No (i.e., must be explicitly absent) |
| Vaginal or anal penetration with penis | Yes (e.g., inside/into victim) | N/A (e.g., rape, have sex, assault) | No (i.e., must be explicitly absent) |
| Sexual pleasure experienced | Yes (e.g., enjoys, likes it, orgasm) | N/A (e.g., finishes sexual assault) | No (i.e., must be explicitly absent) |
| **Victim characteristics** | | | |
| Alone when contacted by perpetrator | Yes (e.g., left party/bar alone) | N/A (i.e., initial contact not explicit) | No (e.g., victim with friends at bar/party) |
| Screams/yells/cries to get help | Yes (e.g., nonverbally screams, yells help) | N/A (e.g., gets help after, calls police) | No (i.e., must be explicitly absent) |
| Unambiguous verbal requests to stop | Yes (e.g., says no) | N/A (e.g., fights back) | No (i.e., must be explicitly absent) |
| Attempts to physically resist | Yes (e.g. fights back) | N/A (e.g., says no) | No (i.e., must be explicitly absent) |
| Crying | Yes (e.g., teary eyed, bawling) | N/A (e.g., sad, upset, in shock) | No (i.e., must be explicitly absent) |
| Sexual pleasure experienced | No (i.e., must be explicitly absent) | N/A (e.g., gives up resistance) | Yes (e.g., enjoys, likes it, orgasm) |
| | | | |

# APPENDIX E

# COMPARISONS BETWEEN FILM STOPPERS VS. NON-STOPPERS

Table 12

*Comparisons Between Film Stoppers vs. Non-Stoppers*

| Variable | Group Statistics | | | | *t*-test for Equality of Means | | |
|---|---|---|---|---|---|---|---|
| | Group | *n* | *M* | *SD* | *t* | *df* | *p* |
| **Prior Film Exposure Questionnaire, Torture-Porn Scale** | Non-Stoppers | 73 | 7.53 | 3.20 | 2.09 | 99 | *.040* |
| | Stoppers | 28 | 6.07 | 3.04 | | | |
| **PCL-5** (PTSD Symptoms) | Non-Stoppers | 73 | 9.37 | 7.91 | -0.41 | 99 | .683 |
| | Stoppers | 28 | 10.11 | 8.53 | | | |
| **Everyday Event Scripts** | Non-Stoppers | 73 | 12.45 | 4.10 | 1.03 | 99 | .305 |
| | Stoppers | 28 | 11.46 | 4.83 | | | |
| **Typical Rape Scripts** | Non-Stoppers | 73 | 2.45 | 1.91 | 0.41 | 99 | .886 |
| | Stoppers | 28 | 2.39 | 1.73 | | | |
| **STAI-S6** (State Anxiety) | Non-Stoppers | 73 | 16.16 | 4.76 | -1.94 | 99 | *.055* |
| | Stoppers | 28 | 18.18 | 4.41 | | | |
| **PDEQ-7** (State Dissociation) | Non-Stoppers | 73 | 10.62 | 3.71 | -0.36 | 99 | .723 |
| | Stoppers | 28 | 10.93 | 4.55 | | | |
| **CAVEAT: Anger** (Irréversible) | Non-Stoppers | 73 | 2.77 | 1.34 | -1.71 | 99 | *.091* |
| | Stoppers | 28 | 3.25 | 1.08 | | | |
| **CAVEAT: Joy** (Irréversible) | Non-Stoppers | 73 | 0.08 | 0.43 | 1.00 | 99 | .319 |
| | Stoppers | 28 | 0.00 | 0.00 | | | |
| **CAVEAT: Sadness** (Irréversible) | Non-Stoppers | 73 | 2.74 | 1.23 | -1.37 | 99 | .175 |
| | Stoppers | 28 | 3.11 | 1.17 | | | |
| **CAVEAT: Disgust** (Irréversible) | Non-Stoppers | 73 | 3.59 | 0.76 | -1.79 | 99 | *.077* |
| | Stoppers | 28 | 3.86 | 0.36 | | | |
| **CAVEAT: Fear** (Irréversible) | Non-Stoppers | 73 | 1.79 | 1.43 | -1.06 | 99 | .291 |
| | Stoppers | 28 | 2.14 | 1.58 | | | |
| **Percentage of Time Looking at Screen** (Irréversible) | Non-Stoppers | 73 | 94.16 | 9.04 | 0.87 | 99 | .386 |
| | Stoppers | 28 | 92.18 | 12.94 | | | |
| **Age** | Non-Stoppers | 73 | 19.44 | 1.82 | -1.16 | 99 | .248 |
| | Stoppers | 28 | 19.89 | 1.60 | | | |

*Notes*. To reduce the likelihood of a Type 1 Error resulting from 13 simultaneous comparisons, a Bonferroni correction was used to adjust the conventional .05 *p*-value to .004 (.05/13). Before conducting each independent samples *t*-test, a Levene's test was conducted to test at the 0.05 level the null hypothesis that that the variances of the two populations from which the samples were drawn are equal. The null was rejected for joy, $F(1, 99) = 4.26$, $p = .042$, which was likely due to floor effects of the stoppers. Additionally, the null was rejected for disgust, $F(1, 99) = 12.63$, $p = .001$, which was likely due to ceiling effects for the stoppers.

# APPENDIX F

# EVENT SEGMENTATION TASK INSTRUCTIONS

**Event Segmentation Task Instructions**

1. **Instructions for practice trial of non-stressful event segmentation task:** "The next part of this study involves you watching some films. First, I want to remind you that participation in this study is voluntary and you may discontinue watching any of the films at any time without penalty. You can choose to stop the film by pressing this button – the one labeled 'stop.' Okay, now I'm going to tell you what you're going to be doing while watching this film. While watching each film on this monitor, you're going to press the spacebar of this keyboard after each *meaningful unit of activity* ends and another *meaningful unit of activity* begins. We want you to indicate the *smallest* units that you find meaningful. Okay, let's begin. I'll be standing in the hallway but looking at you through the window.
    - **Shaping feedback during practice trials:** If the participant presses the spacebar fewer than six times, tell the participant: "We need to complete the task one more time, but this time indicate a few more meaningful units of activity."
    - **Response to any question on the task:** If the participant asks for clarification on how to complete the task, tell the participant: "While watching each film, press spacebar after each *meaningful unit of activity* ends and another *meaningful unit of activity* begins. We want you to indicate the *smallest* units that you find meaningful. Let's see how you do on this first film."
2. **Instructions for non-stressful event segmentation task:** "Thanks for your effort on the first film. The second film is going to be a little bit longer. Remember that the stop button is available. Also, remember to press the spacebar after each meaningful unit of activity ends. Indicate the smallest units that you find meaningful. Okay, let's begin."
    - **Returning with questionnaire packet:** "Alright, before you watch the next film, I would like you to complete this small questionnaire packet. When you're done, place the questionnaire packet in this tray."
3. **Instructions for stressful event segmentation task:** "Thanks again for your effort thus far. We have one more film. Remember that the stop button is available. And, like before, remember to press the spacebar after each meaningful unit of activity ends. Indicate the smallest units that you find meaningful. Okay, let's begin."
    - **Returning with questionnaire packet:** "Thanks again for your effort. [If "stop" button pressed: "It's perfectly fine that you wanted to stop watching the film."] I would now like you to complete this small questionnaire packet. When you're done, place the questionnaire packet in the tray."

# APPENDIX G

# EVENT RECALL TASK

| Event Recall Task |
| --- |
| **Write everything that happened in the film.**<br>**Include as much detail as possible and use the same order of actions.**<br>**You will be given seven minutes.** |
| |

# APPENDIX H

# RECOGNITION MATERIALS (*IRRÉVERSIBLE*)


Target
Foil
Target
Foil
1
2
3
4
5
6
7
8
9
10


Target
Foil
Target
Foil
11
12
13
14
15
16
17
18
19
20

# APPENDIX I

# INFORMED CONSENT FORM

## Informed Consent Form

I agree to participate in the research project titled "Understanding Stressful Experiences" being conducted by Andrew M. Sherrill, M.A., a graduate student in the clinical psychology program at Northern Illinois University (NIU), under the supervision of Joe Magliano, Ph.D. and Michelle Lilly, Ph.D., faculty members of NIU's psychology department. I have been informed that the purpose of the study is to better understand how individuals process and understand stressful experiences.

I understand that if I agree to participate in this study, I will be asked to answer several questionnaires that will take approximately 30 minutes to complete. Next, I will be asked to watch several short films that vary in the extent that they depict violent events and brief nudity. While watching these films, I will make judgments that reflect how I am understanding the films. Lastly, I have been informed that after I watch each film, I will be asked about my understanding of each film. In total, participation may last from 90 minutes to 120 minutes.

I am aware that my participation is voluntary and may be withdrawn at any time without penalty or prejudice. In addition, I am aware that if I have any questions concerning this study, I may contact Dr. Joe Magliano at 815-753-0805 or Dr. Michelle Lilly at 815-753-4602. I understand that if I wish further information regarding my rights as a research subject, I may contact the Office of Research Compliance at NIU at 815-753-8588.

I understand that the intended benefit of this study is to advance the field of psychology by identifying problematic cognitive processes that often result from stressful experiences. I have been informed that the potential risk I could experience during this study include possible discomfort associated with viewing graphic material. I have been informed that I can stop the film at any point by pressing a button labeled "stop." I understand that all information gathered during this experiment will be kept confidential. I realize that NIU does not provide compensation or insurance for injury or illness incurred as a result of participation in NIU-sponsored research projects.

I hereby state that I am 18 years or older. I understand that my consent to participate in this project does not constitute a waiver of any legal rights or redress I might have as a result of my participation. Lastly, I acknowledge that I have received a copy of this consent form.

_____

Signature of Subject Date

_____

Signature of Witness Date

# APPENDIX J

# POSITIVE MOOD INDUCTION STORY

**Positive Mood Induction Story**

*Instructions*: Below is a story rated as one of the most uplifting stories of 2011. This story is intended to promote a positive mood in the reader. Please read the story while feeling positive.

**Grandmother graduates college after 42 years**
Thursday was the graduation day a Hamden grandmother has been looking forward to for 42 years. Dora Anne Council, 76, was among the 870 graduates to receive their diplomas at Gateway Community College Thursday night.

"They said, 'Grandma, you're one of a kind.' But I'm not one of kind because all you have to do is want something bad enough," Council said.

In 1969, she first enrolled in what was then called South Central Community College. Shortly after, she decided to put her education on hold to help support her family.

"I wanted to go to college when I was young, but I knew I couldn't because I had to get a job," Council said. "I lucked out and got a job as a telephone operator and that was a good accomplishment."

Thirty years later, she decided it was time to go back to school, and she had the full support of her family when she went back to what is now Gateway Community College.

"I told her, 'Look mom, you want to go back. It's your turn now,'" her son, Jimmy-Lee Moore, said. "Hey, I have the money, I'll pay for whatever you need. You let me know."

On Thursday night, Council sat amongst her classmates, most of whom are around the same age as her grandchildren.

"They think I'm so smart. I said, 'I'm no smarter than you are,'" Council said. "The answers are in the book."

When Dora's name was called out, there was a huge round of applause.

"It feels wonderful! Wonderful! Wonderful!" she exclaimed following graduation. She received an associate degree in general studies.

# APPENDIX K

# DEBRIEFING FORM

**Debriefing Form**

Thank you for participating in our study!

As you will recall, the purpose of the study is to better understand how individuals process and understand stressful experiences. This information could be used to develop more effective psychotherapies for individuals with histories of stressful and traumatic experiences. Your participation in this project will help us advance our understanding of the origins of debilitating conditions like posttraumatic stress disorder (PTSD).

For further reading on the topic of memories of stressful experiences, please see:

Brewin, C. R. (2011). The nature and significance of memory disturbance in posttraumatic stress disorder. *Annual Review of Clinical Psychology, 7*, 203-227.

Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. *Acta Psychologica, 127*, 553-566. doi:10.1016/j.actpsy.2007.11.002

Zacks, J. M., & Sargent, J. Q. (2010). Event perception: A theory and its application to clinical neuroscience. *The Psychology of Learning and Motivation, 53*, 253-299. doi:10.1016/S0079-7421(10)53007-

The information you provided in this study will be stored in a secure database and filing cabinet. You will receive credit for PSYC 102 via SONA Systems following your participation. Please keep this sheet for documentation of your participation. Again, if you have any questions about this study, please contact either Dr. Joe Magliano (815-753-0805 or jmagliano@niu.edu) or Dr. Michelle Lilly (815-753-4602 or mlilly1@niu.edu). If you have questions about your rights as a research participant, contact the Office of Research Compliance at 815-753-8588 or via email at researchcompliance@niu.edu.

Thank you!

# APPENDIX L

# COUNSELING RESOURCES IN DEKALB

## Counseling Resources in DeKalb

DeKalb and Northern Illinois University are fortunate in having several free or low-cost counseling services available to the community. This list is intended to help you find timely and appropriate assistance. Sometimes one agency will have a high demand for services that necessitates a waiting period for new clients, or you may have personal reasons for choosing one agency over another. Counselors at any of these agencies will gladly assist you in making a final decision about where to seek help.

***CAMPUS SERVICES***

**COUNSELING AND STUDENT DEVELOPMENT CENTER**
*Phone*: 815-753-1206
*Address*: Campus Life Building – 200
*Fees*: None for counseling, modest testing fees.
*Hours*: Monday–Friday 8:00 am–4:30 pm; open whenever NIU is open, including breaks
*Description of Services*: This service provides students with short-term, individual and group counseling for a broad range of personal concerns. Career counseling services include interest assessment, workshops, and use of computerized career counseling programs. Educational counseling services include assistance with test anxiety and study skills. Assessments of drug and alcohol abuse are also provided. First appointment scheduled within 3-7 days.

**COUNSELING LABORATORY**
*Phone*: 815-753-9312
*Address*: 416 Graham Hall
*Fees*: None for students, faculty, or staff.
*Hours*: Call for available counseling hours.
*Description of Services*: A wide range of services is offered by the counselors including both personal and vocational counseling. In general, the approach used is one that promotes growth and focuses on increasing emotional well-being and self-awareness. All counselors are either doctoral or masters level students who are being supervised by members of the counseling faculty. First appointments scheduled within 3-5 days.

**FAMILY CENTER**
*Phone*: 815-753-1684
*Address*: 429 Garden Road
*Fees*: $5.00 per session fee for students; faculty, staff, and community members charged on a sliding scale; no one will be denied services due to inability to pay.
*Hours*: Wednesday 2:00 pm–10:00 pm; Thursday 10:00 am–10:00 pm; by appointment Monday through Friday; open whenever NIU is open, including breaks.
*Description of Services*: Individual, couple, and family counseling. Services provided by graduate students under the supervision of Marriage and Family Therapy faculty. First appointment scheduled within 4 days.

**PSYCHOLOGICAL SERVICES CENTER**
*Phone*: 815-753-0591
*Address*: Normal Road and Lincoln Hwy
*Fees*: No fee for students; faculty, staff, and community members charged on a sliding scale.
*Hours*: Monday 12:00 pm–8:00 pm; Tuesday 11:00 am–7:00 pm; Wednesday–Friday 9:00 am–5:00 pm; open whenever NIU is open, including breaks
*Description of Services*: Individual, couples, family, and group psychotherapy, Intellectual, personality, and academic assessments. Clients are generally seen by advanced level graduate student staff under faculty supervision. Services tailored to meet a client's specific needs.

**UNIVERSITY RESOURCES FOR WOMEN**
*Phone*: 815-753-0320
*Address*: 105 Normal Road
*Fees*: No fee for students, faculty or staff
*Hours*: Monday – Friday 8:00 am – 4:30 pm; evening hours by appointment; open whenever NIU is open, including breaks.
*Description of Services*: Short-term counseling to individuals about their academic progress, careers, personal development, and other special concerns. Offered also are support groups, information and referral, issues regarding workplace disputes, and issues involving sexual harassment.

***COMMUNITY RESOURCES***
**BEN GORDON COMMUNITY MENTAL HEALTH CENTER**
*Phone*: 815-756-4875 and 1-866-242-0111 (*Crisis Line*)
*Address*: 12 Health Services Drive – DeKalb
*Fees*: Sliding fee scale based on income. Insurance accepted.
*Hours*: Monday-Thursday: 8:00 am–8:30 pm Friday: 8:00 am–5:00 pm
*Description of Services*: Comprehensive counseling services to all residents of DeKalb County. Services to all persons affected by mental health problems, substance abuse, family/child welfare concerns. 24-hour sexual assault/abuse services can be accessed through the Crisis Line. First appointment scheduled within 30 days.

**FAMILY SERVICE AGENCY, CENTER FOR COUNSELING**
*Phone*: 815-758-8636
*Address*: 14 Health Services Drive – DeKalb
*Fees*: $75.00 per visit, insurance accepted, including NIU Student Insurance, payment plans and scholarship funds available.
*Hours*: Monday–Wednesday: 9:00 am–8:00 pm, Thursday–Friday: 8:00 am–4:00 pm, additional hours available by appointment.
*Description of Services*: Individual, couple, group counseling for children, adults, senior citizens, and families. First appointment scheduled within 1-7 days.

**Private counselors, clinical social workers, and psychologists are available in the yellow pages of the phone book under "Psychologist" or "Mental Health Services. "**

# APPENDIX M

# EXPLICIT EVENTS OF *BIG NIGHT*

## Explicit Events of *Big Night*

| **Stanley Tucci "Egg Cooker" Events (including fine-grained subcomponents)** | |
|---|---|
| **ST1** | Enter room from main door (walk through door, stop after several feet, look around, rub eyes) |
| **ST2** | Get eggs (reach for bowl of eggs, remove bowl from shelf, walk to counter, place bowl on counter) |
| **ST3** | Get pan (reach for pan, take pan off rack, place pan on stove) |
| **ST4** | Communicate with MA (ST: "Are you hungry?" MA: nonverbal communication, ST: "I'll do it") |
| **ST5** | Ignite stove (reach for knob, turn knob, adjust flame) |
| **ST6** | Oil pan (reach/pick-up oil, pour oil, put oil down) |
| **ST7** | Crack eggs (reach for individual eggs, lift eggs from bowl, crack eggs, throw eggshells away) |
| **ST8** | Scramble eggs (reach/pick-up fork, place fork in bowl of unshelled eggs, scramble, remove fork, put fork down) |
| **ST9** | Season eggs (reach for seasoning, pinch seasoning, put seasoning in eggs) |
| **ST10** | Cook eggs (put eggs in pan, adjust flame, reach/pick-up spatula, manipulate/flip eggs, put down spatula, turn off stove) |
| **ST11** | Gather table setting for ST and MA (walk to cupboard, reach/pick-up 2 forks, reach/pick-up 2 plates) |
| **ST12** | Set table for ST and MA (walk to main table, place 2 forks on table, place 2 plates on table) |
| **ST13** | Serve eggs to ST and MA (reach/pick-up pan, reach/pick-up spatula, walk to table, divide eggs, serve eggs on 2 plates) |
| **ST14** | Place remaining eggs on stove (flip remaining eggs, puts spatula in pan, place the pan on the stove) |
| **ST15** | Serve bread to ST and MA (reach/pick-up bread, place bread on MA's plate, give MA plate, break bread for ST) |
| **ST16** | Sit down at table (pull chair out, sit down, scoot chair in) [before/after TS] |
| **ST17** | Eat breakfast (reach/pick-up fork, eat eggs with fork, reach/pick-up bread, eat bread with hand) [before/after TS] |
| **ST18** | React to TS's entrance (turn head toward TS, look at TS, maintain stare at TS) |
| **ST19** | Gather table setting for TS (walk to cupboard, reach/pick-up 1 fork, reach/pick-up 1 plate) |
| **ST20** | Set table for TS (walk to table, place 1 fork on table, place 1 plate on table) |
| **ST21** | Serve eggs to TS (reach/pick-up pan with eggs and spatula, serve eggs on 1 plate, place pan/spatula on stove) |
| **ST22** | Serves bread to TS (reach for and put bread into basket, place basket near TS's seat) |
| **ST23** | Hug TS (look at TS eating, put arm around TS, remove arm from TS) |
| **Marc Anthony "Egg Eater #1" Events (including fine-grained subcomponents)** | |
| **MA1** | Sleep (lay on table, keep eyes closed) [note: this could be a description, but since it ends we're counting it as an event] |
| **MA2** | Wake up (open eyes, look around, sit up, stretches neck) |
| **MA3** | Nod in affirmative to ST's question (look at ST when spoken to, nod) [note: MA doesn't say "yes" or anything else] |
| **MA4** | Get off table (swing legs over table edge, slide off table, stand on floor) |
| **MA5** | Stretch body (walk around room, stretch back, stretch legs using corner table for support) |
| **MA6** | Get bread (reach for and gather bread from corner table, walk to table, place bread on table) |
| **MA7** | Kneel/squat near table (walk next to table, drop down to knees or squat, place elbows on table) ["sitting" okay too] |
| **MA8** | Look at ST cooking |
| **MA9** | Sit on butcher block (stand up, walk to butcher block, climb onto butcher block) |
| **MA10** | Snack on piece of bread (reach for and pick up bread from basket, eat bread) |
| **MA11** | Say thank you to ST (reach for and grab plate with eggs from ST, "grazie") |
| **MA12** | Eat breakfast (eat eggs with fork, build eggs sandwich, eat egg sandwich) |
| **MA13** | Look at ST and TS hug |
| **MA14** | Get off butcher block (slide off table, stand on floor) |
| **MA15** | Leave kitchen (walk to exit door, walk through exit door) |
| **Tony Shalhoub "Egg Eater #2" Events (including fine-grained subcomponents)** | |
| **TS1** | Enter room from exit door (walk through door, stop after several feet, look around, touch pants, touch pasta maker) |
| **TS2** | React to ST's stare (briefly look at ST, divert additional eye contact) |
| **TS3** | Move chair to table (reach/pick-up chair, walk to table, place chair in front of table) |
| **TS4** | Sit down at table (sit down, scoot chair in) |
| **TS5** | Eat breakfast (reach/pick-up fork, eat eggs with fork, reach/pick-up bread, eat bread with hand) |
| **TS6** | Hug ST (put arm around ST, remove arm from ST) |

# APPENDIX N

# EXPLICIT EVENTS OF *IRRÉVERSIBLE*

## Explicit Events of *Irréversible*

| **Jo Prestia "Perpetrator" Events (including fine-grained subcomponents)** | |
|---|---|
| **JP1** | Enter hallway (walk into hallway, stop after about ten feet) |
| **JP2** | Pin C against wall (push C's back against wall, step immediately in front of C) |
| **JP3** | Assault C (choke C, slap C, punch C, knee C, bring C to ground, drag C) |
| **JP4** | Speak to C (yell [not talk] at C while pointing) |
| **JP5** | Look a V (look at/attends to/notices V while attacking C, maintain eye contact with V) [note: do not include "realize"] |
| **JP6** | Chase V (chase V to foreground, chase V to background, chase V to foreground) |
| **JP7** | Pin V against wall (push V's front against wall, trap V with arms, shove V's back against wall, grab arms) |
| **JP8** | Speak to V (talk to V including threats and offensive language, yell at V) |
| **JP9** | Threaten V with knife (take out knife, hold knife near V's face/neck, touch knife to V's face/neck, put knife in pocket) |
| **JP10** | Look at V's body (looks down V's body, looks up V's body) |
| **JP11** | Grope V (grope buttocks, breasts, and other body parts as she's pinned against wall and on the ground) |
| **JP12** | Kiss V (kiss V's neck while she is pinned against wall and on the ground) |
| **JP13** | Bring V to ground (grab V's head, pull down V's head, hold knife behind V's head, straddle V, push V body to ground) |
| **JP14** | Lay on V (drop P's torso onto V's torso) |
| **JP15** | Cover V's mouth (cover V's mouth with hand, block V's attempt to stop him) |
| **JP16** | Lift V's dress (reach for V's dress, grab dress, lift up dress to expose naked body, block V's resistance) |
| **JP17** | Remove V's top (reach for knot of V's dress top, untie knot, pull down to) |
| **JP18** | Remove V's underwear (reach for V's underwear, grab underwear, stretch/pull down underwear, block V's resistance) |
| **JP19** | Take out penis (subtle/off-screen: unbutton/unzip pants, grab penis, pull penis out of pants) |
| **JP20** | Penetrate ["rape" in correct context] V's vagina/anus (subtle/off-screen: grab P's penis, place near V's orifice, thrust) |
| **JP21** | Lubricate P's penis (lick P's hand, subtle/off-screen: apply saliva to P's penis) |
| **JP22** | Grab V's hair (reach for V's hair, grab hair, pull hair/head backward) |
| **JP23** | Get off V / Finish or disengage penetration (hands on ground, push up torso, subtle/off-screen: disengage penetration) |
| **JP24** | Sit down (use hands to walk off V's body, sit on ground) |
| **Monica Bellucci "Main Victim" Events (including fine-grained subcomponents)** | |
| **MB1** | Walk down hallway (walk down hallway, walk near/past/by P and C, stop when P attacks C) |
| **MB2** | Look at P and C (look at P assault C, gasp, maintain staring at P assault C) [note: do not include "realize"] |
| **MB3** | Run from P (run to foreground, run to background, run to background) |
| **MB4** | Scream (scream in Italian [assuming "help" does not count as an inference] while running from P and during assault) |
| **MB5** | Shove/push P (place hands on P's chest, push P away) |
| **MB6** | React to knife (stare at knife, close eyes, become quiet, look up hallway, look down hallway) |
| **MB7** | Attempt to escape (slide down/up wall while at knifepoint, attempt to push and crawl away when brought down) |
| **MB8** | Cry (sob/tear/cry throughout assault) |
| **MB9** | Speak to P (talk in French [assuming "no" or "stop" does not count as an inference] during assault) |
| **MB10** | Attempt to block P from touching her body (push away P's hands from buttocks and other body parts) |
| **MB11** | Attempt to block P from removing clothes (push away P's hand from lifting dress, removing underwear, and untied top) |
| **MB12** | Attempt to peel away P's hand from V's mouth (grab P's hand, dig fingernails into P's hand) |
| **Jara Millo "Escaped Victim" Events (including fine-grained subcomponents)** | |
| **JM1** | Enter hallway (walk into hallway, stop after about ten feet) |
| **JM2** | Speak to P (talk to P while walking into hallway, yell at P after being pinned against wall) |
| **JM3** | Scream (scream in Spanish [assuming "help" does not count as an inference] while being attacked by P) |
| **JM4** | Attempt to escape (grab P's arms, restrain P's arms from additional hits, crawl away) |
| **JM5** | Leave hallway (crawl toward exit, stand up, run out of hallway) |
| **Unaccredited Actor "Bystander" Events (including fine-grained subcomponents)** | |
| **UA1** | Enter hallway (walk into hallway, stop after about ten feet) |
| **UA2** | Look at P and V (look at P assault V, maintain staring, does not intervene or get help) [note: do not include "realize"] |
| **UA3** | Leave hallway (turn around, walk out of hallway) |