Journal of Anxiety Disorders 26 (2012) 225–232

Contents lists available at SciVerse ScienceDirect

Journal of Anxiety Disorders

The effects of dissociation on information processing for analogue trauma and neutral stimuli: A laboratory study

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ARTICLE INFO

Article history:
Received 4 July 2011
Received in revised form 2 November 2011
Accepted 7 November 2011

Keywords:
Dissociation
Attention
Explicit memory
Implicit memory

ABSTRACT

This study investigated the effects of high and low levels of dissociation on information processing for analogue trauma and neutral stimuli. Fifty-four undergraduate females who reported high and low levels of trait dissociation were presented with two films, one depicting traumatic events, the other containing neutral material. Participants completed a divided attention task (yielding a proxy measure of attention), as well as explicit memory (free-recall) and implicit memory (word-stem completion) tasks for both films. Results indicated that the high DES group showed less attention and had poorer recall for the analogue trauma stimuli, relative to the neutral stimuli and the low DES group. These findings suggest that high levels of trait dissociation are associated with reductions in attention and memory for analogue trauma stimuli, relative to neutral stimuli and relative to low trait dissociation. Implications for the role of cognitive factors in the etiology of negative post-trauma responses are discussed.

Historically, dissociation has featured prominently in writings about emotional adaptation following traumatic events. Pierre Janet was the first to highlight the importance of dissociation and to discuss how dissociation could be both adaptive and maladaptive as a means of coping with traumatic events. In particular, dissociation has been linked with fundamental alterations in attention and memory, which can be psychologically protective as well as damaging (Putnam, 1989). Recently, interest in dissociation has increased, as investigators have recognized that dissociation during a traumatic event (termed *peritraumatic dissociation*) possibly is associated with increased likelihood and severity of posttraumatic stress disorder symptoms, presumably owing to disturbances in cognitive processing during the traumatic event (e.g., Gershuny & Thayer, 1999; Ozer, Best, Lipsey, & Weiss, 2003). Although considerable attention has been paid to dissociation in general (Giesbrecht, Lynn, Lilienfeld, & Merckelback, 2008), there have been relatively few empirical tests of dissociation in the context of processing trauma cues.

Conceptually, there are many definitions of dissociation. Most of these definitions agree that dissociation is a type of cognitive processing that interferes with successful integration of material which normally is encoded under deliberate, conscious awareness (DePrince & Freyd, 2007). Beyond this basic tenant, theorists differ widely with respect to the amount of interference or integration that is necessary to meaningfully conceptualize trauma-related dissociation. Although the wide range of definitions may be one reason that the literature on dissociation has reached widely disparate conclusions (Giesbrecht et al., 2008; Van der Hart, Nijenhuis, Steele, & Brown, 2004), it also is notable that dissociation has been conceptualized as a state, as a taxon, and as a trait (DePrince & Freyd, 2007). Peritraumatic dissociation is one example of state dissociation, which authors have suggested may reflect transient emotional processes such as fear of dying or panic (DePrince & Freyd, 2007). In contrast, taxon conceptualizations view dissociation as a pathological response to trauma, thus excluding non-pathological forms of dissociation such as day-dreaming (Waller, Putnam, & Carlson, 1996; Waller & Ross, 1997). The taxon view of dissociation assumes that trauma-induced forms of dissociation are distinct from more typical alterations in consciousness. Conceptualizations of dissociation as a trait suggest that dissociation is an individual difference factor, which exists on a continuum, shows stability across situations, and can be assessed using measures such as the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986). Despite considerable conceptual discussion of dissociation, there have been only a handful of empirical studies designed to examine whether dissociation as a trait influences how traumatic material is processed.

To date, most studies that have focused on information processing associated with dissociation have selected individuals based on high and low scores on the DES. Although some authors have suggested that the study of extreme groups is not an optimal research strategy (e.g., MacCallum, Zhang, Preacher, & Rucker, 2002), this approach has been used extensively to study the impact of dissociation on cognitive processes and represents an initial starting point in this literature. Freyd, Martorello, Alvarado, Hayes, and Christman

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doi:10.1016/j.janxdis.2011.11.003

(1998) selected participants who scored high and low in trait dissociation using the DES and administered a standard Stroop task to examine the effects of dissociation on attentional processing. High DES participants showed greater Stroop interference than low DES participants, indicating disruption in consciously controlled attention. DePrince and Freyd (1999) extended this study, adding emotional Stroop words reflecting a sexual assault (in order to utilize trauma-relevant stimuli) and examined selective versus divided attention, as well as memory recall. The results replicated Freyd et al. (1998) with respect to standard Stroop administration. Under selective attention instructions, high DES participants' reaction times were slower, relative to divided attention instructions, suggesting that individuals with higher levels of trait dissociation have greater experience with divided attention. As well, high DES participants recalled fewer assault-related words and more neutral words than the low DES group on a free-recall task, suggesting that the cognitive processes underlying dissociation may disrupt memory retrieval processes for trauma-related information. de Ruiter, Phaf, Veltman, Kok, and Van Dyck (2003) extended these findings, using an event-related potential paradigm. In this study, participants completed a letter detection task using both threatening and neutral words. As an additional stimulus feature, words were selected based on their affective valence, which was intended to divide participants' attention and facilitate dissociative processes. Their results suggest that individuals with high dissociation outperformed individuals with low dissociation on the letter detection task, despite the affective stimuli. These results provide evidence of enhanced attentional processing under conditions of both selected and divided attention for individuals high in dissociation. Noting that there may be a bidirectional association between attention and working memory (e.g., Downing, 2000), de Ruiter, Phaf, Elzinga, & Van Dyck, 2004) examined verbal working memory span among college students scoring in the low, medium, and high ranges of trait dissociation. Their results indicated that individuals with high dissociation showed a significantly larger verbal working memory span relative to individuals scoring in the medium to low range of this trait. These authors suggest that high levels of dissociation may be associated with superior explicit memory retrieval processes, as a result of enhanced attentional processing.

Together, the above studies document that changes in attention and memory are associated with high levels of trait dissociation. More importantly, these findings suggest that attentional context may play a critical role in the conditions under which trauma-related information is encoded and recalled. The results from these studies however are mixed. With respect to attention, DePrince and Freyd (1999) found that high DES participants showed disruptions in processing under selective attention conditions, but enhanced processing under divided attention conditions when presented with trauma-relevant stimuli. In contrast, de Ruiter et al. (2003) found that high levels of dissociation facilitated both selective and divided attention for threatening stimuli, relative to low levels of dissociation. With respect to memory, one study suggests that individuals with high DES scores showed greater disruptions in retrieval processes for trauma-relevant words, relative to individuals with low DES scores (DePrince & Freyd, 1999), while a second study suggested that individuals with high DES scores have larger working memories in general, relative to individuals with low DES scores (de Ruiter et al., 2004). When considering these findings, it is possible that variation in these results reflects differences in methodology, suggesting that continued study of this issue is warranted.

From a theoretical standpoint, dual representation theory (Brewin, Dalgleish, & Joseph, 1996) provides a clear discussion of dissociation and its hypothesized effects on attention and memory for trauma stimuli. According to this theory, individuals who are prone to dissociation will prematurely inhibit the processing of conceptual information (e.g., meaning) of a traumatic event. Incomplete processing is likely to lead to an increase in attentional biases and impaired conceptual memory for trauma material, which is reflective of efforts to avoid verbally accessible memories and images of the traumatic event. Furthermore, when conceptual information fails to be processed, information processing is limited to perceptual information such as sensory stimuli of the event. Dual representation theory postulates that dissociation should not interfere with the recall of perceptual trauma material (e.g., color, smell) because this information is implicitly encoded and automatically retrieved from situationally accessible memories. Thus, given that dissociation tends to be focused on deliberate efforts to avoid threatening material, it should not influence incidental learning, as is typically assessed via implicit memory.

As recognized previously, there is mixed empirical support for disturbances in attention and memory for emotion-based stimuli among individuals scoring high in trait dissociation (Giesbrecht et al., 2008). Unfortunately, most of this work has not used stimuli that evoke high levels of distress, as is relevant for understanding trauma exposure. This leaves unanswered questions about whether the observed changes in attention and memory that have been noted among individuals high in trait dissociation could be relevant when processing trauma material. When trauma-related stimuli are used, single-words have served as stimuli, which may be processed differently from multi-dimensional video or audio stimuli that unfold as a participant experiences them. Some authors further suggest that to effectively assess memory recall, information processing should be activated with stimuli that closely resemble real-life circumstances, as opposed to single-words (Radomsky & Rachman, 1999). Moreover, much of this literature has not considered the role of potential confounds, including prior trauma exposure and current negative mood states, as these variables may influence laboratory responding (Giesbrecht et al., 2008). In the present study, individuals who reported high and low levels of trait dissociation, based on their DES scores, were selected for participation. An extreme group design permitted comparability of the results with previously published studies. To examine the association between trait dissociation and information processing, participants were presented with analogue trauma and neutral film stimuli in a controlled laboratory environment. Previous studies have documented that film stimuli can successfully produce a large array of emotions and elicit responses that are typical to those seen in more naturalistic environments (Carleton, Sikorski, & Asmundson, 2010; Davies & Clark, 1998; Horowitz, 1975; Philippot, 1993). Within the trauma literature, several authors have relied on film stimuli as trauma analogs, noting that this manipulation can create intrusive and repetitive thoughts about the film and thus, mirror actual trauma exposure (e.g., Carleton et al., 2010; Davies & Clark, 1998; Horowitz, 1975). Previous work has illustrated that although this methodology creates distress, its effects are not long-lasting (Palyo, 2008), which makes it well suited for this type of study. In an effort to disentangle trauma exposure and current negative mood states from dissociative style, these variables served as covariates.

In accordance with related work in the anxiety disorders arena (Coles & Heimberg, 2002), both explicit and implicit memory were assessed. Explicit memory represents deliberate, effortful retrieval of information and often is assessed using free-recall or recognition tasks. Implicit memory represents retrieval of information that is learned incidentally as an indirect effect of experience and is assessed without directions for participants to try to retrieve information (Coles & Heimberg, 2002). The current study used a paradigm in which a priming stimuli that shared no physical features with the testing cue was used to assess implicit memory. This type of priming facilitates processing of conceptual features of the stimulus, as opposed to processing perceptual stimuli

features and was intended to measure implicit retrieval of stimuli. For the present study, the film clips served as priming stimuli and incomplete word-stems based on content from each film were used as testing cues to assess implicit memory. Although the priming stimuli and the testing cue were two different mediums, research has shown that conceptual priming can measure indirect memory recall for physically dissimilar primes (Graf & Schacter, 1989; Radomsky & Rachman, 1999; Weldon & Jackson-Barrett, 1993). Finally, a divided attention task was used as a proxy assessment of participants' attention for the films. This task involved the presentation of callouts during the films, followed by a count-estimate recall of the number of callouts afterward. This task was intended to assess attentional processes, not the encoding of conceptual information. Divided attention tasks have been used in previous research of this type, and have been shown to be a useful approach for studying attentional processes (DePrince & Freyd, 2001; Eysenck & Keane, 2010; Most et al., 2001).

When considering the influence of dissociation on information processing, four sets of outcomes are plausible. First, dissociation may have no effect on attentional processing, but may disrupt memory retrieval processes for both explicit and implicit recall. This outcome would suggest that dissociation is associated with reduced encoding of material at both explicit and implicit levels, but has no impact on attentional processing of the stimuli. Second, dissociation may disrupt retrieval processes for explicit recall, but have no effect on implicit recall or attentional processing, thereby impairing the encoding of conceptual information. This outcome would indicate that dissociation is associated with disruption of the retrieval of conceptual information from explicit memory, but has no effect on attentional processing or implicit retrieval processes. Third, dissociation may have a pervasive influence and may disrupt attentional processing as well as retrieval processes for explicit and implicit recall. This outcome could suggest that dissociation either impairs attentional processing, which in turn impacts memory retrieval, or works in combination on both attention and retrieval processes when encoding stimuli information. Lastly, dissociation may disrupt attentional processing and explicit memory retrieval, but have no association with changes in implicit memory retrieval. This possible outcome would be predicted by dual representation theory (Brewin et al., 1996).

1. Methods

1.1. Participants

Potential female participants were recruited from introduction to psychology courses and invited to the study, based on responses to the Dissociative Experiences Scale (Bernstein & Putnam, 1986). A total of 223 women who scored above 20 (high) or below 10 (low) on the DES during group testing were sent an invitation; cut-off scores for dissociative group membership were based on previous research with similar samples (DePrince & Freyd, 1999, 2001). From this pool, 39% ($n = 86$) of women signed up to participate. Individuals who had directly experienced or witnessed a previous traumatic event, as measured by the Life Events Checklist (Blake et al., 1990) were further assessed for severity of the event through a series of semi-structured questions administered by the experimenter. An event was considered traumatic if it involved actual or threatened death or serious injury to oneself or others, and if it elicited a response of intense fear, helplessness, or horror (APA, 2000). Potential participants who had experienced a traumatic event were excluded if they reported on-going emotional distress related to the event. Twenty-two potential participants were excluded from further participation based on this criteria. One additional participant withdrew from the study protocol. An additional subset of participants ($n = 9$) were excluded from final data analysis due to instability in their dissociation scores upon re-administration of the DES. The final sample included 54 participants. Significant differences between high and low dissociation groups did not emerge with respect to the number of reported traumatic events participants directly experienced ($t(52) = .18$, $p = .86$) or witnessed ($t(52) = 1.80$, $p = .08$). Additionally, there were no significant differences between DES groups on demographic variables (see Table 1).

1.2. Measures

1.2.1. Selection and group description measures

The Dissociative Experiences Scale (Bernstein & Putnam, 1986) is a 28-item self-report questionnaire that measures the frequency of dissociative experiences. The DES is used to assess episodes of dissociation, with questions including experiences that may occur in one's daily life such as not recognizing friends or family, having no recollection of past events, or being unable to discriminate between an actual occurrence and a dream. Participants rated a series of dissociative experiences with respect to how often the experience applied to them on a scale ranging from 0 to 100%. The DES demonstrates high internal consistency among items at $\alpha = .70$; test-retest reliability is good at $r = .84$ (Bernstein & Putnam, 1986). Coefficient alpha for the current sample was .94.

1.2.2. Life Events Checklist (LEC; Blake et al., 1990)

The LES is a 17-item self-report measure that contains a checklist of traumatic life events. Each item has a designated response that best describes the individual's experience with the event. Participants were instructed to rate their experience of each event on a 5-point nominal scale (1 = *the event happened to me*, 2 = *witnessed the event*, 3 = *learned about the event*, 4 = *saw the event on television*, 5 = *did not experience the event*). The LEC demonstrates adequate psychometric properties with undergraduate samples (Gray, Litz, Wang, & Lombardo, 2004) and was used in the present study to identify participants who were exposed to traumatic events. Additional questions were added to the LEC for individuals who endorsed experiencing a trauma, instructing them to provide a description of the event, the age in which the event occurred, and how much they were still bothered by this event. In addition, a series of semi-structured follow-up questions were administered by the experimenter to determine the severity of the event and the participants' emotional response to the event. Events that involved actual or threatened death or serious injury, and elicited a response of intense fear, helplessness, or horror above a distress score of 50 [scale from 0 (*not at all*) to 100 (*extreme*)] were considered to be "traumatic" (see Beck, Grant, Clapp, & Palyo, 2009). A participant was excluded from participation if she endorsed experiencing a traumatic event and reported on-going emotional distress from this event.

The LEC also was used to determine previous trauma exposure for all participants. In particular, each event that a participant had experienced or witnessed was totaled to form an index of previous trauma exposure.

1.3. Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996)

The BDI-II contains 21 items that assess depression severity. Each item is rated from 0 to 3, with higher scores reflecting greater depressive symptoms. The BDI-II demonstrates excellent internal consistency ($\alpha = .93$; Beck et al., 1996). Coefficient alpha for the current sample was .89.

Table 1
Characteristics of high and low DES groups.

	Low DES group (n = 27)		High DES group (n = 27)		p
	M	*SD*	*M*	*SD*	
Age (years)	18.74	1.06	19.19	1.75	.27
Number of years enrolled in college	1.59	.93	1.86	1.23	.39
Ethnicity					.27
Caucasian	n = 13	(48.1%)	n = 9	(33.3%)	
Not Caucasian	n = 14	(51.9%)	n = 18	(66.7%)	
Household income					.79
<$50,000	n = 15	(55.6%)	n = 17	(63.0%)	
>$50,000	n = 10	(37.0%)	n = 10	(37.0%)	
Not reported	n = 2	(7.40%)			
Dissociative Experiences Scale	4.99	2.69	32.96	10.89	.001
Number of trauma events experienced (lifetime)	2.07	1.33	2.15	1.51	.85
Number of trauma events witnessed (lifetime)	1.11	1.01	1.78	1.65	.08
Beck Anxiety Inventory	5.19	4.26	13.07	14.24	.01
Beck Depression Inventory-II	6.59	6.52	12.44	8.13	.01

1.4. Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988)

The BAI is a 21-item scale that assesses cognitive, affective, and somatic anxiety symptoms. Individuals report the severity of their symptoms on a Likert scale ranging from 0 (*not at all*) to 3 (*severely*). The BAI demonstrates excellent internal validity (α = .91; Creamer, Foran, & Bell, 1995) and good test–retest reliability (r = .75; Beck et al., 1988). Coefficient alpha for the current sample was .95.

1.5. Dependent measures

1.5.1. Divided Attention Task

A divided attention task was used as a proxy assessment of participants' attention for the films. Participants were instructed to divide their attention between two visual stimuli: (1) film content and (2) a series of callouts that were inserted into each film. The callouts consisted of 30 white dots (.4 mm in circumference) that individually appeared for 200 ms in random locations on the screen and throughout random intervals of each film. Prior to the presentation of each film, participants were instructed to pay attention to both the film and the callouts that would be appearing throughout the film. Participants were not instructed to count the callouts but merely to pay attention to them. After the presentation of both films, participants were asked to report the number of callouts that they observed during each film, where a greater number of callouts reported (<30) represented greater attention to the film. In the current study, no participant provided a rating above 30 for either film.

1.5.2. Confidence in report of callout detection

As an additional measure of attention, participants were asked to report how confident they believed their estimate to be of the reported number of callouts for each film. Participants rated their confidence levels on a scale from 1 (*not at all confident*) to 10 (*extremely confident*).

1.5.3. Explicit memory

To measure explicit memory, a free-recall task was used in which participants recalled detailed memories from each film. Participants were instructed to write down their memories for each film, giving as much detail as possible. Each memory was scored based on two criteria: (1) accuracy of the memory and (2) level of detail, as described next.

1.5.4. Accuracy of memory

Two raters coded each memory as either accurate or inaccurate. A memory was categorized as accurate if the memory depicted actual content from the films, including correct descriptions of the scenes. An inaccurate memory was defined as a memory that was inconsistent with the actual film content or depicted false details from the films' scenes. Comments that pertained to other aspects of the procedure (e.g., the participant's distress level) were not coded. Interrater reliability was determined using intraclass correlation and was excellent at r = .99. Discrepancies between raters for accuracy were resolved by the first author who remained unaware of participants' group status. To control for individual differences in the number of memories reported, the percentage of accurate memories was computed for each participant.

1.5.5. Level of detail of memory

The same two raters coded the level of detail of each accurate memory, using a 5-point Likert scale from 1 (*no detail*) to 5 (*extremely detailed*). A code of 1 was used for memories that provided a brief statement about a scene without incorporating any detail (e.g., "there was a clip about a car accident"). A code of 3 was given for memories that described characters from a scene and a statement about the general outcome of the scene (e.g., "there was a clip with several teenagers involved in a car accident and they all died"). A code of 5 was given for memories that included intricate details from a scene such as identifying characters (e.g., teenagers), recalling specific dates, reporting colors of objects (e.g., blue car), or sounds depicted in the films (e.g., woman screaming for help).[1] Detail scores for each accurate memory were summed and divided by the number of accurate memories reported. Participants who received greater detail scores recalled a greater level of detail. Interrater agreement was determined using intraclass correlation and was good at r = .91. Interrater disagreements for level of detail were resolved by the first author who remained unaware of participants' group status.

1.5.6. Implicit memory

To assess implicit memory, words were selected that referenced cues in each film (e.g., for the neutral film, words such as *bridge* and *guitar* were selected, whereas for the analogue trauma film, words such as *crash* and *death* were selected – see description of film stimuli). The task measured priming for previously encoded

[1] Detailed coding procedures for the explicit memory recall are available from the first author.

details from the films, using word-stems as semantic cues. Successful retrieval of the word-stems required conceptual processing. Participants were instructed to complete a series of word-stems with the first word that came to mind. Each word-stem consisted of the first three letters of the stimuli word. The word-stems were randomized within condition; the participant thus was presented with two separate lists of 10 word-stems each, neutral and analogue trauma. The implicit word-stem tasks were scored as not correct (0) or correct (1) with the rater using experimenter-derived lists of correct responses. A total score was computed for each film type.

1.5.7. Film stimuli

Two-eight minute film clips were created to serve as analogue trauma and neutral stimuli. The analogue trauma film consisted of eight graphic scenes comprised of footage from the aftermath of both real-life and fictional motor vehicle accidents, a genocide documentary, an implied electrocution (Brown, Danquah, Miles, Holmes, & Poliakoff, 2010), the aftermath of a family homicide, and a fatal alligator attack (*Faces of Death*, James & Schwartz, 1981). The horrific content depicted in the analogue trauma film included dead, mutilated bodies, graphic images of severe injuries, gunfire, and screams from bystanders witnessing the events. Several scenes from the analogue trauma film were used in previous research and have been shown to be distressing (Holmes, Brewin, & Hennessey, 2004). The neutral film contained footage from infomercials and documentaries and included clips on how escalator handrails are made, the operation of zambonis, the construction of the Bering Strait Bridge, a documentary on Moby Dick, a vitamin infomercial, and a clip on the history of guitars.

1.6. Procedure

All procedures were approved by the University's Institutional Review Board. Potential female participants were recruited based on their scores on the DES, which was initially administered to students during group testing. Participants who scored above 20 (high) or below 10 (low) on the DES were invited to the experiment via Those who chose to participate were asked to provide informed consent and were re-administered the DES to ensure stability of responding. In addition, participants were administered a demographic form, the BDI-II, the BAI, and were screened for trauma exposure using the LEC.

Individuals who met the inclusion criteria were presented with the analogue trauma and the neutral films, in random order. Prior to the presentation of each film, participants were told to pay close attention to the films and to attend to the callouts appearing sporadically on the screen. Following each film, participants completed the explicit memory task and a filler task, followed by the implicit memory task and a second filler task. Each filler task consisted of 10 algebraic equations and occupied participants for 10 min. The filler tasks were unrelated to the memory recall tasks and were used to prevent carryover effects (Coles & Heimberg, 2002).After viewing both films, participants were asked to report the number of callouts they observed for the analogue trauma film and the neutral film separately and to rate how confident they believed their estimate to be.

Following completion of the protocol, participants were debriefed and provided contact information for mental health resources. Each participant was awarded extra credit for their introduction to psychology course as well as being entered in a raffle to earn a $25.00 gift certificate. Six certificates were given out over a total of twelve months.

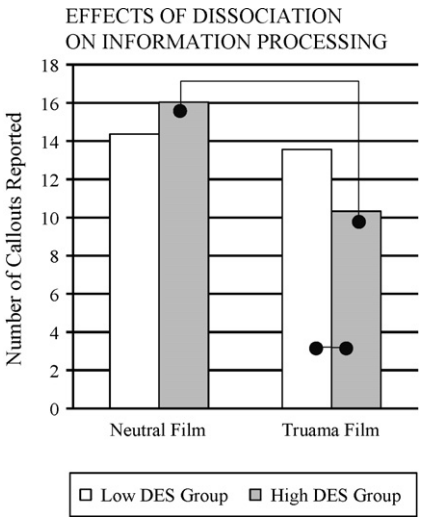

Fig. 1. Number of callouts reported (attention), for high and low DES groups, across the analogue trauma and neutral films.

2. Results

2.1. Analytic approach

Order effects were tested using independent sample t-tests for each dependent variable. No significant order effects emerged across these analyses (p-values ranged from .11 to .94).

Data were screened based on procedures recommended by Tabachnick and Fidell (2001). Data distributions were within the normal range for all but one dependent variable, percentage of accurate memories, which was leptokurtic (kurtosis = 10.33). A series of 2 (DES group: high, low) × 2 (film type: analogue trauma, neutral) MANOVAs with repeated measures on the second factor were used to examine the divided attention task, confidence in report of callouts, percentage of accurate memories, and the level of detail of memory (Vasey & Thayer, 1987). Although percentage of accurate memories demonstrated a leptokurtic distribution, Tabachnick and Fidell (2001) suggest that the univariate algorithm is robust to violations of normality if the sample size produces 20 degrees of freedom, the sample is distributed evenly across cells, and if the violations do not stem from outliers. Because the current data met these criteria, no transformations were performed. Significant effects for the MANOVAs were followed using the Tukey procedure, with comparison-specific error terms for contrasts involving the repeated measure (film type). Effect size was computed for each significant effect using partial eta squared (η_p^2). Cohen's system (1988) was used to interpret effect sizes wherein η_p^2 of .02–.12 is a small effect, .13–.44 is a medium effect, and over .44 is a large effect. To assess implicit memory, two separate ANOVAs were used for the analogue trauma and neutral film conditions, given separate assessments for each film condition. Each of the above analyses was repeated in order to control for potential confounds, using either a MANCOVA or ANCOVA. In particular, the number of previous traumas directly experienced and witnessed (totaled), current level of anxiety, and current level of depression served as separate covariates in these analyses.

2.2. Divided Attention Task

2.2.1. Number of callouts detected

Results evidenced a significant Group × Film interaction for the trauma film $F(1, 52) = 5.39$, $p = .02$, $\eta_p^2 = .09$ (see Fig. 1). Tukey's procedure indicated that the high DES group reported fewer

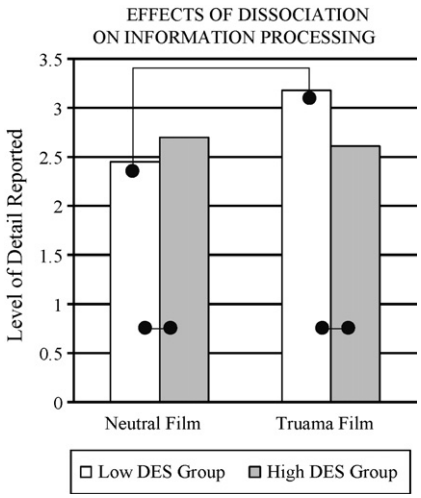

Fig. 2. Level of reported detail (explicit memory) for high and low DES groups, across the analogue trauma and neutral films.

callouts ($M = 10.33$, $SD = 7.00$) from the analogue trauma film, relative to the low DES group ($M = 13.56$, $SD = 6.47$). Additionally, the high DES group reported significantly more callouts from the neutral film ($M = 16.04$, $SD = 8.18$), compared to the analogue trauma film. These results suggest that individuals with high trait dissociation scores paid less attention to the analogue trauma material, relative to individuals with low trait dissociation scores. Additionally, these results showed that the high DES group paid more attention to the neutral film, relative to the analogue trauma film.

2.2.2. Confidence in report of callout detection

No significant effects were noted across groups for the rating of confidence in detection of the embedded callouts for the neutral film (high DES group $M = 5.37$, $SD = 1.92$; low DES group $M = 5.59$, $SD = 2.00$), or the analogue trauma film (high DES group $M = 4.89$, $SD = 1.67$; low DES group $M = 5.37$, $SD = 2.11$). This finding suggests that irrespective of group status, participants were equally confident in their attention for the films.

2.3. Explicit memory

2.3.1. Accuracy of memory

There were no significant differences between groups for the percentage of accurate memories reported for the neutral film (high DES group $M = .98$, $SD = .05$; low DES group $M = .99$, $SD = .03$), or the analogue trauma film (high DES group $M = .99$, $SD = .03$; low DES group $M = .97$, $SD = .09$). This finding suggests that both the high and low DES groups were accurate on this memory measure across each film.

2.3.2. Level of detail of memory

A significant Group × Film interaction emerged for the level of detail of memories $F(1, 52) = 17.32$, $p = .001$, $\eta_p^2 = .25$ (see Fig. 2). Post hoc comparisons indicated that for the analogue trauma film, the high DES group reported significantly less detailed memories ($M = 2.61$, $SD = .93$), relative to the low DES group ($M = 3.18$, $SD = .74$), whereas for the neutral film, the high DES group reported significantly more detailed memories ($M = 2.70$, $SD = .89$), relative to the low DES group ($M = 2.45$, $SD = .58$). Additionally, the low DES group reported significantly more detailed memories for the analogue trauma film, relative to the neutral film. These results suggest that individuals with high trait dissociation were less able to explicitly recall analogue trauma information, but were better able to explicitly recall neutral information, relative to individuals scoring low on the DES. In addition, individuals with low trait dissociation were better able to recall analogue trauma material, relative to neutral material.

2.4. Implicit memory

2.4.1. Correct word-stem completion

A significant effect was found for the analogue trauma film $F(1, 52) = 6.16$, $p = .02$, $\eta_p^2 = .11$, indicating that the high DES group reported fewer analogue trauma cue words ($M = 3.81$, $SD = 1.62$), relative to the low DES group ($M = 5.00$, $SD = 1.88$). No significant effects were found for the neutral film (high DES group $M = 4.07$, $SD = 1.38$; low DES group $M = 4.74$, $SD = 1.68$). These results suggest that individuals with high trait dissociation scores were less able to implicitly recall analogue trauma material, relative to individuals with low trait dissociation scores.

2.4.2. Controls for previous trauma exposure, depression and anxiety

In order to rule out possible explanations for these findings, specifically previous trauma exposure or current negative mood states, all analyses were repeated, using trauma exposure, depression (BDI-II) and anxiety (BAI) as separate covariates. Results remained the same, suggesting that these three variables did not significantly impact the obtained results.

3. Discussion

The current study was designed to examine the effects of high and low levels of dissociation on attention and memory for analogue trauma and neutral film stimuli, using a laboratory film paradigm. Using a divided attention task as a proxy measure of attentional processes, participants scoring high in trait dissociation showed reduced attention to the analogue trauma stimuli, relative to the neutral stimuli and relative to low DES participants. During the neutral film stimuli, no notable differences in attention were observed between the high and low DES groups. Interestingly, no differences were found between high and low dissociation groups with respect to their confidence in identifying visual callouts during the films, indicating perhaps that individuals who are high in trait dissociation do not perceive their reduced attention. This lack of awareness for reduced attention has been identified in related research as *inattentional blindness*, or the failure to notice salient stimuli when one's attention is fixated on other objects or events (see Simons, 2000). Use of related paradigms (e.g., Most et al., 2001) could help to elaborate this finding. Results further showed that attentional differences were partially mirrored by differences in the amount of detail recounted during assessment of explicit memory. In particular, the high DES group recounted significantly fewer details from the analogue trauma film, relative to the low DES group, while the opposite pattern was noted regarding the neutral film. The two groups did not differ with respect to the accuracy of memories of the analogue trauma and neutral stimuli, indicating that both groups cognitively processed the films. The implicit memory measure showed a similar pattern of results as the explicit memory measure, with the high DES group showing less recall of the analogue trauma stimuli than the low DES group. No between-group differences were noted in implicit memory for the neutral stimuli. These results were obtained with statistical control for participants' previous trauma exposure and levels of current anxiety and depression, suggesting that these factors cannot account for the obtained results.

These findings suggest that dissociation is associated with reduced attention during disturbing films, as well as difficulties in encoding and later retrieval of this information from memory. In particular, individuals scoring high in trait dissociation

showed reduced attention and disruptions in retrieval processes (both explicit and implicit memory) for the analogue trauma stimuli. These results suggest that there may be interplay between attentional processes and memory retrieval among individuals high in dissociation; this interplay may work to inhibit the processing and later recall of traumatic information. Previous studies from cognitive science have identified an association between emotional stimuli and attentional processing during the initial encoding phase, which in turn impacts both deliberate and incidental memory recall (Kensinger, Piguet, Krendl, & Corkin, 2005; Wessel & Merckelbach, 1997). Research also has suggested that cognitive mechanisms such as attentional narrowing, or focusing one's attention on the center of an object as opposed to objects in the periphery, may be involved in the association between encoding emotional stimuli and retrieval processes (Riggs et al., 2011). Results from the current study echo these findings, as participants' attention for the films was significantly associated with their level of dissociation and attention seemed to influence encoding and the later retrieval of the analogue trauma stimuli.

In considering these results, it is tempting to speculate that the observed attention and memory efforts might represent some form of avoidant processing style. However, a review conducted by Giesbrecht et al. (2008) concluded that the inability to recall information may be linked to common cognitive failures (e.g., lapses in attention, daydreaming), as opposed to deliberate avoidant processing. Variations across experimental paradigms however, may play a role in the discrepant findings across the literature. Previous work has relied on the think-no think task, letter detection, the directed forgetting paradigm, and autobiographical memory tasks. The literature currently remains inconclusive regarding the influence of dissociation on avoidant information processing (Giesbrecht et al., 2008). However, it seems important to explore potential mechanisms that may underlie the association between dissociation and reduced information processing, in an effort to understand this finding. Avoidance is but one potential mechanism that could explain the finding that individuals scoring high in dissociation show disruptions in attention and memory for emotionally disturbing stimuli. This could be a fruitful area for future research.

To date, a number of intriguing issues surface when considering the influence of dissociation on attention and memory for trauma stimuli. As reviewed by Giesbrecht et al. (2008), some of the cognitive phenomena that have been associated with dissociation only appear when stimuli carry negative emotional valence. Future research examining specific components of dissociation, such as absorption, could prove to be a useful extension to the current literature (Giesbrecht et al., 2008), particularly in studies that incorporate trauma-relevant stimuli. This type of investigation could begin to resolve discrepant findings within the larger literature and perhaps expand our understanding of how dissociation interrupts the processing of trauma cues. Second, it is notable that the current data were obtained using 8-min long film stimuli. In some respects, this is an advance over previous research, which has relied on single-word stimuli. In future work, it would be interesting to examine more fine-grain indicators of cognitive processing, in order to establish in detail how dissociation changes the way that trauma stimuli are attended to and processed. Inclusion of more subtle measures, such as eye tracking, could begin to elucidate some of the mechanisms involved in the processing of trauma-relevant stimuli. An additional feature of the current study is inclusion of several covariates within the statistical analyses, in an effort to control for potential confounds. Perhaps most importantly, previous trauma exposure did not exert a significant effect on the obtained data. This methodological feature allows for separation of the effects of dissociation from the effects of trauma exposure per se, for the first time within this line of inquiry. Because dissociation has been discussed both as a corollary to and as a consequence of trauma exposure, future work on the role of dissociation in post-trauma adaptation needs to more explicitly examine the role of trauma history.

As much as the current data are intriguing, they do not illuminate how dissociation impacts longer-term psychological adaptation after trauma exposure. Consideration of ways that dissociation is associated with emotional processing of trauma stimuli could expand our understanding of emotional vulnerability following extreme events. As noted previously, dissociation has been postulated to be protective during trauma exposure (Putnam, 1989) although delineation of how this process may occur has not been examined. One could question, for example, if the reduced attention and diminished processing of trauma material somehow reduces the longer-term negative emotional impact of trauma. Examination of this type of empirical question could greatly facilitate understanding of why most people show natural emotional recovery following trauma exposure, while a small percentage do not recover and ultimately, are diagnosed with Posttraumatic Stress Disorder (Norris & Slone, 2007).

Although these results are interesting, this study is not without limitations. First, the current sample was restricted to female college students and was relatively small in size. Thus, generalizability of these results is limited. Future studies should recruit a larger, more diverse sample and assess whether the effects found in this study are consistent across various demographic variables, particularly gender. Second, some authors suggest that dichotomization of quantitative measures can result in the loss of important information, and restrict the conclusions that one can draw (MacCallum et al., 2002). It is possible that the inclusion of a medium level dissociation group could have provided additional information regarding the relationship between dissociation and information processing. However, because most other studies in this area (e.g., DePrince & Freyd, 2001) dichotomize dissociation scores into high and low subgroups, we utilized this design feature to maintain consistency with the larger literature. Future studies could consider including the full range of DES scores, to capture dissociation as a continuous variable in order to elucidate our understanding of how dissociation effects information processing. Because, extreme group designs can significantly inflate obtained effect size (MacCallum et al., 2002), the observed effects for outcome variables in the current study (which ranged from small to medium) should be regarded as preliminary. In addition, it should be noted when examining explicit and implicit memory, Graf and colleagues have suggested that recall from one memory system can potentially influence recall from the other (Graf & Schacter, 1989; Graf, Shimamura, & Squire, 1985). The current study assessed both explicit and implicit memory, and as such, it is possible that memory recall from the explicit task influenced recall for the implicit task. Although clinical research examining memory recall typically assesses both types of memory within the same paradigm (Coles & Heimberg, 2002), it would seem important to explore the risk for confounding memory that this practice may carry.

In sum, this study suggests that trait dissociation plays a role in cognitive processing of analogue trauma stimuli. Through use of an experimental paradigm, we focused on attention and memory for both analogue trauma and neutral stimuli, among individuals scoring high and low in trait dissociation. Results suggest that trait dissociation is associated with decreased attention to analogue trauma stimuli, as well as poorer retrieval for explicit and implicit memory. Although dissociation has received considerable discussion within the trauma literature, it remains an elusive construct that has not systematically been studied. The current paradigm offers a new avenue for laboratory study of dissociation in the context of analogue trauma stimuli and enhances our knowledge of the effects of trait dissociation on information processing. Additional insight into the etiology of dissociation could help to refine early

intervention efforts, particularly in the identification of potential risk factors associated with the later development of post-trauma sequelae or other forms of psychopathology.

Acknowledgements

This project served in partial fulfillment of the requirements of the first author's Masters degree. We appreciate the help of her committee members, Drs. Roger Azevedo and Meghan McDevitt-Murphy. Dr. Rick Dale assisted with the preparation of this manuscript as well. We also acknowledge the assistance of Dr. Emily Holmes, who kindly provided a portion of the analogue trauma stimuli that were used in this study. Preliminary data for this study was presented at the November, 2009 meeting of the Association of Behavioral and Cognitive Therapies, New York, New York.

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