Dissociation and Pain Perception: An Experimental Investigation

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Dissociation and Pain Perception:

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Dissociative symptoms and abnormalities in pain perception have been associated with a range of disorders. We tested whether experimentally induced increases in state dissociation would cause an analgesic response, and whether this effect would be moderated by participants' history of trauma and dissociative experiences. Participants (n=120) were classified based on their histories of traumatic and dissociative experiences: No trauma or dissociation (NN), trauma without dissociation (TN), or trauma with dissociation (TD). All participants were randomized to a dissociation induction condition via audiophotic stimulation or a credible control condition and were compared on pre-post changes in subjective pain and pain tolerance in response to a standard cold-pressor test. Unexpectedly, dissociation induction did not lead to greater pain tolerance or reduced self-reported pain. However, increases in state dissociation significantly predicted increased immersion time and decreased subjective pain.

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Dissociation and Pain Perception: An Experimental Investigation

Although the DSM-IV Dissociative Disorders category comprises only dissociative amnesia, dissociative fugue, depersonalization disorder, and dissociative identity disorder (DID), dissociative symptoms are also associated with a number of disorders outside that category, such as panic disorder (Schmidt, 1999), the eating disorders (Demitrack, Putnam, Brewerton, & Brandt, 1990; Hallings-Pott, Waller, Watson, & Scragg, 2005), borderline personality disorder (Bohus et al., 2000), and posttraumatic stress disorder (McNally, 2003). Higher levels of trait dissociation have been found to be associated with a history of childhood trauma (Lochner et al., 2004) and have been found to predict bingeing and vomiting behavior (Waller, Ohanian, Meyer, Everill, & Rouse, 2001), as well as higher levels of depression (Brodsky, Cloitre & Dulit, 1995), alcoholism, and suicidality (Maaranen, Tanskanen, Honkalampi, Haaatainen, Hintikka, & Viinamaki, 2005).

Despite recent attempts to elucidate the concept of dissociation (e.g. Gershuny & Thayer, 1999; Holmes et al., 2005), this concept remains loosely and inconsistently defined. According to van der Kolk and Fisler (1995), “Dissociation refers to a compartmentalization of experience: elements of the experience are not integrated into a unitary whole, but are stored in memory as isolated fragments and stored as sensory perceptions, affective states or as behavioral reenactments” (p. 506). From this perspective, dissociation is a cognitive mechanism that is inferred from subsequent severe disturbances of memory, such as those found in Dissociative Identity Disorder. Other authors have focused on the phenomenological aspects of dissociation, which include derealization, depersonalization, time distortion, and confusion (e.g. Spiegel & Cardena, 1991; Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003).

Although these authors have conceptualized dissociation as an alteration in subjective experience, it may also have physiological concomitants. Several investigators have found individuals with a history of dissociative experiences to display psychophysiological abnormalities. In an investigation of individuals who had survived a life-threatening cardiac event, those who had displayed high levels of peritraumatic dissociation later displayed higher electromyogram and skin conductance responses relative to those who displayed lower levels of peritraumatic dissociation (Ladwig et al., 2002). As compared to normal controls, individuals with depersonalization disorder were found to have increased galvanic skin responses to unpleasant stimuli and decreased galvanic skin responses to neutral stimuli (Sierra et al., 2002). And, in a comparison of rape victims who reported having experienced high or low levels of dissociation during the trauma (peritraumatic dissociation), high dissociators were found to display a suppression of physiological responsivity when discussing the trauma (Griffin, Resick & Mechanic, 1997), although a similar study of nonsexual assault trauma victims failed to replicate this finding (Nixon, Bryant, Moulds, Felmingham, & Mastrodomenico, 2005).

Though these investigations focused on physiological differences between subjects who differed in the frequency and intensity of their prior experience of dissociation, it may also be that within-subject differences in physiological responding are correlated with differences in state dissociation. In an investigation of borderline patients who were exposed to a series of startling tones, those displaying high state dissociation were found to display a dampened startle response, while those with low state dissociation displayed a heightened startle response (Ebner-Priemer et al., 2005). Though this is the only known study that examined physiological differences as a function of state dissociation, there may be other physiological correlates. One such potential correlate is pain perception. Just as increased levels of dissociative symptoms are observed across disorders, variations in pain perception are thought to occur across a number of disorders (for a review, see Lautenbacher & Krieg, 1994). For example, individuals with bulimia nervosa were found to have higher pain thresholds in response to both thermal pain stimulation (TPS) and submaximal effort tourniquet test (SETT) than normal controls (de Zwaan, Biener, Bach, Wiesnagrotzki, & Stacher, 1996; de Zwaan, Biener, Schneider, & Stacker, 1996), and similar results were found for individuals with a history of bulimia nervosa whose symptoms were in remission (Stein et al., 2002). Decreased sensitivity to experimentally induced pain has also been reported among individuals with schizophrenia (Blumensohn, Ringle, & Eli, 2002; Dworkin, 1994), and major depression (Dworkin, Clark, & Lipsitz, 1994). In a meta-analysis and review of pain perception and major depression, Dickens, McGowan, and Dale (2003) reported that depressed subjects were less likely to perceive sensory stimuli as painful relative to nondepressed subjects.

Because analgesia and dissociation both represent alterations in perception that are positively correlated with other indicators of psychopathology, one might question whether there is a relationship between the two. Indeed, there is some reason to believe that both dissociative symptoms (i.e. derealization, depersonalization, amnesia) and stress-induced analgesia (SIA) do co-occur. Among patients with borderline PD, a positive association has been found between increased insensitivity to pain and dissociative experiences (Russ, Shearin, Clarkin, Harrison, & Hull, 1993; Russ, Clark, Cross, Kemperman, Kakuma, & Harrison, 1996; Bohus et al., 2000), and levels of state dissociation have been found to be elevated during episodes of self-cutting (Kemperman, Russ, & Shearin, 1997). However, no investigations have addressed this relationship in normal subjects.

Moreover, although there have been a number of investigations of SIA, it has yet to be examined in the context of dissociative symptoms. However, there are some interesting parallels between the two constructs. Both peritraumatic dissociation (Birmes et al., 2003; Punamaki, Komproe, Qouta, Elmasri, & de Jong, 2005; Gershuny, Cloitre, & Otto, 2003; Tichenor, Marmar, Weiss, Metzler, & Ronfeldt, 1999; Spiegel, Koopman, Cardena, & Classen, 1996) and SIA (Nishith, Griffin, & Poth, 2002) have been found to predict PTSD status in trauma victims. SIA has been experimentally induced via exposure to acute stressors (Janssen & Arntz, 2001; Bandura, Cioffi, Taylor, & Brouillard, 1988) and by exposing traumatized individuals to trauma-related stimuli (Pitman, van der Kolk, Orr, & Greenberg, 1990; Nishith et al., 2002). Dissociation has been observed to occur in response to acute stressors (e.g Kindt & van den Hout, 2003; Sterlini & Bryant, 2002) and it has been suggested that higher levels of trait dissociation should predict the magnitude of the dissociative response (Kihlstrom, Gilsky, & Anguilo, 1994) . When Kindt and van den Hout (2003) induced state dissociation in a nonclinical sample using an aversive film, they found that those with higher levels of trait dissociation displayed greater acute increases in dissociation. It is possible that in the course of these SIA inductions, participants may have experienced an increase in state dissociation, which may have mediated the analgesic response. Finally, there appears to be a functional similarity between the two phenomena. Dissociation has been conceptualized as an avoidant strategy for coping with the painful emotions caused by the traumatic event (Davidson & Foa, 1991). Just as SIA serves to diminish the experience of physical pain, some authors have proposed that dissociation may be a stress response that protects from emotional upset (Shilony & Grossman, 1993; Kihlstrom, Glisky & Angiulo, 1994; van der Kolk & van der Hart, 1989).

The temporal concordance and functional similarity of these phenomena suggest that they may not be independent, and some authors have suggested that dissociative symptoms may be caused by opioid-mediated mechanisms similar to those implicated in SIA (van der Kolk & Greenberg, 1987; van der Kolk, Greenberg, Orr, & Pitman, 1989). It is also possible that alterations in cognitive processing in the context of dissociation may result in alterations in pain perception. Russ and colleagues (1996) suggested that individuals with BPD may "use dissociative mechanisms (reinterpreting pain sensations) to 'numb' or 'block out' pain" (p. 63). Because dissociation by definition comprises perceptual abnormalities, the question remains whether alterations in pain perception tend to occur independently of dissociative symptoms, or whether they may be a by-product of dissociation.

One way to investigate the relationship between SIA and dissociation would be to induce dissociative symptoms in the laboratory and measure changes in pain perception and pain tolerance. The use of an experimental induction of dissociation offers several advantages over the naturalistic study of dissociation. First, in contrast with naturally-occurring stress-induced dissociation, such as that observed in emergency services personnel (Marmar, Weiss, Metzler, & Delucchi, 1996), the induction of dissociation in the laboratory using nonstressful methods provides the opportunity to investigate dissociative symptoms without the confounding effects of hyperarousal. Second, the use of experimental induction of dissociation allows for stronger causal inference than a correlational examination. Finally, the experimental induction of dissociation helps ameliorate the potential confound of retrospective self-report bias that has been suggested as a limitation of prior dissociation research (Candel & Merckelback, 2003; Marmar et al, 1994).

Methods for inducing dissociation in the laboratory have included dot-staring and silent repetition of one's own name (Miller, Brown, DiNardo, & Barlow, 1994), a Velten-style dissociative mood induction (Zoellner, Sacks, & Foa, 2003), stimulus deprivation (Leonard, Telch, & Harrngton, 1999), and exposure to an aversive film (Kindt, van den Hout, & Buck, 2005). Another dissociation induction approach involves the use of pulsed audio-photic stimulation, in which steadily flashing lights and pulsing tones are delivered through an eyepiece and an earpiece. Previous investigations in our laboratory have suggested that this multimodal method induces dissociative symptoms more reliably and effectively than alternative methods (Leonard et al., 1999; Leonard, Telch, & Owen, 2000).

In the current study, we induced dissociative symptoms using pulsed audiophotic stimulation, so as to assess whether changes in state dissociation would lead to alterations in pain perception. We had 120 nonclinical participants undergo a cold pressor test, and then we randomized them to receive either a dissociation induction (pulsed audiophotic stimulation) or a credible control condition. We then asked them to complete a second cold pressor test. It was predicted that individuals receiving the dissociation induction condition would show greater improvements in cold pressor performance (as measured by immersion time and subjective pain) than individuals receiving a credible control task. We also predicted that these effects would be moderated by history of trauma and dissociation, such that individuals with a history of traumatic and dissociative experiences would show greater increases in pain tolerance and significantly greater reductions in pain perception relative to those without a history of trauma.

Because exposure to stressors may induce dissociation in those with a vulnerability to it (Kindt & van den Hout, 2003), we also expected that the magnitude of participants' dissociative response to the pulsed audio-photic stimulation would be moderated by a history of trauma and dissociation, such that individuals with a history of trauma and dissociation would show the greatest increase in state dissociation, while individuals with no history of trauma would show the smallest increase in state dissociation.

Method

Participants

120 undergraduates (90 women and 30 men) enrolled in an introductory psychology course at the University of Texas at Austin participated in this study in order to earn credit toward a research requirement. Participants ranged in age from 18 to 30 (M = 19.98, S.D. = 1.97) and consisted of diverse ethnic groups: Caucasian (62.5%), Asian/Pacific Islander (18.3%), Hispanic (7.5%), African American (6.7%), and other (5.0%).

Design

All participants initially completed a battery of self-report measures and a cold pressor test. Based on their responses to these measures, participants were classified into one of three trauma history groups: no trauma (NT), trauma and dissociation (T/D), and trauma and no dissociation (T/N). An equal number of participants from each trauma history group was then assigned to receive ten minutes of dissociation induction (pulsed audio photic stimulation) or a control induction. This procedure resulted in a 3×2×2 mixed-model design, with trauma history status (NT, T/D, T/N) and the dissociation induction task (audio-photic stimulation, music control) as the between-subjects variables and assessment occasion (pre and post-induction) serving as the within-subjects variable. There were two primary dependent variables of interest: pain tolerance as indexed by immersion time and pain perception as indexed by subjective pain ratings.

Apparatus

Cold Pressor

A plastic tank measuring 13” × 28” × 14” contained ice, water, and a small motorized water circulator. The water was kept between 0 and 2 degrees Celsius, and water temperature was measured immediately following each trial.

Digital Audio Video Integration Device (D.A.V.I.D)

The D.A.V.I.D, developed by Mind Alive Devices (Edmonton, Alberta, Canada) is marketed as a relaxation device, though it has been found to induce dissociative symptoms (Leonard, Telch, & Harrington, 1999; Leonard, Telch, & Owen, 2000). The device includes a headset and plastic mask, which are connected to a small console. The headset emits controllable ticking sounds, similar to those made by a metronome. The plastic mask resembles ski goggles and delivers pulsed orange lights at controllable rates. In this study, the audio and video stimulus frequency was set at 7.8 Hz (cycles per second), which is the rate at which the device is suggested to induce dissociative states.

Measures

Acute Dissociation Index (ADI: Leonard et al., 1999).

The ADI is a 26-item self-report scale, developed specifically for laboratory dissociation challenges, in which participants rate the severity of dissociative thoughts and sensations (e.g. “Things around you seeming unreal.”) on an 11-point scale. The ADI was designed with the factor structure of the DES (Bernstein and Putnam, 1986) in mind, and the content of the items reflects that of the DES. It was created based on a six factor solution: Amnestic Experiences, Gaps in Awareness, Depersonalization, Derealization, Absorption, and Imaginative Involvement. A total score can be obtained by averaging the 26 items, while the subscale scores can be obtained by averaging the items included in each of the following subscales: amnestic experiences, items 1-5; gaps in awareness, items 6-7; depersonalization, items 8-13; derealization, items 14-16; absorption, items 17-23; imaginative involvement, items 24-26. Psychometric data regarding the factor structure is unavailable.

Anxiety Sensitivity Index (ASI; Peterson & Reiss, 1987).

The ASI is a 16-item self-report questionnaire assessing an individual's fear of anxiety. Each item is measured on a Likert-style scale from 0 (very little) to 4 (very much). The ASI is a widely-used measure that has shown good psychometric properties among both clinical and non-clinical populations (Reiss, Peterson, Gursky, & McNally, 1986; Telch, Shermis, & Lucas, 1989). Support has been found for a 3-factor structure: Physical Concerns, Mental Incapacitation Concerns, and Social Concerns, all of which load onto a higher-order anxiety sensitivity construct (Zinbarg, Barlow, & Brown, 1997).

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

The BAI is a 21-item self-report scale assessing recent symptoms of anxiety.

Dissociative Experiences Scale (DES; Bernstein and Putnam, 1986).

The DES is a 28-item self-report measure used to measure dissociative experiences and to identify patients with severe dissociative disorders. Responses are scored on an 11-point Likert scale (0%=never; 100%=always). The DES has shown good psychometric properties (Carlson & Putnam, 1993).

Peritraumatic Dissociative Experiences Questionnaire (PDEQ; Marmar et al., 1994).

The PDEQ is an 8-item self-report questionnaire capturing retrospective reports of dissociative experiences at the time of trauma. Participants rate the degree to which they experienced different aspects of dissociation (e.g. "Sense of time change during event.") on a 5-point Likert scale (1=not at all, 5=extremely). The PDEQ is scored as the mean item response across all items, with a possible range of 1.0 to 5.0, and 1.5 is considered to be a clinically salient level of dissociation (Marmar, Weiss, Metzler & Delucchi, 1996).

Posttraumatic Stress Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997).

The PDS is a 49-item self-report scale that assesses DSM-IV symptoms of PTSD. In addition to measuring PTSD diagnostic criteria and symptom severity, the PDS uses an extensive checklist of traumatic events to assess the participant's history of traumatic experiences. Participants receive these instructions: "Put a checkmark in the box next to ALL of the events that have happened to you or that you have witnessed."

Procedure

Classification by trauma and dissociation history

Based on their responses to the PDS and PDEQ, all participants were classified as having no trauma history (NT), a history of trauma without dissociation (T/N), or a history of trauma with dissociation (T/D). Participants who did not endorse any one of the twelve types of traumatic events on the PDS were assigned to the NT group. Participants who did endorse having experienced or witnessed one or more traumatic events were assigned to either the T/N or T/D group, depending on their whether their PDEQ scores were above the clinical cutoff value of 1.5 established by Marmar, Weiss, Metzler, & Delucchi (1996).

Procedures common to all participants

After giving informed consent, all participants completed a packet of self-report questionnaires. They then completed the first cold pressor test. The Cold pressor test was administered using standard procedures (Hilgard, Morgan, & McDonald, 1975; Wolf & Hardy, 1941). Participants were asked to immerse their dominant arm up to their elbow and to keep it motionless. They were told that they were free to remove their arm whenever they felt that the pain or discomfort was unbearable. Participants were prompted to report the degree of pain they were experiencing from 0 (no pain at all) to 10 (the most pain ever) and fear they were experiencing from 0 (no fear at all) to 10 (the most fear ever) at 30 second intervals, and again at the moment they removed their arm from the water. After completing the cold pressor test, participants were then randomly assigned to the dissociation induction or music control condition.

Dissociation induction condition

Participants receiving pulsed audio photic stimulation were fitted with the D.A.V.I.D and were told to close their eyes, relax, and await further instructions. The D.A.V.I.D was set to factory preset program number 11, which delivers pulsed stimulation at 7.8 Hz. The D.A.V.I.D was turned on, and participants were left alone in the room for ten minutes. The experimenter then returned to the room and had the participant undergo a second cold pressor procedure, identical to the first. After the completion of this test, the D.A.V.I.D was turned off and removed. The participant completed the posttest state dissociation measure (ADI) and was debriefed.

Music control condition

Participants in the music control condition performed an identical procedure to those in the dissociation induction condition. However, the D.A.V.I.D was not turned on. Rather, participants listened to a classical music piece. Music was used because it was thought that complete silence would amount to sensory deprivation, which has been shown to induce mild increases in state dissociation (Leonard et al., 1999).

Results

Equivalence of experimental and control groups at baseline

A series of one-way ANOVAs revealed no significant differences on any of the measures between the dissociation induction and control conditions suggesting that the randomization was successful in producing equivalent groups. A series of one-way ANOVAs was also performed to test for baseline differences between the three trauma status groups. These analyses revealed a significant main effect of trauma status for generalized anxiety (BAI), F (2,114)= 8.45, p = .01, state dissociation (ADI-1), F (2,114) = 8.05, p = .01., trait dissociation (DES), F (2,114) = 10.44, p = .00, and anxiety sensitivity (ASI), F (2,112) = 4.97, p =.03. Post hoc multiple comparisons revealed that individuals with a history of traumatic and dissociative experiences scored higher than individuals in the other two trauma/dissociation history groups on each of the four measures. In subsequent analyses, we controlled for these differences using a composite index of standardized scores on the ADI-1, ASI, BAI, and DES.

Effects of the dissociation induction procedure on state dissociation

We examined between-group differences in state dissociation from pre- to post-induction by performing a series of 2 (Induction: dissociation, control) × 3 (History: no trauma, trauma/no diss., trauma/diss) × 2 (Time: pre- and post-induction) repeated measures ANOVAs, first for the composite ADI score and then for each of the individual subscales.

There was a significant increase in state dissociation composite scores from pre- to post-induction across all groups F (1, 112) = 60.31; p =.00. There was also a significant Induction × Time interaction, F (1,112) = 6.70 ; p = .01), indicating that participants receiving pulsed audio-photic stimulation showed a greater increase in state dissociation than those in the control group (See Table 2). There were no significant differences in state dissociation between trauma history groups. These findings suggest that our dissociation manipulation was successful in producing heightened state dissociation.

Significant Time × Induction differences were found for 4 of the 6 ADI subscales: Gaps in Awareness, F (1,111) = 9.50, p =.00, Depersonalization, F (1,111) = 4.17, p =.04, F (1,111) = 7.15, p =.01, Derealization, F (1,111) = 7.15, p = .01, and Absorption, F (1,111) = 3.95, p = .05. For each of these subscales, those receiving the dissociation induction displayed greater increases than those receiving the control induction (See Table 2).

A significant Time × History effect was found only for the Depersonalization subscale, on which individuals with a history of trauma and dissociation displayed a significantly greater increase than those with a history of trauma without dissociation, F (2,111)=5.00, p =.01 (See Table 2).

Effects of the dissociation induction on cold pressor performance

Means and standard deviations for immersion time and subjective pain during the cold pressor challenge are presented in Table 3. Our central hypotheses concerning the effects of dissociation and trauma history on cold pressor performance and pain perception were tested separately using 2 (Induction: dissociation, control) x 3 (History: no trauma, trauma/no diss., trauma/diss) × 2 (Time: pre- and post-induction) ANCOVAs with repeated measures on the Time Factor. Because the trauma history groups differed significantly at baseline on the BAI, ASI, DES, and ADI-1 measures, a composite of these four measures was included as a covariate in all analyses. Contrary to prediction, there were no significant main effects or interactions for dissociation condition, trauma history, or time.

Exploratory analyses

Based on previous reports of an association between indices of psychopathology and differences in pain perception (e.g. Lautenbacher & Krieg, 1994; Russ et al., 1993; Dickens et al., 2003), we conducted exploratory analyses in an attempt to identify whether any of the clinical measures predicted change in cold pressor performance. Three conceptually distinct clusters of predictor variables were examined. These included (a) anxiety as measured by the BAI and the ASI; (b) trait dissociation as measured by the DES and the DSI; and (c) changes in state dissociation as measured by the six subscales of the ADI.

We conducted a series of hierarchical linear regression models with post-induction immersion time and subjective pain as the dependent variables. Independent variables were entered in a series of blocks. The first block contained the Time 1 cold pressor index (immersion time or subjective pain). The second block included the two anxiety measures (BAI and ASI); the third block included the two trait dissociation measures (DES and DSI); and the fourth block included the residualized change scores for state dissociation (one for each of the six subscales of the ADI).

Predictors of post-induction immersion time (Table 4)

On blocks 1 and 2, the only significant predictor of immersion time at post-induction was immersion time at pre-induction, $B = .78$, t (110) = 14.60, p =.00. Neither of the anxiety measures were significant; and their inclusion in the model did not produce a significant change in the model. In block 3, we added the dissociation measures, and found trait dissociation significantly predicted lower post-induction immersion time , $B = -.50$, t (109) = -1.96, p = .05. In Block 4, trait dissociation continued to be a significant, negative predictor of immersion time at post-induction, after controlling for residualized change scores in state dissociation B =-.50, t

(103) = -2.02, *p* = .05. The residualized change score of the Derealization subscale of the ADI was found to be a significant positive predictor of immersion time, *B* = 24.12, *t* (103) = 2.28, *p* = .02. The inclusion of the ADI subscale change scores explained an additional 3.6% of the variance. The overall model was highly significant (i.e., adjusted multiple R^2 = .68; *F* (11,103) = 23.39, *p* = .00) indicating that a large amount of the variance was accounted for by these predictor variables. An examination of the tolerances of the individual variables found them to be acceptably high, indicating an absence of multicollinearity.

Predictors of post-induction subjective pain (Table 5)

On blocks 1 and 2, the only significant predictor of subjective pain at post-induction was subjective pain at pre-induction, *B* = .96, *t* (110) = 17.94, *p* = .00. Neither of the anxiety measures was significant, and their inclusion in the model did not produce a significant change in the model. In block 3, we added the dissociation measures, and found them both to be nonsignificant. In block 4, both the Gaps in Awareness and Depersonalization subscales significantly predicted lower subjective pain in response to the cold pressor challenge, *B* = -.24, *t* (103) = -2.17, *p* =.03 and *B* = -.44, *t* (103) = -2.5, *p* = .01. For the final step of the model, the multiple R^2 was .78 and significant, *F* (11,103) = 32.59, *p* =.00. The adjusted R^2 was .75, indicating that a large amount of the variance was accounted for by these predictor variables. An examination of the tolerances of the individual variables found them to be acceptably high, indicating an absence of multicollinearity.

Discussion

In the present study, we sought to investigate experimentally the relationship between dissociation and pain perception. Contrary to prediction, the induction of dissociation did not lead to either greater pain tolerance or reduced self-reported pain in response to a standard cold pressor test. What might account for these null findings in light of prior research suggesting a co-occurrence of dissociation and analgesia (Bohus et al., 2000)? One possibility is that there is no direct association between dissociation and pain perception but they share common risk factors (psychiatric disorders) or common triggers (e.g. exposure to trauma-related stimuli). Dissociation may not necessarily be contributing to analgesia, but merely occurring alongside it.

Another more speculative possibility is that the dissociation induction was simply not strong enough to elicit a significant analgesic response. It may be that dissociative symptoms contribute to the experience of analgesia, but only when state dissociation reaches a magnitude equivalent to that which occurs during a traumatic event. An inherent limitation of the use of laboratory analogues is that those analogues may differ too greatly from the natural phenomena under study. Since there is no known measure of state dissociation that has been normed on individuals immediately following trauma, it is not possible to judge the degree of similarity between the dissociative symptoms induced through our dissociation challenge (i.e., pulsed audio/photic stimulation) and those that occur during real traumas.

Despite our finding that dissociation induction had no significant effect on cold pressor performance, we did find that increases in the Derealization subscale of the ADI was associated with increases in cold pressor immersion time, wheras increases in the Depersonalization and Gaps in Awareness subscales were associated with decreases in subjective pain. One possibility is that these state dissociation indices are causally related to alterations in pain perception, but that the magnitude of the difference between the changes of those in the dissociation induction and control conditions was not sufficient to lead to a statistically significant difference between groups. Alternatively, a third variable may have accounted for both the observed increase in state dissociation and the observed changes in cold pressor performance. It is also possible that the dissociation induction was affecting individuals inconsistently.

The dissociation induction procedure led to significantly greater increases than the music control in 4 of the 6 subscales: Derealization, Depersonalization, Gaps in Awareness, and Absorption. However, our data suggest significant variance in response to the dissociation induction, and this variance can only be picked up by analyzing it at the subscale level. Although dissociation has at times been conceptualized as a unidimensional construct (Bernstein & Putnam, 1986; Bernstein, Ellason, Ross, & Vanderlinden 2001), and pathological dissociation as a categorical taxon (Simeon, Knutelska, Nelson, Guralnik, & Schmeidler, 2003) some authors have suggested that dissociation is a multidimensional construct (e.g Holmes et al., 2005). Our data support such a conceptualization. Because the Depersonalization, Derealization, and Gaps in Awareness subscales were found to be correlated with changes in cold pressor performance, it may be that a dissociation induction more specifically targeted at one or more of those dimensions would cause a more dramatic change in cold pressor performance. Future investigations of dissociative pathology may benefit from the use of multiple dissociation induction techniques targeting differing subscales.

Table 1

Mean scores of clinical measures at baseline by experimental condition and trauma status

Measures		Dissociation Induction			Music Control			Total		
		NT	TD	TN	NT	TD	TN	NT	TD	TN
		n=24	n=18	n=14	n=28	n=24	n=12	n=52	n=42	n=26
ADI 1	*M*	23.13	29.33	20.43	25.00	40.33	23.83	24.07[a]	34.83[b]	22.13[a]
	SD	3.41	3.85	4.37	3.09	3.34	4.72	2.30	2.55	3.22
ASI	*M*	9.75	17.06	10.54	11.96	16.93	13.67	10.85[a]	16.72[b]	12.10[a]
	SD	7.20	8.13	9.11	6.94	8.83	5.03	7.08	8.43	7.45
BAI	*M*	5.83	11.33	6.50	8.68	14.08	6.00	7.25[a]	12.71[b]	6.25[a]
	SD	1.54	1.78	2.02	1.43	1.54	2.18	1.05	1.18	1.48
DES	*M*	24.50	44.67	17.29	23.04	52.08	35.00	23.77[a]	48.38[b]	26.14[a]
	SD	4.93	5.69	6.45	4.56	4.93	6.97	3.36	3.76	4.75
DSI	*M*	41.54	50.72	47.29	44.71	48.00	43.00	43.13	49.36	45.14
	SD	3.10	3.58	4.06	2.87	3.10	4.39	2.12	2.37	2.99
PDEQ	*M*		28.61	12.25		22.50	11.75		25.56[b]	12.09[a]
	SD		1.57	1.78		1.36	1.92		1.04	1.31

Note. Different superscripts denote differences between trauma status groups

Trauma history groups were assigned according to PDEQ scores.

Participants in the NT condition did not complete the PDEQ.

Table 2

Means of ADI Subscales at Pre- and Post-Induction by Trauma and Induction

	Experimental Condition					
	Dissociation Induction			Music Control		
ADI Subscale	NT	TD	TN	NT	TD	TN
Amnestic Experience						
Pre	2.65 (2.77)	2.17 (3.29)	1.36 (1.82)	2.56 (3.20)	3.70 (4.15)	2.50 (2.24)
Post	2.96 (4.16)	5.43 (7.63)	.25 (.62)	4.43 (6.92)	4.72 (5.3)	1.57 (2.59)
Gaps in Awareness						
Pre	1.21 (2.09)	2.06 (2.28)	.93 (1.64)	1.74 (2.26)	3.30 (2.96)	1.83 (2.44)
Post	3.39 (2.10)	3.94 (2.60)	3.64 (2.47)	2.04 (2.52)	4.61 (3.77)	2.08 (2.78)
Depersonalization						
Pre	0.13 (0.63)	0.28 (0.57)	0.43 (1.60)	0.52 (1.28)	1.43 (3.41)	0.58 (1.38)
Post	3.00 (5.65)	5.44 (5.62)	1.50 (1.70)	2.26 (3.35)	3.87 (6.04)	0.83 (1.27)
Derealization						

Pre	0. 00 (0.00)	0.39 (0.70)	0.21 (0.58)	0.44 (1.45)	0.61 (1.90)	0.00 (0.00)
Post	2.61 (5.37)	4.06 (4.21)	1.71 (2.61)	1.41 (2.16)	2.17 (2.69)	0.08 (0.29)
Absorption						
Pre	5.04 (6.40)	8.78 (7.40)	3.93 (3.85)	7.30 (6.50)	13.52 (10.91)	6.67 (5.41)
Post	12.26 (12.03)	18.78 (9.24)	7.75 (3.86)	12.93 (9.22)	18.78 (9.24)	7.75 (3.86)
Imaginative Involvement						
Pre	.91 (1.76)	1.67 (1.81)	1.14 (1.46)	.67 (2.17)	3.96 (4.27)	1.50 (3.53)
Post	1.39 (3.16)	2.56 (5.19)	1.29 (2.76)	1.67(3.37)	3.61 (5.12)	0.75 (2.30)

Table 3

Dependent Measures at Pre- and Post-Induction, Split by Experimental Condition and Trauma

	Experimental Condition					
	Dissociation Induction			Music Control		
Measure	NT	TD	TN	NT	TD	TN
Immersion Time (sec)						
Pre						
M	156.25	123.21	106.13	157.97	143.16	117.53
SD	114.16	103.64	114.08	116.25	113.26	113.52
Post						
M	161.61	124.44	110.90	167.49	140.50	106.31
SD	106.83	94.20	107.74	118.82	104.71	99.61
Pain (0-10)						
Pre						
M	5.80	5.84	6.08	5.88	6.83	5.79
SD	1.60	1.96	1.87	2.12	1.81	1.57
Post						
M	5.72	5.88	6.72	5.83	6.42	5.53
SD	1.91	2.27	2.08	2.40	1.83	2.01

Table 4

Summary of Hierarchical Regression Analysis

for Variables Predicting Immersion Time

at Post-Induction (N = 114)

Variable	*B*	*SE B*	ß	*T*	Sig.	R^2	ΔR^2
Step 1						.66	--
Immersion time pre	0.78	0.05	0.81	14.70	.00*		
Step 2						.66	.00
Immersion time pre	0.78	0.05	0.81	14.60	.00*		
ASI	0.37	0.94	0.03	0.40	.69		
BAI	0.32	0.96	0.02	0.34	.74		
Step 3						.68	.02
Immersion time pre	0.79	0.05	0.82	14.98	.00*		
ASI	0.31	1.01	0.02	0.30	.76		
BAI	0.70	0.97	0.05	0.72	.47		
DSI	0.72	0.43	0.10	1.67	.10		
DES	-0.50	0.26	-0.12	-1.96	.05*		
Step 4						.71	.03
Immersion time pre	0.80	0.05	0.82	15.24	.00*		
ASI	0.15	1.04	0.01	0.14	.89		
BAI	1.00	0.96	0.07	1.04	.30		
DSI	0.61	0.44	0.09	1.38	.17		
DES	-0.50	0.25	-0.123	-2.02	.05*		

ADI (Amnestic Experiences) Res. Ch.	2.82	7.49	0.03	0.38	.71
ADI (Gaps in Awareness)Res.Ch.	-10.26	6.32	-0.10	-1.62	.11
ADI (Depersonalization): Res.Ch.	-5.41	10.30	-0.05	-0.53	.60
ADI (Derealization): Res.Ch.	24.12	10.56	0.22	2.28	.02*
ADI (Absorption): Res.Ch.	1.75	7.99	0.02	0.22	.83
ADI (Imaginative Involvement): R.C.	-8.72	6.98	-0.08	-1.25	.21

*p<.05.

Table 5

Summary of Hierarchical Regression Analysis

for Variables Predicting Subjective Pain

at Post-Induction (N=114)

Variable	B	SE B	ß	t	Sig.	R^2	ΔR^2
Step 1						.74	--
Subjective pain pre	0.96	0.05	0.86	17.83	.00		
Step 2						.74	.00
Subjective pain pre	0.96	0.05	0.86	17.94	.00		
ASI	0.00	0.02	-0.09	-1.48	.14		
BAI	0.00	0.02	0.01	0.16	.88		
Step 3						.75	.01
Subjective pain pre	0.98	0.05	0.88	18.05	.00*		
ASI	-0.01	0.02	-0.05	-0.70	.48		
BAI	0.00	0.02	0.04	0.56	.58		
DSI	-0.72	0.01	-0.05	-0.98	.33		
DES	0.00	0.00	-0.08	-1.51	.13		
Step 4						.78	.03
Subjective pain pre	1.01	0.06	0.90	18.07	.00*		
ASI	-0.01	0.02	-0.05	-0.66	.51		
BAI	0.02	0.02	0.07	1.08	.28		
DSI	0.00	0.01	-0.04	-0.81	.42		

DES	0.00	0.00	-0.08	-1.53	.13
ADI (Amnestic Experiences) Res. Ch.	0.03	0.13	0.02	0.27	.79
ADI (Gaps in Awareness)Res.Ch.	-0.24	0.11	-0.12	-2.17	.03*
ADI (Depersonalization): Res.Ch.	-0.44	0.18	-0.21	-2.50	.01*
ADI (Derealization): Res.Ch.	0.26	0.18	0.12	1.43	.16
ADI (Absorption): Res.Ch.	0.24	0.14	0.12	1.75	.08
ADI (Imaginative Involvement): R.C.	0.01	0.12	-0.01	0.11	.91

*p<.05.

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