

University of Groningen

The impact of dissociation on perceptual priming and intrusions after listening to auditory narratives

Dorahy, Martin J.; Peck, Rowan K.; Huntjens, Rafaele J. C.

Published in:
Journal of trauma & dissociation

DOI:
[10.1080/15299732.2015.1134746](https://doi.org/10.1080/15299732.2015.1134746)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Dorahy, M. J., Peck, R. K., & Huntjens, R. J. C. (2016). The impact of dissociation on perceptual priming and intrusions after listening to auditory narratives. *Journal of trauma & dissociation*, 17(4), 410-425. <https://doi.org/10.1080/15299732.2015.1134746>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

ARTICLE

The impact of dissociation on perceptual priming and intrusions after listening to auditory narratives

Martin J. Dorahy, PhD^{a,b}, Rowan K. Peck, MSc^a, and Rafaele J. C. Huntjens, PhD^c

^aDepartment of Psychology, University of Canterbury, Christchurch, New Zealand; ^bThe Cannan Institute, Belmont Private Hospital, Brisbane, Australia; ^cDepartment of Clinical Psychology, University of Groningen, Groningen, The Netherlands

ABSTRACT

This study investigates the causal role of dissociation in intrusive memory development and possible underlying aberrant memory processes (e.g., increased perceptual priming). Using an audio-only adaption of the trauma film paradigm, we divided 60 participants into 3 conditions and presented them with different visual tasks—mirror staring, dot staring, or neutral images. The former 2 conditions were hypothesized to induce dissociation. Postaudio, a number of factors were assessed, including state dissociation, perceptual priming and conceptual priming, as well as intrusions over 3 days. Participants in the dissociation conditions displayed an increase in perceptual priming compared to those in the control condition and reported more distressing intrusions. No differences were found in conceptual priming and the overall number of intrusions between conditions. Findings contribute to the growing knowledge on the impact of dissociation and cognitive processing in the etiology of posttraumatic stress disorder intrusions.

ARTICLE HISTORY

Received 5 August 2015
Accepted 12 December 2015

KEYWORDS

Dissociation; intrusions;
perceptual priming;
posttraumatic stress disorder

Memories of traumatic events underpinning posttraumatic stress disorder (PTSD) are characterized by heightened processing of perceptual details (e.g., sights, smells) and reduced processing and elaboration of language-based meaning and organization (Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Holmes, Brewin, & Hennessy, 2004). Perceptually strong and conceptually weak event representations heighten associations between cued (e.g., a loud noise) and original (e.g., a gunshot) stimuli and between the stimuli and a strong affective response (e.g., intense fear). Moreover, because of the lack of elaboration and therefore integration into autobiographical memory stores (Brewin, 2014), strong perceptual memories have a greater chance of having unintentional, cue-driven retrieval, heightening intrusions of memories and affect (e.g., intense fear after any loud noise; Kleim, Ehring, & Ehlers, 2012; Sündermann, Hauschildt, & Ehlers, 2013). This study aimed to address whether dissociation can be manipulated experimentally to produce intrusions via reduced perceptual processing. An analogue

trauma paradigm was used. This work was designed to address the theoretical proposition that dissociation during exposure to overwhelming stimuli is directly associated with an increase in perceptual processing of the stimuli, which provides the cognitive foundations for later posttraumatic intrusion experiences (e.g., Huntjens et al., 2013).

Studies have shown an association between PTSD and increased trauma-related perceptual priming (Lyttle, Dorahy, Hanna, & Huntjens, 2010). Dissociation during and immediately after a traumatic event (peritraumatic dissociation) has been associated with PTSD, heightened perceptual processing, and intrusive memories (Holmes et al., 2004; Ozer, Best, Lipsey, & Weiss, 2003). The analogue trauma film (TF) paradigm examines these variables in the laboratory. This paradigm shows short films with stressful scenes to mimic a traumatic event and assess intrusions (e.g., Holmes et al., 2004; Kindt, Van den Hout, Arntz, & Drost, 2008). Some studies have used techniques for inducing dissociation (e.g., hypnosis, Holmes, Oakley, Stuart, & Brewin, 2006; hyperventilation, Lickel, Nelson, Lickel, & Deacon, 2008; eliciting third-person perspectives, Zoellner, Sacks, & Foa, 2007; dot staring, Leonard, Telch, & Harrington, 1999; Miller, Brown, DiNardo, & Barlow, 1994). Participants then record intrusions over the following days.

Spontaneous dissociation (i.e., induced by the TF without further manipulation) seems to produce intrusions in analogue samples (Holmes & Bourne, 2008). Yet attempts to manipulate dissociation in the TF paradigm have failed in consistently producing associations with intrusive memories (Holmes et al., 2004). There may be differences in the power of specific induction techniques to induce dissociation to the level that intrusive memories are produced. The central goal of the current study was to combine powerful and continuous (i.e., during stimulus presentation) dissociation manipulations with comprehensive measures of perceptual and conceptual priming and intrusion frequency and distress. This would allow an examination of whether dissociation during the time of processing was associated with greater perceptual priming and increases in intrusions.

An adapted version of the TF paradigm was used to simulate trauma stimuli. Krans, Naring, Holmes, and Becker (2010) showed that traumatic analogue symptoms could arise from listening to a traumatic event (i.e., no visual stimuli), with the development of vivid, intrusive visual images as a result of the audio stimuli. The current study used the auditory format and attempted to manipulate dissociation via two separate visual means in order to continuously induce experiences of dissociation during presentation of the experimental stimuli (i.e., in contrast to providing dissociation manipulation instructions only at the start of the experiment). We included and compared two different induction tasks that had proved effective in the past. Three groups were exposed to auditory stimuli, with the control group watching neutral pictures and two dissociation groups watching a spinning dot (Lickel et al., 2008) or staring at a mirror (Brewin & Mersaditabari, 2013; Brugger, 2002; Caputo, 2010).

Both dissociation manipulations were expected to result in significant levels of dissociation compared to the control group, but it was left open whether one would outperform the other. In line with the empirical literature outlined previously that shows a link between dissociation, reduced perceptual priming, and increased intrusions, it was hypothesized that those in the dissociation conditions would show *greater* levels of perceptual priming and *lower* levels of conceptual priming compared to those in the neutral condition. The dissociation conditions were also predicted to produce more intrusions.

Methods

Participants

Sixty college students between 18 and 74 years of age ($M = 24.57$, $SD = 10.12$) were recruited. Of these, 78% ($n = 47$) were female. All had normal vision and hearing. They completed the study for course credit or a small (\$10) voucher.

Materials

Audio clips

Two auditory clips manipulated analogue distress, both consisting of approximately 7 min of edited film excerpts. The neutral clip followed an emerging artist promoting his material. The threat clip presented a man wrongly accused of terrorism and subjected to multiple torture methods.¹ Excerpts were selected so that both audio clips included spoken words that could be extracted and used in two postaudio word tasks. Selected extracts were chosen so the assessment tasks' target words from each clip were directly comparable in frequency of use within the audio and frequency of use within the English language. Using the movie scripts to identify sequences that included the target words, we spliced these sequences together to maintain the overall cohesiveness of the story.

Visual tasks (dissociation manipulations)

Spinning dot. The current study utilized a black dot surrounded by a series of spiraling/spinning lines (see Supplemental Material). The spinning dot video was presented on a computer monitor directly in front of participants for the duration of the audio clips.

Mirror. Participants were asked to look at themselves in a mirror during the clip presentation (e.g., Caputo, 2010). A 30 cm × 40 cm mirror was placed against the computer, and participants stared intently at their eyes for the duration of the clips.

Neutral images (control). During the clips, the control group had neutral images presented on a computer. Images had no relevance to the threat or neutral audio stimuli and controlled any effects of divided attention (hearing the story while watching the screen) in the two dissociation conditions. Images were randomly presented for 3 s. They were from the Geneva Affective Picture Database (Dan-Glauser & Scherer, 2011) and consisted of mostly inanimate objects (e.g., a chair, a wheel), selected as neutral on valence and arousal (Dan-Glauser & Scherer, 2011).

Questionnaires

The Dissociation Tension Scale (DSS; Stiglmayr et al., 2010) assesses psychological and somatoform dissociative experiences with 21 items and aversive inner tension with 1 item. Ratings are made over the past 7 days from 0% (*never*) to 100% (*constantly*). Total mean scores average the 21 dissociation items and range from 0 to 100. In the current study the DSS had a reliability of $\alpha = .78$. The DSS was used to ensure that no differences existed in trait dissociation across the three conditions, which might have undermined the results of the dissociation manipulations.

The State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1983) consists of two separate 20-item self-report measures assessing state (STAI-S) and trait (STAI-T) anxiety. Responses are made on a 4-point scale from 1 (*not at all*) to 4 (*very much so*). The STAI-T had an internal consistency in this study of $\alpha = .86$, and the STAI-S had an internal consistency of $\alpha = .93$ at Time 1 (preaudio) and $\alpha = .94$ at Time 2 (postaudio). The STAI was used to assess similarities in trait anxiety across conditions and to examine changes in state anxiety across neutral and threat audio clips.

The Modified Peritraumatic Dissociative Experiences Questionnaire (M-PDEQ; Marshall, Orlando, Jaycox, Foy, & Belzberg, 2002) is adapted from the Peritraumatic Dissociative Experiences Questionnaire (Marmar, Weiss, & Metzler, 1997), which measures dissociation around the time of a traumatic event. The M-PDEQ contains eight items with responses from 1 (*not at all true*) to 5 (*extremely true*). An example item is “being a spectator in your own body.” Cronbach’s alpha for the M-PDEQ in this study was .87. The M-PDEQ was used to assess whether the two dissociation manipulations actually produced increases in dissociation.

Three Emotional Response Questions (ERQ) based on previous work (Davies & Clark, 1998) assessed levels of affectivity before and after the presentation of the audio clips to assess changes in affect. Participants rated their levels of happiness, depression, and anger *at that moment* from 1 (*very slightly or not at all*) to 5 (*extremely*).

The postaudio self-report of task commitment asked participants to rate from 0 (*not at all focused*) to 10 (*attention completely focused*) the extent to which they

had attended to the visual and audio elements of the study (i.e., “On the following scale please indicate how much attention you were able to pay to the [audio clips]/[visual presentation] you just [heard]/[saw]”). Participants were also asked to rate from 0 (*not at all distressing*) to 10 (*extremely distressing*) levels of distress for the neutral audio and threat audio (i.e., “On the following scale please indicate the extent to which you found the [interrogation]/[artist] clip distressing”). These questions indicated self-reported attention and distress across the two clips. At 3- to 4-day follow-up, participants rated from 0 (*never remembered to record intrusions*) to 10 (*always remembered to record intrusions*) the extent to which they recorded all intrusive memories, indexing diary compliance. Finally, three “yes,” “no,” or “not sure” questions assessed whether they were aware of listening to extracts of movies and whether they had seen *Chasing Amy* and *Rendition*.

Assessment of perceptual and conceptual priming

White-noise word identification task

The white-noise masked word identification task measured perceptual priming (Deutsch & Bentin, 1994; Ratcliff, Allbritton, & McKoon, 1997). This task presents spoken words concurrent with white-noise interference, causing words to be obscured. The level of interference reduces over repeated presentations, and words become clearer. Individuals with greater perceptual priming identify previously encoded words faster than those with lower perceptual priming. In this study, eight words were taken from each audio script and presented in counterbalanced order (i.e., neutral then threat or threat then neutral) to control ordering bias. Both word sets represented the overall theme of the audio (i.e., threat-related words were selected from the threat clip, artist-related words were selected from the neutral clip). Although some threat words may not have seemed threatening, they were used in a threatening way in the audio. Word frequencies in the English language were matched between the two word lists (i.e., neutral, threat), with frequencies taken from the Corpus of Contemporary American English (corpus.byu.edu/coca/a), a compendium of 450 million words taken from 1990–2012; words used in the word lists had an overall mean frequency of approximately 78 words per million. Selected words from each audio script were matched on the number of times they were used in the audio clips, with each word used an average of 2.31 times. The words were also matched between threat and neutral on the number of syllables; selected words had an average of two syllables. One-way *t* tests showed that the word lists did not differ across frequency in language, frequency within the clip, or number of syllables: frequency in language, $t(14) = 0.19$, $p = .85$; frequency within the clip, $t(14) = -0.38$, $p = .71$; number of syllables, $t(14) = 0.00$, $p = 1.00$.

The word lists were individually converted to speech using Mac OS 10.7 text-to-speech software and made into an audio file. A British English voice

was chosen for clarity. Participants heard each word (see Supplemental Material) repeated 10 times with the noise-to-word ratio changing each time. An approximate 2-s interval was between each word repetition, resulting in each word identification task lasting approximately 30 s. Computer sound engineer software (VirtualDJ Pro) was used to add white noise over the word. The balance of white noise to word cross-fade changed 10% with each repetition, resulting in the initial word presentation being 10% word and 90% white noise and the final presentation being 100% word and 0% white noise. Participants said the word out loud as soon as they thought they knew what it was. If they were correct, the time was recorded and they moved to the next word. If they were incorrect, they kept trying until they were correct.

Word-cue association task

The word-cue association task tested conceptual priming by measuring retrieval of previously encoded words (targets) using word cues that are associated with the target words and therefore act as semantic retrieval cues. Responding with the target word from the cue word requires conceptual processing. Conceptual priming is demonstrated if the words heard during the audio clips are chosen over more commonly and closely associated words when participants are exposed to the cue words (Schacter & McGlynn, 1989). A correct response was made if words from the audio clips (targets), or minor changes (e.g., pluralization), were given in reply to the cue words. The cue words were presented in counterbalanced order (threat then neutral; neutral then threat). Participants were asked to say the first word that came into their head when they heard the cue word.

Eight target words taken from the neutral and threat audio clips were presented aurally in British English. Word frequencies in the English language were matched between the threat and neutral word lists. Taken from the Corpus of Contemporary American English (corpus.byu.edu/coca/a), the words had a mean frequency of approximately 67 words per million. Words from the clips were matched on the number of times they were used, with each word said on average 2.5 times. The associated (cue) word was selected to be moderately associated with its target, with a mean association of 3.5 (all between the third and fourth most commonly associated word; see Supplemental Material). Word associations were taken from the Edinburgh Associative Thesaurus (<http://www.eat.rl.ac.uk/>). One-way t tests showed no differences between the word lists across frequency of use in the English language, frequency of use within the audio clips, or association relationship with the cued word: frequency of use in the English language, $t(14) = 0.02$, $p = .98$; frequency of use within the audio clips, $t(14) = 0.13$, $p = .90$; association relationship with cued word, $t(14) = 0.68$, $p = .51$.

Intrusion diary

Participants recorded intrusions (i.e., “any memories/images/thoughts about the clips occurring when you had not intended to”) related to the audio clips for 3 days. They also recorded their level of distress for each intrusion from 0 (*not distressing*) to 10 (*extremely distressing*), as well as briefly described the contents of the intrusion (Holmes & Steel, 2004; Lapsa & Alden, 2006).

Procedure

Participants were individually assessed in a quiet, dimly lit room. After giving consent, they provided basic demographic information and completed the ERQ (Time 1), the STAI, and the DSS. Participants were then randomly assigned to one of the three conditions (neutral image, spinning dot, mirror). Before the random presentation of each audio clip, a brief paragraph was read explaining the context of the clip, but this paragraph did not contain target word stimuli. Audio clips were then played through over-ear headphones, with participants instructed to attend carefully to the audio presentation while simultaneously paying attention to the visual presentation (i.e., themselves in the mirror, the spinning dot, the neutral pictures). The experimenter left the room for the duration of the audio task to minimize disturbance. Participants had an approximate 1-min gap between audio clips.

Following the second audio clip participants completed the postaudio measures of commitment to task, the ERQ (Time 2), the STAI-S, and the M-PDEQ. They then did the white-noise masked word identification task and the word-cue association task in random order. Finally, participants were given the intrusion diary and instructions.

At follow-up participants returned intrusion diaries and completed the four questions examining diary compliance, their awareness of watching movie extracts, and whether they had seen the two movies. The study was approved by the University’s Human Ethics Committee .

Design

Independent variables included condition (neutral image, spinning dot, mirror), clip/audio (neutral, threat), time (preaudio, postaudio), word type (neutral, threat), and day (Day 1, Day 2, Day 3). The central independent variables for assessing the hypothesis of a link between dissociation and increased perceptual and reduced conceptual priming were condition and word type. The central independent variable for examining intrusions was day. Both parametric and nonparametric tests were used depending on the nature of the dependent variable under examination and whether it violated the assumptions for using parametric statistics (Field, 2015).

Results

Descriptive statistics and manipulation checks

Table 1 shows demographic information and trait measures for the three conditions. Groups did not differ in age, gender, STAI-T, or DSS: age, $F(2, 57) = 0.54$, $p = .59$, $\eta_p^2 = .02$; gender, $\chi^2(2, N = 60) = 4.42$, $p = .11$; STAI-T, $F(2, 57) = 0.21$, $p = .81$, $\eta_p^2 = .01$; DSS, $F(2, 56) = 0.55$, $p = .58$, $\eta_p^2 = .02$.

Participants reported good attention to the audio ($M = 7.52$, $SD = 1.55$) and visual ($M = 6.17$, $SD = 1.77$) elements, and no differences were present across conditions in audio attention or visual attention: audio attention, $F(2, 57) = 0.37$, $p = .69$, $\eta_p^2 = .01$; visual attention, $F(2, 57) = 0.55$, $p = .58$, $\eta_p^2 = .02$. Participants reported lower distress for the neutral audio ($M = 1.62$, $SD = 1.61$) than the threat audio ($M = 6.95$, $SD = 2.05$), $t(59) = 21.23$, $p < .001$. No differences between groups were evident for distress for the neutral clip or the threat clip: neutral clip, $F(2, 57) = 0.34$, $p = .71$, $\eta_p^2 = .01$; threat clip, $F(2, 57) = 0.04$, $p = .97$, $\eta_p^2 = .001$.

Approximately 35% ($n = 21$) of participants were aware that they were listening to movie extracts. The proportions did not differ between groups, $\chi^2(2, N = 60) = 1.48$, $p = .60$. Only 7% ($n = 4$) reported having seen the movie *Chasing Amy*, whereas 5% ($n = 3$) reported having seen *Rendition*. These participants were spread across groups.

Regarding the audio clips' ability to manipulate emotion, related-samples Wilcoxon signed-rank tests revealed a significant decrease in ERQ happiness levels preaudio ($M = 3.40$, $SD = 0.62$) to postaudio ($M = 2.88$, $SD = 0.85$),

Table 1. Demographic information and task measurement scores for the dissociation conditions and neutral condition.

Variable	Neutral	Spinning dot	Mirror group
<i>N</i>	20	19	21
Female (male)	14 (6)	18 (1)	15 (6)
Age	25.70 (9.04)	22.58 (7.27)	25.15 (13.10)
STAI-T	43.60 (11.24)	42.74 (8.54)	41.71 (7.63)
DSS	8.82 (5.56)	6.79 (6.28)	8.08 (6.24)
Audio attention	7.65 (1.38)	7.26 (1.69)	7.62 (1.60)
Visual attention	5.85 (2.11)	6.21 (1.51)	6.43 (1.66)
Distress in neutral	1.75 (2.10)	1.74 (1.33)	1.38 (1.32)
Distress in threat	6.85 (2.30)	7.00 (1.97)	7.00 (1.94)
ERQ happiness preaudio	3.35 (0.75)	3.37 (0.60)	3.48 (0.51)
ERQ happiness postaudio	3.10 (0.79)	2.58 (0.84)	2.95 (0.86)
ERQ depression preaudio	1.45 (0.83)	1.63 (0.76)	1.43 (0.75)
ERQ depression postaudio	1.55 (0.60)	2.11 (0.94)	1.95 (0.92)
ERQ anger in preaudio	1.15 (0.37)	1.37 (0.83)	1.14 (0.36)
ERQ anger in postaudio	1.30 (0.47)	1.74 (0.81)	1.76 (1.09)
Preaudio STAI-S	36.40 (12.39)	38.37 (10.68)	34.86 (8.94)
Postaudio STAI-S	36.05 (10.26)	46.26 (10.25)	42.33 (13.09)
M-PDEQ	12.90 (4.70)	20.21 (6.24)	18.10 (6.46)
Diary compliance	6.80 (2.33)	7.52 (1.95)	7.10 (2.21)

Notes: Unless noted otherwise, all data are M (SD). STAI-T = State Trait Anxiety Inventory–Trait subscale; DSS = Dissociation Tension Scale; ERQ = Emotional Response Questions; STAI-S = State Trait Anxiety Inventory–State subscale; M-PDEQ = Modified Peritraumatic Dissociative Experiences Questionnaire.

$Z = -4.12, p < .001$. An increase in ERQ depression was evident preaudio ($M = 1.50, SD = 0.77$) to postaudio ($M = 1.87, SD = 0.85$), $Z = -2.99, p < .01$. An increase in ERQ anger ratings was also evident preaudio ($M = 1.22, SD = 0.56$) to postaudio ($M = 1.60, SD = 0.85$), $Z = -2.81, p < .01$. Kruskal–Wallis tests found no significant differences between groups for ERQ happiness preaudio, though postaudio trended toward significance: preaudio, $\chi^2(2, N = 60) = 0.25, p = .88$; postaudio, $\chi^2(2, N = 60) = 4.78, p = .09$. The groups showed no difference for ERQ depression preaudio or postaudio: preaudio, $\chi^2(2, N = 60) = 1.87, p = .39$; postaudio, $\chi^2(2, N = 60) = 4.06, p = .13$. They also showed no difference for ERQ anger preaudio or postaudio: preaudio, $\chi^2(2, N = 60) = 0.58, p = .75$; postaudio, $\chi^2(2, N = 60) = 3.17, p = .21$.

A Condition \times Time analysis of variance (ANOVA) on STAI-S scores (see Table 1) produced a main effect for time, $F(1, 57) = 21.53, p < .001, \eta_p^2 = .27$, with higher state anxiety following the audio clips. There was no main effect for condition, $F(2, 57) = 1.75, p = .18, \eta_p^2 = .06$, suggesting that anxiety did not differ between conditions. However, this result was qualified by a Condition \times Time interaction, $F(2, 57) = 6.17, p = .004, \eta_p^2 = .18$. Groups did not differ on preinduction state anxiety, $F(2, 57) = 0.54, p = .59, \eta_p^2 = .02$. However, they differed on postinduction state anxiety, $F(2, 57) = 4.05, p = .02, \eta_p^2 = .12$, with the only difference being more anxiety in the spinning dot than the neutral condition. Regarding change over time, STAI-S scores increased from preinduction to postinduction in both dissociation conditions (spinning dot, mirror) but not the neutral condition: spinning dot, $t(18) = -3.52, p = .002$; mirror, $t(20) = -3.94, p < .001$; neutral, $t(19) = 0.25, p = .81$. Thus, the dissociation tasks induced more anxiety.

A multivariate ANOVA found no multivariate effect for order (whether neutral or threat audio was presented first) on the key dependent variables of M-PDEQ, perceptual priming, conceptual priming, overall frequency of intrusion, and overall distress of intrusions, $V = .25, F(10, 108) = 1.53, p = .14, \eta_p^2 = .12$. Thus, order was not used as an independent variable.

Manipulation of dissociation

A one-way ANOVA on total M-PDEQ scores postinduction across the three conditions was significant, $F(2, 57) = 8.12, p < .001, \eta_p^2 = .22$, with the spinning dot and mirror conditions higher than the neutral/control condition ($p < .001$ and $p < .05$, respectively) but not differing from each other ($p = .78$; see Table 1). Although there was a medium positive correlation between DSS scores and total M-PDEQ scores, $r(59) = .27, p < .05$, M-PDEQ scores continued to show the same between-group differences when DSS scores were controlled, $F(2, 53) = 4.41, p < .05$. Consequently, the dissociation manipulations were capable of inducing dissociation.

Perceptual and conceptual priming

White-noise task

A 2 (Word Type: neutral, threat) \times 3 (Condition: neutral, spinning dot, mirror) mixed ANOVA on the white-noise task (perceptual priming) showed a main effect for word, $F(1, 57) = 10.83, p = .002, \eta_p^2 = .16$, with faster identification of threat compared to neutral words (see Table 2). The condition main effect was also significant, $F(2, 57) = 3.57, p = .034, \eta_p^2 = .11$. Latency was slower in the neutral condition compared to the spinning dot ($p = .02$) and mirror ($p = .03$) conditions. The interaction between word type and condition fell marginally short of significance, $F(2, 57) = 3.01, p = .057, \eta_p^2 = .10$. Simple effects analyses showed no difference in response latency for neutral and threat words in the neutral condition, $t(19) = 0.104, p = .92$. However, latency for threat words was faster in the spinning dot and mirror conditions: spinning dot, $t(18) = 2.58, p = .02$; mirror, $t(20) = 3.09, p = .006$. Examining the spinning dot and mirror tasks in isolation showed no difference in latency to neutral words or threat words: neutral words, $t(38) = -0.20, p = .84$; threat words, $t(38) = -0.08, p = .94$. Supporting the link between dissociation and perceptual priming, the M-PDEQ and white-noise priming task were significantly correlated, $r(60) = .27, p < .05$.

Word-cue task

The word-cue association task (conceptual priming) showed low correct responses in the neutral category, resulting in a positive skew in the data. A nonparametric Wilcoxon matched-pairs signed-rank test showed significantly more correct responses for the threat words ($M = 2.09, SD = 1.33$) than the neutral words ($M = 0.39, SD = 0.74$), $Z = -5.47, p < .001$. Independent-samples Kruskal-Wallis tests showed no significant differences between the three groups for neutral word-cue scores (M rank: neutral = 30.20, spinning dot = 30.11, mirror = 31.14; $\chi^2[2] = 0.07, p = .96$) or threat word-cue scores (M rank: neutral = 30.15, spinning dot = 34.11, mirror = 27.57; $\chi^2[2] = 1.47, p = .48$). There was no significant correlation between dissociation (M-PDEQ) and conceptual priming, $r(59) = .12, p = .36$.

Diary

Mean compliance for completing the intrusion diary (see Table 1) was relatively high ($M = 7.13, SD = 2.16$), with no differences between conditions,

Table 2. Mean (*SD*) latencies in white-noise task for the three conditions.

Word type	Neutral ($n = 20$)	Spinning dot ($n = 19$)	Mirror ($n = 21$)
Neutral	19.02 (1.96)	18.08 (1.94)	18.21 (2.17)
Threat	19.06 (1.97)	16.82 (2.84)	16.89 (2.87)

$F(2, 57) = 0.55, p = .58, \eta_p^2 = .02$. Nonparametric assessment showed that overall (i.e., across conditions) there was a reduction in intrusions across the 3 days, $\chi^2(2, N = 60) = 39.22, p < .001$, with Day 2 ($M = 0.92, SD = 0.94$) having fewer intrusions than Day 1 ($M = 1.33, SD = 0.98; Z = 3.26, p = .001$) and Day 3 ($M = 0.53, SD = 0.79$) having fewer intrusions than Day 2 ($Z = 3.74, p < .001$). No differences were evident across the 3-day diary entry period for distress of intrusions, $\chi^2(2, N = 22) = 0.25, p = .88$ (Day 1: $M = 3.62, SD = 2.48$; Day 2: $M = 3.65, SD = 1.99$; Day 3: $M = 3.45, SD = 2.34$). The content of intrusions was primarily what was heard in the threat audio clip (e.g., “I thought about the sounds of the torturing when I heard water”).

For differences across conditions for each diary entry day, Kruskal–Wallis tests showed a nonsignificant trend for Day 1, $\chi^2(2, N = 60) = 4.99, p = .08$, with the spinning dot condition (M rank = 23.47) producing more intrusions than the neutral condition (M rank = 16.70; $Z = -2.03, p = .04$; see Table 3). The conditions did not differ on intrusions on Day 2 or Day 3 or on total 3-day intrusions: intrusions on Day 2, $\chi^2(2, N = 60) = 0.71, p = .70$; intrusions on Day 3, $\chi^2(2, N = 60) = 1.21, p = .55$; total 3-day intrusions, $\chi^2(2, N = 60) = 2.13, p = .34$. For the distress of intrusions for each condition, Kruskal–Wallis tests showed a significant difference for both Day 1 and total 3-day distress: Day 1, $\chi^2(2, N = 60) = 6.85, p = .03$; total 3-day, $\chi^2(2, N = 60) = 6.21, p = .045$ (see Table 3). For Day 1, the spinning dot condition (M rank = 25.21) produced more distressing intrusions than the neutral condition (M rank = 15.05; $Z = -2.82, p = .005$). For combined distress across the 3 days, the spinning dot condition (M rank = 24.13) also produced more distressing intrusions than the neutral condition (M rank = 16.08; $Z = -2.22, p = .03$). Similarly, the mirror condition (M rank = 24.50) produced more distressing intrusions across the 3 days than the neutral condition (M rank = 17.33; $Z = -1.93, p = .05$). No other differences were evident. The M-PDEQ correlated significantly with Day 1 and total frequency of intrusions as well as with distress of intrusions on Day 1, Day 2, and all 3 days: Day 1 frequency, $r(60) = .30, p < .05$; total frequency, $r(60) = .28, p < .05$; Day 1 distress, $r(60) = .51, p < .001$; Day 2 distress, $r(59) = .50, p < .001$; 3-day distress, $r(60) = .49, p < .001$.

Table 3. Means (*SD*) for intrusion frequency and distress across the 3 days.

Diary entry	Neutral ($n = 20$)	Spinning dot ($n = 19$)	Mirror ($n = 21$)
Day 1 frequency	1.10 (0.85)	1.74 (1.05)	1.19 (0.98)
Day 2 frequency	0.75 (0.79)	1.05 (1.08)	0.95 (0.97)
Day 3 frequency	0.35 (0.59)	0.63 (0.89)	0.62 (0.86)
Total frequency	0.73 (0.74)	1.25 (1.00)	0.92 (0.93)
Day 1 distress	1.61 (2.21)	3.45 (1.96)	2.57 (2.42)
Day 2 distress	1.15 (1.86)	1.95 (2.08)	2.39 (2.44)
Day 3 distress	1.00 (1.97)	1.82 (2.74)	1.02 (1.79)
Total distress	1.25 (1.82)	2.40 (1.99)	2.00 (1.84)

Discussion

The current study aimed to (a) examine the causal role of dissociation in eliciting increased perceptual priming, reduced conceptual priming, and intrusive memories; and (b) investigate the impact of different induction procedures for dissociation delivered continuously during stimulus presentation. The audio-only adaptation of the TF paradigm successfully increased levels of negative affect and distress, reduced levels of positive affect, and induced substantial levels of intrusions, thus supporting the idea that an audio-only TF paradigm is a viable alternative to the audiovisual version (Krans et al., 2010). As expected from theory, based on the proposition that dissociation during trauma processing underpins heightened perceptual processing and posttraumatic intrusions, peri-experiment dissociation, an analogue of peritraumatic dissociation, led to increased perceptual priming and more distressing intrusions. No differences across dissociation and nondissociation conditions were found for conceptual priming.

Both the spinning dot and mirror staring tasks produced increases in peri-experiment dissociation compared to the control condition. The tasks continued to elicit more dissociation even after recent dissociative episodes (i.e., DSS) were controlled. A greater level of perceptual priming was found in the dissociation conditions, yet conceptual priming did not differ across the three groups. It seems the dissociation conditions increased perceptual priming but had no differentiating impact on conceptual priming, suggesting a complex relationship between perceptual and conceptual priming. Higher levels of conceptual priming were connected to the threat-related words compared with the neutral words, irrespective of group membership. This indicates the unexpected finding of greater conceptual priming for threat words, which is in contrast to Lytle and colleagues' (2010) clinical study showing lower priming for specific conflict-related words (associated with terrorism activity in Northern Ireland) compared to general threat-related words and neutral words. One reason for the apparent contradiction could be the use of a nonclinical analogue sample versus a clinical sample, such that the former may show enhanced conceptual priming to low-level threat whereas the latter demonstrates reduced conceptual priming to stimuli resembling their core trauma schema.

The frequency of intrusions decreased progressively over 3 days, but their distress did not. The frequency of intrusions did not differ across conditions. However, the spinning dot condition showed a trend toward more intrusions on Day 1 than the neutral condition. The spinning dot did produce more distressing intrusions on Day 1 than the neutral condition, whereas both the spinning dot and the mirror conditions showed more distressing intrusions across the 3 days than the neutral condition. Consequently, compared to the neutral condition, the spinning dot condition more effectively produced

more distressing and potentially more frequent initial intrusions, while the mirror staring condition produced more distressing overall intrusions. Although many studies have focused on the frequency of intrusions, Michael, Ehlers, Halligan, and Clark (2005) found that severity was a better predictor of PTSD. Krans et al. (2010) found that intrusions after listening to audio-only distressing stimuli were generally vivid and visual. The fact that numerous studies utilizing the TF paradigm have successfully elicited more intrusions in experimental than control groups—whereas the current study did not—could indicate that the heightening of perceptual processing via a dissociation induction increased distress but not frequency when limited to audio threat stimuli. It would be useful to study other characteristics of intrusions (e.g., here-and-now quality) in future studies (Michael, Ehlers, & Halligan, 2005).

State anxiety was elevated in the two dissociation conditions compared to the control condition, suggesting that the visual manipulations (mirror and spinning dot) may exacerbate anxiety. Those in the dissociation conditions also experienced greater levels of dissociation. Experiences of dissociation may have caused anxiety, or alternatively anxiety caused by the tasks may have increased dissociation (American Psychiatric Association, 2013). The main analyses were rerun controlling for state anxiety, with no significant differences found from the original analyses. Further assessment of the role of anxiety in dissociation and subsequent intrusions is needed, perhaps using a condition that induces both anxiety and dissociation and comparing intrusion levels and distress to an anxiety-only condition.

Limitations relate to the sample having a relatively high proportion of females (72%) and being college students. Although women are more likely to develop PTSD (Tolin & Foa, 2006), they tend to rate the same traumatic events as more dangerous and frightening than men, which could potentially mean that the average level of distress induced by the audio clips was higher than it would have been with an equal gender split. Previous studies have shown that higher IQ and education act as protective factors against PTSD and peritraumatic dissociation (Brewin, Andrews, & Valentine, 2000).

The study required that the word stimuli also appear in the audio clips. All attempts to match the words in relation to all relevant frequencies (e.g., in the clips and in the English language) were made. Unexpected biases still possibly remained. Analogue trauma techniques have inherent limitations in their generalizability to real-life situations and PTSD development. The current study did, however, demonstrate the potency of the audio version of the TF paradigm for evoking distressing intrusions, especially during a dissociative induction that heightened perceptual processing.

One final limitation arises from not having tested the effect of each audio clip individually. Affectivity and anxiety were assessed after both audio clips were presented. Therefore, it is impossible to definitively attribute the changes in

affect to any one clip in particular. However, ratings of distress level from each audio clip give an indication of the impact of both, and participants rated the threat audio as significantly more distressing than the neutral audio, which implies that the observed effects were due to the threat audio.

Conclusion

In sum, the mirror staring and spinning dot tasks produced higher levels of perceptual priming and more distressing intrusions than a nondissociative control task. Taken together, the findings support the hypothesized causal link between peritraumatic dissociation, increased perceptual processing, and initial distressing intrusions. Both the mirror staring and spinning dot staring tasks produced quite similar outcomes with regard to perceptual priming and intrusions. Future work should explore induction methods that reliably differentiate different types of dissociation, such as the distinction between detachment (i.e., alterations in consciousness) and compartmentalization (i.e., dissociation at the structural level of personality). This would allow for a more specific examination of the association between dissociation, perceptual processing, and the development of later intrusions.

Note

1. The neutral clip was compiled from the movie *Chasing Amy* (1997; rated R16, offensive material was removed). The threat clip was compiled from the movie *Rendition* (2007; rated R16).

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- 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., & 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., 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., & Mersaditabari, N. (2013). Experimentally-induced dissociation impairs visual memory. *Consciousness and Cognition*, *22*, 1189–1194. doi:10.1016/j.concog.2013.07.007
- Brugger, P. (2002). Reflective mirrors: Perspective-taking in autoscopic phenomena. *Cognitive Neuropsychiatry*, *7*(3), 179–194. doi:10.1080/13546800244000076
- Caputo, G. B. (2010). Apparitional experiences of new faces and dissociation of self-identity during mirror gazing. *Perceptual and Motor Skills*, *110*(3C), 1125–1138. doi:10.2466/pms.110.3c.1125-1138

- Dan-Glauser, E. S., & Scherer, K. R. (2011). The Geneva Affective Picture Database (GAPED): A new 730 picture database focusing on valence and normative significance. *Behavior Research Methods*, 43, 468–477. doi:10.3758/s13428-011-0064-1
- Davies, M. I., & Clark, D. M. (1998). Predictors of analogue post-traumatic intrusive cognitions. *Behavioural and Cognitive Psychotherapy*, 26, 303–331.
- Deutsch, A., & Bentin, S. (1994). Attention mechanisms mediate the syntactic priming effect in auditory word identification. *Journal of Experimental Psychology: Learning Memory and Cognition*, 20(3), 595–607.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of post-traumatic stress disorder. *Behaviour Research and Therapy*, 38, 319–345. doi:10.1016/S0005-7967(99)00123-0
- Field, A. P. (2005). *Discovering statistics using SPSS* (2nd ed.). London, UK: Sage.
- Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. *Acta Psychologica*, 127(3), 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., Oakley, D. A., Stuart, A. D. P., & Brewin, C. R. (2006). Investigating peritraumatic dissociation using hypnosis during a traumatic film. *Journal of Trauma & Dissociation*, 7(4), 91–113. doi:10.1300/J229v07n04_06
- Holmes, E. A., & Steel, C. (2004). Schizotypy: A vulnerability factor for traumatic intrusions. *Journal of Nervous & Mental Disease*, 192(1), 28–34.
- Huntjens, R. J. C., Dorahy, M. J., & Van Wees-Cieraad, R. (2013). Dissociation and memory fragmentation. In F. Kennedy, H. Kennerley, & D. Pearson (Eds.), *Dissociation and cognitive therapy* (pp. 92–103). London, UK: Routledge.
- Keane, T. M., Weiss, D. S., & Metzler, T. J. (1997). The Peritraumatic Dissociative Experiences Questionnaire. In J. P. Wilson & C. R. Marmar (Eds.), *Assessing psychological trauma and posttraumatic stress disorder* (pp.412–428). New York, NY: Guilford Press.
- Kindt, M., Van den Hout, M., Arntz, 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
- Kleim, B., Ehring, T., & Ehlers, A. (2012). Perceptual processing advantages for trauma-related visual cues in post-traumatic stress disorder. *Psychological Medicine*, 42, 173–181. doi:10.1017/S0033291711001048
- Krans, J., Naring, G., Holmes, E. A., & Becker, E. S. (2010). “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
- Laposa, J. M. & Alden, L. E. (2006). Functional peritraumatic cognitive strategies and intrusive memories. *Behaviour Research and Therapy*, 44, 925–946.
- Leonard, K. N., Telch, M. J., & Harrington, P. J. (1999). Dissociation in the laboratory: A comparison of strategies. *Behaviour Research and Therapy*, 37, 49–61. doi:10.1016/S0005-7967(98)00072-2
- Lickel, J., Nelson, E., Lickel, A. H., & Deacon, B. (2008). Interoceptive exposure exercises for evoking depersonalization and derealization: A pilot study. *Journal of Cognitive Psychotherapy*, 22(4), 321–330. doi:10.1891/0889-8391.22.4.321
- Lytte, N., Dorahy, M. J., Hanna, D., & Huntjens, R. J. C. (2010). Conceptual and perceptual priming and dissociation in chronic posttraumatic stress disorder. *Journal of Abnormal Psychology*, 119, 777–790. doi:10.1037/a0020894

- Marshall, G. N., Orlando, M., Jaycox, L. H., Foy, D. W., & Belzberg, H. (2002). Development and validation of a modified version of the Peritraumatic Dissociative Experiences Questionnaire. *Psychological Assessment, 14*(2), 123–134. doi:10.1037/1040-3590.14.2.123
- Michael, T., Ehlers, A., & Halligan, S. L. (2005). Enhanced priming for trauma related material in posttraumatic stress disorder. *Emotion, 5*, 103–112. doi:10.1037/1528-3542.5.1.103
- Michael, T., Ehlers, A., Halligan, S. L., & Clark, D. M. (2005). Unwanted memories of assault: What intrusion characteristics are associated with PTSD? *Behaviour Research and Therapy, 43*, 613–628. doi:10.1016/j.brat.2004.04.006
- Miller, P. P., Brown, T. A., DiNardo, P. A., & Barlow, D. H. (1994). The experimental induction of depersonalization and derealization in panic disorder and nonanxious subjects. *Behaviour Research and Therapy, 32*(5), 511–519. doi:10.1016/0005-7967(94)90138-4
- Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin, 129*, 52–73. doi:10.1037/0033-2909.129.1.52
- Ratcliff, R., Allbritton, D., & McKoon, G. (1997). Bias in auditory priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*(1), 143–152.
- Schacter, D. L., & McGlynn, S. M. (1989). Implicit memory: Effects of elaboration depend on unitization. *American Journal of Psychology, 102*, 151–181. doi:10.2307/1422950
- Spielberger, C. D., Gorsuch, R. L., & Lushene, R. G. (1983). *Manual for the State Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Stiglmayr, C., Schminke, P., Wagner, T., Braakman, D., Schweiger, U., Sipos, V., & Keinast, T. (2010). Development and psychometric characteristics of the Dissociation Tension Scale. *Journal of Personality Assessment, 92*(3), 269–277. doi:10.1080/00223891003670232
- 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
- Tolin, D. F., & Foa, E. B. (2006). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Bulletin, 132*(6), 959–992. doi:10.1037/0033-2909.132.6.959
- Zoellner, L. A., Sacks, M. B., & Foa, E. B. (2007). Dissociation and serenity induction. *Journal of Behavior Therapy and Experimental Psychiatry, 38*, 252–262. doi:10.1016/j.jbtep.2006.06.003