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Intrusive images in trauma film paradigm. The role of peritraumatic tasks, emotional regulation strategies, and emotional states

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Abstract: This study examined the impact of a concurrent task during trauma exposure on intrusive visual images reported one week after exposure. We predicted that intrusion frequency will be reduced in the visuospatial condition compared to the no task control condition. Two experimenters were conducted to test this assumption. In both studies participants were exposed to a traumatic material (audio video and written story) under one of two conditions: while tapping a complex pattern of five key on a concealed keyboard (visuospatial condition) or with no extra task (control condition). The analyses indicated that intrusive images could develop from exposure to a traumatic event, without being personally involved. Moreover, a concurrent visuospatial task during exposure lead to less intrusions compared to control condition. The practical implications of these results for PTSD treatment and secondary traumatization are discussed.

Keywords: trauma, intrusive images, visuospatial task.

Introduction

Most people are exposed, directly or indirectly, to at least one life-threatening situation during the course of their lives (Ozer, Best, Lipsey, & Weiss, 2003). Posttraumatic stress disorder (PTSD) is one of the most common psychological response to a traumatic event (Figley, 1995; Kerasiotis & Motta, 2004). The primary symptoms of PTSD include re-experiencing of the trauma in the form of intrusions, avoiding stimuli associated with the trauma, negative alterations in cognitions and mood, and arousal (American Psychiatric Association, 2013). Among the four clusters of symptoms, intrusions are considered the most frequently endorsed PTSD symptom (Durham, McCammon, & Allison, 1985). These intrusions are uncontrollable, distressing, and repeatedly come into consciousness in different forms, like sounds, smells, tastes or bodily sensations, but visual images are the most common (Brewin, 2003; Brewin & Holmes, 2003; Ehlers et al., 2002). In this research, we

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explored the mechanisms that may account for the development of intrusions after exposure to traumatic stimuli, and also the variables associated with these intrusions.

Memory Systems and Trauma-Related Memory

Information-processing theories sustain that cognitive processes may explain the maintenance of PTSD symptoms (Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 1998). The research on memory retrieval added evidences for the fact that involuntary access to trauma memory is enhanced, whereas voluntary access is impaired in PTSD (Ehlers & Clark, 2000; Laposa & Rector, 2012). Several models of PTSD have attempted to explain this discrepancy between easily triggered re-experiencing of the trauma and difficulties in intentional memory recall (Moore & Zoellner, 2007; Williams, 2006). For example, the dual representation theory (Brewin et al., 1996) suggests that there are two types of memory representations of the trauma (Brewin, 1989). Thus, oral or written narrative memories of a trauma are thought to reflect the operation of a "verbally accessible memory" (VAM) system that corresponds to ordinary autobiographical memory. In this system, information received a relatively high level of conscious processing (Brewin & Holmes, 2003). Flashbacks reflect the operation of a "situationally accessible memory" (SAM) system. Information in this system can be accessed automatically by situational reminders of the traumatic event and may be spontaneously re-experienced in the form of detailed visual images of scenes of the trauma. In the context of trauma exposure, information processing shifts in favor of visuospatial processing. As a results, memory representations are rich in sensory details, but they are not conceptually integrated within autobiographical memory (Holmes & Bourne, 2008).

It is considered that the development of trauma-related memory would be impaired when we are engaged in a concurrent task that relies on the same processing resources used for encoding the traumatic information, because perceptual information related to traumatic event would be less well encoded, leading ultimately to fewer sensory-based intrusions (Brewin & Holmes, 2003). Consequently, the interference of visuospatial processing should reduce intrusion development. Several studies have been conducted to explore this hypothesis derived from the dual representation theory and the results supported the fact that engaging in a visuospatial task (e.g., playing Tetris, tapping a spatial pattern on a keypad) during exposure to an aversive material resulted in significantly fewer intrusions over a one-week period compared to a no task control condition (e.g., Bourne, Frasquilho, Roth, & Holmes, 2010; Holmes, Brewin, & Hennessy, 2004; Holmes, James, Coode-Bate, & Deeprose, 2009; Krans, Naring, Holmes, & Becker, 2010). These finding has been extended to a

visuospatial task performed in the post-exposure period (Holmes et al., 2009; Holmes, James, Kilford, & Deeprose, 2010).

The role of emotional states and emotional regulation strategies

Previous studied showed that peritraumatic negative emotional states, like fear or anxiety, may explain the intrusions development (Clark, Mackay, & Holmes, 2015; Măirean & Ceobanu, 2017). Consequently, strategies used for regulating unwanted emotional states may also be related with posttraumatic symptomatology. Cognitive reappraisal and expressive suppression are two types of emotional regulation strategies that have been studied in relation to posttraumatic stress symptoms. Cognitive reappraisal is considered an antecedent-focused emotion regulation strategy that involves changing the meaning of a negative situation, before the occurrence of emotional responses, while expressive suppression is a response-focused emotion regulation strategy that involves efforts to inhibit the expression of unwanted emotional states (Gross, 1998).

Cognitive reappraisal was generally negatively associated with traumatic stress, whereas expressive suppression manifested positive associations with traumatic stress symptoms (e.g., Boden et al., 2013; Ehring & Quack, 2010; Măirean, 2016; Moore, Zoellner, & Mollenholt, 2008). The role of expressive suppression was also investigated in relation to intrusions generated by watching a traumatic film and the results showed that this emotional regulation strategy significantly predicted intrusions (Măirean & Ceobanu, 2017; Seligowski, Lee, Bardeen, & Orcutt, 2015).

Study 1

The present study examined the effects of a concurrent task during the encoding of analog trauma on subsequent intrusions, based on theoretical framework provided by the dual representation theory (Brewin et al., 1996). Tasks included visuospatial tapping. According to this theoretical approach, visuospatial tasks compete for the limited resources in the SAM system, leading to perceptual information being less well encoded and resulting in fewer sensory-based intrusions (cf. Brewin & Saunders, 2001). Based on this assumption and on previous research, we expect that interference of visuospatial processing during encoding will reduce intrusion development. The study compares the effects of a visuospatial tapping task with a no task control condition, during exposure to a traumatic material. The main outcome variable was the number of intrusive images of the trauma recorded in an intrusion provocation task, after one week. This intrusive image may be considered an analog of re-experiencing symptoms in PTSD. To control for individual differences that could be related to intrusion development, we assessed trait

dissociation. We also used additional measures to assess possible competing explanations for the results: to measure global distraction effects we designed an attention rating and a recall test; mood, state anxiety, and state dissociation ratings allowed the averseness of the trauma material to be confirmed.

The stressful film paradigm was used in the current study. This method has been used in many studies testing hypotheses from information processing models of PTSD (Butler, Wells, & Dewick, 1995; Davies & Clark, 1998; Holmes & Bourne, 2008). Usually, non-clinic participants view a trauma film while performing a concurrent task that relies on visuospatial resources. One week after film exposure, participants report their intrusive images. Intrusions are not a sign of pathology per se and the form of intrusions among those with and without PTSD is similar in nature (Ehlers et al., 2002; Michael, Ehlers, Halligan, & Clark, 2005). Accordingly, we examined intrusions among healthy individual as this may inform understanding of intrusions in PTSD.

Method

Participants

Participants were invited to participate in exchange for course credit. As required by the research ethics, the invitation contained information about the graphic nature of the film. In total, 95 participants completed the study. Exclusion criteria were represented by history of road-traffic accidents. Moreover, as part of informed consent for the experiment, all participants confirmed to the experimenter in writing that they had not previously received any treatment for a mental health problem (in the form of psychological therapy or medication). Seventeen participants failed to complete the intrusion provocation task at follow up session and were excluded from the dataset. The final sample of the 78 participants consisted of 85.5% women and 14.5% men. The participants were students, most of them working or seeking employment. Ages ranged from 19 to 46, with a mean age of 35.5 years, *SD* = 9.09.

Materials and measures

Trauma Film. A 4-min trauma video depicting traumatic scenes of real-life footage of the horrible aftermath of road traffic accidents was used to model a traumatic experience. It was projected on a 200x200 cm screen using an audiovisual LCD projector (Sanyo, model PLC-XU3000A). It consisted of scenes of horrific content, from the aftermath of a road traffic accident, including injured victims screaming, emergency service personnel working to extract trapped victims, dead bodies being moved, and children crying. With respect to the ethical issues of showing a film with traumatic content, previous studies using other trauma films (e.g., Brewin & Saunders, 2001; Davies & Clark, 1998) found that participants did not report ongoing distress subsequent

to the end of the experiment. The film used does fulfill criterion A1 of diagnostic from DSM–5 (APA, 2013), in that participants witnessed actual death and suffering. It was also rated as extremely negative and led to negative mood change. Moreover, the intrusions were reported as unwanted and distressing, as we will present bellow in the Results section.

Experimental Tasks During the Trauma Film. The concurrent visuospatial task involved continuous tapping a specified pattern of five keys on a concealed keyboard. Participants were told that the computer was wired up to record the number of correct sequences. They were given 1 min to practice tapping the sequence *JYPVA* (an irregular pattern as used in previous studies, Brewin & Saunders, 2001; Holmes et al., 2004) using their dominant hand. Only at this stage they were able to look at the keyboard, and visual feedback was given of the characters tapped on the computer monitor. The keyboard was then concealed from view.

Dissociative Experiences Scale, revised (DES-II; Bernstein & Putnam, 1986) was used to measure trait dissociation. The DES-II contains 28 items and answers are rated on an 11-point scale from 0% (never) to 100% (always). Alpha Cronbach Coefficient for this scale in our sample was .89.

Dissociative States Scale (DSS; Bremner et al., 1998) was used for measuring state dissociation. The questionnaire contains 19 items and answers are rated on a 5-point scale from 0 (not at all) to 4 (very much). Cronbach alpha for the current sample was .81.

State Anxiety Scale (STAI-S, Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used to measure current state of anxiety, asking how respondents feel "right now". The scale consists of 20 items, rated on a 4 point Likert scale from 1 (not at all) to 4 (very much). Cronbach alpha for the current sample was .82.

The Positive Affect Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) is a widely used inventory for the assessment of positive and negative affectivity. It consists of a 10-item scale for positive affect (PA) and another 10-item scale for negative affect (NA). Participants rated all the items on a 5-point scale (1 = *very slightly or not at all*, and 5 = *very much*) with the "in this moment" time frame. The ratings on the mood questionnaire were summed into a single score (positive items being reversed). Cronbach alpha for the current sample was .83.

An intrusion provocation task (Lang, Moulds, & Holmes, 2009) was included to measure the intrusion frequency. Participants were presented with ten written fragments from the film and then they were required to think freely for two minutes whenever an intrusion occurred. They also had to mention the frequency of intrusion and its type (image or thought).

The Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1980) contains three subscales: intrusions (8 items), avoidance (8 items) and arousal subscale (6 items). Answers are rated on a 5-point scale from 0 (not at all) to 4 (very much). Cronbach alpha coefficients are .88 for the intrusions, .85 for avoidance, and .90 for arousal.

Posttraumatic Cognitions Inventory (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999) was used to measure posttraumatic cognitions. The PTCI consists of three subscales: negative cognitions about the self (21 items), negative cognitions about the world (7 items) and self-blame (5 items). Statements are rated on a 7-point scale from 1 (totally disagree) to 7 (totally agree). Cronbach alpha coefficients are. 85 for negative cognitions about self, .88 for negative cognitions about the world, and .83 for self-blame.

Attention and memory were rated on an 11-point scale from 0 (not at all) to 10 (completely). Cued-recall memory was assessed with 10 open-ended questions about the film. Recognition memory was assessed with 10 statements of the film with a yes / no response (Holmes et al., 2004).

Procedure

Before starting the study, participants were informed that the film contain graphic scenes of the aftermath of a road traffic accident. They were also informed that their participation is voluntary and that they could finish the experiment at any point. All participants were encouraged to contact the experimenter before the follow-up session if they feel distressed; they were also given the experimenter's contact details. Participants signed an informed consent and filled in the DES-II, STAI-S, DSS, and PANAS. Before the exposure to the traumatic material, participants were randomly assigned into two experimental conditions: a visuospatial tapping condition and a no-task control condition. They were instructed according to experimental condition and the film was started. In the experimental condition, the participants had to carry out a concurrent visuospatial task, tapping a pattern on a concealed keyboard. The cover story was that the aim of the study was to identify how efficient they are in realizing a task in condition of exposure to different stimuli. The real dependent variable was the number of intrusive memories of the film over the next week. After the film, participants filled in the mood questionnaire (PANAS), STAI-S, DSS, the attention rating. After one week, participants returned for follow-up. The intrusion provocation task was performed and participants filled in the cued-recall and recognition memory test, the IES, PTCI, and ratings about the perceived goal of the study. Finally, participants were debriefed and thanked for their involvement.

Results

Randomization and manipulation check

Independent sample *t* test with experimental condition (control, visuospatial interference) as the between-subject factor indicated no significant difference between conditions in trait dissociation, ($t_{(76)}$ = -1.49; p = .139) or age ($t_{(76)}$ = 1.06; p = .291). The ratings on the mood questionnaire were summed into a single score, higher scores indicating negative affect. A 2 condition (control vs. visuospatial interference) x 2 mood (pre-film vs. post-film) mixed model ANOVA with condition as the between-subject factor and mood ratings as the within-subject factor showed a significant increase in negative affect from pre- to post-test, ($F_{(1, 77)}$ = 56.46; p < .001). The main effect of condition and the interaction were non-significant (both p > .05). The same pattern emerged for state anxiety (STAIS), with a significant increase from pre- to post-test, ($F_{(1, 77)}$ = 9.19; p = .003) and for state dissociation ($F_{(1, 77)}$ = 12.18; p = .001). Watching the film was evaluated as stressful by all the participants, with no significant differences between participants from the two conditions ($t_{(76)}$ = 0.59; p = .557). Moreover, the film was evaluated as strongly negative, regardless of the experimental condition ($Z_{(2, 76)}$ = -1.02; p = .307). Means and standard deviations for these variables are presented in Table 1.

Table 1. Means and standard deviations of control measures within and across conditions

		Control condition		Visuospatial interference		Total	
		M	SD	M	SD	M	SD
DES-II		411.6	317.91	318.80	224.60	364.03	276.22
STAI-S	Pre	24.60	10.02	21.77	7.24	23.15	8.77
	Post	28.02	10.61	22.72	7.81	25.30	9.60
Mood	Pre	45.05	11.97	41.77	8.08	43.37	10.23
	Post	53.63	13.14	50.47	11.20	52.01	12.21
DSS	Pre	19.81	6.38	15.82	3.98	17.76	5.62
	Post	21.57	8.73	16.22	5.36	18.83	7.65

Intrusion frequency

As predicted, the number of intrusive images reported in the provocation task was lower in the visuospatial condition than in the no task control condition, ($t_{(76)}$ = 1.05; p = .033).

Other PTSD symptoms

Independent sample *t* test with condition (control vs. visuospatial interference) as the between-subject factor showed no significant differences between conditions on the IES-avoidance subscale, IES-intrusion subscale, IES-arousal subscale, or the PTCI subscales, all $p > .05$. Means and standard deviations for these variables are presented in Table 2. Further, the results showed that there were significant positive correlations between the intrusion images and the IES-intrusion scale ($r = .35$; $p < .001$), IES-avoidance scale ($r = .350$; $p = .033$), and IES-arousal scale ($r = .29$; $p = .010$). Correlation coefficients between these variables are reported in Table 3.

Table 2. Means and standard deviations of experimental measures within and across conditions

	Control condition		Visuospatial interference		Total	
	M	SD	M	SD	M	SD
Number of intrusive images	15.71	14.60	25.87	47.27	20.92	15.50
IES-intrusion	9.09	6.37	7.12	4.63	8.11	5.61
IES-avoidance	7.12	3.57	5.45	3.81	6.29	3.76
IES-arousal	6.54	5.35	4.77	4.31	5.66	4.90
PTCI-negative self	31.09	9.31	28.22	6.38	29.66	8.05
PTCI-negative world	18.96	4.72	19.12	4.87	19.04	4.76
PTCI-self-blame	7.41	1.97	6.87	2.18	7.14	2.08
Attention	96.68	5.84	97.32	5.24	97.01	5.52
Cued-recall	3.87	1.43	4.58	1.47	4.22	1.48
Recognition	7.83	1.50	8.19	1.40	8.01	1.45

Table 3. Correlation coefficients between the frequency of intrusive images and other PTSD symptoms

	1	2	3	4	5	6	7
1. Intrusion.images	1						
2. IES_ intrusions	.353**	1					
3. IES_avoidance	.309*	.709**	1				
4. IES_arousal	.298*	.862**	.743**	1			
5. PTCI_neg.self	-.006	.401**	.216	.444**	1		
6. PTCI_neg.world	.075	.285*	.222	.325**	.758**	1	
7. PTCI_selfblame	.105	.069	-.061	.102	.382**	.283*	1

M	20.92	8.11	6.29	5.66	29.66	19.04	7.14
AS	35.50	5.61	3.76	4.90	8.05	4.76	2.08

Note. * $p < .05$, ** $p < 0.01$, *** $p < .001$.

Attention and memory

Independent sample *t* test with condition (control vs. visuospatial interference) as the between-subject factor and the attention rating as the dependent variable was not significant, ($t_{(76)} = 0.51$; $p = .610$). The two conditions were comparable on cued-recall and recognition memory performance, $t_{(76)} = 1.92$; $p = .060$), respectively, ($t_{(76)} = 0.96$; $p = .340$). The results are presented in Table 4.

Table 4. Means and standard deviations of attention and memory within conditions

	Control condition		Visuospatial interference		t(76)
	M	SD	M	SD	
Attention	96,68	5.84	97.32	5.24	0.51
Cued-recall memory	3.87	1.43	4.58	1.47	1.92
Recognition memory	7.83	1.50	8.19	1.40	0.96

Study 2

The results of Study 1 sustain the fact that intrusive images could develop from exposure to a traumatic material. Clinical models of PTSD (Brewin & Holmes, 2003) focus on intrusive memories developed from direct sensory experience. However, intrusive images can also reflect a story told by another (Figley, 1995; Pearlman & Mac Ian, 1995) and they can develop from listening or reading an aversive story, without being personally involved, as studies of secondary traumatic stress have shown (Figley, 1995; Pearlman & Mac Ian, 1995). In a second study, we wanted to explore further the occurrence of intrusive memories by using an intrusion diary that represents a widely used method for measuring intrusions in film-paradigm research (e.g., Holmes et al., 2004). We also explored the role of emotional regulation strategies in intrusions development. Based on these previous findings, we expect to find a positive relation between expressive suppression, intrusions, and distress generated by intrusions. On the contrary, we expect negative relations between cognitive reappraisal, intrusions, and distress associated with intrusions. We also explored the relation between emotional states and intrusions and we expect to find a positive relation between negative emotional states during trauma exposure and soon after exposure and future rating of intrusions and distress.

Method

Participants

As in our first study, participants were invited to participate in exchange for course credit. In total, 83 participants completed the study. Exclusion criteria were history of road-traffic accidents and, as part of informed consent, all participants confirmed in writing that they had not previously received any treatment for a mental health problem. A number of 15 participants failed to complete the diary and were excluded from the analyses. The final sample of the 68 participants consisted of 89.7% women and 10.3% men. The participants were students from the first year of study.

Materials

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) is a 10-item self-reporting scale designed to measure an individual's tendency to use cognitive reappraisal (six items) and expressive suppression (four items) to regulate emotions. Each item consists of a seven-point Likert scale (1 – strongly disagree; 7 – strongly agree). Higher scores indicated higher frequencies of using expressive suppression ($\alpha = .76$) and cognitive reappraisal ($\alpha = .62$).

Trauma history questionnaire (THQ, Green, 1996) consists of 24 items that measure previous potentially traumatic life events experiences. For each item, the participants need to mention if the event occurred in their life or not. The Alpha Cronbach coefficient in the present sample is .69.

The Positive Affect Negative Affect Schedule (PANAS; Watson et al., 1988) is a widely used inventory for the assessment of positive and negative affectivity. It consists of a 10-item scale for positive affect (PA, $\alpha = .86$) and another 10 item scale for negative affect (NA, $\alpha = .87$). Participants rated all the items on a 5-point scale (1 = *very slightly or not at all*, and 5 = *very much*) with the "in this moment" time frame.

The peritraumatic questionnaire (PEQ, Evans, Ehlers, Mezey, & Clark, 2007) consists of 15 items that assess peritraumatic emotions on a Likert scale from 0 (not at all) to 4 (very much). The Alpha Cronbach coefficient is .92.

An *intrusion diary* was used to record intrusive memories of the film during the next seven days after watching the film. Every day, the participants wrote a description of their intrusions and also rated the distress associated with each intrusion on a 11-point scale, from 0 (not at all distressing) and 10 (extremely distressing). Every participant receives verbal and written instruction about what is an intrusion and how to complete the journal. Intrusion was defined as spontaneously occurring memories of the film, not deliberate memories.

Procedure

A similar procedure as in first study was implemented. Participants signed an informed consent and filled in the ERQ, THQ, and the mood questionnaire. Then, they watched the film on a 200x200 cm screen using an audiovisual LCD projector. At the end, participants filled in the mood questionnaire and received detailed description for completing the journal. After one week, participants returned the journal. Finally, participants were debriefed and thanked for their involvement.

Results

The results showed that the number of intrusions positively correlated with negative affect, peritraumatic emotions, and trauma history. Psychological discomfort positively correlated with negative affect and peritraumatic emotions. The results are presented in Table 5.

Table 5. Pearson correlations between the main study variables

	1	2	3	4	5	6	7
1. Intrusions	1						
2. Psychological distress	.46***	1					
3. Cognitive reappraisal	-.07	-.03	1				
4. Expressive suppression	-.03	-.06	.05	1			
5. Negative affect	.48***	.46***	.05	-.31**	1		
6. Peritraumatic emotions	.50***	.46***	.06	-.24*	.69***	1	
7. Trauma history	.30*	-.03	.03	.22	.06	.07	1
M	8.58	5.48	26.33	13.82	26.23	13.19	24.52
SD	5.60	2.18	4.57	5.40	7.62	5.48	1.20

Note. * $p < .05$, ** $p < 0.01$, *** $p < .001$.

Two multiple linear regression analyzes were conducted, with intrusions and distressed associated with intrusions as dependent variables. The results indicated that trauma history and peritraumatic emotions significantly predicted intrusions (see Table 6), while negative affect significantly predicted distress generated by intrusions (see Table 7). Cognitive reappraisal and expressive suppression were not significant predictors for intrusions and distress generated by intrusions.

Table 6. Hierarchical regression models of emotional regulation strategies and emotional states on intrusions

	β	t	ΔR^2	Δ Rch^2
Step 1			.07*	.09*
Trauma history	0.30*	2.55		
Step 2			.06	0.01
Cognitive reappraisal	-0.08	-.71		

Expressive suppression	-0.10	-.85		
Step 3			.32***	.26***
Negative affect	0.27†	1.90		
Peritraumatic emotions	0.32*	2.31		

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 7. Hierarchical regression models of emotional regulation strategies and emotional states on emotional discomfort

	β	t	ΔR^2	Δ Rch^2
Step 1			.001	.001
Trauma history	-0.03	-0.29		
Step 2			.006	.004
Cognitive reappraisal	-0.02	-0.21		
Expressive suppression	-0.06	-0.46		
Step 3			.28**	.27***
Negative affect	0.30*	2.00		
Peritraumatic emotions	0.29	1.97†		

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

Discussion

The goal of the present study was to explore whether people develop intrusive images from exposure to a traumatic material, without being personally involved. We also wanted to investigate if the frequency of these intrusions could be modulated by interfering with encoding information in SAM memory. Further, we explored the associations of emotional states and emotional regulation strategies with intrusions.

The results of the two studies offer some insights into the mechanisms underlying spontaneous, incontrollable intrusive memories of traumatic material. We used dual-representation theory (Brewin et al., 1996) as basis for the predictions tested in the first study. As discussed in the introduction, the theory proposes that there are different memory systems, broadly visual and verbal. Based on this assumption and on previous research in the field, in the first study we hypothesized that a concurrent visuospatial tapping task during exposure to a traumatic material would conduct to poorer encoding of some perceptual details of the trauma, making the representations less likely to be accessed by retrieval cues encountered after the trauma exposure and less likely to intrude during the following week. We used a visual spatial task because dual-representations theory predicts that this form of disturbed encoding might decrease rather than increase the probability of later intrusive images of a trauma.

The results showed that people develop intrusion from such exposure. The nature of the intrusions that participants reported tended to be of the worst moments in the film, such as “children crying in one of the car”, and the number of different types of intrusions of the film is similar to that reported after real

trauma (Ehlers et al., 2002; Holmes, Creswell, & O'Connor, 2007). All of these findings sustain the external validity of the analog film paradigm and its utility in studying the responses of people exposed to trauma. A second major finding of this study was that participants who were engaged in a concurrent visuospatial tapping task during the trauma film reported experiencing fewer intrusive images in the subsequent week than those who had not performed such a task. As discussed in the introduction, this finding is in line with the predictions made by the dual representation theory (Brewin et al., 1996). It also replicates the effect found in previous research (Brewin & Saunders, 2001; Holmes et al., 2004). We must notice that the reduction in intrusions does not mean that the task protected the participants against negative mood or distress caused by the film (Holmes et al., 2004). Our result showed an increase in negative mood, state anxiety and state dissociation from pre-film to post-film. Moreover, the effect of the visuospatial task was not simply due to distraction in terms of attention self-report. The two conditions were comparable on attention paid to the film, cued-recall measure concerning events in the film and recognizing details of the event. Therefore, we can assume that the effect of the tapping task in reducing intrusions was due to its visuospatial nature. Further, as expected, the results of the second study confirmed the associations between intrusions and negative affective states, but contrary to our hypothesis and to previous studies, cognitive reappraisal and expressive suppression were not significant predictors for intrusions.

Our studies have a number of limitations. First, a possible limitation or the first study consists on the use of the provocation task to assess the main dependent variable. This task was also used in previous studies (Krans et al., 2010), but clinical psychology research attempting to explore this phenomenon regularly used intrusion diaries (e.g., Brewin & Saunders, 2001; Butler et al., 1995; Davies & Clark, 1998). Although we mention this approach as a possible limitation, we must notice that our results are consistent with previous research that used diaries (Holmes et al., 2004; Krans et al., 2010). Secondly, it is possible that the familiarity with the tapping task (over practice) to have specific effects on intrusion frequency because it reduces the visuospatial resources required for the task. It would be interesting to study if variations in the degree of visuospatial load will have different effects on subsequent intrusions. Future investigation is required to understand how different cognitive load tasks interfere with the development of intrusions. Thirdly, we studied only visual intrusions, and therefore our results cannot be generalized to intrusions from other modalities. Fourth, dual-representation theory (Brewin, 2003; Brewin et al., 1996) makes the specific prediction that concurrent verbal interference will lead to less contextual information being encoded and will increase the likelihood of intrusions. Further experiments should attempt to compare the

visuospatial tapping task and the verbal task against a control condition within the same experiment.

Despite these limitations, the studies produce valuable insight for both theoretical and practical perspective. Theoretically, our current results are in line with dual-representation theory of PTSD (Holmes & Bourne, 2008) and showed that intrusive visual images can develop from exposure to traumatic information and the frequency of these intrusions can be modulated. Although more research is needed to clarify the psychological processes that may account for the influence of a concurrent task on intrusion development and despite the significant gap between analog and real trauma, our results suggest that it may be possible to model some peritraumatic processes in the laboratory. Therefore, our studies are valuable because they examined the intrusive visual images from an aversive material. Our findings have some practical implications, especially for the treatment of PTSD. Such findings help researchers to develop interventions for assisting people to increase their own role in taking control after exposure of a negative event. Therefore, recognizing and finding factors that prevent the intrusion development is an important step in making people understand their personal risk and taking self-protective measures.

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