



Attentional control affects the relationship between tonic immobility and intrusive memories

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ARTICLE INFO

Article history:

Received 12 October 2010

Received in revised form

17 February 2011

Accepted 22 February 2011

Keywords:

Tonic immobility

Freezing

Attentional control

Intrusions

Images

PTSD

Trauma memories

ABSTRACT

Background and objectives: Cognitive control and tonic immobility (TI) have both been implicated in the development of PTSD, but it is not known how these factors are related. The present study investigated if a specific form of cognitive control (attentional control) would moderate the relationship between TI and intrusive memories.

Methods: Participants ($N = 43$) completed the Attentional Control Scale (ACS) before watching an aversive film. They completed the Tonic Immobility Scale (TIS, with an immobility and fear subscale: TIS-TI and TIS-Fear) afterwards and recorded intrusive memories of the film in the subsequent week.

Results: TIS-TI was related to intrusion frequency, while ACS was not. However, ACS had a moderating role; the relationship between TIS-TI and intrusion frequency was significant in low ACS but not in high ACS participants. The TIS-Fear subscale was not related to intrusion frequency in low ACS or high ACS participants.

Limitations: Replication of the results is merited in selected extreme groups and males.

Conclusions: The results may imply that enhanced attentional control serves as a protective factor against the development of intrusive memories after trauma.

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1. Introduction

Threat responses such as flight (avoidance) are intensely investigated and proved of great importance in the aetiology of threat-related psychopathology (e.g., posttraumatic stress disorder, PTSD), thereby providing useful treatment strategies (Brewin, 2006). However, threat responses typically include several stages: fight-flight is preceded by a freezing response and possibly followed by tonic immobility (TI; Lang, Bradley, & Cuthbert, 1997; Marx, Forsyth, Gallup, Fusé, Lexington, 2008). TI has been described as the final stage after encountering a predator. When escape or resistance is unsuccessful, prey animals may enter in a death-feigning state of TI, which may be of evolutionary advantage in that many predators are interested in living prey only. The most pronounced features of TI are physical immobility and muscular rigidity, but additional features such as suppressed vocal behavior, analgesia, waxy flexibility and tremors in the extremities have also been reported (Gallup, 1974). However, in TI the prey animal is still highly alert and features of the event and the environment are still actively processed.

Despite the numerous studies that have focused on human fight–flight responses, freezing and TI have been described in non-

human animal studies mainly. The few studies that investigated the effects of peritraumatic TI in humans have shown its potential importance with respect to the development of psychological impairment and psychiatric disorders such as PTSD (Bovin, Jager-Hyman, Gold, Marx, & Sloan, 2008; Galliano, Noble, Puechl, & Travis, 1993; Heidt, Marx, & Forsyth, 2005). There is also some prospective evidence for the role of TI in PTSD development. An experimental PTSD analogue study showed that (either voluntary or involuntary) immobility during an aversive film resulted in more intrusive memories of that film relative to free-to-move counterparts (Hagenaars, Van Minnen, Holmes, Brewin, & Hoogduin, 2008). Immobility also seemed to affect intrusion quality as it was associated with intrusive images, but not intrusive thoughts (Hagenaars, Brewin, Van Minnen, Holmes, & Hoogduin, 2010). However, it remains unclear to what extent induced immobility is similar to spontaneous immobility. The present study therefore used an observational, quasi-experimental design with an aversive film to model a traumatic experience.

Theoretically, TI could enhance PTSD development in several ways. First, victims were more likely to be blamed if they did not show active struggling (McCaul, Veltum, Boyechko, & Crawford, 1990), which may result in less post-trauma social support and more negative cognitions about oneself, both predictive factors in PTSD development (Ehlers & Clark, 2000; Ozer, Best, Lipsey, & Weiss,

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2003). Second, the intense peritraumatic distress associated with TI may be responsible for later PTSD development, possibly as an indicator of perceived life stress (Ozer et al., 2003) or trauma severity (Brewin, Andrews, & Valentine, 2000). Third, controllability is considered a key factor in TI as well as PTSD development (Marx et al., 2008). That is, physical restraint or entrapment and intense fear are the two conditions that elicit TI. Animals indeed showed increased susceptibility to TI after an uncontrollable than after an escapable shock (Maser & Gallup, 1974). So as a consequence, individuals with poor controllability capacities may be more vulnerable to experience TI. TI might also specifically affect the development of intrusive memories. That is, another defense response that includes immobility (freezing) is associated with enhanced sensory intake (Bradley, Codispoti, Cuthbert, & Lang, 2001). This may cause a dominantly perceptual information processing style, which is considered to result in the development of vivid, intrusive memories (Ehlers & Clark, 2000). Indeed, a previous experiment showed that immobility during an aversive film resulted in higher frequencies of intrusive memories of that film (Hagenaars et al., 2008).

It has been suggested that cognitive control affects the development of involuntary memories. The fact that involuntary memories were found to be associated with self-reported weaker cognitive control (distractability; Verwoerd & Wessel, 2007), as well as with deficient inhibitory control that showed on experimental tasks (Verwoerd, Wessel & De Jong, 2009) seems to confirm this idea. Note that in the latter study, involuntary memories were associated with inhibition at the cognitive level and not response inhibition, suggesting the relevance of cognitive control. Additional evidence comes from studies on working memory capacity. For example, lower working memory capacity was associated with relatively high levels of intrusive memories (Klein & Boals, 2001), whereas people with high working memory capacity were better able to suppress intrusive thoughts (Brewin & Beaton, 2002; Brewin & Smart, 2005). Working memory capacity refers to “the ability to control attention to maintain information in an active, quickly retrievable state” (Engle, 2002, p. 20). By definition, it is at least related to but possibly isomorphic to the concept of executive attention or attentional control. Moreover, self-reported low attentional control was also related to higher intrusive memory frequency in an experimental study, although this was true for the participants that had to record their intrusions in a diary and not for those who had to complete a questionnaire assessing intrusive memories only (Verwoerd, De Jong, & Wessel, 2008).

The first aim of the present study concerns the associations between attentional control and TI, and intrusion development. It was hypothesized that poor attentional control and more TI would be associated with increased intrusion frequency. Second, following Derryberry and Reed (2002), attentional control was hypothesized to serve as a moderator. That is, although TI is thought to enhance the development of intrusive memories (Bovin et al., 2008; Hagenaars et al., 2008), this effect may be neutralized in participants with high attentional control, as these participants would be able to inhibit their intrusive memories (Verwoerd et al., 2009). Poor attentional control may be related to general psychological distress, or negative affect (e.g., Derryberry & Reed, 2002), which can affect memory and attention processes (e.g., concentration problems) and thus intrusion development. The present study therefore controlled for neuroticism.

2. Method

2.1. Participants

Participants were recruited at Leiden University campus. Forty-three participants (9 males) were included after screening for exclusion criteria (psychotic disorders, depression, PTSD, panic

disorder, blood phobia, and having been in a serious traffic accident). Age ranged from 17 to 30, with a mean age of 19.2 years ($SD = 2.2$).

2.2. Material

A 10-min film depicting four traumatic scenes of real-life footage of the horrible aftermath of road traffic accidents was used to model a traumatic experience (Steil, 1996). This particular four-scene film has been used before and proved effective in evoking horror (Hagenaars et al., 2008).

2.3. Measures

2.3.1. Attentional control

The Attentional Control Scale (ACS, Derryberry & Reed, 2002; Verwoerd, de Jong, & Wessel, 2006) was used to assess the participants' general capacity for attentional control. More specifically, the 20 self-report ACS items address attentional focus (the ability to focus attention), attentional shift (the ability to shift attention between tasks), and thought control (the ability to flexibly control thought). The 20 ACS items are scored on a 4-point Likert-scale, ranging from 1 (almost never) to 4 (always). Internal consistency of the ACS was shown to be good (Cronbach's $\alpha = .88$; Derryberry & Reed, 2002).

2.3.2. Tonic immobility

Presence and severity of TI during the film were assessed using part 1 of the Tonic Immobility Scale (TIS; Forsyth, Marx, Fusé, Heidt, & Gallup, 2000). The TIS was adjusted for this purpose; that is, items that originally referred to sexual assault as the main event were changed so that they addressed the film used in the present study as the main event. The 10 self-report items are scored on a 7-point Likert scale, ranging from 1 (not at all) to 6 (extremely/very much). Exploratory and confirmatory factor analyses showed that the TIS comprises two subscales (Fusé, Forsyth, Marx, Gallup, & Weaver, 2007): Fear (TIS-Fear; 3 items) and Tonic Immobility (TIS-TI; 7 items). Internal consistency was strong for TIS-Fear (Cronbach's $\alpha = .90$) and TIS-TI (Cronbach's $\alpha = .94$; Fusé, Forsyth, Marx, Karekla, & Gallup, 2002).

2.3.3. Intrusive memories

Participants recorded intrusive memories of the film for seven days using an Intrusion Diary. Verbal and written instructions were given about the nature of involuntary intrusions and how to keep the diary. Intrusive memories were described as “spontaneously occurring” rather than deliberate memories of the film. The importance of recording every intrusion was emphasised. To check the intrusive character of the memories participants had to describe the content of each intrusion, indicate whether it was image or thought based, and indicate how spontaneous it was. The total number of intrusions was calculated by adding up all intrusive images (not thoughts) in the diary.

2.3.4. Neuroticism

The Neuroticism subscale of the Revised Eysenk Personality Questionnaire (EPQ-N; Eysenk, Eysenk, & Barrett, 1985) was used to assess negative affect. The 12 self-report items of the EPQ-N are scores on a yes/no scale. Neuroticism was assessed in order to rule out that any moderating effects would be due to differences in neuroticism instead of differences in attentional control.

2.3.5. Mood

Participants rated horror (PTSD criterion A2 in the DSM-IV) before and after the film on an 11-point scale (0–10) to check the film's impact on emotional state.

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