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Perceived control and avoidance in posttraumatic stress

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ABSTRACT

Despite much evidence concerning the importance of control over stressors in animal models of adaptation to stress, there is a dearth of experimental evidence for the role of controllability in posttraumatic stress disorder (PTSD). This study investigated whether perceived control over aversive stimuli influenced subsequent avoidance in a female community sample with and without PTSD symptomatology. Female participants ($N = 145$) with high or low PTSD symptoms were randomized to receive instructions indicating either controllable or uncontrollable offset of aversive, positive, and neutral images; despite this perception, the actual duration of presentations was standardized in both conditions. Participants subsequently completed an emotional avoidance task. There was a significant group × condition interaction effect, such that those with PTSD symptoms who were told they lacked control displayed greater avoidance of the subsequent stressor relative to those told they had control. This pattern was not observed in those without PTSD symptoms. This finding suggests that ongoing experiences of uncontrollability may heighten psychological vulnerabilities implicated in PTSD.

Control percibido y evitación en estrés postraumático

A pesar de la abundante evidencia existente acerca de la importancia del control sobre los estresores en modelos animales de adaptación al estrés, hay una escasez de pruebas experimentales sobre el papel de la controlabilidad en el trastorno de estrés postraumático (TEPT). En este estudio se investigó si el control percibido sobre los estímulos aversivos influyó en la evitación posterior en una muestra de población femenina con y sin sintomatología de TEPT. Las participantes femeninas ($N = 145$) con alta o baja sintomatología de TEPT recibieron de forma aleatorizada instrucciones que indicaban una compensación controlable o incontrolable de imágenes aversivas, positivas y neutrales; a pesar de esta percepción, la duración real de las presentaciones se estandarizó en ambas condiciones. Los participantes completaron posteriormente una tarea de evitación emocional. Hubo un efecto significativo de interacción grupo x condición, de modo que aquellos con síntomas de TEPT a los que se les dijo que carecían de control mostraron una mayor evitación del estresor posterior en relación con aquellos a los que se les dijo que tenían control. Este patrón no se observó en aquellos sin síntomas de TEPT. Este hallazgo sugiere que las experiencias continuas de incontrolabilidad pueden aumentar las vulnerabilidades psicológicas implicadas en el TEPT.

创伤后应激中的感知控制与回避

尽管有许多证据表明适应应激的动物模型中控制压力源的重要性，但缺乏关于可控性在创伤后应激障碍（PTSD）中作用的实验证据。这项研究考察在有无创伤后应激障碍症状的女性社区样本中，对厌恶刺激的感知控制是否影响随后的回避症状。具有高或低PTSD症状的女性被试（$N = 145$）随机接受厌恶、积极和中性图像的消除是可控或不可控的指示。尽管有这种主观提示，实际演示图像的持续时间在这两种情况下都是标准化的。被试随后完成了情绪回避任务。存在显著的实验组*条件相互作用效应，使得那些被告知他们缺乏控制的PTSD症状的受试者相对于那些被告知他们已经控制的受压者显示出更大的回避。没有PTSD症状的被试中没有观察到这种模式。这一发现表明，持续不受控制的经历可能会增加PTSD所暗含的心理脆弱性。

HIGHLIGHTS
• Enhancing a sense of diminished controls enhances avoidance in PTSD

Individual differences in perceived control and mastery are vulnerability factors in anxiety and stress-related disorders, with diminished perceived control being associated with conditions such as posttraumatic stress disorder (PTSD; Chorpita & Barlow, 1998; Grills-Taquechel, Littleton, & Axsom, 2011; Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011). Individuals with PTSD who report negative beliefs about personal control, including appraising symptoms as uncontrollable or having a sense of diminished self-agency, display poorer outcomes following

trauma exposure and treatment (Ayers, 2007; Dunmore, Clark, & Ehlers, 2001; Kleim, Ehlers, & Glucksman, 2007; Livanou et al., 2002).

Altering the perception of control appears to influence outcomes such as avoidance and distress beyond the objective controllability or predictability of the stimulus (Geer, Davidson, Gatchel, Riggs, & Johnson, 1970; Salomons, Johnstone, Backonja, Shackman, & Davidson, 2007). For example, Panic Disorder patients told (counterfactually) that they could control carbon dioxide levels in an interoceptive exposure exercise reported fewer symptoms, less anxiety, and fewer catastrophic thoughts (Sanderson, Rapee, & Barlow, 1989). Similarly, manipulating the perceived controllability of painful stimuli appears to alter cortisol release, pain tolerance, subjective helplessness, and avoidant and passive coping responses to pain; these effects are associated with individual differences in activation of neural networks implicated in cognitive emotion regulation (Mohr, Leyendecker, Petersen, & Helmchen, 2011; Salomons et al., 2007; see Wiech et al., 2014, for review). Moreover, Litt (1988) found that participants led to perceive control over a painful stimulus showed better distress tolerance on a subsequent cold pressor task. In a direct test of the impact of controllability on emotional distress tolerance, non-clinical participants who were told they could not opt out of electric shocks showed increased glutamate activation in the vmPFC and 15 minutes later terminated distressing images sooner than those told they could opt out (Bryant, Felmingham, Das, & Malhi, 2014).

Cognitive models of PTSD emphasize that posttraumatic distress, distress intolerance, and avoidance are maintained by maladaptive beliefs about one's capacity for control (Resick & Schnicke, 1992) or by appraisals of trauma-related emotions and memories as uncontrollable (Ehlers & Clark, 2000). In this context, distress tolerance is defined as the 'perceived capacity to withstand negative emotional and/or other aversive states (e.g. physical discomfort), and the behavioral act of withstanding distressing internal states elicited by some type of stressor' (Leyro, Zvolensky, & Bernstein, 2010). While suggestive, the existing correlational studies do not examine the function of discrete experiences of perceived control after PTSD onset, or examine putative mechanisms such as distress tolerance or avoidance. Distress tolerance is significantly associated with PTSD severity (Marshall-Berenz, Vujanovic, & Zvolensky, 2011) and avoidance of trauma reminders (Vujanovic et al., 2011), and links PTSD with a range of comorbid problems (e.g. Anestis & Joiner, 2012; Bonn-Miller, Vujanovic, Boden, & Gross, 2011; Gaher, Hofman, Simons, & Hunsaker, 2013). Distress tolerance difficulties may motivate avoidance strategies that maintain symptoms and, since cognitive and/or emotional processing of distressing trauma-related material is a

key therapy target in PTSD, may reduce treatment compliance (Ehlers & Clark, 2000; Jaycox, Foa, & Morral, 1998). Accordingly, this study manipulated perceived controllability of an aversive stimulus in participants with and without PTSD symptoms, and indexed their subsequent avoidance of distressing stimuli. We hypothesized that participants with PTSD symptoms would be more susceptible to the deleterious effects of perceived lack of control, and therefore show greater avoidance to the subsequent stimulus relative to those who believed they had control.

1. Method

1.1. Participants

Participants were recruited by a two-stage process via Mechanical Turk. A screening measure was initially conducted of Mechanical Turk crowdsourcing workers via the Mechanical Turk interface that assessed exposure to a traumatic event via the traumatic events checklist on the Posttraumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997). One hundred and fifty-seven females of pre-screened respondents completed the study via the Mechanical Turk interface. We aimed to recruit at least 70 participants per cell to achieve an effect size of 0.5 between the two conditions, providing power of 80% to detect a difference between conditions at the 5% significance level. The study focused on females because of evidence of gender differences in posttraumatic stress and responses related to controllability (see Shansky, 2015). Participants were eligible if they aged at least 18 years, reported no history of severe suicidality on the screening measures, and passed screening questions on Mechanical Turk that are aims to detect non-veridical or nonsensical information. The screening questions that aimed to check veridicality of responses included questions that would not be reasonably endorsed (e.g. *Have you ever fallen more than 100 metres*). Due to the potential sensitivity of trauma history disclosure, users were assured that identifying data would not be collected. Information regarding ethnicity and socioeconomic status was not elicited. Twelve participants discontinued prior to completing the experimental tasks, leaving 145 cases for analysis. If participants indicated marked distress on any rating scales, then they were emailed by a psychologist and tailored advice was given regarding local advice for mental health options.

1.2. Procedure

This study was approved by the UNSW Human Research Ethics Committee (HC13047). All tasks

were presented on an external website using classic ASP and Javascript on a Microsoft Azure SQL server, which allowed stimulus presentation and response time accuracy to be verified to within 2 ms. Eligible workers received a notification from their Mechanical Turk account inviting them to participate in an 'Imagery and Memories Study' online at the time of their choosing via a web link. Participants were recompensed a minimum of US$3 into their Amazon accounts. Participants were instructed to choose a time when they would not be interrupted, and to maximize their browser window and minimize external distractions. At the conclusion of the experiment all participants were debriefed and, if indicated, provided with referral information. The possibility that participants experienced mild deception about their degree of control at some stage was debriefed, but the manipulation was not described in detail in order to reduce the impact of any cross-talk within Mechanical Turk user networks.

1.3. Perceived control manipulation

Participants viewed an identical four-minute slideshow of pleasant (e.g. a nature scene), neutral (e.g. a chair), and unpleasant (mild aggression or physical injury, e.g. angry male face; dental procedure) images drawn from the International Affective Picture System (Lang, Bradley, & Cuthbert, 2008) and supplemented by similar images presented at 800 × 533 pixels on a black background. Negative images were presented for longer duration than positive and neutral images because the negative images were intended to create the aversive stimulus, whilst the positive and neutral images provided alternate stimuli between the aversive images. Each picture was preceded by a fixation cross for 0.75–1.75 seconds and appeared for a predetermined duration of 8.5–11.5 seconds (negative images) or 2.5–4.5 seconds (positive and neutral images) followed by a rating screen picturing a visual analogue scale on a black background prompting the user to rate the pleasantness or unpleasantness of the image by pressing a number key (0 = 'extremely pleasant', 9 = 'extremely unpleasant'). All participants were instructed to look carefully at the images the whole time because they would be asked important questions about them later. The sequence of affective valence was quasi-randomized such that each unpleasant picture was separated by 1–3 neutral or pleasant images.

Although image duration was standardized, perceived control was manipulated prior to viewing the images. Participants were randomized to receive instructions indicating either high offset controllability ('If any picture is too unpleasant, or upsets you too much, you can easily remove it by pressing your rating early, before the ratings screen even appears') or low offset controllability ('If a picture is

unpleasant, you will just need to keep watching it, even if this is unpleasant at times. The timing will vary from picture to picture, and you will not be able to do anything to control this'). The task commenced with a brief practice task in which those in the low control condition had no control, and those in the high perceived control condition had offset control. Participants in the high control condition were informed that there may be a slight delay for the system to respond after they try to terminate the image. To standardize onset unpredictability in both conditions, a variable 1.5–2.5 seconds delay was implemented from rating time to onset of the next image in order to the minimize the perception of participants in the low controllability condition that they had control of the image offset. Offset unpredictability was also present in both conditions because of the variable duration to image offset independently of key press. As instruction comprehension is known to affect validity of experimental data on Mechanical Turk (Crump, McDonnell, & Gureckis, 2013), participants could not proceed with the practice task until they had read over the instructions for at least 30 seconds.

1.4. Post-manipulation ratings

Following the perceived controllability induction task, subjective ratings of controllability (1 = 'no control at all', 5 = 'total control'), how distressing the negative images were (1 = 'not at all', 5 = 'extremely distressing'), perceived ability to regulate emotions during the negative images (1 = 'no ability at all', 5 = 'total ability'), and current mood state (1 = 'no distress', 5 = 'extreme distress'), were elicited on a 5-point Likert scale, alongside items designed to test and encourage attentiveness ('What colour was the star that you saw?', 'How confident are you of answering detailed questions about these pictures later?').

1.5. Avoidance task

Participants' delay in reading a potentially distressing story was used to provide a behavioural index of avoidance. Participants selected the highest level of distressing content they were willing to read in a subsequent story task from 0 ('Story with no distressing content') to 7 ('Story with maximum level of highly distressing content') before clicking 'Continue' to read the story. Delay between story selection and clicking 'Continue' was recorded.

1.6. Self-report measures

The PDS (Foa et al., 1997), which comprises 17 items that map onto the DSM-IV definition of PTSD, demonstrates excellent internal consistency and shows good

agreement with structured clinical interview. A PDS severity cut-off of 11 was employed as scores greater than 11 indicates presence of PTSD symptomatology (Foa et al., 1997). This resulted in PTSD scores being categorized as PTSD+ (PDS > 11) or PTSD- (PDS ≤ 11). The PDS was administered after the experimental tasks due to the possibility that it could induce transient distress for some participants. This DSM-IV version of the PDS was used because this study commenced before DSM-5 assessment scales were available.

The Depression, Anxiety and Stress Scale-Depression index (DASS-D; Lovibond & Lovibond, 1995) contains 17 items measuring depressive symptoms and shows excellent reliability and convergent and discriminant validity in both clinical and nonclinical samples (Brown, Chorpita, Korotitsch, & Barlow, 1997; Crawford & Henry, 2003).

2. Results

2.1. Participant characteristics

The final dataset consisted of 145 participants. There were 38 in the PTSD+ group/High Perceived Control (age, M = 31.74, SD = 12.25), PTSD+ group/Low Perceived Control (age, M = 34.25, SD = 11.29), PTSD- group/High Perceived Control (age, M = 33.82, SD = 11.26), PTSD- group/Low Perceived Control (age, M = 35.63, SD = 14.72). Participants reported exposure to a range of traumatic events, including sexual assault (n = 55), road accident (n = 17), nonsexual assault (n = 28), accidental injury (n = 26), natural disaster (n = 30), and torture (n = 2); 13 participants reported more than one traumatic event. The PTSD+ group ranged in symptom severity from 12 to 51 (M = 22.08, SD = 8.37) and the PTSD- group ranged from 0 to 11 (M = 5.31, SD = 3.22). The PTSD+ mean was indicative of moderate to severe posttraumatic symptomatology (Foa et al., 1997); 80.3% of the PTSD+ participants reached the cut-off score of 15 suggestive of PTSD diagnosis in community samples (Sheeran & Zimmerman, 2002).

Table 1 presents the mean participant characteristics for each group. Separate 2 (Group) × 2 (Condition) analyses of variance (ANOVAs) of age and DASS scores did not indicate significant differences between participants in the two perceived control conditions. The PTSD+ group showed elevated levels of depression relative to the PTSD- group (MD = 4.86; $F_{1,141}$ = 13.87, p < .01; η^2 = .089). Importantly, participants in the two perceived control conditions did not differ in terms of either PTSD [$F_{1,141}$ = 0.02, p < .89; η^2 = .000] or depression [$F_{1,141}$ = 2.51, p < .12; η^2 = .02] severity.

2.2. Manipulation checks

Table 1 presents the mean ratings for manipulation checks. Those in the low perceived control condition reported experiencing a lower degree of control during the image rating task (Mean Difference = -.889, t_{143} = -.4112, p < .05). Overall, those in the low perceived control condition gave higher post-task distress ratings (MD = .38, t_{143} = 2.44, p < .05), but reported similar ability to manage their emotional reactions to these images (MD = .287, ns).

2.3. Effects on distress tolerance

To explore whether PTSD symptomatology was associated with greater sensitivity to the effects of perceived control, a 2 (Group) × 2 (Condition) ANOVA was performed on delay to commence the distress tolerance task. Results indicated no main effect for Condition ($F_{1,141}$ = 3.51, ns) or Group ($F_{1,141}$ = .01, ns). However, there was a significant Group × Condition interaction ($F_{1,141}$ = 5.61, p = .019, η^2 = .038). As shown in Figure 1, for the PTSD+ group, the low perceived control manipulation was associated with 2.77 seconds longer delay on average to read a distressing story relative to those receiving the high perceived control manipulation (MD = 2.18 s; t_{69} = 3.13, p < .01; 95% C.I. = .69–3.66); that is, the delay in responding was twice as long for PTSD+ participants in the low perceived control relative to the high perceived control condition. This difference in delay between the perceived control conditions was not observed in the PTSD- group (MD = -.25 s; t_{72} = -.337, ns). Considering the prominence of depression in theories of learned helplessness, and the observed elevated depressive symptoms in PTSD

Table 1. Mean participant characteristics and manipulation checks.

| | High posttraumatic stress | | low posttraumatic stress | |
	High Control (n = 38)	Low Control (n = 36)	High Control (n = 33)	Low Control (n = 38)
Age	31.74 (12.25)	33.82 (11.26)	34.25 (11.29)	35.63 (14.72)
PDS severity	22.55 (8.37)	21.55 (8.74)	4.94 (2.95)	5.65 (3.46)
DASS Depression	8.84 (7.41)	12.27 (10.73)	5.33 (5.70)	6.05 (7.15)
Controllability	1.89 (1.23)	.76 (1.25)	2.00 (1.37)	1.18 (1.45)
Distress	1.53 (.89)	2.06 (1.03)	1.31 (.92)	1.61 (.95)
Emotion regulation	2.79 (1.04)	2.52 (1.06)	2.83 (1.06)	2.53 (1.13)

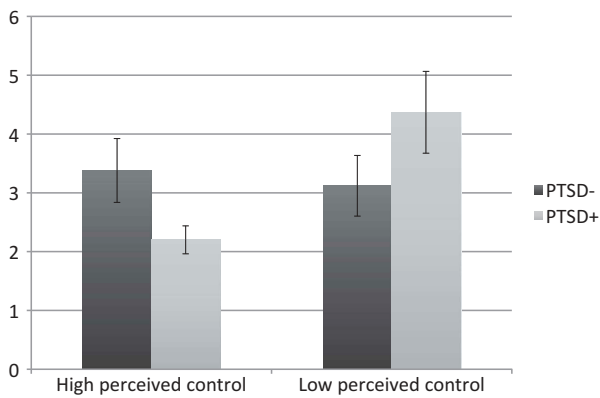Note. Standard deviations appear in parentheses.

Figure 1. Mean delay (seconds) to read a potentially distressing story by experimental condition (high vs low perceived control manipulation) and PTSD symptomatology (PTSD+ vs PTSD-, i.e. low and high PTSD symptomatology, respectively). Error bars indicate standard error.

+, a post-hoc ANCOVA including DASS-D scores was undertaken for this interaction; it remained significant over and above the influence of depressive symptoms ($F_{1,141} = 5.79$, $p = .017$, $\eta^2 = .040$).

3. Discussion

PTSD symptomatic individuals who were led to believe they had no control over a series of aversive images subsequently showed greater avoidance than their counterparts who believed they did have control over the images. Although the difference in commencing reading the potentially distressing story was only 2.77 seconds, this meant that the PTSD symptomatic participants who perceived that they lacked control delayed the task twice as long as those who thought they had control. This differential pattern was not observed in those without PTSD symptoms.

These findings suggest that PTSD may be associated with greater sensitivity to the adverse effects of perceiving that one lacks control over negative outcomes. This supports the applicability of stressor controllability effects as a model for conceptualizing PTSD (Foa, Zinbarg & Rothbaum, 1992). The effects of perceived control over aversive images appeared to generalize to a different aversive stimulus (a distressing story) in PTSD-symptomatic individuals. To our knowledge, this represents the first evidence that experiences of perceived control (or lack thereof) over aversive cues may affect subsequent tolerance of distress in those with PTSD symptoms.

In terms of cognitive models (Ehlers & Clark, 2000), there is much evidence that people with PTSD interpret their responses to environmental occurrences in excessively negative ways, including perceiving a lack of control over internal and external events (Dunmore et al., 2001; Ehring, Ehlers, & Glucksman, 2006). The symptomatic trauma survivors in the current study may have

been more sensitive to the perceived lack of control because they engaged in more extreme appraisals about the adverse outcomes of uncontrollability. This maladaptive appraisal may have contributed to lower estimates of their capacity to tolerate distress when subsequently confronted by new, potentially distressing, stimuli.

It is also possible that the experience of lacking control may have reactivated a sense of uncontrollability in participants with PTSD symptoms. Fear conditioning models posit that the fear and distress experienced at the time of the trauma becomes strongly associated with the external stimuli and internal responses that were present at the time (Milad, Rauch, Pitman, & Quirk, 2006). Losing control is a very common psychological experience during trauma (Foa, Zinbarg, & Rothbaum, 1992), and so it is feasible that participants with PTSD symptoms had memories of uncontrollability reactivated by this perceived lack of control, which in turn heightened their anxiety and diminished their capacity to tolerate distress subsequently. This possibility remains speculative because we did not directly assess the sense of control that participants associated with their trauma exposure at any point during the experiment.

The current findings have potential implications for recovery from trauma and also for treatment of PTSD. Since inadequate distress tolerance and greater avoidance may present a barrier to effective treatment, factors affecting these processes in PTSD are of clinical interest and worthy of further investigation. Successful exposure therapy involves the patient tolerating distressing memories to the point of extinction learning and mastery of the feared reminders (Davis, Myers, Ressler, & Rothbaum, 2005). Perceptions of poor control over feared memories may reduce the capacity to engage in exposure and may undermine treatment response. Consistent with this interpretation is evidence that poor response to exposure therapy is predicted by excessive fear responses (Blanchard et al., 2003) and exaggerated amygdala reactions (Bryant et al., 2008) in response to trauma reminders. It is for this reason that some commentators recommend that therapists should attend to clients' moment-to-moment experience of control in order to reduce avoidance and increase distress tolerance during therapy (e.g. Hembree, Rauch, & Foa, 2003). In this context, it is also worth noting that treatment for PTSD has been shown to be enhanced by preparing PTSD patients for exposure therapy with distress tolerance training that, in part, aims to enhance their sense of control (Bryant et al., 2013; Cloitre et al., 2010).

We recognize several methodological limitations. First, the generalizability of these results to males or to clinically-presenting populations is unknown. It could be argued that crowdsourcing workers are likely to be less helpless and less functionally impaired than clinically presenting patients. Similarly, the focus on females precludes inferences regarding how generalizable these

findings are to males. Second, the nature of this online population precluded use of clinical interviews in order to verify diagnostic status and trauma history. Third, there were no established, well-validated paradigms suitable for online use in manipulating perceived control over aversive cues or for measuring tolerance for broad affective distress; for example, the online nature of the study resulted in not being able to assess time spent on viewing stimuli. Further validation of our paradigms will assist in interpreting this result. For ethical reasons we did not assess the level of distressing film that participants elected to be exposed to because we did not actually present these films, and it was considered inappropriate to deceive participants by having them choose a film they would not see. Finally, the absence of a baseline control condition limits inferences regarding the effects of perceived control manipulations.

The current finding provides the first evidence to our knowledge that people with PTSD symptoms are particularly susceptible to the adverse effects of perceived lack of control. Understanding such effects may help delineate symptom maintenance processes and could help to establish an evidence base for when and how standard treatments should be adapted to enhance the experience of perceived control.

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