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The Role of Disgust in Posttraumatic Stress: A Critical Review of the Empirical Literature

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Abstract
The current review provides a detailed analysis of the burgeoning literature examining the role of disgust in understanding posttraumatic stress symptomatology. Research in this area generally converges to suggest (1) posttraumatic stress is associated with the experience of elevated disgust, (2) individual differences in disgust vulnerabilities may relate to increased posttraumatic stress symptom levels, (3) retrospective report of peritraumatic disgust is related to posttraumatic stress symptom levels, and (4) posttraumatic stress symptom levels appear to be associated with increased disgust, including in response to traumatic event cues. Importantly, much of this research suggests observed relations between disgust and posttraumatic stress are at least somewhat unique from relations between fear/anxiety and posttraumatic stress. Future research is now needed to identify mechanisms involved in these relations in order to inform the prevention and treatment of disgust-related posttraumatic stress disorder.

Keywords
Disgust, Trauma, PTSD, Posttraumatic Stress

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Introduction
Theoretical models of posttraumatic stress disorder (PTSD) have traditionally posited a central role for affective processes, in particular fear and anxiety, in predicting trajectories of symptom remittance or non-remittance following exposure to a traumatic event. Conditioning theories of PTSD suggest that traumatic event exposure provides the context for potent fear conditioning, during which previously neutral stimuli acquire the ability to evoke intense fear and anxiety even in the absence of present danger. Subsequent avoidance of anxiety associated with both internal (e.g., thoughts, feelings, memories) and external

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(e.g., places, people, activities) reminders of the traumatic event is thought to prevent extinction, thereby maintaining elevated posttraumatic stress reactions (Engelhard, de Jong, van den Hout, & van Overveld, 2009; Foa & Kozak, 1986; Keane, Zimering, & Caddell, 1985; Mineka & Oehlberg, 2008). Similarly, cognitive models of PTSD suggest that after a traumatic event, some individuals continue to interpret the experience in a way that involves persistent threat-related appraisals (e.g., the world is a dangerous place), leading to continued feelings of anxiety and fear surrounding the memory of the experience (Ehlers & Clark, 2000).

Despite this firm theoretical grounding, empirical research has offered mixed support for the centrality of fear and anxiety in understanding posttraumatic stress reactions. For example, while several studies have linked intensity of fear experienced during a traumatic event (i.e., peritraumatic fear) to severity of subsequent posttraumatic stress symptoms (Breslau & Kessler, 2001; Brewin, Andrews, & Rose, 2000; Creamer, McFarlane, & Burgess, 2005; Schnurr, Spiro, Vielhauer, Findler, & Hamblen, 2002), others have failed to observe this relation, particularly when considering the influence of other peritraumatic responses (Lancaster, Melka, & Rodriguez, 2011; Resick, 2008; Rizvi, Kaysen, Gutner, Griffin, & Resick, 2008; Roemer, Orsillo, Borkovec, & Litz, 1998). Similarly, heightened posttraumatic fearful/anxious reactivity has been documented among individuals with PTSD in response to ideographic traumatic event cues presented in the laboratory (e.g., Lanius et al., 2003; Orr et al., 1998; Pitman, Orr, Forgue, de Jong, & Claiborn, 1987; Shin et al., 1997). However, many studies utilizing this paradigm have either failed to replicate this finding (Carson et al., 2000; Olatunji, Babson, Smith, Feldner, & Connolly, 2009; Shin et al., 1999, 2004), or have documented heightened reactivity for several negative emotion states among individuals with PTSD (as opposed to specificity of fear/anxiety; Pitman, Orr, et al., 1990; Pitman et al., 1987; Shin et al., 1997). Finally, structural models comparing Axis I diagnoses in the National Comorbidity Survey (NCS) suggest PTSD may be more closely aligned with the characteristic features of mood disorders (e.g., major depressive disorder, dysthymia), as compared to anxiety disorders (e.g., panic, social phobia; Cox, Clara, & Enns, 2002; Watson, 2005).

Several researchers have suggested fear and anxiety likely represent only a fraction of the entire range of affective responses associated with both normative and pathological reactions to traumatic events (Brewin, et al., 2000; Dalgleish & Power, 2004; Davidson et al., 1996; Resick & Miller, 2009; Resick & Schnicke, 1992). Indeed, the recently released fifth edition of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5; American Psychiatric Association [APA], 2013) removed the diagnosis of PTSD from the anxiety disorders in favor of a separate category entitled *Trauma- and Stressor-Related Disorders*, reflecting a broader reconceptualization of symptomatic responding to traumatic events. Importantly, this new diagnostic nosology includes a cluster of symptoms entitled *Negative Alterations in Cognitions and Mood*, which recognizes that PTSD may be characterized, in part, by the persistence of an array of negative emotions. Supporting this notion, a number of studies have begun to examine associations between posttraumatic stress reactions and emotions other than fear and anxiety. For example, longitudinal studies suggest a range of peritraumatic emotions including anger, shame, and guilt serve as independent predictors of posttraumatic stress symptoms even after accounting for relations with peritraumatic fear (Brewin, et al., 2000; Resick, 2008). The present manuscript reviews a mounting literature suggesting that the emotion of disgust in particular, may offer additional insight into understanding responses to traumatic events and should be considered when conceptualizing the revised diagnostic profile of PTSD.

Disgust, defined broadly as a rejection or revulsion response aimed at removing oneself from the presence of a potential contaminant (Davey, 1994; Olatunji & Sawchuk, 2005; Rozin, Haidt, & McCauley, 2000) is considered a basic emotion with a unique profile of behavioral, cognitive, physiological, and neurobiological activity (Cisler, Olatunji, & Lohr, 2009) that distinguishes it from other negative emotions such as fear, anger, and sadness (Ekman, 1992; Izard, 2007; Olatunji & Sawchuk, 2005). Disgust, meaning literally "bad taste," is thought to have emerged to prevent the ingestion of harmful substances and functions through gustatory reactions, such as nausea and vomiting (Rozin et al., 2000; Woody & Teachman, 2000). Rozin et al. (2000) argued that while disgust may have evolved as a protective factor related to food-rejection, other stimuli have become capable of evoking disgust in humans. Such stimuli may include those that remind us of our mortality and blur the line that differentiates humans from other animals (e.g., unconventional or inappropriate sexual acts, body-envelope violations, poor

hygiene, material related to death or decay; Haidt, Rozin, McCauley, & Imada, 1997; Olatunji & Sawchuck, 2005; Rozin et al., 2000), and those representing morally reprehensible or undesirable behaviors (e.g., rape, genocide, hypocrisy, racism, exploitation; Rozin et al., 2000; Simpson, Carter, Anthony, & Overton, 2006) or characters (e.g., murderers, homeless people; Olatunji & Sawchuck, 2005; Rozin et al., 2000).

Drawing from well-developed models of peritraumatic fear conditioning, we might expect traumatic events to offer robust disgust conditioning opportunities as well (Badour, Feldner, Blumenthal, & Knapp, 2013; Dalgleish & Power, 2004). During a traumatic event, individuals may be exposed to a wide array of disgust elicitors including tangible contaminants such as bodily fluids (e.g., blood, semen, vomit; Curtis, Aunger, & Rabie, 2004; de Jong, van Lankveld, Hermien, Elgersma, & Borg, 2010), as well as situations involving disease, death, betrayal, and violations of morality (Fairbrother & Rachman, 2004; Haidt et al., 1997; Rachman, 2004; Simpson et al., 2006). Classical conditioning during a trauma is likely to lead to increased frequency and/or intensity of experienced disgust in response to trauma cues in the environment (i.e., disgust-relevant re-experiencing), while operant conditioning processes are likely to reinforce escape from, and avoidance of, stimuli capable of evoking a disgust response. Indeed, preliminary research offers support for a conditioning model of disgust in posttraumatic stress, even after accounting for peritraumatic fear and posttraumatic anxiety experienced in response to traumatic event cues (Badour, Feldner, Blumenthal, & Knapp, 2013).

In line with models of fear and anxiety, basic research supports a role for traditional classical (i.e., signal learning) and operant conditioning processes in the acquisition and maintenance of disgust (Parker, Limebeer, & Rana, 2009; Schafe & Bernstein, 1996). However, emerging research suggests evaluative conditioning, argued by some to be a unique form of classical conditioning (e.g., Baeyens, Crombez, van der Bergh, & Eelen, 1988), may also be involved in the acquisition of conditioned disgust responses. Evaluative conditioning has been defined as the transfer of the hedonic value (e.g., like/dislike, pleasant/unpleasant) of an unconditioned stimulus (UCS) to a previously neutral stimulus (conditioned stimulus [CS]; Baeyns, Eelen, Crombez, & van den Bergh, 1992). Of note, the association between the CS and UCS in evaluative conditioning does not involve prediction of a UCS as in traditional classical conditioning, but rather involves a reference to the affective value of the UCS even in the absence of the expectation that the UCS will occur again (De Houwer, Thomas, & Baeyens, 2001; Olatunji, Forsyth, & Cherian, 2007). Within the context of peritraumatic conditioning this might involve transfer of disgusting or repulsive aspects of the trauma onto the self or onto others. Examples of resulting appraisals might include a sexual assault victim who views herself as dirty or contaminated as a result of feelings of disgust associated with the assault (Badour, Feldner, Blumenthal, & Bujarski, 2013; Olatunji, Elwood, Williams, & Lohr, 2008), or a combat veteran who views others as immoral because of disgusting acts witnessed during war (Litz et al., 2009).

Importantly, this type of conditioning may facilitate unique properties that distinguish disgust responses from other emotions such as fear or anxiety (Olatunji, Forsyth, et al., 2007; Schienle et al., 2001). For example, emotional responses acquired via evaluative conditioning demonstrate resistance to extinction as compared to those acquired via stimulus-stimulus associations (Baeyens et al., 1988; Diaz et al., 2005; Vansteenwegen et al., 2006). Consistent with this idea, increasing evidence among samples with specific phobias and contamination-based obsessive-compulsive disorder indicates disgust reactions appear resistant to extinction following exposure as compared to fear or anxiety reactions (McKay, 2006; Olatunji, Smits, Connolly, Willems, & Lohr, 2007; Smits, Telch, & Randall, 2002). Although relative resistance of disgust to extinction has not yet been specifically examined within the context of PTSD, preliminary work does suggest that disgust-based reactions following traumatic events may respond to targeted cognitive-behavioral interventions among individuals with PTSD (Jung & Steil, 2012, 2013; Steil, Jung, & Stangier, 2011).

Expanding upon this background, the current review aims to provide a summary and critical evaluation of the emerging literature regarding the relation between disgust and posttraumatic stress symptomatology following exposure to traumatic events in order to identify areas in need of further investigation. Given both conceptual overlap and previous empirical findings documenting correlations between measures of disgust and measures of fear/anxiety among individuals with PTSD (Badour, Bown, Adams, Bunaciu, & Feldner, 2012; Engelhard, Olatunji, & de Jong, 2011; Olatunji, Armstrong, Fan, & Zhao, 2014) and other types of psychopathology

(for a review see Cisler et al., 2009), this review will highlight studies that have controlled for relations with fear/anxiety when examining links between disgust and posttraumatic stress symptomatology. To accomplish these goals, the first section discusses the operational definitions used in regard to key constructs considered. The second section consists of a detailed review of empirical studies that have examined associations between disgust and posttraumatic stress reactions. This section is comprised of several subsections in order to highlight themes and focus on specific relations within this broader topic area. The final section discusses areas for additional consideration including those in need of further inquiry.

Operational Definition of Key Constructs

Traumatic Event Exposure

The DSM-IV-TR (APA, 2000) defines traumatic event exposure as meeting Criterion A for the diagnosis for PTSD. Specifically, a traumatic event involves life threat, threatened or actual serious injury, or threat to one's physical integrity (Criterion A1) that is accompanied by intense feelings of fear, helplessness, or horror (Criterion A2). Research examining the sequelae of traumatic events typically emphasizes the direct experience of trauma; however, traumatic events can also be learned about or witnessed. The studies reviewed herein have conceptualized traumatic event exposure in a number of ways. Many studies examining correlates of posttraumatic stress symptoms require exposure to a Criterion A event. However, other studies assess for history of exposure to potentially traumatic events (PTEs), or experiences that may constitute traumatic event exposure without explicitly assessing criteria A1 or A2. Commonly reported PTEs include combat exposure, sexual or physical abuse or assault, motor vehicle or industrial accidents, natural or manmade disasters, life-threatening illnesses, or sudden unexpected deaths. Samples are often comprised of individuals sharing a history of exposure to a common traumatic event or PTE (e.g., combat, sexual victimization) while others include persons with a mixture of experiences. This distinction is important for the present review in light of evidence suggesting that certain traumatic experiences may be more likely to involve feelings of disgust (Badour et al., 2011; Feldner, Frala, Badour, Leen-Feldner, & Olatunji, 2010). The current review adopted an inclusive approach such that studies involving any of these definitions of traumatic event exposure were reviewed.

Posttraumatic Stress Symptoms and PTSD

There are several ways in which symptoms of posttraumatic stress symptoms have been conceptualized and assessed. One approach has been to establish a continuous index of total symptom severity. This is typically accomplished by calculating a total of the frequency and/or intensity ratings for each of the 17 DSM-IV-TR-defined symptoms of PTSD (APA, 2000; Blake et al., 1995). A second approach involves the examination of symptom frequency or intensity within the three clusters of PTSD symptoms: reexperiencing (e.g., intrusive thoughts, nightmares), avoidance (e.g., trying to not think about a traumatic event), and hyperarousal (e.g., easily startled) symptoms. Finally, many studies examine whether participants meet current or lifetime criteria for a PTSD diagnosis. Specifically, PTSD is defined as the non-remittance of symptoms (i.e., at least one reexperiencing symptom, three or more avoidance/numbing symptoms, two or more hyperarousal symptoms; APA, 2000) by one month following traumatic event exposure. This pattern of symptoms must be accompanied by significant distress and/or impairment in important areas of functioning. As a PTSD diagnosis must be established via clinical interview following a Criterion A-defined traumatic event, some studies not meeting these rigorous assessment standards have included a dichotomous index of PTSD that will be referred to as a *probable* diagnosis throughout this manuscript. Structured clinical interviews for PTSD including the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995) and various versions of the Structured Clinical Interview for DSM (SCID; First, Spitzer, Gibbon, & Williams, 1997; Spitzer & Williams, 1985; Spitzer, Williams, Gibbon, & First, 1990) require a history of Criterion A trauma exposure in order to establish a PTSD diagnosis. As such, diagnostic status established in studies utilizing these assessment tools will be referred to as a PTSD diagnosis throughout, even if explicit information regarding the Criterion A status of trauma exposure is unavailable.

Disgust

Although disgust has been correlated with unique patterns of physiological and neurobiological activation (Cisler et al., 2009), research has yet to establish a specific profile in these modes of responding that

reliably distinguishes the experience or expression of disgust from other negative emotions. To date, there has also been no attempt to specifically assess psychophysiological correlates of disgust (e.g., levator labii electromyogram activity) within the context of responding to traumatic events. As such, this review will focus exclusively on studies that have included subjective indices of disgust.

Moreover, while the term *horror* has received some attention within the PTSD literature due to its inclusion as an emotion that previously served as one of three qualifying emotions required for meeting the definition of a traumatic event in previous iterations of the DSM (i.e., fear, helplessness, horror; DSM-IV-TR; APA, 2000), this emotion has not been particularly well defined or thoroughly studied within the emotion literature. Some define horror as a mixture of extreme fear and disgust (McNally, 2002), while others have suggested it is a member of an emotion system including anxiety and fear (Munn, 1940; Panksepp, 1982). Still others yet have proposed that horror can be used interchangeably with the emotion of *terror* (Darwin, 1998). Given the lack of definitional clarity of this construct, studies examining horror in the absence of specific indices of disgust will not be included in the present review.

Finally, terms that have been used to assess disgust responses have varied. While many studies have employed the term *disgust,* others have used labels such as *revulsion, sickening,* or *gross* to assess disgust responses (Feldner et al., 2012; Engelhard et al., 2011). The terms disgust *response* and disgust *responding* will refer to a single rating of disgust. In contrast, the term disgust *reactivity* will be used to index change in disgust following exposure to an emotion elicitation task.

Selection of Studies

Potentially relevant studies were identified in one of two ways: a search of PsycINFO, Medline, Pilots, and PsycArticles databases, or a backward literature search (i.e., identifying references in another article). Searches of each electronic database included all combinations of the following key terms: disgust, disgusted, PTSD, posttraumatic stress, trauma, traumatic events. These searches were only limited by excluding theses, dissertations, and articles in languages other than English. Next, we obtained all potentially relevant articles cited in the studies found in the database searches. Empirical studies were then included in the review if at least some participants in the study were exposed to traumatic events (or PTEs), a measure of posttraumatic stress or PTSD diagnostic status was administered, and empirical relations were examined between posttraumatic stress symptoms and/or PTSD and disgust. Based upon these criteria, a total of 29 articles were retained for the final review. Key methodological aspects, analytic approaches, and results of studies are presented in Table 1.

Review of Empirical Literature Examining Disgust and Posttraumatic Stress

The primary content of the review is divided into three sections. First, studies that examine individual differences in vulnerabilities associated with the experience and/or regulation of disgust and how these factors relate to the expression of disgust during traumatic events as well as to subsequent posttraumatic stress symptom reactions are reviewed (Individual Differences in Disgust Vulnerabilities). Second, a number of studies are presented in which the presence and/or intensity of disgust responding during a traumatic event has been linked to posttraumatic stress symptoms (Peritraumatic Disgust). Third, studies examining how the persistence of disgust following traumatic event exposure relates to posttraumatic stress are reviewed (Posttraumatic Disgust).

Individual Differences in Disgust Vulnerabilities

Disgust propensity (i.e., the ease/frequency with which disgust is experienced) and disgust sensitivity (i.e., the degree to which the experience of disgust is perceived as negative or potentially harmful; Van Overveld, et al., 2006) are considered trait-like disgust vulnerability factors that have been linked to a variety of anxiety disorders (Cisler et al., 2009; Olatunji & Cisler, 2009). Researchers have begun to examine how these factors might influence responses to traumatic events and posttraumatic stress reactions.

Disgust propensity. Disgust propensity (DP) may inform our understanding of responses to traumatic events in at least two ways. First, consistent with preliminary empirical evidence (Engelhard et al., 2011), we would expect elevated DP to increase the likelihood of experiencing feelings of disgust in response to stimuli present during a traumatic event (i.e., peritraumatic disgust). Second, after a traumatic event,

Table 1. Overview of studies (listed alphabetically) examining relations between disgust and posttraumatic stress.

		Measures of Primary Variables					
Author(s)/ Year	**Sample**	Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	**Summary of Relations Between Disgust and Posttraumatic Stress**
Amdur, Larsen, & Liberzon, 2000	Male Vietnam veterans with ($n = 17$) and without PTSD ($n = 11$). Non-combat exposed controls ($n = 14$)	IAPS slides – Distressing (low valence, high arousal) – Unattractive (low, valence, low arousal) – Exciting (high valence, high arousal)	Disgust responding – Intensity of disgust following presentation of each IAPS slide		Combat exposure in Vietnam – Assessment not specified – No details available regarding A1 or A2	Current PTSD diagnosis – SCID-P (diagnostic status)	ANOVA – Participants with PTSD endorsed the highest disgust to the emotionally evocative slides regardless of slide type
Badour, Bown et al., 2012	Adult women with a history of interpersonal victimization ($N = 49$)	Not applicable	Disgust propensity – DPSS-R Disgust sensitivity – DPSS-R Peritraumatic disgust – Intensity of peritraumatic self-focused and perpetrator-focused disgust – SUDS (0 – 100)	Anxiety sensitivity – ASI-3 Peritraumatic fear – Intensity of peritraumatic fear – SUDS (0 – 100)	Sexual or physical assault – Inclusionary criteria meeting A1 and A2	Past month PTSD symptom severity – CAPS (frequency and intensity)	Zero-order correlations – Disgust sensitivity correlated with PTSD symptom severity. Hierarchical linear regression – Peritraumatic perpetrator-focused disgust (but not self-focused disgust) predicted PTSD symptom severity after accounting for peritraumatic fear, disgust propensity, disgust sensitivity, anxiety sensitivity, negative affect, and contamination-based obsessive-compulsive symptoms.
Badour, Feldner, Babson, Blumenthal, & Dutton, 2013	Adult women with a history of sexual ($n = 22$) or physical assault ($n = 18$)	Script-Driven Imagery – 1 neutral (1) – 1 traumatic event (1)	Disgust responding - Intensity of disgust prior to and following each script – VAS (0 – 100)		Sexual or physical assault – Inclusionary criteria meeting A1 and A2	Past month PTSD symptom severity – CAPS (frequency and intensity)	Zero-order correlations – PTSD symptom severity was positively correlated with change in disgust following the traumatic event script. – PTSD symptom severity was negatively correlated with change in disgust following the neutral script. Hierarchical linear regression – Among both sexually and physically assaulted women PTSD symptom severity significantly predicted change in disgust following the traumatic event after accounting for contamination-based obsessive-compulsive symptoms and change in disgust following the neutral script.
Badour et al., 2011	Adults ($N = 87$; 67 female) with a history of interpersonal ($n = 60$) or non-interpersonal ($n = 27$) traumatic events	Script-Driven Imagery – 1 neutral (1) – 1 traumatic event (1)	Disgust responding – Intensity of disgust following each script – VAS (0 – 100)		Mixture of traumatic events – Inclusionary criteria meeting A1 and A2	Past month PTSD symptom severity – CAPS (frequency and intensity)	Zero-order correlations – PTSD symptom severity was significantly correlated with intensity of disgust following the traumatic event script, but not the neutral script. ANOVA – PTSD symptom severity was no longer associated with disgust reactivity when controlling for negative affect.

(continued)

Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables					Summary of Relations Between Disgust and Posttraumatic Stress
		Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	
Badour, Feldner, Blumenthal, & Bujarski, 2013	Adult women with a history of sexual victimization ($N = 38$)	Not applicable	Disgust sensitivity – DPSS-R		Sexual victimization – Inclusionary criteria meeting A1 and A2	Past month PTSD symptom severity – CAPS (frequency and intensity)	Zero-order correlations – Disgust sensitivity significantly correlated with PTSD symptom severity. Linear regression with bootstrapping test for indirect effect – An indirect effect of disgust sensitivity on PTSD symptom severity was found through increased sexual assault-related mental contamination. – The relation direct effect of disgust sensitivity on posttraumatic stress was still significant after accounting for the indirect effect.
Badour, Feldner, et al., 2012	63 adolescents aged 10-17 years (37 female) with a mixture of traumatic events	Voluntary Hyperventilation challenge (not relevant to disgust assessment)	Peritraumatic disgust – Intensity of peritraumatic disgust – SUDS (0 – 8)		Mixture of traumatic events – Inclusionary criteria meeting A1 and A2 (assessed via ADIS-C)	Past 2-week PTSD symptom severity – CPSS (frequency)	Zero-order correlations – PTSD symptom severity was not significantly correlated with intensity of peritraumatic disgust.
Badour, Feldner, Blumenthal, & Knapp, 2013	Adult women with a history of sexual victimization ($N = 46$)	Script-Driven Imagery – 1 neutral (1) – 1 traumatic event (1)	Peritraumatic disgust – Intensity of peritraumatic perpetrator-focused disgust – SUDS (0 – 100) Disgust responding – Intensity of disgust prior to and following each script – VAS (0 – 100)	Peritraumatic fear – Intensity of peritraumatic fear – SUDS (0 – 100) Anxiety responding – Intensity of anxiety prior to and following each script – VAS (0 – 100)	Sexual victimization – Inclusionary criteria meeting A1 and A2	Past month PTSD symptom severity – CAPS (frequency and intensity)	Zero-order correlations – PTSD symptom severity was significantly correlated with peritraumatic disgust, and disgust reactivity following the traumatic event script. Linear regression with bootstrapping test for indirect effect – An indirect effect of peritraumatic disgust on PTSD symptom severity was found through increased disgust reactivity to the traumatic event script. This relation remained significant after accounting for peritraumatic fear and anxious reactivity to the traumatic event script. – The direct effect of peritraumatic disgust on PTSD was no longer significant when controlling for the indirect effect.
Carson et al., 2000	Female Vietnam veterans with ($n = 17$) or without ($n = 21$) a current diagnosis of PTSD	Script-driven imagery procedure – 3 neutral (2[S]; 1[I]) – 1 fear (S; public speaking) – 2 positive (1[S]; 1[I]) – 1 action (S) – 1 stressful, non-Vietnam-related (I) – 3 Vietnam-related (1[S]; 2[I])	Disgust responding – Intensity of disgust following each script – Likert-type scale (0 – 12)		Witnessing death or serious injury as combat nurse in Vietnam – Inclusionary criteria meeting A1 – No details provided regarding A2	Current PTSD diagnosis – CAPS (diagnostic status)	Independent samples *t*-tests – The PTSD and no-PTSD groups did not differ in terms of disgust ratings in response to the individualized Vietnam scripts. – Tests of subjective reactivity were not reported for the remaining scripts.

(continued)

Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables					Summary of Relations Between Disgust and Posttraumatic Stress
		Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	
Engelhard et al., 2011	Dutch male veterans deployed to Afghanistan. Assessed pre-deployment, 6-months, and 15-months post-deployment.[a] (pre-deployment $N = 176$; 6 mo. $N = 138$; 15 mo. $N = 107$)	Not applicable	Disgust propensity – DS-R – DPSS-R Disgust sensitivity – DPSS-R Peritraumatic disgust – Intensity of peritraumatic "revulsion" – Likert-type scale (0 – 3)	Anxiety sensitivity – ASI-3 Peritraumatic fear – Intensity of peritraumatic fear – Likert-type scale (0 – 3)	War zone stressors in Afghanistan – PTEs – No details available regarding A1 or A2	Continuous index of past month of PTSD symptom severity – PSS (frequency)	Zero-order correlations: – Peritraumatic disgust and disgust sensitivity correlated with PTSD symptom severity at 6-months – No significant relations emerged for disgust variables and PTSD symptom severity at 15-months Hierarchical linear regression: – Intensity of peritraumatic disgust related to PTSD symptom severity at 6-months after accounting for peritraumatic fear. – DPSS-R sensitivity no longer related to PTSD symptom severity at 6-months after accounting for neuroticism and anxiety sensitivity.
Finucane, Dima, Nuno, & Halvorsen, 2011	Adults with chronic pain ($n = 220$; 150 female), major depression ($n = 24$; 17 female), or PTSD ($n = 64$; 26 female). Healthy control participants included 131 undergraduate students ($n = 131$, 94 female)	Not applicable	Trait disgust – Disgust subscale of the BES	Trait fear/anxiety – Fear subscale of the BES	Not specified: – Patients referred to Traumatic Stress Centre – No details available regarding A1 or A2	Current PTSD diagnosis – Unspecified clinical interview – IES-R	Discriminant function analysis – Disgust (as compared to fear, anger, sadness, and happiness) maximally distinguished PTSD from the other groups. Mann-Whitney *U* test – As compared to the healthy control group, individuals with PTSD reported more frequent disgust.
Foy, Sipprelle, Rueger, & Carroll, 1984	Treatment-seeking male Vietnam veterans ($N = 43$) with ($n = 21$) and without ($n = 22$) a probable diagnosis of PTSD.	Not applicable	Distress associated with experienced disgust – Disgust item on study specific problem checklist	Distress associated with experienced anxiety – Anxiety item on study specific problem checklist	Combat exposure in Vietnam – CES – No details available regarding A1 or A2	Probable PTSD diagnosis – Study specific problem checklist. Continuous index of PTSD symptom severity – Study specific problem checklist	Stepwise discriminant function analysis – Following entry of distress associated with persistent anxiety, distress associated with persistent feelings of disgust contributed the greatest amount of variance to predicting the correct classification of PTSD diagnostic status. – Additional items included, alcohol abuse, suicidal thoughts, hostility, marital problems, depression, irritability, and restlessness
Fredman et al., 2010	Adult women exposed to extensive flooding in St. Louis, Missouri ($N = 205$)	Not applicable	DIS/DS – Threat/harm aspects of the disaster (including seeing or doing something perceived as disgusting)		– Living in affected area – No details available regarding A1 or A2	Continuous index of PTSD symptom severity – Modified version of the National Women's Study PTSD Module (Kilpatrick, Resnick, Saunders, & Best, 1989)	Descriptive Information – Seeing or doing something perceived as disgusting was most commonly endorsed threat/harm variable Structural Equation Model – Threat/harm variable was positively associated with PTSD symptoms

(continued)

Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables: Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	Summary of Relations Between Disgust and Posttraumatic Stress
Hathaway, Boals, & Banks, 2010	Undergraduate students with a mixture of potentially traumatic events ($N = 598$; 394 female)	Not applicable	Peritraumatic disgust – Study specific question designed to assess the dominant peritraumatic emotion. – Disgust, guilt, and shame/embarrassment collapsed into "disgust-related" emotion category	Peritraumatic fear – Study specific question designed to assess the dominant peritraumatic emotion. – Fear	Mixture of PTEs – TEQ – No details available regarding A1 or A2	Continuous index of past month of PTSD symptom severity – PCL-S (intensity) Probable PTSD diagnosis – > 44 cutoff on PCL-S	ANOVA – Individuals reporting disgust-related emotions (as well as anger, sadness, and fear) exhibited the highest level of PTSD symptoms. Chi-square – Following anger, individuals reporting disgust-related emotions as the dominant emotion during their traumatic event were most likely to exceed the cutoff for probable PTSD.
Lancaster et al., 2011	Undergraduate students with a mixture of potentially traumatic events ($N = 341$; female = 200; African-American = 107; European-American = 234)	Not applicable	Peritraumatic disgust – Intensity of peritraumatic fear – Likert-type scale (0 – 8)	Peritraumatic fear – Intensity of peritraumatic fear – Likert-type scale (0 – 8)	Mixture of PTEs – BTQ – No details available regarding A1 or A2	Continuous index of past month PTSD symptom severity – PCL-S (intensity)	Stepwise regression (forward entry) – After accounting for Criterion A2 emotions (fear, helplessness, horror), disgust accounted for a significant portion of variance in PTSD symptom severity. – As a function of gender: Disgust significantly related to PTSD symptom severity among women (but not men). – As a function of race: Disgust predicted PTSD symptom severity among European Americans (but not African-Americans).
Langston, Davis, & Swopes, 2010	Treatment-seeking children and adolescents aged 9-17 ($N = 47$; female = 27) with a mixture of traumatic events	Not applicable	Peritraumatic disgust – UCLA-RI (Child and Adolescent Versions) – *"Did you feel that what you saw was disgusting or gross (yes/no)?"*		Mixture of traumatic events – Inclusionary criteria meeting A1 and A2	Continuous index of past month PTSD symptom severity – UCLA-RI (Child and Adolescent Versions; frequency) TRNS (Child Version) – Presence of past week and past month nightmares	Chi-Square – Individuals with trauma-related nightmares were more likely to report having felt disgusted by what they saw during their traumatic event relative to those with idiopathic nightmares.
Lanius et al., 2007	Adults with a mixture of traumatic events with a current diagnosis of PTSD either with ($n = 15$; female = 11) or without a comorbid diagnosis of major depression ($n = 11$, female = 7). The control group had no history of PTSD ($n = 16$; female = 13)	Script-Driven Imagery – 1 neutral (1) – 1 traumatic event (1)	Disgust responding – Intensity of disgust following each script averaged across 3 trials during an fMRI – Likert-type scale (0 – 6)		Mixture of traumatic event – Inclusionary criteria meeting A1 and A2	Current PTSD diagnosis – CAPS (diagnostic status)	ANOVA – Both PTSD groups reported significantly greater disgust relative to the control group. – No differences emerged between the two PTSD groups. – Tests of subjective reactivity were not reported for the remaining scripts.
Lanius et al., 2003	Adults with a history of CSA or a MVA during adulthood. ($N = 20$) with (CSA = 7, MVA =3) and without (CSA = 6, MVA = 4) a current diagnosis of PTSD	Script-Driven Imagery – 1 neutral (1) – 1 sad (1) – 1 anxious (1) – 1 traumatic event (1)	Disgust responding – Intensity of disgust following each script averaged across 3 trials during an fMRI – VAS (0 – 7)		CSA or MVA: – Inclusionary criteria meeting A1 and A2	Current PTSD diagnosis – CAPS (diagnostic status)	Independent samples *t*-test: – Ratings of disgust in response to the traumatic event script did not differ as a function of PTSD diagnosis. – Tests of subjective reactivity were not reported for the remaining scripts.

(continued)

Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables					Summary of Relations Between Disgust and Posttraumatic Stress
		Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	
McMillen, North, & Smith, 2000	Adults exposed to the 1994 earthquake in Northridge, California ($N = 136$; 67 female)	Not applicable	DIS/DS – Threat/harm aspects of the disaster (including seeing or doing something perceived as disgusting)		Living in affected area – No details available regarding A1 or A2	Probable PTSD diagnosis – DIS/DS Meeting criteria for each symptom cluster – DIS/DS	Logistic regression – No threat or harm-related variables significantly predicted a probable PTSD diagnosis or meeting criteria for any of the symptom clusters
Olatunji et al., 2014	Combat veterans with ($n = 21$, 2 female) and without PTSD ($n = 16$, 1 female). Non-veteran healthy controls (n =22, 2 female)	Not applicable	Disgust sensitivity – DPSS-R		Combat exposure – Inclusionary criteria meeting A1 – No details provided regarding A2	Current PTSD diagnosis – MINI	ANOVA – Veterans without PTSD reported significantly lower levels of disgust sensitivity than veterans with PTSD and healthy controls. – Veterans with PTSD did not differ from healthy controls in disgust sensitivity.
Olatunji et al., 2009	Adults ($N = 99$; 71 female) with a mixture of traumatic events	Script-Driven Imagery – 1 neutral (S) – 1 traumatic event (I)	Disgust responding – Intensity of disgust following each script – VAS (0 – 100)		Mixture of traumatic events – Inclusionary criteria meeting A1 and A2	Current PTSD diagnosis – CAPS (diagnostic status)	ANCOVA – After controlling for disgust responding to a standardized neutral script, a significant PTSD diagnosis by gender interaction was found such that females with PTSD reported greater disgust in response to the traumatic event script as compared to females without PTSD and men with or without PTSD.
Orr et al., 1998	Adult women with a history of CSA with a current diagnosis of PTSD ($n = 29$), a lifetime (but not current) diagnosis of PTSD ($n = 24$) and without a history of PTSD ($n = 18$)	Script-Driven Imagery – 4 neutral (3[S]; 1[I]) – 2 fear (S) – 2 positive (1[S]; 1[I]) – 1 action (S) – 1 non-CSA-related traumatic event (I) – 2 CSA-related (1)	Disgust responding – Intensity of disgust following each script – 12-point Likert-type scale		Two or more episodes of penetrative CSA – No details available regarding A1 or A2	Current/Lifetime PTSD diagnosis – SCID-I (diagnostic status)	Pairwise comparisons – Ratings of disgust averaged across the two CSA scripts did not differ as a function of diagnostic status. – Tests of subjective reactivity were not reported for the remaining scripts.
Orr, Pitman, Lasko, & Herz, 1993	Male WWII and Korean War veterans with ($n = 8$) and without PTSD ($n = 12$)	Script-Driven Imagery – 3 neutral (2[S]; 1[I]) – 1 fear (S; public speaking) – 2 positive (1[S]; 1[I]) – 1 action (S) – 1 pre-Vietnam-related traumatic event (I) – 3 combat-related (1[S]; 2[I])	Disgust responding – Intensity of disgust following each script – 12-point Likert-type scale		Combat exposure in WWII or Korean War – CES – No details available regarding A1 or A2	Current PTSD diagnosis – SCID-I (diagnostic status)	Independent samples t-tests – Ratings of disgust averaged across the two individualized combat scripts did not differ as a function of PTSD diagnosis. – Tests of subjective reactivity were not reported for the remaining scripts.

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Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables: Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	Summary of Relations Between Disgust and Posttraumatic Stress
Pitman, Orr, et al., 1990	Male Vietnam veterans with ($n = 7$) and without ($n = 7$) a current diagnosis of PTSD	Script-Driven Imagery – 3 neutral (2[S]; 1[I]) – 1 fear (S; public speaking) – 2 positive (1[S]; 1[I]) – 1 action (S) – 1 pre-Vietnam-related traumatic event (I) – 3 combat-related (1[S]; 2[I])	Disgust responding – Intensity of disgust following each script – 12-point Likert-type scale		Combat exposure in Vietnam – RCS – No details available regarding A1 or A2	Current PTSD diagnosis – SCID-NP-V (diagnostic status)	Independent samples *t*-tests – The PTSD group reported significantly greater disgust following the individualized combat scripts as compared to the anxious control group. – Tests of subjective reactivity were not reported for the remaining scripts.
Pitman, van der Kolk, Orr, & Greenburg, 1990	Male Vietnam veterans with ($n = 8$) and without ($n = 8$) a current diagnosis of PTSD.	Distressing Film Paradigm – 15-minute combat segment from *Platoon* – 15-minute and 30-minute segments from neutral video	Disgust responding – Intensity of disgust following each video – 12-point Likert-type scale		Combat exposure in Vietnam – Study-specific interview – No details available regarding A1 or A2	Current PTSD diagnosis – SCID-NP-V (diagnostic status)	Repeated measures ANOVA – Collapsed across drug group, individuals with PTSD reported greater disgust in response to the combat video.
Pitman et al., 1987	Male Vietnam veterans with a current diagnosis of PTSD ($n = 18$) or another anxiety disorder ($n = 15$).	Script-Driven Imagery – 3 neutral (2[S]; 1[I]) – 1 fear (S; public speaking) – 2 positive (1[S]; 1[I]) – 1 action (S) – 1 pre-Vietnam-related traumatic event (I) – 3 combat-related (1[S]; 2[I])	Disgust responding – Intensity of disgust following each script – Likert-type scale		Combat exposure in Vietnam – RCS – No details available regarding A1 or A2	Current PTSD diagnosis – SCID-NP-V (diagnostic status)	MANOVA – The PTSD group reported significantly greater disgust following the individualized combat scripts. – Tests of subjective reactivity were not reported for the remaining scripts.
Power & Fyvie, 2013	Study 1: Treatment-seeking adults with a current diagnosis of PTSD resulting from a range of traumatic events ($N = 75$) Study 2: Subsample from Study 1 completing 8 sessions of trauma-focused cognitive behavioral therapy ($n = 20$)	Not applicable	Study 1: Frequency of trait disgust following the traumatic event – Disgust subscale of the BES Study 2: Anxiety-based versus non-Anxiety-based (collapsed across disgust, anger, or sadness) PTSD groups – Highest subscale score on the BES	Study 1: Frequency of trait anxiety following the traumatic event – Anxiety subscale of the BES Study 2: Anxiety-based versus non-Anxiety-based (collapsed across disgust, anger, or sadness) PTSD groups – Highest subscale score on the BES	Study 1 and 2: Mixture of traumatic events – Inclusionary Criteria meeting diagnostic criteria for PTSD	Study 1 and 2: Current PTSD diagnosis – Unspecified clinical interview Continuous index of past week PTSD symptom severity – IES-R (intensity)	Study 1: Categorization based on highest emotion subscale rating: – 46.3% were categorized as Anxiety-based PTSD. – 53.7% were categorized as non-Anxiety-based PTSD (Anger = 25.4%, Sadness = 17.9%, Disgust = 10.4%). Independent samples *t*- tests: – Non-Anxiety-based PTSD group endorsed significantly greater disgust, anger, and sadness, compared to the Anxiety-based PTSD group. – No differences were found for anxiety, happiness, or PTSD symptom severity. – Time since problem onset and use of dysfunctional emotion regulation strategies were greater in the non-Anxiety based PTSD group. This group also engaged in fewer external functional regulation strategies (e.g., reliance on social support).

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Table 1. (continued)

Author(s)/ Year	Sample	Measures of Primary Variables: Emotion Elicitation Procedure	Disgust	Fear / Anxiety Control	Trauma History (Criterion A1/ A2)	Posttraumatic Stress	Summary of Relations Between Disgust and Posttraumatic Stress
							Study 2: Fisher's Exact Probability Test – A significantly greater portion of individuals in the Anxiety-based PTSD group were classified as treatment responders (significant reduction in IES-R scores) as compared to those in the non-Anxiety based PTSD group.
Rüsch et al., 2011	Adult women with BPD and PTSD ($n = 15$), BPD without PTSD ($n = 20$), and PTSD without BPD ($n = 20$)	Implicit Association Test	Disgust propensity – QADS, German version Automaticity of self-disgust vs. self-anxiety association – IAT	Automaticity of self-disgust vs. self-anxiety association – IAT	PTSD group CSA – Childhood Trauma Questionnaire – SCID-I BPD group 90% with CSA 40% adult sexual assault – Not specified Control group Trauma history not assessed	Current PTSD diagnosis – SCID-I	ANOVA – Women with PTSD and/or BPD had higher scores for disgust propensity as compared to healthy controls. – No differences were found between diagnostic groups. – Women in the diagnostic groups displayed a stronger association between disgust and the self during the IAT as compared to anxiety and the self. – The opposite pattern was found for healthy controls.
Shin et al., 1999	Adult women with a history of CSA with ($n = 8$) and without ($n = 8$) a current diagnosis of PTSD	Script-driven Imagery – 2 neutral (I) – 2 traumatic event (I)	Disgust responding – Intensity of disgust following each script averaged across two trials during a PET scan – VAS (0 – 10)		Penetrative CSA – No details available regarding A1 or A2	Current PTSD diagnosis – CAPS (diagnostic status)	ANOVA – A significant group by condition interaction was found such that individuals with PTSD reported significantly greater disgust in response to the traumatic event as compared to those without PTSD.
Shin et al., 2004	Vietnam veterans ($N = 36$) with ($n = 17$; female = 10) and without ($n = 19$; 10 female) a current diagnosis of PTSD	Script-Driven Imagery – 2 neutral (I) – 2 Vietnam-related (I)	Disgust responding – Intensity of disgust following each script averaged across two trials during a PET scan – VAS (0 – 12)		Male Vietnam combat veterans and female Vietnam combat nurses – No details available regarding A1 or A2	Current PTSD diagnosis – CAPS (diagnostic status)	ANOVA – Ratings of disgust in response to the traumatic event script did not differ as a function of PTSD diagnosis. – There was a significant main effect of diagnostic status such that collapsed across script, individuals with PTSD reported higher ratings of disgust.

Note: (I) = individualized; (S) = standardized; ADIS-C = Anxiety Disorders Interview Schedule for the Diagnostic and Statistical Manual-Fourth Edition: Child Version (Silverman & Albano, 1996); ANOVA = analysis of variance; ASI-3 = Anxiety Sensitivity Index-3 (Taylor et al., 2007); BES = Basic Emotions Scale (Power, 2006); BPD = borderline personality disorder; BTQ = Brief Trauma Questionnaire (Schnurr, Vielhauer, Weathers, & Findler, 1999) CAPS = Clinician-Administered PTSD Scale (Blake et al., 1995); CES = Combat Exposure Scale (Keane et al., 1989); CPSS = Child PTSD Symptom Scale (Foa, Johnson, Feeny, & Treadwell, 2001); CSA = childhood sexual abuse DIS/DS = Diagnostic Interview Schedule/Disaster Supplement (Robins & Smith, 1983); DPSS-R = Disgust Propensity and Sensitivity Scale-Revised (Van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006); DS-R = Disgust Scale-Revised (Haidt, McCauley, & Rozin, 1994, modified by Olatunji, Williams, Tolin et al., 2007); fMRI = functional magnetic resonance imaging; IAPS = International Affective Picture System (Lang, Bradley, & Cuthbert, 1995); IES-R = Impact of Events Scale-Revised (Weiss & Marmar, 1997); IAT = implicit association test; MANOVA = multivariate analysis of variance; MINI = MINI International Neuropsychiatric Interview (Sheehan et al., 1998); MVA = motor vehicle accident; PCL-S (PTSD Checklist [Specific]; Weathers, Litz, Herman, Huska, & Keane, 1993); PDS = Posttraumatic Diagnostic Scale (Foa, Cashman, Jaycox, & Perry, 1997); PSS = PTSD Symptom Scale (Foa, Riggs, Dancu, & Rothbaum, 1993); PET = positron emission tomography; PTE = potentially traumatic event; PTSD = posttraumatic stress disorder; RCS = Revised Combat Scale (Egendorf, Kadushin, Laufer, Rothbart, & Sloan, 1981); SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders (First, Spitzer, Gibbon, & Williams, 1997); SCID-NP-V = Structured Clinical Interview for DSM-III-R, Non-patient version-Vietnam (Spitzer & Williams, 1985); SCID-P = Structured Clinical Interview for DSM-III, patient version (Spitzer et al., 1990); TRNS, child version (Langston & Davis, 2008); QADS, German version = Questionnaire for the Assessment of Disgust Sensitivity, German version (Schienle, Walter, Stark, Vaitl, 2002); SUDS = Subjective Units of Distress (Wolpe, 1958); TEQ = Traumatic Events Questionnaire (Vrana & Lauterbach, 1994) UCLA-RI = UCLA PTSD Index for DSM-IV (Pynoos, Rodriguez, Steinberg, Stuber, & Frederick, 1998); VAS = Visual Analog Scale (Freyd, 1923); WWII = World War II.

DP may motivate increased intrusions associated with disgust-relevant features of the trauma. We might expect this to lead to increased avoidance of potentially disgust-relevant trauma reminders (particularly when paired with elevations in disgust sensitivity).

What little evidence exists in this area is mixed, with one study documenting higher DP among women with a diagnosis of PTSD as compared to healthy controls (Rüsch et al., 2011), and two others failing to observe significant associations with posttraumatic stress symptom severity (Badour, Bown, et al., 2012; Engelhard et al., 2011). Inconsistency in these findings may be due to methodological or cultural differences among these samples. Specifically, the study by Rüsch et al. (2011) compared levels of disgust propensity among German women with diagnoses of PTSD, borderline personality disorder (BPD), or comorbid PTSD and BPD to healthy controls, while the other two studies examined correlations between continuous indices of posttraumatic stress symptom severity and disgust propensity. Additional research examining relations between disgust propensity and posttraumatic stress are needed.

Disgust sensitivity. Previous research suggests that disgust sensitivity (DS) may potentiate the relation between experienced disgust and psychopathology (e.g., Cisler et al., 2009). Moreover, relative to DP, DS may be a better predictor of certain types of psychopathology (e.g., Olatunji, 2010) as it is associated with the evaluation and regulation of experienced disgust. Consistent with this idea, higher levels of DS have been linked to increased severity of posttraumatic stress symptoms (Badour, Feldner, Blumenthal, & Bujarski, 2013; Badour, Bown, et al., 2012), while disgust *insensitivity,* or low levels of DS, has been offered as a potential protective factor against the development of PTSD (Olatunji et al., 2014). Preliminary evidence suggests individuals high in DS may be more likely to interpret trauma-related feelings of disgust to mean that they have been contaminated by a sexual assault (Badour, Feldner, Blumenthal, & Bujarski, 2013), and DS has been shown to enhance the relation between intensity of peritraumatic disgust and posttraumatic stress symptoms secondary to combat even when accounting for peritraumatic fear (Engelhard et al., 2010). It is important to note that within the study conducted by Engelhard et al. (2010), the direct association between DS and posttraumatic stress symptoms was no longer significant when controlling for anxiety sensitivity and general neuroticism. Moreover, both DS and posttraumatic stress symptoms were assessed six months post-deployment in this study. As such, it is possible that elevations in posttraumatic stress influenced concurrent responding on the measure of DS. Indeed, DS no longer predicted symptoms of posttraumatic stress assessed 15-months post-deployment, highlighting the need for prospective research.

Summary. Nascent findings with regards to DP and DS, while mixed, offer some initial support for a unique role of disgust vulnerabilities in understanding responses to traumatic events. In particular, DS appears to hold promise as a potential risk and/or protective factor in the prediction of posttraumatic stress reactions. While DP and DS are typically conceptualized as trait-like individual difference factors that should be present prior to traumatic event exposure and should remain relatively stable, it is possible that disgust-related responses to traumatic events and/or the presence of posttraumatic stress symptomatology may increase one or both of these factors. Indeed, prospective designs have documented correlations between change in anxiety symptoms and concurrent changes in DP and DS (Berle et al., 2012; Olatunji et al., 2010). This is a particularly important caveat, as inferences regarding links between disgust vulnerabilities and posttraumatic stress reactions must currently be derived from studies in which the assessment of disgust vulnerabilities has been limited to samples that have already been exposed to traumatic events.

Peritraumatic Disgust

A host of studies have examined PTSD Criterion A2 emotions (i.e., fear, helplessness, or horror), as well as other peritraumatic experiences (e.g., anger, shame, dissociation) as they relate to subsequent posttraumatic stress symptomatology (for a review see Bovin & Marks, 2011). We now turn to an emerging literature offering preliminary support for a role of peritraumatic disgust in predicting unique variability in posttraumatic stress symptoms, even after considering other peritraumatic responses.

First, Fredman et al. (2010) found that over 75% of women exposed to a disaster involving wide-scale flooding reported seeing or doing things they perceived as disgusting, making this the most commonly endorsed threat or harm-related experience associated with posttraumatic stress symptom severity (cf., McMillen et al., 2000). Another study found that

children and adolescents who reported feeling disgusted by what they saw during a traumatic event reported increased trauma-related nightmares (Langston et al., 2010). Commensurate levels of posttraumatic stress symptoms have been documented among individuals reporting a disgust-related emotion (i.e., disgust, guilt, and shame/embarrassment) as their predominant peritraumatic emotion, even as compared to those endorsing fear, anger, or sadness as predominant (Hathaway, Boals, & Banks, 2010). Intensity of peritraumatic disgust has also been shown to correlate with posttraumatic stress symptoms associated with traumatic interpersonal violence (Badour, Bown, et al., 2012; Badour, Feldner, Blumenthal, & Knapp, 2013) and a range of PTEs (Lancaster et al., 2011) even after accounting for other peritraumatic emotions (e.g., fear, helplessness, horror, guilt, anger). However, one study failed to replicate these findings among a sample of traumatic event-exposed adolescents (Badour, Feldner, et al., 2012). The age of participants or the relatively restricted range of posttraumatic stress symptoms (i.e., most participants were relatively healthy) in this sample may have accounted for the lack of significant findings.

In an effort to move toward a prospective investigation of the relation between peritraumatic disgust and subsequent posttraumatic stress reactions, Engelhard et al. (2011) assessed combat veterans both 6 and 15 months post-deployment to examine relations among peritraumatic disgust, fear intensity, and posttraumatic stress symptom severity. Disgust intensity during combat assessed at six months post-deployment correlated with posttraumatic stress symptom severity, even after accounting for peritraumatic fear intensity. However, neither ratings of peritraumatic disgust nor fear remained significant predictors of posttraumatic stress symptom severity when this sample was assessed again 15 months post-deployment.

Summary. Taken together, these findings converge to offer preliminary evidence that peritraumatic disgust may be uniquely related to posttraumatic stress reactions following an array of traumatic experiences. However, confidence in this conclusion is limited by the general reliance on retrospective self-report of peritraumatic emotion (Badour, Bown, et al., 2012; Engelhard et al., 2011; 2000; Pitman & Orr, 1990; Robinson & Clore, 2002). Due to a scarcity of well-established measures and obvious obstacles to assessing peritraumatic experiences during traumatic event exposure, there has been no controlled investigation of the reliability and validity of retrospective report of peritraumatic disgust (Andrews, 1998; Brewin, et al., 2000). There are, however, at least two lines of evidence relevant to this issue. First, Marshall and Schell (2002) assessed ratings of peritraumatic dissociation immediately following exposure to a traumatic event and again at 3- and 12-month follow up to examine reliability of retrospective report of peritraumatic dissociation over time. Although ratings of dissociation correlated across time, the strength of this correlation was strongly influenced by change in PTSD symptoms across time. Engelhard, van den Hout, and McNally (2008) demonstrated a similar recall bias in report of past stressful and traumatic experiences, such that individuals with elevated symptoms of PTSD were more likely to report increased adverse events over time. This is relevant to many of the studies in the current review that have relied upon retrospective report of emotional responding to traumatic events that occurred many years prior to the assessment. Assessment of the presence and/or intensity of peritraumatic disgust is likely influenced by posttraumatic appraisals and experiences, as well as by symptoms of psychopathology at the time of assessment in cross-sectional designs.

Prospective studies have attempted to overcome these limitations by narrowing the time between traumatic event exposure and assessment of peritraumatic responding (e.g., within 24-hours to 1 month post-exposure; Birmes et al., 2003; Bryant, Harvey, Guthrie, & Moulds, 2000). Unfortunately these studies have not included measures of disgust. The study conducted by Engelhard et al. (2011) was the first to incorporate a prospective component, but the first assessment of peritraumatic emotional responding was conducted six months following exposure to the traumatic event. As such, it is possible that the significant cross-sectional relation observed six months post-deployment reflected a spurious effect driven by biases in the retrospective report of peritraumatic emotion. Alternatively, it is possible that the direct relation between peritraumatic disgust and posttraumatic stress symptoms may diminish over time. Indeed preliminary evidence suggests that the relation between peritraumatic disgust and persistent posttraumatic stress symptomatology is mediated by an increase in feelings of disgust experienced in response

to traumatic event cues (Badour, Feldner, Blumenthal, & Knapp, 2013).

Posttraumatic Disgust

The persistence of disgust after a traumatic event has been assessed in two ways. First, researchers have examined reported frequency of experiencing general feelings of disgust (e.g., trait disgust) among persons with PTSD. Second, laboratory paradigms have been used to elicit and assess emotional responses to a variety of stimuli among individuals with PTSD and elevated posttraumatic stress symptoms.

Trait disgust. Results from several studies suggest that PTSD is associated with elevations in trait, or general (cf., traumatic event-specific) feelings of disgust. One early study conducted with Vietnam veterans identified persistent feelings of disgust as the second strongest predictor of a PTSD diagnosis following ongoing problems with tension/anxiety (Foy et al., 1984). Results of a more recent study estimated that disgust may be the primary experienced emotion among as many as 10% of individuals with PTSD (Power & Fyvie, 2013). Moreover, another study found that compared to happiness, sadness, fear, and anger, frequency of experienced disgust following a traumatic event best distinguished individuals with PTSD from those with depression, chronic pain, and no disorder (Finucane et al., 2011). Finally, while not assessing the frequency of experienced posttraumatic disgust per se, Rüsch et al., (2011) utilized an Implicit Association Test to assess the automaticity or associations between the self and the emotions of disgust and anxiety among a sample of women with PTSD subsequent to childhood sexual abuse (CSA) and healthy controls. Individuals with PTSD evidenced stronger associations between the self and disgust relative to the association with anxiety, while healthy controls displayed the opposite pattern.

Real-time laboratory elicitation of disgust. Several laboratory-based procedures have been used to examine posttraumatic disgust responding and reactivity. These methods have included presentation of both standardized and ideographic traumatic event stimuli (e.g., videos, scripts) and general emotion-eliciting stimuli (e.g., standardized pictures). Such procedures allow for real-time assessment of posttraumatic stress-related emotional responding and reactivity, overcoming many of the limitations inherent to retrospective self-report. Three such procedures have been employed to examine links between posttraumatic stress symptomatology and disgust.

International Affective Picture System. The International Affective Picture System (IAPS; Lang et al., 1995) is a set of emotionally-normed pictorial stimuli comprised of a variety of emotionally-evocative pictures ranging in valence (e.g., pleasant to unpleasant) and arousal (e.g., minimally to highly arousing). One study employed positively (e.g., nude females, sports scenes) and negatively valenced (e.g., mutiliated bodies, dead animals, guns, snakes, pollution) pictures from the IAPS to compare emotional responding among veterans with PTSD, combat-exposed controls, and individuals with no trauma history (Amdur et al., 2000). On average, individuals with PTSD reported significantly greater feelings of disgust, anger, shame, and sadness. These findings were interpreted as reflecting a general pattern of heightened negative affective responding associated with PTSD, as responses did not vary as a function of valence and arousal characteristics of the stimuli.

Distressing film paradigm. The distressing film paradigm has been used as a method for presenting standardized reminders of specific traumatic events (e.g., film clips depicting combat to combat veterans) in order to examine predictors of subjective and physiological response patterns as a function of posttraumatic stress symptomatology (Kinzie et al., 1998; McFall, Murburg, Ko, & Veith, 1990). The only study to examine disgust responding utilizing this method documented higher ratings of disgust, fear, anger, guilt, and sadness in response to a combat scene among veterans with PTSD as compared to both veterans without PTSD and men with no history of combat exposure (Pitman, van der Kolk et al., 1990). While those with PTSD displayed greater disgust in response to standardized combat stimuli, this response may have reflected general heightened negative affect in response to traumatic event reminders compared to controls.

Script-driven imagery. Script-driven imagery, which involves the presentation of standardized and/or ideographic audio-recorded scripts, has been widely used to examine patterns of subjective, physiological, and neurobiological responding associated with posttraumatic stress (for reviews see Lanius, Bluhm, Lanius, & Pain, 2006; Orr & Roth, 2000). This procedure allows for the assessment of emotional responding and reactivity following traumatic event-related

scripts as well as neutral or emotionally evocative (but not traumatic event-related) scripts.

Some evidence using this paradigm supports a relatively specific pattern of elevated disgust responding/reactivity among persons with PTSD. Adult women with PTSD endorse greater disgust and guilt (but not fear, anger, sadness, or shame) in response to ideographic scripts involving CSA (Shin et al., 1999). In a similar sample, disgust reactivity following imagery of past experiences involving either CSA or adult sexual assault predicted severity of posttraumatic stress symptoms even after accounting for anxiety reactivity to the script as well as intensity of peritraumatic fear (Badour, Feldner, Blumenthal, & Knapp, 2013). Women with PTSD also report more disgust compared to women without PTSD and men (with or without PTSD) in response to ideographic imagery of a range of traumatic events (Olatunji et al., 2009). Neither PTSD diagnosis, nor gender, was associated with anxiety responding to the traumatic event script in this study. These authors did not observe associations between PTSD or gender and either disgust or anxiety responding to an ideographic neutral script, suggesting the findings were specific to traumatic event-related content. These authors noted that a larger proportion of women (with or without PTSD) relative to men had experienced a sexual trauma, which may have contributed to these findings.

Other studies have documented elevations in a number of negative emotions, including disgust, following traumatic event-related imagery among persons with PTSD. Elevations in disgust, fear, anger, sadness, and guilt responding have been observed among men with PTSD as compared to healthy controls and those with other anxiety disorders (Lanius et al., 2007; Pitman, Orr et al., 1990; Pitman et al., 1987). A sample of male Vietnam combat veterans and female nurses with PTSD also reported higher disgust, fear, and guilt in response to ideographic traumatic event and neutral scripts compared to those without PTSD (Shin et al., 2004). A script by PTSD diagnosis interaction was observed such that fear and guilt were higher in response to the traumatic event imagery, while elevations in disgust did not appear to be content specific. Using a similar method among a mixed trauma sample, Badour et al. (2011) found a positive correlation between PTSD symptom severity and disgust, anxiety, and anger ratings in response to ideographic traumatic imagery, but not neutral imagery. These relations were no longer significant, however, after accounting for the effect of trait elevations in negative affect. Finally, Badour, Feldner, Babson, et al. (2013) observed a significant positive relation between PTSD symptom severity and both disgust and anxiety reactivity in response to individualized traumatic imagery involving sexual or physical victimization. This relation remained significant even after accounting for responding to an individualized neutral script.

The majority of studies using this method have identified a pattern of heightened disgust responding among persons with PTSD or elevated posttraumatic stress symptoms. However, additional studies have either not observed differences in any form of subjective responding to traumatic event imagery as a function of PTSD (Carson et al., 2000; Orr, et al., 1993) or have documented specific PTSD-related elevations in emotions other than disgust (Lanius et al., 2003; Orr et al., 1998). There are several issues that warrant consideration with respect to the inconsistency of these findings. First, many studies utilizing the script-driven imagery procedure have included very small sample sizes, with some investigations including fewer than 10 persons meeting criteria for PTSD (See Table 1). While small sample sizes are common in studies focused on physiologic responding and neuroimaging in PTSD (Jelicic & Merckelbach, 2004; Karl et al., 2006; Pole, 2007), larger sample sizes may be required to detect reliable differences in subjective responding. Assessment of subjective responding to the script-driven imagery procedure is also delayed in many studies employing neuroimaging procedures in order to avoid interference with scanning procedures (e.g., Lanius et al., 2003; Shin et al., 1997, 1999, 2004). This could result in natural decay of the emotion elicited prior to measurement of the response, thereby resulting in an assessment strategy that is not optimal for measuring self-reported emotional reactions.

Dichotomization of participants based on the presence or absence of a PTSD diagnosis may fail to account for important variability in emotional responding to the script-driven imagery procedure (Badour, Bown, et al., 2012; Weathers, Ruscio, & Keane, 1999). Taxometric research suggests a dimensional, as opposed to categorical, structure for posttraumatic stress symptoms, with PTSD representing the upper end of this continuum (Broman-Fulks et al., 2009; Ruscio, Ruscio, & Keane, 2002). Dichotomous indices of PTSD have been criticized for failing to acknowledge the presence of symptoms that fall below the threshold for a PTSD diagnosis but remain

clinically significant (e.g., Weathers et al., 1999). As persons with sub-clinical PTSD have been shown to evidence heightened neurological activity in response to traumatic imagery (Peres et al., 2007), it stands to reason that subjective emotional responding may also be heighted compared to those with minimal symptoms.

Refinement and standardization of methods in assessing emotional responding/reactivity across laboratory studies is also needed. The majority of laboratory studies reviewed herein examine traumatic event-related disgust responding without considering the potential importance of baseline differences in levels of trait disgust (Finucane et al., 2011; Foy et al., 1984; Power & Fyvie, 2013) or individual differences in general negative affectivity (Badour et al., 2011) as a function of PTSD or elevated posttraumatic stress. These studies also rarely consider that individuals with PTSD may react to general emotionally-evocative (Amdur et al., 2000) or neutral stimuli (Shin et al., 2004) with heightened disgust as well as other emotions that may complicate the interpretation of study findings.

Finally, other factors that may influence disgust-specific responding such as gender (Olatunji et al., 2009; Rohrmann, Hopp, & Quirin, 2008; Schienle, Schäfer, Stark, Walter, & Vaitl, 2005), traumatic event type (Badour et al., 2011; Badour, Feldner, Babson, et al., 2013; Feldner et al., 2010), and individual difference factors (e.g., DP/DS; Engelhard et al., 2011) should also be considered. Elucidation of these factors may offer important insight into the nature of disgust responding/reactivity within the context of posttraumatic stress.

Summary. The preponderance of existing evidence generally appears to support a pattern of persistent elevated disgust among individuals with PTSD as well as elevated posttraumatic stress symptomatology. Findings from a number of descriptive studies converge to suggest that the presence of heightened posttraumatic disgust may offer incremental predictive utility in differentiating between individuals with and without PTSD, even after considering the role of other negative emotions and problems frequently identified among this population (e.g., depression, substance use; Finucane et al., 2011; Foy et al., 1984). As a whole, results of laboratory studies aimed at further elucidating the processes underlying posttraumatic disgust responding are consistent with those of descriptive studies. Specifically, the majority of laboratory studies find an association between posttraumatic stress symptoms and increased disgust elicited in response to a wide variety of emotionally evocative and traumatic event-related stimuli. That being said, evidence regarding the specific nature of this relation is relatively mixed. Findings from some studies suggest PTSD is likely characterized by an undifferentiated elevation in negative affect, as represented by a range of negative emotions including disgust. However, other studies support a relatively unique association between posttraumatic stress symptoms and disgust responding/reactivity. Interestingly, these findings have primarily been observed among samples of women whose posttraumatic stress symptoms are secondary to traumatic experiences involving sexual victimization. There is increasing evidence to suggest interpersonal traumas (Badour et al., 2011), and particularly those involving sexual victimization (Badour, Feldner, Babson, et al., 2013; Badour, Feldner, Blumenthal, & Knapp, 2013; Feldner et al., 2010) may be linked to both increased feelings of disgust and subsequent appraisals regarding the self as disgusting or having been contaminated by the traumatic experience (Badour, Feldner, Babson, et al., 2013; Badour, Feldner, Blumenthal, & Bujarski, 2013; Fairbrother & Rachman, 2004; Rüsch et al., 2011). As it is possible that disgust, and related processes (e.g., contamination concerns), may be particularly germane to certain types of traumatic experiences, it will be important for researchers to consider these as well as other methodological issues discussed above when conducting future research in this area. Specifically, it may be important to conduct additional controlled investigations comparing relations between disgust and posttraumatic stress following different traumatic experiences. While sampling from individuals with heterogeneous traumatic event histories may increase external validity by capturing the complex nature of traumatic event exposure, this approach may come at the loss of internal validity, requiring that findings from such studies be interpreted with caution at this early stage in this literature.

It is important to note that none of the studies reviewed in this section controlled for potential differences in individual vulnerabilities to disgust (i.e., disgust propensity/sensitivity). Such differences may account, at least in part, for the association between posttraumatic disgust and PTSD. For example, it is likely that individuals high in disgust propensity will report elevations in disgust both before and after traumatic event exposure, and that posttraumatic disgust may serve as a mediator of the relation between this

disgust vulnerability and PTSD. Finally, given a robust tradition of utilizing laboratory paradigms to elicit and measure unique patterns of psychophysiological arousal associated with a diagnosis of PTSD (Orr & Roth, 2000), future research should consider incorporating objective measurements of emotional responding that will increase differentiation between fear/anxiety and disgust responding (e.g., levator labii activity; Chapman, Kim, Susskind, & Anderson, 2009; Vrana, 1993).

Additional Considerations and Future Directions

The state of the literature linking disgust to posttraumatic stress is in its relative infancy, highlighting the need for additional research to identify both mechanisms underlying this relation and factors that may influence this relation. We now turn our attention to several areas for further consideration that may hold promise in this domain.

Gender

Preliminary evidence suggests the link between traumatic event-related disgust and PTSD symptomatology is particularly pronounced among women as compared to men (Lancaster et al., 2011; Olatunji et al., 2009). At least two factors may contribute to this difference. First, basic research consistently demonstrates differences in the experience and expression of disgust as a function of gender (Curtis et al., 2004; Haidt, McCauley, & Rozin, 1994; Rohrmann et al., 2008; Schienle et al., 2005; Tucker & Bond, 1997). Second, although men are more likely to be exposed to PTEs, research consistently demonstrates that women have a disproportionate risk of exposure to traumatic events linked to disgust (e.g., sexual victimization; Tolin & Foa, 2008). It is likely that the combination of these factors will result in particularly strong associations between disgust and PTSD among women; additional research is needed.

Cultural Factors

While evidence supports the universality of disgust as an emotion evident across cultures (Biehl et al., 1997; Ekman et al., 1987; Ekman, Sorenson, & Friesen, 1969; Haidt & Keltner, 1999), the experience and expression of disgust may be influenced by cultural differences (Elwood & Olatunji, 2009). Indeed, the only study to examine specific cultural differences in relations between disgust and posttraumatic stress found intensity of peritraumatic disgust to predict PTSD symptom severity among European Americans, but not among African Americans following a range of PTEs (Lancaster et al., 2011). Replication and expansion of work is needed to identify mechanisms that may underlie these and other potential differences in the relation between disgust and posttraumatic stress across cultures.

Developmental Considerations

The two studies examining relations between disgust and symptoms of posttraumatic stress during childhood and adolescence have offered mixed results (Badour, Feldner, et al., 2012; Langston et al., 2010). Significant methodological differences in these studies precludes conclusions regarding how disgust may or may not relate to posttraumatic stress during specific developmental periods. However, as compared to adults, both the rate and phenomenology of PTSD differs among children and adolescents (Carrion, Weems, Ray, & Reiss, 2002; Kilpatrick et al., 2003; Saul, Grant, & Carter, 2008), and the experience and expression of disgust are subject to important developmental changes across time (Olatunji & Sawchuk, 2005). Younger children, in particular, may be less able to fully appreciate more abstract concepts such as the properties of contagion and contamination (Fallon, Rozin, & Pliner, 1984; Rozin, Fallon, & Augustoni-Ziskind, 1985). They may also be less likely to associate feelings of disgust with moral transgressions (Danovitch & Bloom, 2009; Rozin, Hammer, Oster, Horowitz, & Marmora, 1986). Additional research is needed to determine whether children and adolescents understand and experience disgust in relation to traumatic events in the same way as adults, and whether this translates into similar associations with posttraumatic stress reactions.

Treatment Implications

While exposure is an efficacious approach to reducing conditioned fear and anxiety within the context of PTSD (Institute of Medicine, 2008), some scholars have suggested that exposure may be less effective in reducing other types of persistent negative emotions in this context (e.g., Resick & Schnicke, 1992). This is consistent with both findings regarding the relative resistance of extinction of disgust following exposure (McKay, 2006; Olatunji, Smits, et al., 2007; Smits et al., 2002) and the supposition

that disgust may not as readily respond to exposure as a result of evaluative conditioning processes involved in disgust acquisition (Olatunji, Forsyth, et al., 2007; Schienle et al., 2001). Although there has yet to be an empirical investigation of traumatic event-related disgust within the context of treatment for PTSD, Power and Fyvie (2013) found that relative to those with anxiety-based PTSD, fewer individuals with non-anxiety based PTSD (i.e., those for which disgust, anger, or sadness was predominant) were classified as treatment responders following eight sessions of exposure-focused cognitive behavioral therapy.

If disgust is indeed relatively resistant to extinction within the context of PTSD, due to evaluative conditioning or other as yet unidentified processes, it may be important to consider incorporating additional exposure trials (McKay, 2006; Smits et al., 2002) or disgust-focused exposure exercises into treatment for some individuals (Hirai et al., 2008). Indeed, targeted disgust exposure has resulted in improvement over traditional fear/anxiety-focused exposure in terms of both symptom-specific and global health indicators in the treatment of blood-injection injury phobia. Consideration of adjunctive or alternative treatments may also be warranted. Basic research suggests that approaches such as counterconditioning or reappraisal of a UCS may be useful alternatives to traditional exposure when targeting reduction of evaluatively conditioned responses (De Houwer, Thomas, & Baeyens, 2001). However, research has yet to specifically examine whether evaluatively conditioned disgust responds to these approaches.

Within the context of PTSD intervention, preliminary evidence does suggest that cognitive therapy with focused imagery rescripting may be helpful in reducing contamination concerns among individuals with a history of childhood sexual abuse (Jung & Steil, 2012, 2013; Steil et al., 2011). Additional research in this area is certainly needed to document how disgust may relate to treatment for PTSD, and whether tailoring of PTSD interventions to target disgust and related phenomena may result in greater reduction of symptoms for some individuals. At the very least, clinicians should consider assessing for disgust and related cognitions (e.g., "I am disgusting," "I have been contaminated") among individuals presenting with concerns stemming from exposure to traumatic events, including PTSD, as these may potentially warrant specific clinical attention.

Conclusion

There is a mounting literature emphasizing the importance of considering a range of affective experiences outside the domain of fear and anxiety in the context of traumatic event exposure and subsequent posttraumatic stress reactions. In particular, disgust may play an important, and relatively unrecognized role in understanding emotional responding to traumatic events and subsequent posttraumatic stress reactions. Although this line of research represents an important step in elucidating the range of negative affective experiences involved in posttraumatic stress reactions, continued refinement, replication, and extension is needed. In particular, emphasis on the use of prospective designs would serve as an ideal complement to the predominantly cross-sectional research that currently exists. Prospective studies would allow for empirical examination of whether elevated trait disgust or disgust vulnerabilities prior to traumatic event exposure or intensity of disgust experienced during a traumatic event confer risk for subsequent posttraumatic stress symptoms. Although laboratory studies have begun to move beyond many of the limitations of retrospective self-report by assessing changes in disgust in response to traumatic event cues or other emotionally-evocative stimuli in real time, it will be important to identify whether this heightened responding/reactivity represents a risk factor for the development and/or maintenance of PTSD, or if it simply marks the presence of posttraumatic stress symptomatology. Future research should have an eye toward the potential implications of disgust and related processes (e.g., contamination concerns) in the prevention and treatment of posttraumatic stress reactions, recognizing that identification of pre-trauma and traumatic event-related variables that serve as unique risk factors for the development and maintenance of posttraumatic stress is critical to informing prevention efforts in this domain (Feldner, Monson & Friedman, 2007).

Author's note

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