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BRIEF ARTICLE

## Emotion regulation of fear and disgust: differential effects of reappraisal and suppression

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### ABSTRACT

Although excessive fear has been central to traditional conceptualisations of the anxiety disorders, recent research suggests that disgust may also play a role in the development of some anxiety disorders. While dysregulation of emotion may confer risk for the development of anxiety disorders, it remains unclear if there are differences in the extent to which fear and disgust can be effectively regulated. To fill this important gap in the literature, unselected participants ( $N = 95$ ) experienced fear or disgust via video exposure, and they were instructed to employ either reappraisal or suppression to regulate their emotional experience while viewing the videos. For those exposed to fear-relevant content, change in emotional distress did not significantly differ between those that suppressed and those that reappraised. However, significantly less emotional distress was observed for those that reappraised compared to those that suppressed when exposed to disgust-relevant content. Although physiological arousal varied over time as a function of the emotional content of the videos, it did not vary as a function of emotion regulation strategy employed. These findings suggest that reappraisal may be especially effective in regulating verbal distress when exposed to disgusting cues in the environment. The implications of these findings for the treatment of anxiety disorders that are characterised by excessive disgust reactions will be discussed.

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### KEYWORDS

Disgust; fear; emotion regulation; suppression; reappraisal; anxiety

Anxiety disorders have traditionally been conceptualised as emerging partially from dysregulation in fear. Fear is a basic emotion that functions as an organism's defensive response to threat. Although dysregulated fear has dominated thinking about the origins of anxiety disorders, a growing body of research suggests that some anxiety-related disorders may be better characterised by dysregulated disgust (Olatunji, Cisler, McKay, & Phillips, 2010). Disgust is thought to have evolved for the function of facilitating avoidance of contaminants. This "diseases-avoidance" function has informed theoretical formulations of the role of disgust in various disorders (Oaten, Stevenson, & Case, 2009). Although excessive fear and disgust reactions are observed in anxiety disorders, much remains unknown regarding how the emotions can be effectively regulated. Emotion regulation can be defined as "the processes by which individuals influence

which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998a, p. 275). Emotion regulation can be characterised by actions that aim to alter the form, frequency, duration, or situational occurrence of events that may precede an emotional response as well as the events that may follow an emotional response. Emotion regulation strategies and their effects can have different consequences depending on the time during which they are employed (Gross, 2007). Emotion regulation strategies may also have different effects depending on the emotion. Although fear and disgust are negative emotions, research has revealed distinct response patterns in physiology, behaviour, neural activity, and cognitive processes (see Cisler, Olatunji, & Lohr, 2009).

Basic conditioning research has also revealed important differences between fear and disgust.

Although not a consistent finding, there is some evidence suggesting that disgust is more resistant to extinction than fear (Mason & Richardson, 2010; Olatunji, Forsyth, & Cherian, 2007). This finding has also been observed in the treatment of anxiety disorders where the decay slope for fear is significantly greater than for disgust after *in vivo* exposure-based treatment (Olatunji, Wolitzky-Taylor, Willems, Lohr, & Armstrong, 2009). This suggests that disgust reactions are either resistant to treatment or slower to respond to *in vivo* exposure in comparison to fear responses. Given that difficulties in emotion regulation contribute to disordered anxiety (Cisler, Olatunji, Feldner, & Forsyth, 2010), a better understanding of differences in how fear and disgust are regulated may have important treatment implications.

In recent years, researchers have focused on two emotion regulation strategies: the cognitive change strategy of reappraisal and the response-focused strategy of suppression. Although suppression may reduce expressive behaviour, it also has negative cognitive and affective consequences (Richards & Gross, 2000). For example, while suppression may result in a decrease in negative emotional experiences, it is also associated with a decrease in positive experiences and an increased sympathetic activation of the cardiovascular system. Reappraisal, on the other hand, leads not only to reduced negative emotion, but it also increases positive emotion (Richards & Gross, 2000).

Although suppression and reappraisal are distinct strategies, their effectiveness for regulating fear and disgust remains unclear. In an initial study, Gross and Levenson (1993) examined the effects of suppression on behavioural, physiological, and subjective responses when watching a disgust-eliciting film. The results showed that relative to a no suppression condition, suppression reduced expressive behaviour and increased sympathetic nervous system activity but had no impact on subjective disgust. In a subsequent study, Gross (1998b) found that compared to a control condition, reappraisal and suppression reduced expressive behaviour. However, reappraisal decreased disgust experience, whereas suppression increased sympathetic activation. Although this initial work highlights potential differential effects of reappraisal and suppression on disgust, it remains unclear how these effects differ when compared to fear. Accordingly, the present study examined the effects of reappraisal and suppression on the experience of fear and disgust. It was predicted that relative to suppression, reappraisal would be more effective in

decreasing the experience of fear and disgust. Given theoretical models which posit that the experience of disgust may be fairly impenetrable by cognition (Oaten et al., 2009) and research showing that disgust responses are more resistant to change than fear (Olatunji et al., 2007), it was also predicted that reappraisal would be more effective in decreasing fear compared to disgust.

## Method

### Participants

Participants were 95 (72 females; 65% Caucasian) undergraduate participants at a private University. Mean age of the sample was 19.00 (SD = 1.07; range = 18–22).<sup>1</sup>

### Measures

The *Disgust Propensity and Sensitivity Scale—Revised* (DPSS-R; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) is a 16-item measure of disgust propensity and disgust sensitivity.

The *State-Trait Anxiety Inventory—Trait version, Form Y* (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a 20-item measure of trait anxiety.

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) is a 10-item measure of the tendency to engage in cognitive reappraisal and expressive suppression.

A modified version of the *Differential Emotions Scale* (MDES; Gross & Levenson, 1995) consists of emotion items which correspond to fear and disgust and is preceded by the phrase “I feel ...”: (1) disgusted, nauseated, repulsed; (2) fearful, scared, afraid. Participants rated the intensity of their response on a 9-point scale from 0 (“Do not feel the slightest bit of the emotion”) to 8 (“The most I have ever felt in my life”).

A self-report *Emotion Regulation Response Scale* (ERRS; adapted from Dunn, Billotti, Murphy, & Dalgleish, 2009) included four-items used to assess participants’ regulation strategies during the videos on a scale of 0 “not at all” to 100 “extremely”. The questions were as follows: (1) How much did you find yourself trying to suppress your emotional response to the video? (2) How much did you find yourself trying to change the meaning of the video while you watched it? (3) How much did you find yourself not looking at the video? and (4) How much did you find yourself deliberately thinking about other things while watching the video?

*Fear and Disgust Videos.* The fear and disgust videos consisted of a montage of various stimuli that lasted 10 minutes. The montage consisted of a combination of movie scenes and home videos that were obtained from various internet sources. The disgust video contained clips of rotting food, people vomiting, and people coming into contact with faeces. The fear video contained clips of snakes lunging towards the camera, large spiders, and threatening scenes from horror films.

### Physiological assessment

A BIOPAC MP100 system was used to digitally record skin conductance levels (SCLs) during exposure to the videos. Values were converted to microsiemens

( $\mu\text{S}$ ) and were monitored from the participants' non-dominant hand using Ag–AgCl electrodes. The electrodes were attached to the middle phalanges of the second and third digits by Velcro straps (BIOPAC Systems, Goleta, CA).

### Procedure

After completing the informed consent, participants completed the measures and were then assigned to view the disgust video or the fear video. They were then pseudorandomised to receive either reappraisal instructions or suppression instructions (adapted from Gross, 1998b). The reappraisal instructions were as follows:

We will now show you a short video clip. It is important to us that you watch the video clip carefully, but if you find the video too distressing, just say “stop.” Please try to adopt a detached and unemotional attitude as you watch the video. In other words, as you watch the video clip, try to think about what you are seeing objectively, in terms of the technical aspects of the events you observe. Watch the video clip carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all. Pay close attention to the video clip, because there will be a memory test later.

The suppression instructions were as follows:

We will now be showing you a short video clip. It is important to us that you watch the video clip carefully, but if you find the video too distressing, just say “stop.” This time, if you have any feelings as you watch the video clip, please try your best not to let those feelings show. In other words, as you watch the video clip, try to behave in such a way that a person watching you would not know you were feeling anything. Watch the video clip carefully, but please try to behave so that someone watching you would not know that you are feeling anything at all. Please pay close attention to the video clip, because there will be a memory test later.

Participants completed the MDES again after the videos to assess changes in mood. Participants' SCLs were assessed for a 30-second baseline before the start of the videos and at 2-minute intervals during exposure to the videos. This study was approved by the University Institutional Review Board.

## Results

### Pre-existing demographic differences

A 2 (Emotion Video: Fear, Disgust)  $\times$  2 (Emotion Regulation: Reappraisal, Suppression) univariate analysis of variance (ANOVA) failed to yield a significant Emotion

**Table 1.** Descriptive statistics for individual difference measures, emotion regulation, change in fear, disgust, and emotional distress.

	Condition			
	Fear		Disgust	
	Suppress (N = 24)	Reappraise (N = 24)	Suppress (N = 22)	Reappraise (N = 25)
DPSS-R propensity				
<i>M</i>	22.13	22.75	21.73	2.20
SD	3.86	4.11	4.278	9.97
DPSS-R sensitivity				
<i>M</i>	18.33	17.83	18.45	17.48
SD	5.01	5.04	4.55	4.87
STAI-T				
<i>M</i>	39.13	38.71	42.36	44.40
SD	9.91	8.23	8.31	10.05
ERQ reappraisal				
<i>M</i>	30.63	30.75	28.73	26.52
SD	5.66	4.99	6.64	6.42
ERRS suppress				
<i>M</i>	68.57	54.43	60.84	60.24
SD	20.44	25.97	29.44	23.42
ERRS meaning				
<i>M</i>	36.10	36.43	50.00	46.90
SD	28.02	25.99	27.64	29.06
ERRS not look				
<i>M</i>	7.29	8.52	19.74	21.57
SD	7.49	15.27	21.50	21.87
ERRS think				
<i>M</i>	18.33	24.29	43.37	39.29
SD	17.49	27.83	33.20	29.92
Change in fear				
<i>M</i>	3.25	3.33	2.14	0.32
SD	1.91	1.93	2.27	3.12
Change in disgust				
<i>M</i>	2.21	2.83	4.18	3.20
SD	2.09	2.10	2.38	2.55
Change in distress				
<i>M</i>	2.73	3.08	3.15	1.76
SD	1.65	1.85	1.79	2.55

Note: DPSS-R = Disgust Propensity and Sensitivity Scale-Revised; STAI-T = State-Trait Anxiety Inventory-Trait version; ERQ = Emotion Regulation Questionnaire; Emotion Regulation Response Scale = ERRS.

Video  $\times$  Emotion Regulation interaction for age [ $F(1, 91) = 0.48, p = .48, \text{partial } \eta^2 = .005$ ], suggesting that age was equivalent across conditions. Although there were no significant differences in gender distribution between those in the reappraisal (73% female) and suppression (79% female) conditions [ $\chi^2(1) = .297, p = .586$ ], more females were in the disgust video condition (89% female) than in the fear video condition (63%) [ $\chi^2(1) = 9.33, p = .002$ ]. No significant differences in ethnicity distribution between those in the reappraisal and suppression conditions ( $\chi^2(4) = 3.06, p = .547$ ) and those in the disgust video fear video conditions [ $\chi^2(4) = 4.86, p = .302$ ] were found.

### **Pre-existing individual differences**

A 2 (Emotion Video)  $\times$  2 (Emotion Regulation) multivariate ANOVA was conducted on scores on the DPSS-R, STAI, and ERQ to examine group differences in disgust, anxiety, and emotion regulation traits (see [Table 1](#) for Means). The Emotion Video  $\times$  Emotion Regulation interaction was not significant for any of the measures ( $ps > .24$ ).

### **Emotion regulation responses**

To assess differences in the ERRS, a 2 (Emotion Video)  $\times$  2 (Emotion Regulation)  $\times$  4 (ERRS: Suppression, Meaning, Not Look; Not Think) analysis of covariance (ANCOVA) controlling for gender was conducted (see [Table 1](#) for Means). The results yielded a significant Emotion Video  $\times$  ERRS interaction [ $F(3, 231) = 3.54, p < .02, \text{partial } \eta^2 = .04$ ]. Although those assigned to the disgust video condition did not differ from those assigned to the fear video condition in how much they found themselves suppressing ( $p = .54$ ), those assigned to the disgust video condition reported finding themselves trying to change the meaning of the video ( $p = .08$ ), not looking at the video ( $p < .02$ ), and deliberately thinking about other things while watching the video ( $p < .01$ ) more than those in the fear video condition.

### **Emotional response to video exposure**

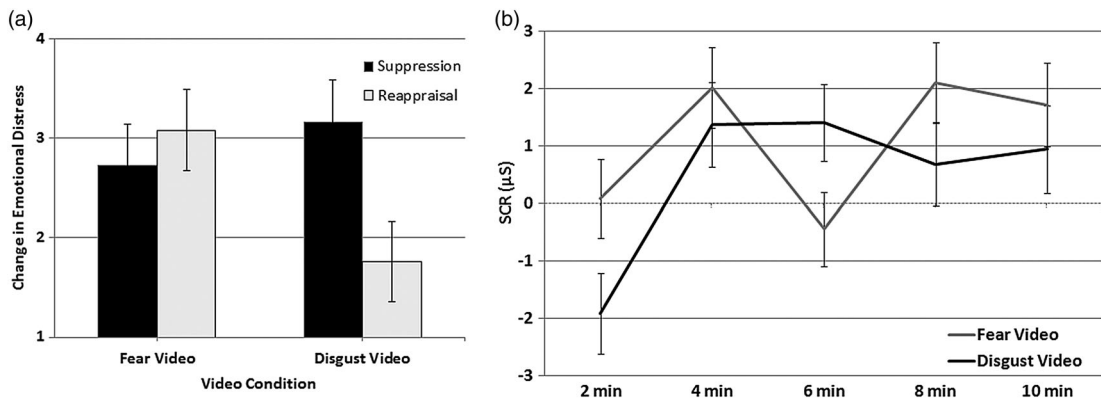
To assess whether the videos elicited the intended emotion, change scores were calculated for disgust and fear MDES ratings (e.g. change in fear = post-video fear rating—pre-video fear rating). A 2 (Emotion Change: Fear, Disgust)  $\times$  2 (Emotion Video) analysis of covariance (ANCOVA) on change scores

when controlling for gender revealed a significant Emotion Change  $\times$  Emotion Video interaction [ $F(1, 92) = 41.13, p < .001, \text{partial } \eta^2 = .31$ ]. Increases in fear were greater in the fear video condition ( $M = 3.29, SD = 1.90$ ) than in the disgust video condition ( $M = 1.17, SD = 2.87$ ),  $F(1, 93) = 18.05, p < .001, \text{partial } \eta^2 = .16$ . Conversely, increases in disgust were greater in the disgust video condition ( $M = 3.66, SD = 2.49$ ) than in the fear video condition ( $M = 2.52, SD = 2.09$ ),  $F(1, 93) = 5.81, p < .05, \text{partial } \eta^2 = .06$ . Changes in fear were also significantly greater than changes in disgust in the fear video condition ( $t = 2.74, p < .008$ ), while changes in disgust were greater than changes in fear in the disgust video condition ( $t = 6.18, p < .001$ ).

### **Effects of emotion regulation on fear and disgust**

*Self-report responses.* A 2 (Emotion Change)  $\times$  2 (Emotion Video)  $\times$  2 (Emotion Regulation) ANCOVA on change scores when controlling for gender revealed a significant Emotion Change  $\times$  Emotion Video interaction [ $F(1, 90) = 40.00, p < .001, \text{partial } \eta^2 = .31$ ]<sup>2</sup> and a significant Emotion Video  $\times$  Emotion Regulation interaction [ $F(1, 90) = 4.91, p < .03, \text{partial } \eta^2 = .05$ ]. The three-way interaction of Emotion Change  $\times$  Emotion Video  $\times$  Emotion Regulation was not significant ( $p = .76$ ). Emotional distress scores were computed by averaging the means of MDES change scores for fear and disgust to examine the Emotion Video  $\times$  Emotion Regulation interaction. Emotional distress in the suppress condition did not significantly differ between those exposed to the fear video and those exposed to the disgust video [ $F(1, 44) = .71, p = .40, \text{partial } \eta^2 = .02$ ]. However, [Figure 1\(a\)](#) shows that those in the disgust video group reported significantly less emotional distress than those in the fear video group when reappraising [ $F(1, 47) = 4.29, p < .05, \text{partial } \eta^2 = .08$ ]. Emotional distress for those that suppressed also did not significantly differ from those that reappraised in the fear video condition [ $F(1, 46) = .48, p = .48, \text{partial } \eta^2 = .01$ ]. However, emotional distress for those that reappraised was significantly less than those that suppressed in the disgust video condition [ $F(1, 45) = 4.61, p < .04, \text{partial } \eta^2 = .09$ ] (see [Table 1](#) for Means).<sup>3</sup>

*Effects for Self-Reported Fear and Disgust.* Although the interaction of Emotion Change  $\times$  Emotion Video  $\times$  Emotion Regulation was not significant, subsequent analyses were conducted to attempt to



**Figure 1.** (a) Emotion distress ratings by emotion regulation instruction and emotional video condition; (b) Mean skin conductance response change (from baseline) at 2-minute intervals by emotional video condition.  $\mu\text{S}$  = microsiemens.

differentiate fear and disgust. A 2 (Emotion Video)  $\times$  2 (Emotion Regulation) ANCOVA for fear ratings when controlling for gender yielded a significant Emotion Video  $\times$  Emotion Regulation interaction [ $F(1, 90) = 4.09, p < .05, \text{partial } \eta^2 = .04$ ]. However, this interaction was only marginally significant for disgust ratings [ $F(1, 90) = 3.12, p = .08, \text{partial } \eta^2 = .03$ ].

**Physiological responses.** SCLs at baseline were subtracted from SCLs for each of five 2-minute intervals throughout the video. Non-responders, defined as those that showed little to no electrodermal lability, were excluded from the analysis. A 2 (Emotion Video)  $\times$  2 (Emotion Regulation)  $\times$  5 (Time: 2 minutes, 4 minutes, 6 minutes, 8 minutes, and 10 minutes) ANCOVA on SCLs during the video when controlling for gender was then conducted. A significant Emotion Video  $\times$  Time interaction was observed [ $F(4, 284) = 3.21, p < .02, \text{partial } \eta^2 = .04$ ]. Separate repeated measures ANOVAs were conducted for fear and disgust video conditions to examine this interaction (see Figure 1(b)). A main effect of time was observed in the fear video condition [ $F(4, 152) = 5.42, p < .001, \text{partial } \eta^2 = .12$ ]. Pairwise comparisons revealed that physiological arousal was variable in the fear condition with a significant increase from 2 to 4 minutes ( $p < .02$ ), a significant decrease from 4 to 6 minutes ( $p < .02$ ), and a significant increase from 6 to 8 minutes ( $p < .009$ ). Physiological arousal from the 8 to 10 minute time point did not significantly differ in the fear condition ( $p = .52$ ). A main effect of time was also observed in the disgust video condition [ $F(4, 144) = 6.85, p < .001, \text{partial } \eta^2 = .16$ ]. Pairwise comparisons revealed that physiological arousal was generally stable in the disgust condition. Although a significant increase in physiological arousal was

observed from the 2 minute to the 4 minute time point ( $p < .001$ ), subsequent time points did not significantly differ from each other in the disgust condition ( $ps > .14$ ).

**Convergence of self-report and emotion regulation responses.** The association between ERRS items and change in fear, disgust, and distress for the fear and disgust video was examined. No significant correlations were observed among those that viewed the fear video ( $r_s$  range from .06 to .23,  $ps > .14$ ). For those who viewed the disgust video, change in fear and overall distress were significantly ( $ps < .04$ ) correlated with the degree to which participants found themselves trying to suppress their emotional response to the video ( $r = .49$  and  $.37$ , respectively), the degree to which participants found themselves not looking at the video ( $r = .47$  and  $.45$ , respectively), and how much participants found themselves deliberately thinking about other things while watching the video ( $r = .36$  and  $.33$ , respectively).

## Discussion

The present study found that while change in distress did not significantly differ between those exposed to fear content and those exposed to disgust content when suppressing, significantly less distress was observed for participants exposed to disgust content compared to those exposed to fear content when reappraising. Of note is that the significant effects for reappraisal when exposed to the disgust video were observed on a composite measure of fear and disgust label "emotional distress", rather than disgust specifically. Examination of differences in self-reported fear and disgust for those who reappraised when

exposed to the disgust video revealed that change in distress may be more strongly driven by fear. However, the effect size for fear and disgust was essentially identical. Given that fear and disgust are both negative avoidance-oriented emotions, self-reported differences may be difficult to observe. This highlights the importance of assessing supposedly distinct emotions at different level of analyses with sufficient specificity.

It has been suggested that the experience of disgust may be cognitively impenetrable (Rozin & Fallon, 1987). For example, the law of contagion contends that disgusting objects transfer their properties to non-disgusting objects through contact. Furthermore, these disgusting properties are perceived to remain even after physical contact has ceased and are dose-insensitive. The law of similarity states that objects that are physically similar to disgusting objects are deemed to be more disgusting. The law of similarity may be conceptualised as a false alarm where the cost of avoidance is small relative to the higher cost of contamination (Oaten et al., 2009). The laws of sympathetic magic suggest that disgust reactions are compelling even in the face of their irrational nature. However, the present findings suggest that distress associated with exposure to disgusting cues may be more cognitively penetrable than distress associated with exposure to fear cues.

Reappraisal is described as *antecedent-focused* in which one re-evaluates an emotional situation in order to alter the emotional response before it occurs. In contrast, suppression is a *response-focused* form of regulation characterised by hiding an emotion that one is experiencing. The timing of the implementation of reappraisal may render it more effective than suppression in regulating distress when experiencing disgust. The experience of disgust may be easier to regulate before it is fully experienced. Once disgust is fully mobilised, it becomes increasingly difficult to penetrate cognitively. The nature of reappraisal may also make it effective for reducing distress associated with disgust. Reappraisal requires adopting a detached and unemotional attitude that involves changing the trajectory of the emotional response by reinterpreting the meaning of the stimulus. This process likely involves reinterpretation of the disgust stimulus in order to reduce the emotional response. In contrast, suppression requires inhibition of the behavioural display of emotion. This limits opportunities to reinterpret the disgust cue, which may account for its inability to reduce distress.

The importance of reinterpreting the stimulus as a means of reducing distress is supported by recent research in disgust learning. Engelhard, Arne, Lange, and Olatunji (2014) showed that counterconditioning trials reduced acquired US expectancy to the CS+ and reduced evaluative conditioned disgust. In this context, pairing the CS+ with a pleasant US compels a reinterpretation of the CS+ which may then account for diminished disgust responses.

Although research has shown that suppression and reappraisal have distinct affective consequences, no significant differences in distress were found between those instructed to suppress and those instructed to reappraise when exposed to fear cues. This may reflect important differences between the disgust video and the fear video employed in the present study. Indeed, physiological arousal was more variable in the fear condition compared to the disgust condition. The disgust video was also marked by contamination outcome expectancies whereas the fear video likely generated harm-relevant outcome expectancies. Harm-relevant outcome expectancies may be associated with elements of unpredictability, given the use of clips from horror films, which may not be salient in the disgust video. Accordingly, exposure to fear and disgust cues may naturally evoke the use of different regulatory strategies. Indeed, those assigned to the disgust video condition found themselves more likely to not look at the video and think about other things while watching the video than those in the fear video condition. Differences in the instinctive use of such strategies may modulate associated distress. Consistent with this view, the present study found that change in distress was associated with reported tendency to suppress emotion, not look at the video, and deliberately think about other things among those exposed to the disgust, but not fear video. When considered in the context of outcome expectancies, unpredictability, and automated regulatory strategies, the emotional intensity of the videos may be contextually distinct. This may account for why reappraisal was more effective than suppression for reducing distress in the disgust video condition but not in the fear video condition. This interpretation is in line with recent research showing that the effect of reappraisal is moderated by the context in which it is employed (Troy, Shallcross, & Mauss, 2013).

Although cognitive-behavioural therapy (CBT) that involves repeated exposure to anxiety-evoking stimuli is a highly efficacious treatment for anxiety disorders,

not all patients fully benefit. For anxiety disorders that are characterised by excessive disgust reactions, augmentation of exposure therapy with reappraisal strategies may improve clinical outcomes. Recent research has shown that habitual use of reappraisal in spider phobia, a disorder that is characterised by disgust, leads to better regulation of emotional responses with less effort, leading to more successful emotional relearning (Hermann et al., 2013). Use of reappraisal strategies for patients with disorders characterised by disgust reactions may be effective in changing rigidly held maladaptive beliefs which may facilitate symptom reduction.

Implementing reappraisal strategies in the treatment of anxiety disorders characterised by disgust reactions may be informed by research on implementation intentions. There is now accumulating evidence showing that forming implementation intentions might be an effective way of mobilising effective emotion regulation (Webb, Schweiger Gallo, Miles, Gollwitzer, & Sheeran, 2012). Furthermore, there is evidence suggesting that disgust can be controlled effectively by forming implementation intentions that support a goal intention. For example, Gallo, Keil, McCulloch, Rockstroh, and Gollwitzer (2009) found that when a goal intention ("I will not get disgusted!") is furnished with an implementation intention ("And if I see blood, then I will remain calm and relaxed!"), arousal ratings of disgusting pictures are reduced compared to when forming only a goal intention or no goal intention at all. Although the present study suggests that reappraisal may be effective in reducing distress associated with disgust, reappraisal may be less effective after the emotional response has already unfolded (Sheppes & Meiran, 2007). This timing characteristic of reappraisal may limit its utility for those who experience significant disgust that can be difficult to control during the initial onset. Future research will be useful in delineating the extent to which implementation intentions potentiate the efficacy of reappraisal strategies in clinical samples that experience heightened disgust response.

The present study suggests reappraisal may be effective in regulating distress when experiencing disgust. However, study limitations must be considered before definitive inferences can be made. Although the fear and disgust-relevant videos evoked the target emotion, they may have been unmatched on other dimensions (i.e. arousal, predictability) that may influence the extent to which the

distress they evoke can be effectively regulated. Future research is needed that equates the magnitude of other properties (i.e. behaviours, physiology) that may influence contextual perceptions. Of course this would be difficult given that it is the differences in those perceptions that define the two distinct emotions. The present study is also limited by exclusive reliance on SCLs as the index of physiology. Although the present findings are consistent with prior studies that have failed to observe an effect of emotional regulation on physiological responses (Gomez, Scholz, & Danuser, in press), use of multiple measures of physiology that have greater sensitivity for detecting responding to fear relative to disgust cues will be needed in future research. By employing multiple levels of analysis, future studies will be positioned to elucidate the utility of reappraisal in diminishing excessive disgust reactions.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Notes

1. *Post-hoc* power analyses using the G\*Power analysis program indicated that we had greater than a .80 power to detect effect sizes as small as  $d = .50$  for the comparison between suppression and reappraisal in the fear and disgust video conditions.
2. This interaction is described in the previous section of the results showing that fear ratings were higher than disgust ratings in the fear video condition and disgust ratings were higher than fear ratings in the disgust video condition.
3. Despite including gender as a covariate in the analysis, it cannot be completely ruled out that differences in the gender distribution between the two film conditions may be partly responsible for the differential findings. To further address this potential confound, we reran the analysis including gender as an additional factor and examining interaction effects including this variable. Gender did not interact with any of the other factors. Most notably is that the Gender  $\times$  Emotion Video [ $F(1, 87) = 0.01, p = .91, \text{partial } \eta^2 = .00$ ] and the Gender  $\times$  Emotion Regulation [ $F(1, 87) = 0.54, p = .46, \text{partial } \eta^2 = .00$ ] condition was not significant. Similarly, gender did not interact with the other factors when examining physiology. Most notably is that the Gender  $\times$  Emotion Video [ $F(1, 68) = 0.12, p = .72, \text{partial } \eta^2 = .00$ ] and the Gender  $\times$  Emotion Regulation [ $F(1, 68) = 0.01, p = .89, \text{partial } \eta^2 = .00$ ] condition was not significant.

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