

## Shaking That Icky Feeling: Effects of Extinction and Counterconditioning on Disgust-Related Evaluative Learning

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Learned disgust appears to play an important role in certain anxiety disorders, and can be explained by the process of evaluative conditioning, in which an affective evaluative reaction evoked by an unconditional stimulus (US) is transferred to a conditional stimulus (CS). Much remains unknown about how disgust-related evaluative learning can be effectively eliminated. Study 1 of the present investigation examined the effects of extinction on reducing the negative evaluation of a CS that was acquired during disgust conditioning. Participants completed acquisition trials, with a disgusting picture as US and two neutral pictures as CS (CS+ was paired with the US; CS- was unpaired), followed by extinction trials ("CS only"; experimental condition) or a filler task (control condition). Extinction trials reduced acquired US expectancy to the CS+, but did not extinguish negative evaluations of the CS+. Study 2 examined the effects of counterconditioning on evaluative learned disgust. After disgust acquisition trials, counterconditioning trials followed in which the CS+ was paired with a pleasant US (experimental condition) or a filler task (control

condition). Counterconditioning trials reduced acquired US expectancy to the CS+ and reduced evaluative conditioned disgust. Implications of the potential differential effects of extinction and counterconditioning on evaluative learning for exposure-based treatment of specific anxiety disorders are discussed.

*Keywords:* disgust; anxiety disorders; evaluative conditioning

EXPECTANCY LEARNING INVOLVES LEARNING that a conditional stimulus (CS) predicts the (re)occurrence of the unconditional stimulus (US) (e.g., a car may activate the expectation of an accident, which evokes fear). Conditioned fear can be extinguished by exposing the person to the CS, so that disconfirming information is learned, and the CS no longer activates the US expectancy. Expectancy learning has received much attention in prognostic and clinical research in anxiety disorders (e.g., Blechert, Michael, Vriends, Margraf, & Wilhelm, 2007; Craske et al., 2008; Engelhard, de Jong, van den Hout, & van Overveld, 2009; Lommen, Engelhard, Sijbrandij, van den Hout, & Hermans, 2013). Indeed, violation of the US expectancy is the model for exposure therapy, the gold-standard psychological treatment for the anxiety disorders (Olatunji, Cisler, & Deacon, 2010). Although expectancy learning focuses largely on the acquisition of fear, given its defining role in anxiety disorders, a growing literature suggests that disgust is also important in the development of anxiety disorders.

This research was supported with a Vidi Innovational Research grant by the Netherlands Organization for Scientific Research to Iris Engelhard. We would like to thank Dirk Hermans and Elizabeth Mason for sharing their stimulus materials, Jesper Tijmstra from the Department of Statistics and Methodology for statistical advice, and the editor and three anonymous reviewers for helpful comments on earlier versions of the manuscript.

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0005-7894/45/708-719/\$1.00/0

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Disgust is usually experienced as a feeling of revulsion and a desire to withdraw from the eliciting stimulus, and may function to protect us from disease (see Oaten, Stevenson, & Case, 2009). Disgust-eliciting stimuli include, for instance, body products, violations of the exterior envelope of the human body (e.g., seeing a man with his intestines exposed after an accident), violations of hygiene, and certain foods (Olatunji, Williams, et al., 2007). The emotion of disgust has been specifically implicated in post-traumatic stress disorder (PTSD), spider phobia, blood-injection-injury phobia, and contamination-based obsessive-compulsive disorder (OCD) (Cisler, Olatunji, & Lohr, 2009). For example, trauma-exposed individuals may experience horror or disgust at the time of the traumatic event (e.g., Engelhard, van den Hout, Arntz, & McNally, 2002), and the intensity of peritraumatic disgust predicts the level of PTSD symptoms, independently of peritraumatic fear intensity (Engelhard, Olatunji, & de Jong, 2011). Research has also shown that when female sexual assault victims recall the assault memory, they report elevated feelings of disgust (e.g., Feldner, Frala, Badour, Leen-Feldner, & Olatunji, 2010).

Disgust also appears to be relevant to negative evaluation of the CSs themselves in certain anxiety disorders. For example, victims of sexual assault may feel dirty despite excessive washing, which is associated with PTSD symptoms (Fairbrother & Rachman, 2004), and may have less pleasure in physical intimacy (Meston, Rellini, & Heiman, 2006). Soldiers deployed to Afghanistan who reported more peritraumatic disgust had more negative evaluations of deployment-related stimuli (Engelhard et al., 2011). In these cases, physical intimacy or deployment-related stimuli do not act as a CS that predicts a subsequent US, but act as a CS that seems to have acquired the hedonic valence of the US itself. This form of Pavlovian conditioning is called *evaluative conditioning* (De Houwer, Thomas, & Baeyens, 2001; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002). It involves changes in liking for a neutral stimulus that result from its contingent presentation with (dis)liked stimuli (e.g., after pairing with a disgusting US, the CS *itself* becomes disliked or disgusting). Woody and Teachman (2000) proposed that while expectancy learning is a prominent explanation for fear acquisition, and may explain the acquisition of some disgust responses, evaluative conditioning may be more useful for understanding disgust (see also Olatunji, Forsyth, et al., 2007; Schienle, Stark, & Vaitl, 2001).

Unlike expectancy learning, evaluative learning seems to be less susceptible to extinction (Hofmann,

de Houwer, Perugini, Baeyens, & Crombez, 2010). This observation is clinically relevant, because negative affective evaluations of the CS that persist after extinction of US expectancies are associated with the return of conditioned fear responses ("reinstatement"; Dirikx, Hermans, Vansteenwegen, Baeyens, & Eelen, 2007; Hermans et al., 2005). Preliminary experimental research suggests that evaluative learned disgust may also be resistant to extinction (Olatunji, Forsyth, & Cherian, 2007), and research in analogue clinical samples has shown that repeated exposure to threat-relevant stimuli significantly reduces fear, but not disgust (e.g., Olatunji, Wolitzky-Taylor, Willems, Lohr, & Armstrong, 2009). Although the mechanisms by which disgust is more refractory than fear remain unclear, the relatively unique interoceptive consequences of disgust (i.e., nausea) may result in a higher likelihood of renewal (Viar-Paxton & Olatunji, 2012). Recent research also suggests that memory recall and recognition is greater for disgusting compared to fearful and neutral stimuli (Chapman, Johannes, Poppenk, Moscovitch, & Anderson, in press).

One limitation of studies suggesting that evaluative learned disgust is resistant to extinction is that they have largely relied on self-report measures, which are prone to demand biases. More recently, Mason and Richardson (2010) did examine whether learned disgust is resistant to extinction using an indirect measure of visual avoidance. They used a conditioning paradigm in which one photograph of a neutral face served as CS+ (i.e., it was followed by a disgusting picture [US]; e.g., of feces in a toilet), and another one served as CS- (it was not followed by a US, but by a neutral image; e.g., of an umbrella). After the conditioning task, a visual avoidance task followed, in which the two CSs were presented simultaneously (side by side) on the screen three times. Then the US and neutral image were shown in the same way as the CSs. Finally, the CSs were presented again side by side, and were immediately followed by the US and neutral image side by side. An eye tracker was used to measure total observation length. As predicted, extinction trials reduced US expectancies, but not dislike and disgust ratings and visual avoidance of the CS+, suggesting that evaluative learned disgust is resistant to extinction. However, several limitations render this conclusion tentative. For example, it is unclear whether the visual avoidance task really measured evaluative learned disgust that survived extinction. During this test, participants were not told that the US would not be presented. Therefore, visual avoidance of the CS+ may have been due to its predictive rather than hedonic value. The visual avoidance task also involved simultaneous CS+/CS- presentations, while the conditioning task involved successive CS+/CS-

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