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The Nature and Function of Disgust in Coping and Control

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Summary. – Disgust is a basic emotion that has its basis in evolutionary theory and its biological protective functions against contamination threat. It is composed of three systems, the first of which is physiologic where it can be distinguished from other negative emotions on the basis of heart rate, blood pressure and gastric motility. The behavioral system is that which provides for the avoidance and aversion of threat. The cognitive system is that which provides for vigilance and attention, and the interpretation of threat for future events. The domains of disgust are assessed by verbal report of aversion and avoidance of specific content, by the propensity to respond with disgust, and by the perceived negative consequences of the disgust response. Individual differences in the domains of disgust include those of gender, the manifestation of anxiety disorders, and in some basic personality traits. The societal and personal costs of disgust and its manifestations can include sexual, interpersonal, and psychopathological domains. Additional research is necessary to further illuminate the functions, benefits, and costs of this basic human emotion.

Disgust is typically included as one of the basic emotions in contemporary emotion classification schemes (Ekman & Friesen, 1975; Izard, 1971). One of the earliest considerations of disgust comes from the writings of Darwin (1872/1965) who proposed that a disgusting stimulus is one that is “offensive to the taste”. Angyal (1941) expanded on this concept by suggesting that the disgust response is motivated by aversion to the oral incorporation of a noxious substance. Yet, disgust remains a complex and understudied emotion despite this substantial history of academic interest. In this chapter, we first review the definitional and measurement aspects of disgust as a discrete emotion. This is followed

by a review of the available evidence regarding the control and regulation of disgust. Finally, we reflect on individual differences and the various implications of disgust.

DEFINING DISGUST: THREE SYSTEMS

The attempt to define mental constructs in the field of psychology has a long and storied past, beginning formally with the work of the structuralists who defined consciousness in terms of its parts. It is tempting to do the same with emotions, including disgust, yet the history of psychology suggests that such attempts are too limiting. The transition to a functionalist approach for understanding psychological constructs points to the core feature of psychological science which is to better understand a construct via an improved understanding of its function within the organism. It is from this functional perspective that we approach the definition of disgust. We define disgust in terms of its functional characteristics in three domains: physiological, behavioral, and cognitive (subjective). That is, the definition of disgust that we present is determined by the effect that disgust, as a response, has on these three components of human functioning. The three components conceptualization mirrors the concept of emotional components provided by Lang's (1970) bio-informational model of emotion.

The physiological correlates of disgust have been distinguished from those of other emotions. These include heart rate, blood pressure, and gastrointestinal motility. Levenson (1992) reviewed the available physiological evidence for disgust responding and posited that these specific forms of physiological responding to disgust stimuli can be generally characterized as activation of the parasympathetic nervous system (i.e., decrease in arousal). Subsequent empirical work has attempted to demonstrate this general concept. Heart rate and blood pressure variability has been the principle methodology for testing the theory of parasympathetic activation in disgust. Several authors have reported findings showing the effect of decreased heart rate in response to the presentation of disgust stimuli (Stark, Walter, Schienle, & Vaitl, 2005; Bradley, Codispoti, Sabatinelli, & Lang, 2001; Levenson, Ekman, & Friesen, 1990). Additionally, increases in gastrointestinal motility have been cited as evidence of parasympathetic activation (Ekman, Levenson, & Friesen, 1983). Van Overveld, de Jong, & Peters (2009) recently reported increased salivary production in response to a guided imagery task. However, the research implicating disgust in gastric functioning is in its infancy. The relation between stomach distress (i.e., vomiting) and parasympathetic activation as it relates to disgust remains an area that requires additional investigation.

Negative emotional states are the hallmarks of much psychological discomfort and are common in anxiety disorders. These states can include fear, anxiety, and disgust. It is these emotional states that give rise to behavioral attempts to cope with those events that give rise to negative affect. Escape and avoidance behaviors are the most common means for controlling the spatial and temporal proximity to threats of danger and the negative affect associated with said threats. Escape responses result in direct negative reinforcement by terminating (or reducing) the strength of the aversive event. Subsequent avoidance occurs when the behavior prevents the aversive stimulus from occurring. Aversive events that are unpredictable and uncontrollable have a stronger negative impact on functioning than the same aversive events that are predictable and controllable through escape and avoidance (Lohr, Olatunji, & Sawchuk, 2007). We have argued (Lohr *et al.*, 2007) that those psychological events are the constructs of danger and safety. During initial learning of danger, individuals associate unconditioned aversive events with prior events that provide predictive information about when and where the aversive event will begin (onset). The accompanying negative affect of fear and the informational feature of danger can then be transferred to the predictive stimulus making it a danger “signal.” Danger signals then serve directive functions for instrumental escape and avoidance. These behaviors result in safety by terminating the aversive stimulus or the prevention of its occurrence.

The analysis of danger and safety was predicated upon the emotions of fear and anxiety. However, recent developments in the analysis of the affective mediation of anxiety disorders have included other emotions, with a focus upon disgust in particular (Olatunji & McKay, 2007; Woody & Teachman, 2000). Inclusion of an additional affective state in the explanation of anxiety disorders may require a clarification of the nature and function of fear versus aversion. Aversion may represent a higher-order construct of negative affect elicited by threat of danger or harm. Thus, all fears represent aversion, but not all aversions represent fear.

The consideration of disgust in understanding aversions may require expansion of behavioral functions beyond avoidance (danger) and approach (safety) to include the mediation of rejection (and its converse, acceptance). Different aversive emotional states may mediate different instrumental behaviors that control relative position and distance. Fear may mediate relative position and relative distance by movement away from the stimulus (escape). Disgust, however, may mediate the relative distance by distal movement of the stimulus (rejection). Indeed, Davey (1994) has characterized disgust as “a type of rejection response characterized by a specific facial expression, a desire to distance oneself from the object of disgust, a physiological manifestation of mild nausea, a fear of oral incorporation of the object of disgust, and a feeling of ‘revulsion’ ” (p. 135).

The learning of visual and olfactory cues to dangerous foodstuffs may provide a means by which to facilitate avoidance of dangerous oral incorporation. Once

incorporated, the only response available is to spit out (or possibly regurgitation). The acquisition of the disgust response may aid in maximizing the rejection of the threatening stimulus. Rejection involves the manipulation of relative motion and relative distance of the substance in question. It is the “casting out” of the offensive substance that characterized rejection rather than escape or avoidance. The acquisition of an anticipatory disgust response may aid in the distancing of the contaminant or taint from the individual (e.g., non-food substances, toxic or spoiled substances, or bacterial/viral substances). Measurement of fear and anxiety often includes assessment of relative distance from the class of objects with danger or harm potential. Indeed, such measurement includes behavioral approach tasks (BATs). It is clear that such a procedure is designed to quantify the amount of approach behavior an individual performs relative to a prepared stimulus, and in the context of disgust research this is typically a noxious stimulus.

The most ambitious and well known study of behavioral approach toward disgusting stimuli was carried out by Rozin, Haidt, McCauley, Dunlop, & Ashmore (1999) who developed the Disgust Behavior Scale (DBS), a comprehensive behavioral measure of disgust. The authors developed 28 disgust oriented tasks that mapped onto the domains of disgusts as theorized by Rozin, Haidt, & McCauley (2000). Most BATs involved three steps and were *in vivo*, although 3 BATs involved watching disgusting videos. The authors also included three non-disgust compliance tasks to rule out the effects of experimental demand. Each task received a 0 to 60 score and participants were scored based on the proportion of steps they completed for any given task. For example, on BAT number 19 participants received a score of 20 if they were willing to touch a mealworm, a 40 if they were willing hold the mealworm in their hand, and a score of 60 if they were willing to touch the worm to their lip. Each task was completed in a stepwise manner, from easiest to hardest. If a given participant was willing to complete the first step, then they did so and went on to step two. If they were willing to complete step two, then they went on to step three, and so forth until the completion of all tasks. Factor analysis of the final DBS items revealed two factors: 1) food-related disgust and 2) body-violation-and-death-related disgust. The two factors of the DBS were highly correlated with the Disgust Scale (DS; see below) whereas the three compliance tasks were not. However, the BAT methodology is limited in two respects.

First, the BAT assesses approach rather than avoidance. Avoidance as a behavior must be inferred from the failure to continue with subsequent steps of the procedure. Second, the standard BAT procedure is limited with respect to research on disgust, as it does not allow for measurement of the rejection. In order to do so, the procedure would have to allow for the movement of the object away from the individual. Attempts to cope with aversive events that mediate fear involve instrumental escape and avoidance behavior that result in the movement of the individual

away from the aversive (dangerous) event. Attempts to cope with aversive events that mediate disgust involve instrumental behavior that moves the aversive event away from the individual. One study (Rinck & Becker, 2007) showed that spider fearful individuals responded more quickly in pushing a spider away relative to the speed of pulling toward. However, there is no research that has compared the speed of pushing a disgusting stimulus away (rejection) relative to pushing oneself away from (escape/avoidance) the disgusting stimulus. While these results provide tentative support for the aversion/rejection hypothesis, they are confounded by the fact that spider fears are characterized by an array of cognitive and emotional sequelae and are not disgust specific. Future studies are needed to fine-tune behavioral tasks of approach, avoidance, rejection, and acceptance.

Cognitive distortions present in disgust typically involve the exaggerated appraisal of threat or contagion. The “law of sympathetic magic” is comprised of two primary cognitive distortions, including the “law of contagion” and the “law of similarity” (Frazer, 1994). The law of contagion can be summarized as “once in contact, always in contact”. The corresponding belief is that an uncontaminated object coming into contact, even briefly, with a disgusting object acquires the contaminated quality of the disgusting object. For example, incidental contact between a shoelace and the floor of a restroom results in the shoelace becoming as contaminated as the floor. More importantly, the contaminated and disgusting shoelace now has the ability to contaminate other objects (e.g., the rest of the shoe), and so on, setting up a “chain of contagion”. The law of similarity states that perceptually similar objects are equal in their threat value. That is, a neutral object that resembles a disgusting object is avoided as if it were the disgusting object. For example, a piece of fudge that is shaped like feces is appraised as more disgusting and is more likely to be avoided than fudge shaped in a cube (Rozin *et al.*, 1999).

The results of previous studies (Charash & McKay, 2002; Cisler, Olatunji, Lohr, & Williams, 2009; Davey, Bickerstaff, & MacDonald, 2006; Mitte, 2008; Rozin, Lowery, Imada, & Haidt, 1999; Rozin, Millman, & Nemeroff, 1986) suggest that disgust is associated with attentional, memory, and interpretation biases. These studies only provide glimpses of the cognitive processes potentially involved in disgust responding and additional research is needed to demonstrate the robustness and reliability of these effects. Research on the role of cognitive processes in disgust is a domain that will likely witness increased interest in the future.

DOMAINS OF DISGUST

In their seminal work, Rozin & Fallon (1987) provided a contemporary analysis in which they conceptualized disgust as a food-related emotion serving primarily

to prevent oral incorporation of noxious substances. Rozin & Fallon (1987) make an important distinction in their definition of disgust by parsing the concept of disgust from that of distaste. They note that distaste is rejection based on the physical senses (e.g., foul smell, sticky texture) as opposed to that of disgust which relies more heavily upon cognition (i.e., knowledge of the nature of the rejected item). It is with this distinction, they suggest, disgust diverges from a simple sensory response to a more complex emotion. Indeed, the recognition that disgust, as an emotional response, relies more on cognitive processes than physiological processes is a necessary premise for investigations into the varied situations in which disgust plays a role.

Subsequent analyses (Rozin *et al.*, 2000; Oaten, Stevenson, & Case, 2009; Olatunji & Sawchuk, 2005) have supported the notion of disgust as a food-related emotion, though the inclusion of additional domains of disgust has broadened its scope. The results of the analysis conducted by Rozin *et al.* (2000) have been particularly persuasive in understanding the domains of disgust. They reported a conceptual structure consisting of the following orthogonal categories: core, animal-reminder, interpersonal, and moral disgust. Core disgust consists primarily of stimuli, situations, or ideas that pertain to actual or potential oral-incorporation. The animal-reminder factor is comprised of those stimuli which remind humans of their animal nature (Rozin & Fallon, 1987). Rozin *et al.* (2000) include body envelope violations (e.g., piercing the skin, bodily orifices) in this factor. It is hypothesized that body envelope violations serve as reminders to the human of their animal-like mortality. Interpersonal disgust refers to the tendency for individuals to react with disgust when coming into contact with unfamiliar or undesirable people. Finally, moral disgust consists of stimuli depicting violations of established socio-cultural mores (Haidt, Rozin, McCauley, & Imada, 1997). For example, hearing about a member of a white supremacist group may result in a characteristic disgust response (Rozin *et al.*, 1999).

Earlier research on the domains of disgust utilized the Disgust Scale (DS; Haidt, McCauley, & Rozin, 1994). The DS is a context-dependent, 32-item measure of disgust proneness and was purported to assess eight domains of disgust, including: 1) Food, 2) Animals, 3) Body Products, 4) Body Envelope Violations, 5) Death, 6) Sex, 7) Hygiene, and 8) Sympathetic Magic. The DS was widely used for over a decade despite significant psychometric limitations. For example, the internal consistencies of the eight DS subscales are largely unsatisfactory (i.e., all α 's < .63; Haidt *et al.*, 1994), thus indicating that the 8 constructs are not unique or valid. This led to the re-examination and revision of the DS and the proposed domains of disgust (DS-R; Olatunji *et al.*, 2008).

Olatunji *et al.* (2008) showed that the DS actually measures three latent constructs as opposed to the eight proposed by Haidt *et al.* (1994). Additionally, seven

items (mostly items from the sexual factor) were removed from the DS to improve the scale's psychometric properties. This resulted in the 25-item revised Disgust Scale (DS-R). The three domains of disgust, as measured by the DS-R, include: 1) Core Disgust, 2) Animal Reminder Disgust, and 3) Contamination Disgust. Items within the core disgust factor were primarily focused on perceptually offensive stimuli and the threat of disease. The animal reminder factor was similar to the original domain as proposed by Haidt *et al.* (1994) in that items reminded human of their animal nature and mortality. Lastly, the items within the contamination factor of the DS-R, although less interpretable and stable, were largely focused on the spread of contagion. The DS-R is highly related to the original DS ($r = .89$) but has significantly improved psychometric properties. The total score and three factors of the DS-R have adequate internal consistency (all α 's $> .70$) and were significantly related to the total score of the Disgust Emotion Scale (DES; Kleinknecht, Thorndike, & Kleinknecht, 1997), thus establishing convergent validity. A subsequent investigation of the three-factor conceptualization demonstrated that the revised structure predicted a variety of behavioral, personality, and clinical characteristics (Olatunji *et al.*, 2008).

A recent investigation by Tybur, Lieberman, & Griskevicius (2009) challenges the structure of disgust originally proposed by Rozin *et al.* (1999) as well as recent modifications by Olatunji *et al.* (2007). Tybur *et al.* (2009) present a model of disgust based in evolutionary function. They propose three domains of disgust that are adaptively advantageous. The functional domains reported by these authors include pathogen-disgust, sexual-disgust, and moral-disgust. Pathogen disgust represents pathogen-contagion disgust and is similar to the core disgust factor of the DS. Sexual disgust is purported to reflect a domain of disgust that prevents sexual acts that are not adaptive for procreation. The moral disgust factor maps directly onto the definition of moral disgust as outlined by Rozin *et al.* (2000). This led to the development of the 21-item (7-items per factor) Three Domains of Disgust Scale (TDDS). The three factors of the TDDS were shown to measure distinct constructs, each of which has adequate reliability as evidenced by satisfactory convergent and discriminant validity. Moreover, Tybur *et al.* (2009) provided sound evidence that the sexual and moral factors are characteristically distinct from pathogen disgust. While the functional aspects of this model are intuitively appealing, research supporting this conceptualization requires replication. Nonetheless, aspects of the model by Tybur *et al.* (2009) are well tolerated by broad and specific aspects of the model outlined by Rozin *et al.* (2000), especially with respect to the avoidance of pathogens and repulsion toward morally wrong behaviors.

The constructs of disgust sensitivity and disgust propensity were originally developed to circumvent that fact that existing disgust-related constructs were con-

text dependent. Cavanagh & Davey (2000) developed the original Disgust Propensity and Sensitivity Scale (DPSS) to measure disgust reactions and perceptions without relying on contexts or stimuli that may not be disgust specific. Disgust propensity, refers to the tendency to experience disgust in reaction to a range of stimuli and disgust sensitivity refers to the perceived unpleasantness of feelings of disgust (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). Disgust sensitivity is considered the disgust analogue to the widely known construct of anxiety sensitivity (Reiss, Peterson, Gursky, & McNally, 1986). Similarly, disgust propensity is considered to be analogous to trait anxiety (Spielberger, Gorsuch, & Lushene, 1970). The DPSS was revised by van Overveld *et al.* (2006) to create a more psychometrically sound measure (DPSS-R). The 16-item DPSS-R is a reliable and valid measure of disgust propensity and sensitivity (van Overveld *et al.*, 2006; Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). Both disgust sensitivity and propensity have evinced adequate internal consistency and convergent validity. Furthermore, disgust propensity and sensitivity explain unique variance in anxiety symptoms such as spider phobia and blood injection and injury phobia (Olatunji *et al.*, 2007).

INDIVIDUAL DIFFERENCES IN DISGUST

The relationship of gender to the experience of disgust is dependent upon how disgust is measured and the context in which it is experienced. Tybur *et al.* (2009) demonstrated that females reported more disgust than males across all three domains of the TDDS, but that the difference was greatest with the sexual domain. Olatunji *et al.* (2008) found that females scored significantly higher on all three domains of disgust as measured by the DS-R, with differences on the core disgust factor being most pronounced. Lastly, previous research has shown that women are less willing to touch disgusting stimuli relative to men (Rozin *et al.*, 1999). However, this effect was almost exclusively explained by one BAT, as women were less likely to actually hold a pair of soiled men's underwear. The context of psychopathology is also relevant to differences in gender.

Disgust plays a key role in the formal disorders of Spider Phobia (SP), Blood-Injection-Injury (BII) Phobia, and contamination-based Obsessive Compulsive Disorder (OCD), all of which females have a higher risk of developing. Specifically, Connolly, Olatunji, & Lohr (2008) showed that disgust propensity mediated sex differences in BII and SP symptoms, an effect that remained intact when controlling for trait anxiety and negative affect. Among women, high levels of disgust responding is a predictor of contamination fear and washing compulsions (Olatunji, Sawchuk, Arrindell, & Lohr, 2005). The authors interpret these findings

to mean that the relationship between gender and OCD symptoms is mediated by disgust responding, as is the case with BII Phobia.

Relatively little research has investigated the relationship of disgust responding and personality traits. Tybur *et al.* (2009) found that the trait of psychopathy is negatively correlated to the moral and sexual domains of disgust but unrelated to the pathogen/contamination domain. The Big Five personality traits are openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The sexual domain of disgust was positively correlated with conscientiousness and agreeableness, but negatively related to openness. The moral domain was also positively correlated with conscientiousness and agreeableness, but was also positively correlated with extraversion. The pathogen/contamination domain was positively related only to neuroticism. However, none of the correlations were greater than $r = .23$, accounting for no more than five percent of the variance in scores.

PERSONAL AND SOCIETAL COSTS OF DISGUST

The emotion of disgust has both evolutionary and ontogenetic benefits. Pathogen/contamination aversion is the most obvious adaptive consequence. The presence and further acquisition of taste aversions function to minimize the costs of oral incorporation of distasteful (and possibly harmful) substances. Tybur *et al.* (2009) propose that disgust functions to minimize the costs of sexual selection and moral transgressions in the interpersonal and social context. The minimization of danger by virtue of disgust may also have personal value in preventing or avoiding unwanted sexual contact (assault). For example, the prevention of non-normal sexual acts is partially driven by disgust sensitivity. Borg, Lieberman, & Kiehl (2008) found that self-report, neural, and behavioral measures all indicated that negative evaluations of incest were highly related to disgust sensitivity. This study provided some of the first biological support for the assertion that moral and disease avoidance disgust are more alike than dissimilar.

It is likely that one important pursuit is that which involves the maximization of moral and/or religious conduct. This can include ritual decontaminations (ablutions) or reparative compensations (undoings). It can also motivate altruistic behaviors that have benefit for the individual and other social group members. Promotion of public health through disease prevention programs has long relied not only upon the good will of individuals but has equated cleansing with moral virtue. Such was the case in the early part of the twentieth century when the City of New York attempted to limit the spread of the Spanish Influenza by public pronouncements that "Cleanliness is next to godliness." Recent empirical sup-

ports these anecdotal examples. By associating a lack of hand hygiene with disgusting imagery, researchers were able to improve hand hygiene more so than with standard health concern messages (Porzig-Drummond, Stevenson, Case, & Oaten, 2009). Although the improvement of hand hygiene may be important for the population at large, it should be noted that increased hand-washing behaviors may exacerbate the sequelae of symptoms associated with contamination-based OCD (Deacon & Maack, 2008).

As with fear and anxiety, disgust-motivated behavior that is excessive and/or outside of existing norms can also incur substantial cost. The most obvious domain is within the area of anxiety disorders, where consistent and reliable functional relations have been shown between disgust and BII, non-predatory animal phobias, and contamination-based OCD. Preliminary research suggests that there are other psychopathic conditions in which disgust is a significant consideration, including eating disorders (Troop & Baker, 2009), sexual dysfunctions such as vaginismus (de Jong, van Overveld, Schultz, Peters & Buwalda, 2009; de Jong & Peters, 2009), mood disorder (Overton, Markland, Simpson, Taggart & Bagshaw, 2008), religious obsessions (Olatunji, Tolin, Huppert, & Lohr, 2005), and Post Traumatic Stress Disorder (PTSD; Petrak, Doyle, Williams, Buchan, & Forster, 1997; Shin *et al.*, 1999). A number of harms done, opportunities lost, and social costs are common consequences of the behavioral excesses and deficits associated with the aforementioned disorders.

CONCLUSIONS

Disgust is a basic emotion that is associated with distinct physiological, behavioral, and cognitive systems. Dominant theory purports that physiological reactions in the presence of disgusting stimuli are often characterized by parasympathetic arousal; however, a mixture of sympathetic and parasympathetic activity are likely related to disgust. Forms of aversions such as avoidance, escape, and rejection are characteristic behavioral responses to feelings of disgust. The laws of sympathetic magic and information processing biases are the most researched areas within the cognitive system of disgust. Consistent with several theoretical perspectives, there is strong evidence in support of multiple domains of disgust. At the very least, these domains include core-pathogen disgust and moral-disgust; however, the classes of stimuli that elicit disgust within these domains vary greatly and may comprise hierarchical sub-domains or separate unique factors. It should be noted that the domain of moral disgust is one that appears to be specifically applicable to the social and/or interpersonal context. If so, the manifestation of disgust may be particularly salient to the rejection function rather than the avoidance function of disgust. Social rejection (e.g., anathema, shunning, casting out) may

also apply to the social emotions of loathing and contempt. To our knowledge, however, the social psychological research on the relationship of social contempt and moral disgust has yet to be addressed via empirical research.

Gender is by far the most robust predictor of trait disgust and little research has investigated the relations between personality and disgust. The individual and societal costs of disgust are many. Disgust protects organisms from oral incorporation of potentially threatening stimuli and undoubtedly plays a crucial role public safety and health. However, the misapplications and excesses of disgust also cause significant harm. The functional relations between disgust and several anxiety disorders suggest that disgust is related to functional impairments that are so frequently associated with disordered anxiety.

Despite the recent upsurge of research on disgust in psychiatric illness (Olatunji & McKay, 2007) our understanding of this emotion pales in comparison to that of other emotions (e.g., fear and anger; Olatunji & Sawchuk, 2005). We believe that this is largely due to a systemic lack of basic research on disgust. While disgust research within clinical and social psychology is active, the results that are gleaned from these data are difficult to interpret due to the lack of basic research. For example, while there is a small amount of literature focused on emotion regulation in disgust-related anxiety disorders, these data do not provide insight into the regulation of disgust specifically. Without a solid understanding of what characterizes normative disgust, the value and implications of research that is driven by theories of pathological disgust remains limited. This firmly suggests that there is a need for research programs that are focused on the cognitive, behavioral, and physiological systems of normative disgust.

References

- Angyal, A. (1941). Disgust and related aversions. *Journal of Abnormal & Social Psychology*, *36*, 393-412.
- Borg, J., Lieberman, D., & Kiehl, K. (2008). Infection, incest, and iniquity: Investigating the neural correlates of disgust and morality. *Journal of Cognitive Neuroscience*, *20*, 1529-1546.
- Bradley, M. M., Codispoti, M., Sabatinelli, D., & Lang, P. J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion*, *1*, 276-298.
- Cavanagh, K., & Davey, G. C. L. (2000). The development of a measure of individual differences in disgust. *Paper presented to the British Psychological Society*. Winchester, UK.
- Charash, M., & McKay, D. (2002). Attention bias for disgust. *Journal of Anxiety Disorders*, *16*, 529-541.
- Cisler, J. M., Olatunji, B. O., Lohr, J. M., & Williams, N. L. (2009). Attentional bias differences between fear and disgust: Implications for the role of disgust in disgust-related anxiety disorders. *Cognition & Emotion*, *23*, 675-687.

- Connolly, K. M., Olatunji, B. O., & Lohr, J. M. (2008). Evidence for disgust sensitivity mediating the sex differences found in Blood-Injection-Injury Phobia and Spider Phobia. *Personality & Individual Differences, 44*, 898-908.
- Darwin, C. (1872/1965). *The expression of the emotions in man and animals*. Chicago: University of Chicago Press.
- Davey, G. C. L. (1994). Disgust. In V. S. Ramachandrian, (Ed.), *Encyclopedia of human behavior* (pp. 135-141). San Diego, CA: Academic Press.
- Davey, G. C. L., Bickerstaffe, S., & MacDonald, B. A. (2006). Experienced disgust causes a negative interpretation bias: A causal role for disgust in anxious psychopathology. *Behaviour Research & Therapy, 44*, 1375-1384.
- Deacon, B., & Maack, D. (2008). The effects of safety behaviors on the fear of contamination: An experimental investigation. *Behaviour Research & Therapy, 46*, 537-547.
- de Jong, P., van Overveld, M., Schultz, W. W., Peters, M. L., & Buwalda, F. M. (2009). Disgust and contamination sensitivity in vaginismus and dyspareunia. *Archives of Sexual Behavior, 38*, 244-252.
- de Jong, P., & Peters, M. L. (2009). Sex and the sexual dysfunctions: The role of disgust and contamination sensitivity. In B. Olatunji, & D. McKay, (Eds.), *Disgust and its disorders: Theory, assessment, and treatment implications* (pp. 253-270). Washington, D.C.: American Psychological Association.
- Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues*. Oxford, England: Prentice-Hall.
- Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science, 221*, 1208-1210.
- Frazer, J. G. (1994). *The new golden bough: A study in magic and religion*. New York: Oxford University Press.
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality & Individual Differences, 16*, 701-713.
- Haidt, J., Rozin, P., McCauley, C., & Imada, S. (1997). Body, psyche, and culture: The relationship between disgust and morality. *Psychology & Developing Societies, 9*, 107-131.
- Izard, C. E. (1971). *The face of emotion*. Norwalk, CT: Appleton-Century-Crofts.
- Kleinknecht, R. A., Thorndike, R. M., & Kleinknecht, E. E. (1997). Structural equation modeling of antecedents to blood/injury – related vasovagal symptoms. *Poster presented at the Western Psychological Association*. Seattle, WA.
- Lang, P. J. (1970). Stimulus control, response control, and the desensitization of fear. In D. J. Levis (Ed.), *Learning approaches to therapeutic behavior change* (148-173). Chicago: Aldine.
- Levenson, R. W. (1992). Autonomic nervous system differences among emotions. *Psychological Science, 3*, 23-27.
- Levenson, R. W., Ekman, P., & Friesen, W. V. (1990). Voluntary facial action generates emotion-specific autonomic nervous system activity. *Psychophysiology, 27*, 363-384.
- Lohr, J. M., Olatunji, B. O., & Sawchuk, C. N. (2007). A functional analysis of danger and safety signals in anxiety disorders. *Clinical Psychology Review, 27*, 114-126.
- Mitte, K. (2008). Trait-disgust vs. fear of contamination and the judgmental bias of contamination concerns. *Journal of Behavior Therapy & Experimental Psychiatry, 39*, 577-586.
- Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin, 135*, 303-321.
- Olatunji, B. O., Cisler, J. M., Deacon, B., Connolly, K., & Lohr, J. M. (2007). The Disgust Propensity and Sensitivity Scale-Revised: Psychometric properties and specificity in relation to anxiety disorder symptoms. *Journal of Anxiety Disorders, 21*, 918-930.

- Olatunji, B. O., & McKay, D. (2007). Disgust and psychiatric illness: Have we remembered? *British Journal of Psychiatry*, *19*, 457-459.
- Olatunji, B. O., Haidt, J., McKay, D., & David, B. (2008). Core, animal reminder, and contamination disgust: Three kinds of disgust with distinct personality, behavioral, physiological, and clinical correlates. *Journal of Research in Personality*, *42*, 1243-1259.
- Olatunji, B. O., Tolin, D. F., Huppert, J., & Lohr, J. M. (2005). The relationship of fearfulness, disgust sensitivity, and religious obsessions in a non-clinical sample. *Personality & Individual Differences*, *38*, 891-902.
- Olatunji, B. O. & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social & Clinical Psychology*, *24*, 932-962.
- Olatunji, B. O., Sawchuk, C. N., Arrindell, W. A., & Lohr, J. M. (2005). Disgust sensitivity as a mediator of the sex differences in contamination fears. *Personality & Individual Differences*, *38*, 713-722.
- Olatunji, B. O., Williams, N., Tolin, D., Abramowitz, J., Sawchuk, C., Lohr, J. M. et al. (2007). The Disgust Scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment*, *19*, 281-297.
- Overton, P. G., Markland, F. E., Simpson, J., Taggart, H. S., & Bagshaw, G. L. (2008). Self-disgust mediates the relationship between dysfunctional cognitions and depressive symptomatology. *Emotion*, *8*, 379-385.
- Petrak, J., Doyle, A., Williams, L., Buchan, L., & Forster, G. (1997). The psychological impact of sexual assault: A study of female attenders of a sexual health psychology service. *Sexual & Marital Therapy*, *12*, 339-345.
- Porzig-Drummond, R., Stevenson, R., Case, T., & Oaten, M. (2009). Can the emotion of disgust be harnessed to promote hand hygiene? Experimental and field-based tests. *Social Science & Medicine*, *68*, 1006-1012.
- Reiss, S., Peterson, R., Gursky, D., & McNally, R. (1986). Anxiety sensitivity, anxiety frequency and the predictions of fearfulness. *Behaviour Research & Therapy*, *24*, 1-8.
- Rinck, M., & Becker, E. S. (2007). Approach and avoidance in fear of spiders. *Journal of Behavior Therapy & Experimental Psychiatry*, *38*, 105-120.
- Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, *94*, 32-41.
- Rozin, P., Haidt, J., & McCauley, C. R. (2000). Disgust. In M. Lewis, & J. M. Haviland, (Eds.), *Handbook of Emotion* (pp. 637-653) New York: Guilford Press.
- Rozin, P., Haidt, J., McCauley, C., Dunlop, L., & Ashmore, M. (1999). Individual differences in disgust sensitivity: Comparisons and evaluations of paper-and-pencil versus behavioral measures. *Journal of Research in Personality*, *33*, 330-351.
- Rozin, P., Lowery, L., Imada, S., & Haidt, J. (1999). The CAD triad hypothesis: A mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *Journal of Personality & Social Psychology*, *76*, 574-586.
- Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality & Social Psychology*, *50*, 703-712.
- Shin, L. M., McNally, R. J., Kosslyn, S. M., Thompson, W. L., Rauch, S. L., Alpert, N. M. et al. (1999). Regional cerebral blood flow during script-driven imagery in childhood sexual abuse-related PTSD: A PET investigation. *The American Journal of Psychiatry*, *156*, 575-584.
- Spielberger, C. D., Gorsuch, R., & Lushene, R. (1970). *The State-Trait Anxiety Inventory (STAI)*. Consulting Psychologists Press: Riverside, CA.
- Stark, R., Walter, B., Schienle, A., & Vaitl, D. (2005). Physiological correlates of disgust and disgust sensitivity. *Journal of Psychophysiology*, *19*, 50-60.
- Troop, N. A., & Baker, A. H. (2009). Food, body and soul: The role of disgust in eating

- disorders. In B. O. Olatunji, & D. McKay, (Eds.), *Disgust and its Disorders: Theory, Assessment, and Treatment* (pp. 229-251). Washington, DC: APA.
- Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Personality Processes & Individual Differences, 97*, 103-122.
- Van Overveld, W. J. M., de Jong, P. J., & Peters, M. L. (2009). Digestive and cardiovascular responses to core and animal-reminder disgust. *Biological Psychology, 80*, 149-157.
- Van Overveld, W., de Jong, P., Peters, M. L., Cavanagh, K., & Davey, G. (2006). Disgust propensity and disgust sensitivity: Separate constructs that are differentially related to specific fears. *Personality & Individual Differences, 41*, 1241-1252.
- Woody, S. R., & Teachman, B. A. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science & Practice, 7*, 291-311.