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EXPLICATION OF MORAL DISGUST: ASSESSING PHYSIOLOGICAL AND  
BEHAVIORAL RESPONSES TO DISGUST ELICITING VIDEOS

A Dissertation  
presented in partial fulfillment of requirements  
for the degree of Doctor of Philosophy  
in the Department of Psychology  
The University of Mississippi

by

SARAH M. SCOTT

May 2019

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## ABSTRACT

The emotion, disgust, consists of four domains: core, animal reminder, contamination, and moral. Moral disgust is a relatively new concept and characterized by moral violations of community, autonomy, and divinity. The CAD triad hypothesis proposes that the moral emotions of contempt, anger, and disgust correspond with the aforementioned violations, respectively. Disgust, like all emotions, is comprised of three components: cognitive, physiological, and behavioral. The current study examined individuals' cognitive (self-report), physiological (skin conductance; heart rate), and behavioral (avoidance; facial muscle activation) responses when exposed to disgust eliciting videos, specifically to explicate the moral domain. Participants were 108 undergraduate students (62% female) who participated in exchange for research or course credit. The sample consisted of 70.4% Caucasian, 13.9% African-American, 13% Asian, 2.8% Hispanic, and 2% multiracial individuals. Ages ranged from 18-26 years ( $M = 19.04$ ;  $SD = 1.33$ ). Individuals presented to the lab, completed self-report measures, and engaged in a behavioral task that entailed watching six 2:00 minute disgust eliciting video clips. Each video clip was associated with a specific domain of disgust, including core, animal reminder, contamination, moral - community, moral - autonomy, and moral - divinity.

Results indicate a significant self-reported disgust response among core, animal reminder, and contamination domains, whereas the moral domains elicited both anger and disgust. Physiologically, no change was measured in skin conductance; heart rate decrease in response to animal reminder, contamination, community, and autonomy video clips. Significant behavioral avoidance was demonstrated when presented with the core and animal reminder video clips.

Further, when measuring facial muscle activation, the levator labii was significantly activated in response to the core video clip, but no others. The current study highlights the difficulty in establishing characteristic responses to disgust stimuli, especially within the moral domain. However, it is evident that the moral domain video clips do elicit a mixed emotional response, primarily anger and disgust. This finding further establishes the complexity of the domain and supports future research focusing on the incorporation of additional physiological measures, as well as parsing out additional emotional responses.

## LIST OF ABBREVIATIONS AND SYMBOLS

DQ	Disgust Questionnaire
BII	Blood-injection-injury
OCD	Obsessive Compulsive Disorder
ANS	Autonomic nervous system
PNS	Parasympathetic nervous system
SNS	Sympathetic nervous system
HRV	Heart rate variability
EMG	Electromyography
BAT	Behavioral avoidance/approach task
PTSD	Posttraumatic Stress Disorder
DPSS-R	Disgust Propensity Sensitivity Scale Revised
DSR	Disgust Scale Revised
TDDS	Three Domains Disgust Scale
SUDS	Subjective Units of Distress Scale
MDES	Modified Differential Emotions Scale
SC	Skin conductance
BPM	Beats per minute
MANOVA	Multivariate Analysis of Variance
EMG-v	Electromyography variance
SC-v	Skin conductance variance

## ACKNOWLEDGMENTS

I express my deepest appreciation to my advisor, Dr. Danielle Maack and my committee members, Drs. John Young, Alan Gross, and Marvin King.

In addition, I thank my family, Nannette Scott, Eddie Scott, and Scotty Scott, for always believing in me and pushing me to succeed.

Additionally, I thank my husband, Bryce Bossin, for supporting me emotionally during this academic pursuit and reminding me to make time for myself.

Lastly, I acknowledge the collegial support from my fellow doctoral students, especially Brooklee Tynes. You made this chapter of my life enjoyable and enriching.

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## I. INTRODUCTION

In humans' everyday life, an emotion is conceived as a feeling, or an inner state (Plutchik, 2001). It is difficult to operationally define an emotion, as it is estimated that there are over 90 definitions of "emotion" proposed within the last century (Plutchik, 2001); however, it is necessary to stress that it is not simply just a state of feeling. The most widely accepted definition of emotion comes from Scherer's major theory of emotion, Component Process Model. Emotion is formally defined as "an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism" (Scherer, 1986; 2001). These five organismic subsystems consist of a combination of the Central Nervous System, Neuro-endocrine System, Autonomic Nervous System, and Somatic Nervous System, which then determine five independent emotional components: 1- cognitive (appraisal), 2- neurophysiological (bodily symptoms), 3- motivational (action tendencies), 4- motor expression (facial and vocal expression), and 5- subjective feeling (emotional experience; Scherer, 2001).

Similar to Scherer, Darwin (1871) proposed that emotional expressions are distinct, serve a useful purpose, are the result of the nervous system, and are the external manifestations of the individuals' state of mind. Emotions are an essential part of life and necessary to survival. Researchers have suggested that select emotions, specifically fear and anger, have evolved to cope with problems faced by our ancestors, such as vicious animal encounters (Cosmides & Tooby, 2004). However, others assert emotions are socially or psychologically constructed

phenomena that are dependent on advanced cognitive processing, rather than biologically inherited (Scarantino & Griffiths, 2011).

Sociologist, Peggy Thoits, organizes emotions on a “micro-level” (social psychological) and “macro-level” (structural-cultural; 1989). Thoits (1989) explains that sociology researchers refer to emotions based on four components, including 1- appraisal of a situational stimulus or context, 2- changes in bodily sensations, 3- outward bodily expressions, and 4- a cultural label applied to specific patterns of one or more of the first three components (Frijda, 1986; Gordon, 1981; Kemper, 1978; Thoits, 1984). Further, it is not necessary for all components to be experienced simultaneously in order to be recognized as an emotion (Thoits, 1989). On a micro-level, subjective self-reports, facial expressions, and physiological changes are often indicators of an emotional experience (Thoits, 1989). On a macro-level, Thoits (1989) describes emotions as consisting of two types of indicators: 1- frequency, intensity, or duration of an emotional experience as measured subjectively and 2- content codes for emotional experiences found in society (e.g., textbooks, magazine articles, television). These sociological levels help explain how emotions are defined, in addition to how they are experienced, as they are largely dependent on society. In summary, there are many definitions of emotions; however, emotions are largely defined by their characteristics or components universally, evolutionarily, and sociologically.

As described above, many major theories of emotion agree there are at least three aspects or components of emotions: 1) the physical component, including physiological arousal (e.g., heart rate, skin conductance); 2) the cognitive component, including the appraisal of the situation/stimulus; and 3) the behavioral component, expressed as an outward response to a situation/stimulus through facial expression or behavioral avoidance (Darwin, 1871; Ekman, 1992; Frijda, 1986; Gordon, 1981; Izard, 1984; Kemper, 1978; Scherer, 2001; Thoits, 1984). The

physical components of emotional arousal are objectively measured through skin conductance, heart rate, and brain activity (Dimberg, 1987; Rohrman & Hopp, 2008; Vrana, 1993). The cognitive component of emotion is typically measured through the use of a subjective self-report measure that asks the individual to rate the emotion he/she perceives as occurring. Finally, the behavioral component is measured by observation, as approach or avoidance of stimuli, in addition to the objective measurement of facial muscle activation (Dimberg, 1987; Rohrman & Hopp, 2008; Vrana, 1993). Ekman and Friesen (1971) reported six basic facial expressions of emotions that are supported across many different cultures, including anger, happiness, fear, surprise, disgust, and sadness. Emotional experiences are often confusing, especially when experiencing more than one emotion at a time; language does not simplify this problem, but introduces ambiguity in describing these emotions (Plutchik, 2001). Thus, using multiple methods of measurement when examining emotions provides the most accurate conceptualization. As a basic emotion with a multifaceted presentation, disgust is an interesting emotion to explore.

### *Disgust Domains*

Within the realm of emotions, disgust has been defined as a response to “something revolting, primarily in relation to the sense of taste, as actually perceived or vividly imagined; and secondarily to anything which causes a similar feeling, through the sense of smell, touch, and even eyesight” (Darwin, 1872/1965, p. 253). The physiological component of disgust is limited in research, but associated with a predominantly parasympathetic response, which will be addressed in depth later (Levenson, 1992; Levenson, Ekman, & Friesen, 1990). Cognitively, the “mental or feeling component of (the) emotion” is described as revulsion and is rather short in duration (Ekman, 1992). From an evolutionary perspective, disgust is considered an adaptive

response to harmful oral stimuli as a means to promote safety through behavioral characteristics, such as nausea and/or distancing oneself from the disgust evoking object, event, or situation (Angyal, 1941; Darwin, 1872/1965; Ekman, 1992). The behavioral component further exemplifies the desire to prevent ingestion, as the characteristic “disgust face” is functional in rejecting unwanted food and odors by wrinkling the nose, lowering the jaw, and raising the upper lip (Ekman & Friesen, 1975; Izard, 1971). To better understand the physiological, cognitive, and behavioral components of disgust, it is important to have a detailed understanding of the four domains of this emotion (i.e., core, animal reminder, contamination, moral).

Rozin, Haidt, and McCauley (1999) proposed four domains of disgust in response to the diverse range of stimuli and situations that elicit a disgust response. Initially, the entire emotion was characterized as an offensive eating experience, yet as the area of research has grown, this oral offensiveness is narrowed to core disgust (Olatunji, Williams, Sawchuk, & Lohr, 2005). Specifically, the core domain is characterized as a real or perceived threat of oral incorporation (Rozin & Fallon, 1987). Core disgust typically includes a reactive sense of offensiveness that is often evoked by spoiled foods, small animals and rodents, bodily waste (feces and urine), and products associated with garbage (Rozin, Haidt, & McCauley, 1999). Furthermore, core disgust has been associated with behavioral avoidance, actively shifting attention away from the stimuli (e.g., gaze avoidance, physically distancing oneself; Olatunji, Haidt, McKay, & David, 2008). An example of behavioral avoidance includes when an individual might encounter a disgust stimulus, such as feces, he or she will not only look away, but also take steps to escape the situation when the stimulus is present.

Additionally, core disgust plays a significant role in the development and maintenance of various psychopathologies. Multiple correlations between spider fear and self-report measures of

core disgust have been found in the literature (de Jong, Andrea, & Muris, 1997; Matchett & Davey, 1991; McKay & Tsao, 2005; Merckelbach, de Jong, Arntz, & Schouten, 1993; Mulkens, de Jong, & Merckelbach, 1998), specifically through associations with the Disgust Questionnaire (DQ; Rozin, Fallon, & Mandell, 1984). De Jong and Merckelbach (1998) elaborated to explain that the DQ only taps core disgust, as it measures oral-centered disgust. Further, disgust literature supports the idea that evolutionarily, spiders are likely to acquire disgust-evoking properties, as they are associated with body products or spoiled foods. De Jong and Merckelbach (1998) explain that spiders can be considered “contaminants” and, among spider-fearful individuals, can reduce the edibility of food through brief contact. Additionally, research has demonstrated a relation between eating disorders and disgust reactions. Specifically, individuals diagnosed with disordered eating endorse higher levels of disgust reactions to food, overweight body shapes, death, and sympathetic magic (Cooper, Morrison, Bigman, Abramowitz, Lewin, & Krener, 1988; Harvey, Troop, Treasure, & Murphy, 2002; Troop, Murphy, Bramon, & Treasure, 2000). McKay and Tsao (2005) implicated core disgust reactions more specific to eating disorders, as these reactions are typically centered around individuals’ response to high calorie food and overweight body shapes.

A second domain of disgust is animal reminder disgust. Becker (1973) argued that the most critical threat to mental health is the certainty of death, which only humans can acknowledge. In general, animal reminder disgust encompasses the emotion evoked when anything reminds individuals of their own mortality and inherent animalistic nature, in addition to mutilations, blood, and death (Rozin, Haidt, & McCauley, 1999). A large body of research examines the role that animal reminder disgust plays in blood-injection-injury (BII) phobia. While specific phobias are primarily characterized by the activation of the sympathetic nervous

system, BII phobia has been demonstrated as having a biphasic physiological response pattern of the typical sympathetic activation followed promptly by significant parasympathetic activation (Öst, Sterner, & Lindahl, 1984; Page, 2003). This biphasic response often results in a vasovagal syncope, or fainting, as the individual exhibits a sudden drop in heart rate and blood pressure. Individuals with BII phobia have demonstrated higher disgust sensitivity on animal reminder subscales than spider phobics and nonclinical controls (Tolin, Lohr, Sawchuk, & Lee, 1997), suggesting that individuals with BII phobia respond to blood-injection-injury stimuli with more disgust than fear.

Furthermore, contamination disgust refers to the emotion elicited when in contact with undesirable people, specifically to protect the body, soul, and social order (Rozin, Haidt, & McCauley, 2008). Contamination disgust domain elicitors consist of direct and indirect contact with strangers, especially those unknown, ill, or tainted by disease, misfortune, or immorality (Olatunji, Cisler, McKay, & Phillips, 2010; Rozin et al., 2008). Examples include contact with a person that has an amputated limb or pneumonia. While fear certainly plays a role in the development of contamination-based Obsessive-Compulsive Disorder (OCD), disgust is also present. Self-report questionnaires of disgust propensity (defined as a tendency to react with a disgust response to any given situation; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) consistently correlate with self-report contamination fears (Olatunji et al., 2010; Olatunji, Lohr, Sawchuk, & Tolin, 2007; Olatunji, Sawchuk, Arrindell, & Lohr, 2005) as well as with behavioral avoidance of contamination-related stimuli (Deacon & Olatunji, 2007). Sawchuk, Lohr, Westendorf, Mennier, and Tolin (2002) reported that disgust may function as the primary emotion in contamination-based OCD and BII phobia with fear as a secondary emotion.

Finally, moral disgust is characterized by the reaction to moral violations, or demonstration that an individual lacks the normal human motives and may be considered “sick” or “twisted” (Olatunji, Adams, Ciesielski, David, Sarawgi, & Broman-Fulks, 2012). In a cross-cultural study of emotional responses, Scherer (1997) reported disgust as the most correlated emotion with appraisals of immorality. Specifically, when individuals are asked to nominate acts that elicit disgust, the majority of acts are moral in nature, including racism, child abuse, hypocrisy, and political parties (Haidt, Rozin, McCauley, & Imada, 1997). Only 25% of the examples that participants offered fell within the core, animal reminder, or contamination domains, suggesting disgust has expanded beyond the traditional domains of disgust and into a more social domain (Haidt et al., 1997; Olatunji et al., 2012). Behavioral avoidance is a common reaction when individuals are exposed to a core disgust stimulus, but is similarly elicited when in the presence of a person that has committed a moral offense, such as incest or murder; Rozin, Lowery, and Ebert (1994) found that those who commit moral transgressions are perceived to be as aversive as someone with a serious contagious illness. When attempting to accurately classify the domains of disgust, especially moral, it is important to identify the three aforementioned components of disgust (physical, cognitive, behavioral).

#### *Physiological Response in Disgust*

The parasympathetic nervous system (PNS) and sympathetic nervous system (SNS) are the two branches subsumed within the autonomic nervous system (ANS) that are involved in the production of physiological arousal. The PNS, more generally, is characterized as “rest and digest.” The PNS involves functions that do not require an immediate reaction to the surroundings, such as a decreased heart rate and blood pressure, increase in salivation, constriction of pupils, and decrease in body temperature (Appelhans & Leuken, 2006).

Contrasting the PNS, the SNS initiates the “fight or flight” response and is used to mobilize the body’s response under stressful conditions. When the SNS is activated, individuals respond with an increased heart rate, increased blood pressure, dilation of the pupils, inhibition of saliva secretion, inhibition of the digestive system, and a release of norepinephrine and epinephrine from the adrenal glands (Appelhans & Leuken, 2006). The PNS and SNS interact antagonistically to influence cardiac activity, so an increase in heart rate could arise from either increased sympathetic activity or decreased parasympathetic inhibition (Appelhans & Leuken, 2006).

The physiological response to disgust is typically characterized by an activation of the PNS, while anxiety, fear, and anger activate the SNS (Fernandez, Pascual, Soler, Elices, Portella, & Fernandez-Abascal, 2012; McKay & Tsao, 2005). However, the expected physiological responses to disgust stimuli are somewhat equivocal. For example, according to a study conducted by Vrana (1993), 50 participants imagined 31 situations eliciting disgust, anger, pleasure, and joy in 8-second trials. The researchers aimed to examine the subjective emotion reported, the participants’ facial muscle pattern, and heart rate. In response to disgust imagery, facial activation differentiated disgust from anger; further, an increase in heart rate during disgust imagery was demonstrated, along with no change in electrodermal skin conductance levels (Vrana, 1993). Similarly, Prkachin, Williams-Avery, Zwaal, and Mills (1999) investigated cardiovascular changes among participants when read 1-minute narratives of different self-referent emotion-evoking incidents. A total of five narratives were read to each participant; each narrative was identified prior to the study in which the participant reported “pure” happiness, anger, fear, sadness, or disgust. In support of Vrana’s findings (1993), Prkachin and colleagues (1999) also found an acceleration in heart rate during disgust imagery. The replicated increased



heart rate found in the studies conducted by Vrana (1993) and Prkachin et al. (1999) are likely due to the imaginal nature of the disgust stimuli; however, overall, research is somewhat unclear regarding a definitive physiological response to disgust.

Rohrman and Hopp (2008) examined cardiovascular reactions in 100 participants while watching a neutral film (screensaver), an upper extremity amputation film (animal reminder domain), and a video of a person vomiting (core domain); each video lasted for 63 seconds. The results from the study indicated that both disgust films did subjectively evoke disgust, as well as an increase in electrodermal activity. Cardiovascular reactions were indicative of a coactivation of the sympathetic and parasympathetic systems; changes in heart rate variability (HRV) and a decrease in diastolic and systolic blood pressure indicate either heightened parasympathetic activity or lowered or stable sympathetic activity. Although disgust was the predominant emotion subjectively reported, Rohrman and Hopp (2008) suggested that other emotions were also induced while watching the disgust films which supports Levenson's (1994) assumption that emotions induced in a laboratory setting are often mixed.

In response to Olatunji and colleagues' (2007) factor analytical studies indicating core disgust and animal-reminder disgust elicitors as two distinguishable constructs, van Overveld, de Jong, and Peters (2009) investigated whether these constructs elicit distinct physiology reaction patterns, particularly among individuals with differing levels of blood fear (characteristic of blood-injection-injury phobia). Researchers conducted guided imagery of core disgust, animal-reminder disgust, and neutral stimuli with 60 total participants (30 low blood-fearful; 30 high blood-fearful). The scripts read were each 5-minutes in length and read aloud to the participants while they closed their eyes and were instructed to fully concentrate on the script. Throughout the imagery, participants' saliva production, facial muscle activation, heart rhythm, blood

pressure, and skin conductance levels were simultaneously measured. Findings from van Overveld and colleagues' study (2009) indicated that guided imagery of disgust elicited an increase in saliva production, decrease in cardiac sympathetic activation, and electromyography (EMG) activity of the major levator labii; however, this physiological response was not dependent on the type of disgust elicitor read to the participant. In contrast, previous research found that high blood-fearful individuals demonstrated more parasympathetic reactivity in cardiac measures when exposed to animal reminder stimuli (e.g., surgery films; Öst et al., 1984). Overall, within van Overveld et al.'s study (2009), the core disgust script did evoke stronger subjective experiences of disgust than the animal reminder script and this subjective response was more pronounced in participants with high blood fear. Van Overveld and colleagues' (2009) study supports the physiological characteristics of disgust independent of specific disgust domains.

De Jong, van Overveld, and Peters (2011) furthered Rohrman and Hopp's research (2008), which examined cardiovascular reactions while watching 63-second video clips of an upper extremity amputation (animal reminder), a person vomiting (core), and a neutral video. De Jong et al. (2011) lengthened the disgust evoking videos to 5 minutes. The videos used in this study included a neutral clip (glass making) and core disgust clip (from MTV's *Jackass*, containing a milk-drinking contest, during which individuals in the film vomited). De Jong and colleagues (2011) primarily sought to examine whether the cardiac and digestive components of the PNS were activated during disgust inducing videos and whether this was more pronounced in participants with high disgust propensity or enhanced disgust sensitivity. Results from the current study indicated a physiological response characterized by increased parasympathetic activity of both the cardiac and digestive components, paired with increased sympathetic

activation of the cardiac system. Additionally, disgust propensity did not moderate subjective disgust, nor did disgust sensitivity enhance physiological reactions. Consistent with Rohrman and Hopp's (2008) findings, evidence to support both a parasympathetic and sympathetic activation as part of the disgust response was demonstrated. De Jong and colleagues (2011) speculated the concurrent activation of sympathetic and parasympathetic systems may support the metabolic requirements of disgust-induced avoidance and escape behaviors, similar to the sympathetic support of the fight/flight responses in a fear-eliciting situation.

Kreibig, Samson, and Gross (2013) conducted a study with 43 women, examining the self-report, facial EMG, cardiovascular, electrodermal, and respiratory measures of these participants in response to film clips that elicited amusement, disgust, or mixed emotions. A total of 45 film clips, between 25-30 seconds each, were used by Kreibig and colleagues (2013) with examples including the following: amusement- a slip of the tongue during wedding vows; disgust- hitting the head against a cliff when attempting to cliff jump into water; and mixed- a boy falling while riding his skateboard on a treadmill. Disgust video clips resulted in an overall decreased cardiac activity (including heart rate), decreased finger temperature, increased skin conductance level, and increased respiration rate with decreased inspiratory flow rate (Kreibig et al., 2013). These findings support previous studies, which have also found cardiac sympathetic withdrawal and decreased finger temperature (de Jong et al., 2011; Rohrman & Hopp, 2008; van Overveld et al., 2009). Further, the mixed emotion video clip suggests a unique emotional state with a subjective co-occurrence of disgust and amusement and distinct physiological response; this differed from the disgust response in that it elicited less sympathetic cardiac withdrawal and a shift to breathing expiration.

Empirical research examining the physiological similarities and differences between physical disgust (specifically core and animal reminder) and moral disgust is sparse with only two independent studies completed (Ottaviani, Mancini, Petrocchi, Medea, & Couyoumdijan, 2013; Zhang, Guo, Zhang, Lou, & Ding, 2015). Ottaviani and colleagues (2013) examined the subjective and autonomic characteristics of physical (core) and moral disgust using audio scripts in 40 participants (20 men, 20 women) while their HRV was being recorded. The physical disgust script used was a man vomiting, while the moral disgust script included an incestuous act between a parent and child. Subjectively, after controlling for disgust sensitivity and obsessive-compulsive tendencies, both scripts elicited disgust; however, the moral disgust script additionally elicited indignation and contempt, while the physical disgust script additionally elicited dirtiness. Physiologically, participants in Ottaviani and colleagues' study (2013) displayed no heart rate change during the vomit script, but a significant increase during the incest script, suggesting enhanced parasympathetic activation in response to the physical disgust script and sympathetic dominance during the moral script. As the study indicated, researchers were examining moral disgust in general and did not consider specific violations. When considering this specific incest situation (a parent violating a child), this type of violation may elicit an anger response, thus activating a sympathetic reaction.

Zhang and colleagues (2015) further explored the relationship between core and moral disgust domains by recording brain processing when participants were shown core disgust, moral disgust, and neutral pictures while performing a modified oddball task. The modified oddball task is a computerized program where subjects respond (using a keyboard, pressing either the "F" key for standard stimuli or "J" key for deviant stimuli) to target stimuli that occur infrequently and irregularly within a series of standard stimuli. This modified task consisted of

four blocks of 100 trials consisting of 70 standard and 30 deviant stimuli trials. A neutral chair picture was the standard stimulus; the 30 deviant stimuli consisted of 10 core disgust images (vomit), 10 moral disgust images (a person kicking a homeless individual), and 10 neutral images (coffee mug). Findings indicated the processing of core and moral disgust pictures were mediated by different neurocognitive mechanisms. More specifically, Zhang and colleagues (2015) reported that core disgust stimuli could be attended to and encoded more rapidly and automatically than moral disgust stimuli. Zhang et al.'s (2015) study supports the theory that moral disgust may elicit multiple emotions (disgust, anger), as the slower response may be due to enhanced attentional resources. Furthermore, a characteristic specific to core disgust is avoidance of pathogens, so the quick response measured by Zhang and colleagues (2015) may be attributed to an evolutionary component of avoidance.

Conflicting evidence regarding the physiological response to disgust stimuli has been demonstrated throughout related research. Much of the literature proposes an activation of the parasympathetic system or decrease in sympathetic activation in response to disgust stimuli (Fernandez et al., 2012; McKay & Tsao, 2005). The heart rate pattern demonstrated in Ottaviani and colleagues' study (2013) using a vocal script replicated previous findings obtained using guided imagery (van Overveld et al., 2009) and video clips (Kreibig et al., 2013; Rohrman & Hopp, 2008), suggesting an increase in parasympathetic activity of the cardiac and digestive components in response to core disgust stimuli. In contrast, findings support a sympathetic activation when reading a disgust evoking narrative (Prkachin et al., 1999) and imagining a disgust-eliciting situation (Vrana, 1993), which is hypothesized as due to mental effort required using imaginal procedures (de Jong et al., 2011; Ottaviani et al., 2013). However, research using video clips of core disgust stimuli, (de Jong et al., 2011), audio scripts evoking animal reminder

disgust (Rohrman & Hopp; 2008), and guided imagery of moral disgust stimuli (Ottaviani et al., 2013) supports coactivation of sympathetic and parasympathetic systems, indicative of mixed emotions.

Research examining the change in skin conductance is sparse, but generally, an increase in skin conductance is experienced when an individual is either positively or negatively aroused (e.g., fear, anger, disgust, embarrassment, sexual arousal; Bradley, Codispoti, Cuthbert, & Lang, 2001; Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 2000; Meissner, Muth, & Herbert, 2011). An increase in skin conductance has been demonstrated in response to core and animal reminder disgust imagery (van Overveld et al., 2009) and core disgust video clips (de Jong et al., 2011; Rohrman et al., 2009). Conversely, Fernandez and colleagues (2012) reported an increase in skin conductance levels in response to videos eliciting fear and anger, but not disgust videos. Overall, changes in skin conductance is a standard measure of autonomic arousal and provide a singular measure that needs supplementing by other physiological, subjective, or behavioral measures.

Literature regarding the physiological response to disgust stimuli is somewhat limited and contradictory. Although much of the disgust research supports an activation of the parasympathetic system or decrease in sympathetic activation, as measured by heart rate pattern (Fernandez et al., 2012; McKay & Tsao, 2005). The disparity in heart rate pattern is likely due to the type of stimuli used and the potential activation of multiple emotions, including both anger and disgust. Additionally, skin conductance is a reliable measure of autonomic arousal (Bradley et al., 2001; Cuthbert et al., 2000; Meissner et al., 2011) and proves beneficial when simply wanting to measure whether an individual is emotionally aroused. In disgust evoking situations, as with any other strong emotion, it is expected that skin conductance will increase. Overall, the

use of physiological measures provides another component of the emotion disgust, but behavioral characteristics and subjective responses offer additional support.

### *Behavioral Characteristics of Disgust*

The primary action tendency for disgust is behavioral avoidance (Izard, 1993), specifically distancing oneself from an object, event, or situation that is perceived as disgust evoking (Olatunji, Lohr, et al., 2007; Rozin et al., 2008). This behavior is characterized as rejection and serves as a defensive function for the individual (Olatunji & Sawchuk, 2005). Further, research provides evidence that disgust functions as a motivator to avoid stimuli associated with contamination in order to prevent the transmission of disease (Matchett & Davey, 1991; Webb & Davey, 1992). Specifically, disgust sensitivity has been associated with contamination fear and washing behavior (Olatunji et al., 2005). Curtis (2007) adds support for the disease prevention role of disgust by emphasizing hygiene behaviors in animal species and the biological capacity that disgust, developed through evolutionary means, has on influencing human culture regarding what people appraise as disgusting. Tybur, Lieberman, and Griskevicius (2009) suggest that individual differences in disgust sensitivity can easily be conceptualized into three relevant domains regarding avoidance of infectious disease, avoidance of costly sexual behavior, and avoidance of antisocial norm violators. Olatunji and Sawchuk (2005) suggest that disgust avoidance may not be predominantly motivated by disease development, but by the avoidance of our human frailty and vulnerability, which is characteristic of the animal reminder disgust domain.

Avoidance of disgust stimuli is typically measured observationally; a behavioral avoidance/approach task (BAT) is an objective measure of steps completed towards a stimulus or situation. However, when conceptualizing avoidance, it is important to consider both active and

passive features. Active avoidance involves some form of escape from the stimulus, whereas passive avoidance is conceptualized as the rejection of a stimulus (Olatunji & Sawchuk, 2005). More specifically, active avoidance includes the physical movement away from a stimulus or situation upon exposure (e.g., leaving the room away from disgusting stimuli) and passive avoidance is often initiated once the individual is exposed to disgust stimuli. An example of passive avoidance would be pushing the stimulus away, closing one's eyes, or plugging one's nose. Research supports that avoidance of disgust stimuli typically involves passive avoidance and rejection, as opposed to the active avoidance or escape behavior (Roseman, Wiest, & Swartz, 1994; Rozin, Haidt, & McCauley, 2000).

Consistent with the function of avoidance, facial features of the disgust response appear to be directed at either discouraging entry of substances into the mouth and nose, or the immediate removal of toxic substances (Olatunji & Sawchuk, 2005; Plutchik, 1980; Rozin et al., 2000). Evolutionarily, this is functional, as the facial expression serves to expel offensive substances from the mouth, while concurrently blocking harmful odors from the nose (Rozin & Fallon, 1987) and can be readily identified across different cultures (Ekman, 1982; Tracy, Robins, & Schriber, 2009). The well-defined facial expression of disgust, otherwise known as the "disgust face" or "gape," is primarily characterized by the raising of the upper lip and wrinkling of the nose (Ekman & Friesen, 1978); however, lowering of the jaw, closing of the eyes and pupil constriction, extrusion of the tongue, and furrowing of the eyebrows are also related to disgust (Ekman, 1982; Izard, 1971; Levenson, 1992; Olatunji & Sawchuk, 2005; Vrana, 1993). Specifically, when measuring disgust, the levator labii muscle region (raising of the upper lip and wrinkling of the nose) in addition to the corrugator muscles (furrowing of the eyebrow; Davey, 2011) provide a reliable, physiological index that appears to be unique to the



emotion disgust (de Jong, Peters, & Vanderhallen, 2002; Vrana, 1993). Similar to disgust, the anger face is also characterized by a furrowing of the brow; however, differences include widening of the nose, thinning of the lips, and raising of the chin (Ekman & Friesen, 1978; Tracy et al., 2009).

Rozin and colleagues (1994) thoroughly analyzed the facial expression of disgust by matching a variety of disgust faces to verbally described disgust eliciting situations. Results indicated that the wrinkling of the nose is likely associated with offensive smells, and to a lesser degree, bad taste. Further, the gape and tongue extrusion are primarily associated with offensive foods and oral irritation, whereas the raised upper lip is associated with a much broader range of disgust elicitors, including aversive interpersonal contact and moral offenses (Rozin et al., 1994). Across many cultures, Haidt and colleagues (1997) found that the words and facial expressions used to reject core disgust stimuli are also used to reject some socially inappropriate situations, including cannibalism, pedophilia, torture, hypocrisy, fawning, and betrayal. Gutierrez, Giner-Sorolla, and Vasiljevic (2012) conducted a study examining participants' subjective emotional response and facial expression in response to scenarios, including descriptions of bodily violations (animal reminder disgust domain) and norm violations (moral disgust domain). The results indicate that verbal self-report of disgust in response to pure moral transgressions (e.g., a coercive workplace relationship) are predicted by endorsement of disgust facial expressions. Interestingly, the same result (endorsement of anger facial expression) was not seen with self-report of anger. Gutierrez and colleagues (2012) suggest facial expressions are not used as an infallible indicator of a "true" emotional state, but as a means to differentiate between two emotions whose terms in English cluster closely (i.e., disgust and anger).

Rozin, Lowery, Imada, and Haidt (1999) conducted the first study to examine whether moral disgust stimuli resulted in the raising of the upper lip and wrinkling of the nose. Participants were read scenarios aloud which described community, autonomy, and divinity violations (subcomponents of moral disgust), then asked to pose the appropriate facial expression given the scenario. Rozin and colleagues (1999) used the Facial Action Coding System (Ekman & Friesen, 1978) to visually code the data, which consists of deconstructing each anatomical movement into either a contraction or relaxation of a particular muscle or group of muscles and categorizing it to a specific emotion. According to this measurement, the nose wrinkle and upper lip raise were negatively associated with the community and autonomy violations and positively correlated with the divinity domain.

Chapman, Kim, Susskind, and Anderson (2009) measured facial muscle activation while providing participants with a sample of distasteful liquid (gustatory distaste), photographs of physical disgust stimuli (physical disgust), and monetary offers of varying fairness in an economic game (morality). Results indicated an increase in levator labii activation in response to elevated gustatory unpleasantness, elevated self-report disgust in response to photographs of physical disgust stimuli, and increased unfairness of offers in the economic game. Chapman and colleagues (2009) concluded that facial muscle activation in response to distasteful liquids and physically disgusting photographs are also associated with perceptions of unfair behavior. More specifically, the researchers argued that disgust can be triggered by “abstract” moral violations and that human morality relies on these responses (Chapman et al., 2009).

The levator labii activation related to moral situations has been replicated in a study by Cannon, Schnall, and White (2011) in which scenarios describing unfair behavior (e.g., cheating at cards) resulted in stronger activation of the levator labii than morally fair scenarios. In support

of Rozin and colleagues' findings (1999), Cannon et al. (2011) found that levator labii activation was specific to fairness and purity; violations within the community and autonomy areas of moral disgust did not result in activation. When considering various violations of moral disgust, the levator labii activation in response to divinity violations and transgressions of fairness and purity is consistent with divinity primarily evoking disgust. However, in the reviewed literature (Cannon et al., 2011; Chapman et al., 2009; Rozin et al., 1999), the moral violations used consisted of vocal scripts and the Ultimatum game. While these stimuli do provide a moral dilemma, they are relatively weak and may not elicit intense emotion (Chapman & Anderson, 2013). Future research examining facial muscle activation would benefit from use of more evocative stimuli in order to elicit substantial emotions, in addition to the combined measurement of facial responses, physiological activation, avoidance, and subjective ratings of emotions when explicating moral disgust.

### *Moral Disgust*

As moral disgust is the primary domain of this scientific inquiry, a more detailed explication of the domain is provided. As previously explained, moral disgust is characterized by a reaction to social transgressions and moral violations (Rozin et al., 2000). Shweder, Much, Mahapatra, and Park (1997) proposed a cluster of moral emotions that are both interrelated and distinguishable reactions in response to others committing moral violations. The moral emotions proposed are contempt, anger, and disgust, all of which involve the disapproval of others (Izard, 1977). Rozin, Lowery, Imada, and Haidt (1999) proposed the CAD hypothesis, suggesting that disgust plays a distinct role in morality. Specifically, the CAD hypothesis proposes the moral emotions of contempt, anger, and disgust correspond with violations of three moral codes, community, autonomy, and divinity (Rozin, Lowery, et al., 1999; Shweder et al., 1997). These

three distinct principles, proposed by Shweder and colleagues (1997), are purported to be used by cultures to approach and resolve moral issues.

The first code includes the ethics of community, which conceptualizes the person as an office-holder within a larger interdependent community. Individuals must determine if an action is right or wrong based upon their duty within a community (Rozin et al., 1999). Examples include watching passively as a group of people are discriminated against, parking your vehicle in a handicap parking spot when not disabled, or failing to take steps to expose a local dog fighting ring. Violations within this code are proposed to primarily elicit contempt (Shweder et al., 1997); however, contempt has proven elusive to measure, as it is an underused term and not considered a primary emotion. Difficulty measuring the term “contempt” is partially due to the fact that the term is not as salient for English speakers as other basic emotions. The label “contempt” is simply just not used (Matsumoto & Ekman, 2004), it is relatively inaccessible among English speakers (Wagner, 2000), and not a term that individuals use even when primed (Matsumoto & Ekman, 2004; Wagner, 2000). Plutchik (2001) describes contempt as a primary dyad of the two emotions, disgust and anger. Prinz (2007) hypothesizes measuring these two basic emotions, disgust and anger, in order to evaluate contempt. This was further explained by Prinz in the following way: ‘When a person merely disgusts us, we look away; but when they disgust and anger us, we cannot look away, so we look down on them, repelled, as we are, by their animality’ (2007; p.74). As such, the description of contempt incorporates the avoidance of disgust, paired with anger’s tendency to punish the offender directly (Dubreuil, 2010). Olatunji and colleagues (2012) further propose that disgust may largely be a product of the intensity of anger that is expressed towards the social and moral transgressions. In a pilot study conducted by Scott and Maack (2016), when viewing a video clip of dog fighting, proposed as a community

violation within the moral domain, an interesting combination of anger and disgust were supported following post-hoc analyses. Specifically, verbal self-report disgust ratings significantly predicted written self-report ratings of both disgust and anger (Scott & Maack, 2016). Generally, contempt is not a widely understood emotion and often encompasses both anger and disgust; using a multimodal approach to measure emotions will allow a better understanding of the complex response to community violations.

The second code within the moral domain of disgust includes the ethics of autonomy, which conceptualizes the person as self-governing. An action would be considered a violation if it infringes upon an individual's rights or freedoms or if it directly hurts another person (Rozin et al., 1999). This code protects the individual from harm or abuse and from interference with obtaining physical needs (Shweder et al., 1997). Examples within this code include providers' refusal to treat an ill person because he/she cannot pay, depriving an individual of basic needs, and physical violence aimed at a specific person. Violations within the autonomy code are proposed to primarily elicit anger (Dubreuil, 2010; Rozin et al., 1999). Anger is described as the typical reaction to more legitimate concerns of harm and justice, even if harm is not present, but only presumed. Further, Gutierrez and Giner-Sorolla (2007) conclude that the presumption of harm to an individual as the result of a taboo violation elicits anger. Giner-Sorolla and Chapman (2017) conducted a study in which they provided participants with two scenarios to read. In both scenarios a girlfriend was found cheating on a boyfriend and, in scenario 1, the boyfriend beat the girlfriend, and in scenario 2, the boyfriend beat the girlfriend's cat. Participants' disgust and anger responses were both recorded via verbal report and expression-endorsement measures. Results supported that both anger and disgust were present, but in relation to domestic abuse, anger was the stronger emotion elicited. The autonomy code is an appropriate example of a

complex emotional response that contains a disgust component (specifically moral disgust). For example, racism displays the presence of both disgust and anger concurrently. Disgust is centrally involved in racist attitudes and prejudicial behavior, but the common behavioral response is an aggressive approach, which is more characteristic of anger (Ernulf & Immala, 1987; Olatunji & Sawchuk, 2005). The interaction of anger and disgust maintain the moral code of autonomy (Rozin, Haidt, & McCauley, 1999).

Finally, the third code of moral disgust, divinity, focuses on the individual as a spiritual entity (Shweder et al., 1997). Within the divinity code, disgust is proposed as the emotion that guards the sanctity of the soul (Rozin et al., 2000). A violation within this code includes a person disrespecting the sacredness of God or causing impurity or degradation to the self or others (Rozin et al., 1999). Jones and Fitness (2008) conclude that disgust is elicited following moral transgressions that consist of purity violations or acts of polluting the body. Themes within this code include sacred order, sanctity, tradition, and natural law (Shweder et al., 1997). Examples of divinity violations include incest, homosexuality, disrespecting a place of worship, and burning a religious book. When Rozin, Lowery, Imada, and Haidt (1999) measured facial action units among participants exposed to divinity violations, the highest correlation was among the traditional disgust facial response (i.e. nose wrinkle, upper lip raise, gape, tongue extrusion). Research in this domain has demonstrated that divinity violations may have a cultural component, as U.S. participants demonstrated higher disgust in response to divinity violations than Japanese participants (Rozin et al., 1999). However, that could be due to the low salience of divinity as a moral matter within the Japanese culture, especially given that two of the five divinity situations used in the study were the following: “A person is eating a piece of rotten meat” and “A person is watching someone as he/she bites into an apple with a worm in it.”

Overall, the three emotions within the domain of moral disgust (contempt, anger, disgust) are typically elicited across cultures by violations within the three moral codes proposed by Shweder and colleagues (community, autonomy, divinity; 1997). These violations prove beneficial in distinguishing between disgust domains and within the moral domain.

Moral disgust has been hypothesized as a contributor in the formation and maintenance of psychopathologies and general social issues, including posttraumatic stress disorder (PTSD), sexual dysfunction, OCD, and social ostracism (Olatunji & Sawchuk, 2005; Rozin et al., 1999). For example, in the experience of PTSD, disgust has been implicated in reactions to reminders of the traumatic event, in addition to physiological reactions of disgust, such as nausea and vomiting (Rozin et al., 1999). Posttraumatic stress symptoms, specifically following sexual trauma, are hypothesized to be amplified by moral disgust, in addition to animal reminder disgust (Olatunji, Babson, Smith, Feldner, & Connolly, 2009). In general, elevated disgust has been linked with PTSD among Vietnam veterans (Foy, Sippelle, Rueger, & Carroll, 1984) and women with a history of childhood sexual abuse (Foy et al., 1984; Shin, McNally, Kosslyn, Thompson, Rauch, Alpert et al., 1999). Furthermore, findings suggest that low disgust sensitivity may play a protective role in experiencing less distress when exposed to traumatic events (Olatunji, Armstrong, Fan, & Zhao, 2014); however, specific relations and mechanisms of moral disgust and PTSD have yet to be explored.

Related to sexual dysfunction, sexual activities have potential to be seen as moral disgust elicitors and can enhance anxiety, thus increasing avoidance of sexually related stimuli and activities (Davey, 2011). For example, research has examined disgust propensity and contamination sensitivity among women diagnosed with sexual complaints (Borg, de Jong, & Schultz, 2010; de Jong, van Overveld, Schultz, Peters, & Buwalda, 2009). Specifically, de Jong

and colleagues (2009) demonstrated through a self-report study that women diagnosed with vaginismus (involuntary muscle spasms of the vaginal muscles upon penetration) display enhanced disgust sensitivity in comparison to controls and women diagnosed with dyspareunia (difficult or painful sexual intercourse). Further, Borg and colleagues (2010) separately demonstrated that women experiencing dyspareunia displayed enhanced automatic sex-disgust associations in an implicit association task. De Jong, van Lankveld, Elgersma, and Borg (2010) detail the relation of disgust and sexual problems and explain that specific sexual activity is likely to elicit strong feelings of disgust if that person believes it is “immoral” or inconsistent with his/her internalized moral values. There is value in understanding disgust’s component in sexual disorders, as it would improve efficacy of sexual disorder treatment options and promote dissemination of accurate information regarding sexual problems.

Although disgust in OCD is present within the contamination subtype, there is evidence to indicate an association between religious-focused OCD and moral disgust. Olatunji, Williams Sawchuk, and Lohr (2005) presented findings that self-report disgust towards stimuli with moral implications (e.g., unusual sexual practices) is significantly related with religious obsessions (i.e., fear that one has or will commit sin, intrusive blasphemous mental images, fear of punishment by God). Considering the divinity violation within moral disgust, moral codes (e.g., Old Testament in the Bible) are incorporated into the notions of purity and function as protectors of the soul from moral pollution (Olatunji et al., 2010). Zhong and Liljenquist (2006) found that a threat to one’s moral purity may further elicit disgust and obsessive processes, including increased urges to wash, among some individuals.

Additionally, social ostracism and discrimination have been linked within the domain of moral disgust. Faulkner, Schaller, Park, and Duncan (2004) conducted six studies with Canadian



undergraduates to examine the relationship between disease vulnerability and xenophobic reactions to foreign peoples. Four of Faulkner and colleagues' (2004) studies were correlational and examined constructs through self-report measures; the remaining two studies were experimental in nature and measured participant attitudes toward different immigrant groups following manipulation of vulnerability to disease through contamination images. Findings demonstrated that perceived vulnerability to disease (which is conceptually linked to disgust) predicted implicit cognitions associating foreign, unfamiliar outgroups (e.g., Nigeria, Mongolia, Peru) with danger, but not foreign, familiar groups (e.g., Scotland, Poland, Iceland; Faulkner et al., 2004). Further, researchers discovered participants assigned to high disease-salience conditions (viewed pictures depicting the transmission of bacteria and germs) expressed fewer positive attitudes toward foreign, unfamiliar immigrants and were more likely to endorse policies that favor foreign, familiar individuals (Faulkner et al., 2004). In summary, Faulkner et al. (2004) concluded that feelings of disease vulnerability should be studied as a psychological factor that actively contributes to xenophobic attitudes.

Research conducted by Navarrete and Fessler (2006) also support Faulkner and colleagues' findings that bias among those outside of one's familiarity is moderated in some way with disease threat. Disgust can be a damaging emotion, as it is irreversible and has lasting effects on an individual the disgust is aimed towards. Specifically, disgust (and contempt) may promote the attribution of one's behavior to his/her character (Hutcherson & Gross, 2011). Due to this long-lasting judgment of an individual's worth, ostracism and loss of regard may also result from a person being labeled as morally disgusting (Hutcherson & Gross, 2011). Eisenberger, Lieberman, and Williams (2003) assert that disgust may, in some sense, be the "worst emotion" brought out in others, as it leads to social rejection and extreme mental and

emotional pain. As Rozin and colleagues (2000) suggest, through the association of disgust directed at those outside of one's social circle, racial attitudes and ethnic prejudices are often encouraged.

Izard (1977) similarly explored contempt and its role in prejudice and racism. Research in this area indicates contempt as the “most subtle and coldest” of the CAD triad. Contempt is often displayed when an individual regards those outside of his or her group as inferior, thus engaging in prejudice behaviors (Izard, 1977). Avoidance of individuals different from oneself precludes exposure to corrective information and continues to reinforce the existing negative beliefs (Olatunji & Sawchuk, 2005). This racial and ethnic prejudice has dire implications, including social ostracism and avoidance of minorities. These prejudicial attitudes and behaviors have been an ongoing challenge for society; however, determining the relation that moral disgust specifically plays in moral functioning is the beginning of furthering research to explore ways that moral disgust may be reduced in society. Generally, moral disgust is a complex domain that is characterized by the avoidance of individuals that commit social transgressions or violations (Rozin et al., 1999). The avoidance and disgust of such people can provide individuals with social norms to abide by and help structure policies preventing acts, such as child pornography and domestic violence; however, moral disgust can also promote ostracism and discrimination against outgroup individuals.

### *Present Study*

Taken together, there is a growing interest in moral disgust. Clarifying the moral domain and understanding its relation with the other three more established domains (i.e., core, animal reminder, and contamination) will prove beneficial considering the implications moral disgust has on psychopathologies and social issues. Presently, research has mostly focused on examining

moral disgust alongside physical disgust through subjective ratings, facial responses, and physiological reactions separately; few studies have used a multi-method approach. Additionally, no research has examined moral disgust (using the CAD triad) alongside all three other disgust domains. As such, this study employed a multi-modal approach to assess the relations between moral disgust and its subdomains, along with core, animal reminder, and contamination domains of disgust. Specifically, the study examined subjective ratings, physiological responses (heart rate, skin conductance), facial muscle activation, and behavioral avoidance when viewing video clips of disgust eliciting material.

The core, animal reminder, and contamination domains of disgust are well-established; however, there is much to be learned about the moral domain of disgust. Based on Shweder's "big three" of morality (community, autonomy, divinity; 1997) and the CAD triad hypothesis (Rozin et al., 1999), moral violations were examined and compared within the moral domain and between domains. The current study examined the emotional elicitation in response to community violations, autonomy violations, and divinity violations. Through multi-method assessment, using subjective measurements, physiological assessment (heart rate, skin conductance), and behavioral data (facial muscle activation, avoidance of video clips), participants' responses to disgust evoking video clips were measured.

*Hypotheses:*

- 1) Disgust video clips within the core, animal reminder, and contamination domains will elicit elevated disgust ratings on the MDES when compared to other emotions (e.g., anger), decreased heart rate, increased skin conductance, activation of the levator labii, and behavioral avoidance.
- 2) Within the moral domain, the following are hypothesized:

- a. Community video clip will elicit elevated anger and disgust ratings on the MDES relative to other emotions (e.g., sadness), increased heart rate, increased skin conductance, an activation of the levator labii, and avoidance.
- b. Autonomy video clip will elicit elevated anger ratings on the MDES relative to other emotions (e.g., fear), increased heart rate, increased skin conductance, and no activation of the levator labii.
- c. Divinity video clip will elicit elevated disgust ratings on the MDES relative to other emotions (e.g., surprise), decreased heart rate, increased skin conductance, activation of the levator labii, and avoidance.

## II. METHODS

### *Participants*

Participants included 108 undergraduate students enrolled in psychology courses at the University of Mississippi who received research or extra course credit in return for participation. A priori analysis using G\*power (Faul & Erfelder, 1992) indicated that for the analyses required, a sample size of 87 was needed to detect an effect size of 0.25 with a power of 0.80. Initially, 109 participants' data was collected in the current study, but one participant was detected as an outlier and removed from data analysis upon completion of Mahalanobis Distance. Participants were characterized as 62% female, 70.4% Caucasian, 13.9% African-American, 13% Asian, 2.8% Hispanic, and 2% multiracial individuals. Sixty-two percent of participants identified as Christian, 14.8% Catholic, 12% agnostic/atheist, 5.6% Hindu, 2.8% Buddhist, 1.9% "other," and 0.9% Jewish. Ages ranged from 18-26 years ( $M = 19.04$ ;  $SD = 1.33$ ).

### *Measures*

*Disgust Propensity and Sensitivity Scale Revised* (DPSS-R; van Overveld et al., 2006) is a 12-item self-report measure that is designed to assess the frequency of experiencing disgust (propensity), in addition to the emotional impact of these symptoms (sensitivity). This measure provided the current study a more comprehensive assessment of general disgust that is not confounded by items that are domain specific. Items are measured on a 5-point Likert-type scale with 1 indicating that the statement about disgust is "never" true to the individual and 5 indicating that the statement about disgust is "always" true. Items on the DPSS-R include statements such as, "I avoid disgusting things" and "I screw up my face in disgust." The DPSS-R

demonstrated fair internal consistency with alpha coefficients of 0.69 (Propensity) and 0.71 (Sensitivity).

*Disgust Scale Revised* (DSR; Olatunji, Williams, Tolin, Abramowitz, Sawchuk, Lohr, & Elwood, 2007) is a 27-item self-report questionnaire that measures individual differences in disgust sensitivity across three domains of disgust: core (e.g., “It would bother me to see a rat run across my path in a park”), animal reminder (e.g., “It would bother me to be in a science class, and to see a human hand preserved in a jar”), and contamination (e.g., “I probably would not go to my favorite restaurant if I found out that the cook had a cold”). The DSR is best conceptualized as context dependent, in that it samples specific objects and situations in which individual differences in disgust response may be observed (Olatunji et al., 2007). The proposed study utilized the DSR as a means to measure disgust sensitivity within the core, animal reminder, and contamination domains, as opposed to measuring an individual’s overall disgust propensity. The DSR is scored by averaging scores within each subscale, rather than summarizing, as there are an uneven number of items within each subscale (Olatunji et al., 2007). The DSR total score has an alpha coefficient of 0.88. Further, two of the three subscales of the DSR demonstrated acceptable internal consistency, including Core Disgust,  $\alpha = 0.78$  and Animal Reminder Disgust,  $\alpha = 0.81$ . However, the Contamination Disgust subscale demonstrated fair internal consistency ( $\alpha = 0.63$ ).

*Three Domains of Disgust Scale* (TDDS; Tybur, Lieberman, & Griskevicius, 2009) is a 21-item self-report measure assessing disgust sensitivity related to pathogen, sex, and moral situations. Items are rated on a 0 to 6 scale (0 being “not disgusting at all” and 6 being “extremely disgusting”) and include concepts from each of the domains: pathogen: “shaking hands with a stranger who has sweaty palms;” sex: “performing oral sex;” and moral:

“shoplifting a candy bar from a convenience store.” The scale is composed of three factors that are each internally consistent and related to other measures of disgust (Tyber et al., 2009). In the current study, the TDDS demonstrated good internal reliability: Pathogen  $\alpha = 0.88$ ; Sexual  $\alpha = 0.87$ ; Moral  $\alpha = 0.93$ . The TDDS was included as a means to assess moral disgust in accord with the other more established domains; only the moral subscale was used in analyses.

*Subjective Units of Distress (SUDS)* ratings are verbally reported levels of any designated emotion. For this study, self-reported ratings of disgust, anxiety, and anger were assessed following a behavioral task on a 0 to 10 Likert-type scale. A SUDS rating is conceptualized as a primary appraisal of a specific emotion regarding the individual’s belief that the situation has the specific emotion-eliciting property. The current study assessed SUDS ratings following each video clip, regardless of how long the video was watched (if at all). This was done by verbally asking the participant, “On a scale from zero to ten, with zero being no disgust at all, five being moderate disgust, and ten being extremely intense disgust, what was the highest level of disgust you felt?” Additionally, on the SUDS data form, participants’ willingness to watch the video was recorded (yes/no), along with the minutes and seconds the participant watched the current video clip.

*Modified Differential Emotions Scale (MDES; Gross & Levenson, 1995)* is a self-report measure that consists of eight categories of emotions. Participants rate the intensity of his/her emotional response on a 9-point Likert-type scale ranging from 0 (“Do not feel the slightest bit of the emotion”) to 8 (“The most I have ever felt in my life”). The list of emotions is preceded by the sentence, “When thinking about the \_\_\_\_ video, I feel...” (1) amused, joyful, merry; (2) angry, irritated, mad; (3) contented, satisfied, comfortable; (4) disgusted, nauseated, repulsed; (5) fearful, scared, afraid; (6) neutral, impartial, disinterested; (7) sad, downhearted, blue; (8)

surprised, amazed, astonished. The MDES was used in the analyses as an indicator of emotions experienced other than the target emotions of disgust and anger.

### *Physiological Indices*

I-330-C2+ (J&J Engineering, Inc., 2004) physiological assessment equipment and software was used to obtain heart rate recordings, skin conductance, and facial muscle activation of participants in response to the viewing of video clips. Electrodes were placed on the wrist and fingers of the participant in order to measure heart rate and skin conductance levels. Consistent with previous research, the average change in logged skin conductance and heart rate between the neutral video clip and disgust video clips constituted the skin conductance variance and heart rate variance, respectively (de Jong et al., 2011; van Overveld et al., 2009). In order to measure activation of the levator labii, electrodes were placed on each side of the participant's upper lip. Similar to heart rate and skin conductance, the average difference between the neutral video clip and disgust video clip constituted the levator labii variance.

### *Video Clips*

Seven different video clips were shown to participants while attached to physiological monitors (see Table 1 for details). Disgust video clips were previously piloted in order to ensure the elicitation of appropriate responses, as few studies have used video clips to measure disgust. Each video clip used was two minutes in length, as this length has been determined as a reliable assessment of frequency components of HRV (Task Force of the European Society of Cardiology and the North American Society of Pacing Electrophysiology, 1996). One clip each from the core, animal reminder, and contaminations domains was used, as those domains are well-established, and three clips from the less-researched domain of moral disgust. Further, within the moral domain, a video clip representing each sub-domain was presented: autonomy



code, community code, and divinity code. Additionally, a neutral video clip was presented between each disgust eliciting video in order to return physiological reactions to baseline before assessment of new clip.

TABLE 1 Disgust video clips

<b>Video Clip</b>	<b>Disgust Domain</b>	<b>Video Description</b>
<b>Vomit</b>	Core	A video clip from MTV's <i>Jackass</i> : A participant in the video eats raw eggs, vomits, cooks the vomit into an omelet, then eats the omelet with a second participant
<b>Surgical removal of a cyst</b>	Animal Reminder	A participant is under anesthesia while a surgeon removes the bone below the gum line, makes an incision, and proceeds to drain a cyst
<b>Contamination via hands</b>	Contamination	Public Service Announcement aired in Australia that explains the dangers of not washing your hands and shows images where contamination is most common (bodily waste, restrooms, food)
<b>Dog fighting</b>	Moral (Community)	National Geographic exposé on dog fighting, depicting graphic images of dogs fighting, wincing, and bleeding while participants cheer on the dogs
<b>Domestic violence</b>	Moral (Autonomy)	A woman driving home to meet her significant other; upon arrival, the significant other hits her on the face and repeatedly kicks her in the stomach while she lay on the ground
<b>Bible burning</b>	Moral (Divinity)	YouTube video comprised of an individual burning the Bible with eerie music in the background
<b>Glass making</b>	Neutral	From producer, Burt Haanstra, a short documentary with music and no dialogue about Dutch glass production in the 1950's

To determine which specific video clip to use for each disgust domain, a pilot study was conducted in which participants viewed a total of 12 videos (three videos within each of the domains: core, animal reminder, contamination, and moral). For the current study, the video that evoked the strongest disgust response within each of the core, animal reminder and

contamination domains from the pilot study was used (see Table 1). The core domain video clip consisted of an excerpt from MTV's *Jackass*, depicting a participant eating raw eggs, vomiting, cooking the vomit, and then eating the omelet with a second participant. The animal reminder video depicted the surgical removal of a cyst in the mouth. A public service announcement aired in Australia regarding the importance of washing your hands and the dangers associated with the spread of bodily waste was viewed as the contamination domain video. Analyses from the pilot study indicate that individuals' scores on the Core subscale of the DS-R predicted disgust response to the vomit video ( $\beta = .518, t(48) = 3.120, p < .001$ ), the Animal Reminder subscale of the DS-R predicted disgust response to the cyst removal video ( $\beta = .386, t(48) = 2.869, p < .01$ ), and the Contamination subscale of the DS-R also predicted disgust response to the hand washing video ( $\beta = .319, t(48) = 3.120, p < .01$ ; Scott & Maack, 2016).

Within the moral domain, the videos used were found to be significantly and uniquely related to moral disgust, as measured by the TDDS in the pilot study (Scott & Maack, 2016). The video representing the autonomy code is a public service announcement depicting domestic abuse ( $\beta = .457, t(48) = 3.364, p < .01$ ). The clip consists of a woman driving home to meet her significant other, upon arrival, he hits her on the face and repeatedly kicks her in the stomach while she lay on the ground. Within the community code, a video consisting of a National Geographic exposé on dog fighting was used ( $\beta = .441, t(48) = 3.266, p < .01$ ) The community clip specifically consisted of anonymous interviews detailing the logistics of dog fighting, in addition to various clips shown of dogs fighting. And a YouTube video comprised of an individual burning a Bible represents the divinity code ( $\beta = .128, t(48) = 3.379, p < .01$ ). This specific clip shows an individual setting the cover of the Bible on fire, then opening to the inside to see the pages burning.

Furthermore, a two-minute video clip from a documentary by Bert Haanstra on the making of glass (1958) was used as the neutral video clip. De Jong and colleagues (2011) showed this video clip to participants and asked them to rate to what extent the clips elicited disgust, fear, happiness, anger, and sadness (0 = not at all, 100 = very much). For the neutral glass-making clip, the mean scores for this clip were all below two, with the exception of happiness, which was rated 33.86 (SD = 27.31). Although this documentary elicited some happiness, it was overall not successful in eliciting strong emotion and is supported as a neutral video clip. The neutral clip was shown prior to the viewing of the first disgust video, between each of the disgust video clips, and following the final disgust video to establish baseline physiological activation and return physiological activation back to baseline between clips.

### *Procedure*

Upon arrival to the lab, participants were presented with a short introduction to the experiment and asked to provide written informed consent. Next, participants were asked to complete a packet of questionnaires that consist of the aforementioned self-report measures: DPSS-R, DSR, and TDDS.

Following measure completion, the experimenter or research assistant, used an alcohol swab to clean the participant's left wrist, right ankle, left forefinger, left middle finger, and upper lip to remove excess oils. The experimenter then placed electrodes on the left wrist and right ankle in order to appropriately measure heart rate. The ankle is the preferred location of the "grounding" electrode, but if the participant preferred not to remove his/her shoe or there was difficulty receiving an accurate heart rate reading, the grounding electrode was placed on the right wrist. Both electrodes on the wrist and ankle were held in place with a sweatband. Skin conductance level was measured by placing the electrodes on the palmar side of the middle

phalanges of the second and third fingers on the left hand. Facial electromyography at the levator labii was measured by placing sticky electrodes on each side of the upper lip.

Following connection of physiological equipment, participants were then introduced to the video portion of the study. Participants were asked to watch and rate reactions to six two-minute video clips, in addition to a neutral video. The order of video clips presented was randomly generated prior to data collection using the Research Randomizer software program (Urbaniak & Plous, 2013). An introduction to each specific video was read to the participant prior to beginning the videos, in addition to reminding the participant that he/she has the option of not watching the clip and can stop at any time. Length of clip watched or refusal was documented to assess avoidance.

The neutral clip was shown first in order to obtain a baseline of the participant's physiological activation, followed by assessment of SUDS as a means to measure his/her reaction to the clip. Then, each disgust clip was shown in random order, immediately followed by administration of the SUDS and MDES. Between each of the disgust video clips, the participant was shown the neutral clip until physiological responses returned to baseline, which is recommended as at least two minutes (Task Force of the European Society of Cardiology and the North American Society of Pacing Electrophysiology, 1996). Following the viewing of all video clips, participants were debriefed and granted research or extra course credit.

### *Statistical Analyses*

All variables were analyzed using SPSS to assess between group and within group differences among heart rate (HR), facial muscle activation (EMG), skin conductance (SC), subjective disgust, subjective anger, and behavioral avoidance. When examining physiological data, several outliers were excluded in accordance with previous research which excludes data

points three standard deviations from the mean (de Jong et al., 2011; van Overveld et al., 2009). Specifically, heart rate variables were excluded if they fell three standard deviations outside of the normal heart rate as reported by de Jong and colleagues (2011). Range allowed for resting (baseline) heart rate was 45.03 – 111.87 beats per minute (BPM) and disgust video clips was 43.61 – 116.81 BPM (de Jong et al., 2011). Using this range, 18 HR variables were removed from core disgust clips, 21 from animal reminder, 22 from contamination, 24 from moral-community, 20 from moral-autonomy, and 21 from moral-divinity.

TABLE 2. Physiological data recorded and excluded

	Heart Rate			Electromyography			Skin Conductance		
	Outlier	Missing	Recorded	Outlier	Missing	Recorded	Outlier	Missing	Recorded
Core	18	15	<b>63</b>	1	4	<b>91</b>	2	14	<b>80</b>
Animal Reminder	21	14	<b>65</b>	0	6	<b>94</b>	2	15	<b>83</b>
Contamination	22	16	<b>69</b>	0	8	<b>99</b>	0	20	<b>87</b>
Moral-Community	24	15	<b>65</b>	0	8	<b>95</b>	3	16	<b>84</b>
Moral- Autonomy	20	21	<b>66</b>	0	11	<b>96</b>	0	22	<b>87</b>
Moral- Divinity	21	16	<b>65</b>	0	8	<b>93</b>	4	17	<b>80</b>

Additionally, physiological equipment used for data collection malfunctioned sporadically, so multiple data points were missing for heart rate, EMG, and skin conductance. Also, physiological responses were not recorded for participants that declined to watch the disgust video clips. Table 2 details physiological data that is missing due to equipment malfunction and/or researcher error, removed for outliers, and total measured.

Exclusion of variables from EMG and SC also included any variables that fell outside of three standard deviations of the group mean. One participant’s EMG data was excluded from the

core disgust video clip. Upon examination, four participants' SC data was removed from moral-divinity, three from moral-community, and two from core, and two from animal reminder disgust video clips. However, four SC variable outliers were removed from baseline, which prevented an additional four SC variance disgust variables from being calculated.

### *Data Analytic Strategy*

*Preliminary Analyses.* Preliminary analyses were computed using multiple paired-sample t-tests to identify the strongest emotion evoked in response to viewing each video clip, as measured by the MDES.

*Primary Analyses.* For the primary analyses, Doubly Multivariate Analysis of Variance (MANOVA) tests were conducted to determine whether Heart Rate variance (HRV), Electromyography variance (EMG-v), Skin Conductance variance (SC-v), subjective disgust (SUDS-disgust), subjective anger (SUDS-anger), and behavioral avoidance differed between video clips and among participants over conditions. Additionally, paired samples t-tests were conducted to identify any significant differences between heart rate, skin conductance, and electromyography activity between videos.

Multiple paired sample t-tests were conducted to determine any significant difference when examining disgust and anger within each video, as well as avoidance between videos. Additionally, paired samples t-tests were also conducted to compare mean heart rate, EMG, and skin conductance between baseline video and disgust video clips.

*Secondary Analyses.* Six logistic regression analyses were conducted to test the predictive ability of self-report measures of domain specific disgust sensitivity (DSR; TDDS) on subjective disgust rating (SUDS) in response to disgust video clips (core, animal reminder, contamination, moral-community, moral-autonomy, moral-divinity). Additional logistic regression analyses

were conducted to identify if DPSS-R could accurately predict the disgust response to video clips (SUDS). This provided a more comprehensive assessment of disgust, as the DPSS-R is not confounded by items that are domain specific.

### III. RESULTS

#### *Preliminary Analyses*

The MDES was used to detect the strongest emotion, as it contains the following eight emotional responses: amusement, anger, satisfaction, disgust, fear, neutrality, sadness, and surprise. In response to the core disgust video clip, there was significantly more disgust reported than all other emotions (all  $p$ 's  $< 0.001$ ). Similarly, in response to both the animal reminder and contamination video clips, significantly more disgust was reported than all other emotions (all  $p$ 's  $< 0.001$ ). However, when watching the moral video clips (community, autonomy, divinity), there was significantly more anger reported than all other emotions, including disgust (all  $p$ 's  $< 0.001$ ). In response to the community video clip, anger was the strongest emotion reported, although disgust and sadness were the second and third strongest emotions, respectively. When comparing disgust and sadness in response to the community video, there was no significant difference in emotional response ( $p = 0.23$ ). The autonomy and divinity clips were similar, in that anger was the strongest emotion evoked; however, there was significantly more disgust reported than all remaining emotions, including amusement, satisfaction, fear, neutrality, sadness, and surprise (all  $p$ 's  $< 0.001$ ).

*Hypothesis 1: Disgust video clips within the core, animal reminder, and contamination domains will elicit elevated disgust ratings on the MDES when compared to all other emotions, decrease in heart rate, increase in skin conductance, activation of the levator labii, and behavioral avoidance.*



Descriptive statistics for constructs of interest are presented in Table 3. A paired samples-t-test identified that disgust (as measured by MDES) was the strongest emotion elicited, relative to all other emotions, when watching the core, animal reminder, and contamination video clips (all  $p$ 's < 0.001). A second paired samples t-test was computed to determine any significant differences in subjective disgust ratings (SUDS) between core, animal reminder, and contamination video clip. Results indicate significantly higher disgust response to the core video clip when compared to both animal reminder ( $t(103) = 6.10; p < 0.001$ ) and contamination ( $t(104) = 8.09; p < 0.001$ ) clips.

TABLE 3. Mean (SD) disgust and anger ratings

	<i>Disgust (SUDS)</i>	<i>Anger (SUDS)</i>	<i>Disgust (MDES)</i>	<i>Anger (MDES)</i>	<i>Sadness (MDES)</i>	<i>HR</i>	<i>EMG</i>	<i>SC</i>
<i>Baseline</i>	--	--	--	--	--	83.17 (12.13)	10.08 (4.33)	16.53 (8.96)
<i>Core</i>	7.54 (2.48)	1.36 (2.28)	6.28 (1.97)	1.30 (1.96)	0.34 (1.16)	82.10 (11.77)	10.86 (5.14)	17.34 (9.04)
<i>Animal Reminder</i>	5.59 (3.26)	0.42 (1.47)	4.43 (2.80)	0.33 (1.11)	0.26 (0.97)	80.93 (12.55)	9.83 (5.07)	16.47 (10.47)
<i>Contamination</i>	5.57 (2.57)	0.81 (1.84)	4.84 (2.17)	1.10 (1.91)	0.33 (1.05)	81.41 (11.75)	9.74 (4.55)	18.12 (12.94)
<i>Moral-Community</i>	4.79 (2.87)	5.71 (2.97)	3.84 (2.48)	5.32 (2.35)	3.55 (2.62)	80.66 (12.54)	9.18 (4.36)	17.13 (11.22)
<i>Moral-Autonomy</i>	5.39 (2.97)	6.56 (2.63)	4.73 (2.50)	5.74 (2.16)	3.41 (2.31)	79.98 (13.12)	9.65 (4.22)	17.78 (10.56)
<i>Moral-Divinity</i>	4.14 (3.54)	4.88 (3.54)	3.45 (2.82)	4.47 (2.99)	2.39 (2.85)	82.45 (13.13)	9.69 (5.34)	15.40 (7.95)

*Note: SUDS = Subjective Units of Distress measured on 0-10 scale; MDES = Modified Differential Emotions Scale measured on 0-8 scale; HR = heart rate; EMG = electromyography; SC = skin conductance*

Doubly Multivariate Analysis of Variance (MANOVA) tests with a Greenhouse-Geisser correction were conducted to examine within subject differences among heart rate, skin conductance, activation of levator labii, and behavioral avoidance among core, animal reminder, and contamination video clips. Results indicate no significant differences in HRV between videos ( $F(1.635, 83.405) = 2.417, p = 0.106$ ). However, when conducting a paired samples t-test to identify overall differences between mean baseline heart rate and core, animal reminder, and

contamination video clips, significance was detected. All three videos demonstrated a decrease in heart rate when compared to baseline. Specifically, significant differences were found between baseline and animal reminder video clips ( $t(64) = 2.73; p < 0.01$ ) and baseline and contamination video clips ( $t(68) = 2.91; p < 0.01$ ); however, no significant difference was found between baseline and core video clips.

Related to skin conductance, results from a doubly MANOVA indicated no significant differences in skin conductance variance between core, animal reminder, and contamination video clips ( $F(2, 136) = 0.85; p = 0.43$ ). Additionally, a paired samples t-test indicated no significant differences in skin conductance when comparing baseline to core, animal reminder, and contamination video clips.

Similarly, a doubly MANOVA was conducted to identify any significant differences in EMG variance among video clips. A significant difference was identified ( $F(2, 160) = 5.54; p < 0.01$ ) between core and animal reminder video clips, as well as core and contamination video clips ( $t(84) = 3.06; p < 0.01$ ;  $t(85) = 2.36; p < 0.05$ , respectively). More variance in EMG activity was identified in response to core video clips when compared to the animal reminder clip ( $p < 0.01$ ) and contamination clip ( $p < 0.05$ ). A paired samples t-test was conducted to identify any significant differences between baseline EMG activity and core, animal reminder, and contamination videos clips; when comparing baseline to the core video clip, there was a significant increase in EMG activity ( $t(90) = 3.02; p < 0.01$ ). No significant differences were found in overall EMG activity when comparing baseline video clip to animal reminder and contamination video clips.

Behavioral avoidance (as measured by time spent watching the video) was demonstrated among 21.3% of participants watching the core video clip, 18.5% watching animal reminder clip,

and 4.6% watching contamination video clip. A paired samples t-test was computed to determine any significant differences in behavioral avoidance between videos; results indicated significantly more participants avoided the core disgust video ( $t(106) = 4.35; p < 0.001$ ) and animal reminder video ( $t(107) = 3.63; p < 0.001$ ) than contamination video clip.

*Hypothesis 2: Within the moral domain, the community video clip will elicit elevated anger and disgust ratings on the MDES relative to other emotions, an increase in heart rate, increase in skin conductance, an activation of the levator labii, and avoidance.*

The MDES was used to identify the strongest emotion elicited when watching the moral-community video clip. A paired samples t-test revealed that there was significantly more anger elicited than all other emotions ( $p < 0.001$ ), although disgust and sadness were the second and third strongest emotions, respectively. No significant difference was found when comparing disgust and sadness evoked ( $t(105) = 1.20; p = 0.23$ ). A paired samples t-test was computed in order to determine any significant differences in subjective disgust and anger responses (assessed with SUDS) among the community clip, as it is hypothesized to elicit similar ratings of disgust and anger. Similar to the findings with the MDES, although both disgust and anger were elicited following the video clip, participants endorsed significantly higher ratings of anger than disgust as measured by SUDS ( $t(106) = 3.86; p < 0.001$ ).

A doubly MANOVA was conducted with a Greenhouse-Geisser correction to assess significant differences in heart rate variance following the community clip when compared to all other video clips; results indicated a significant difference ( $F(3.17, 142.43) = 2.63; p < 0.05$ ). A pairwise comparison identified significantly more heart rate variance when viewing the community video clip when compared to the divinity clip ( $p < 0.01$ ). A paired samples t-test was conducted to compare overall heart rate means between community video clip and baseline video

clip; results indicated a significant decrease in heart rate in response to the community video clip ( $t(64) = 4.2; p < 0.001$ ), contrary to hypotheses.

When examining skin conductance variance among participants, no significant difference was found when comparing the community video clip to all other video clips, including baseline.

Similarly, a doubly MANOVA was conducted with a Greenhouse-Geisser correction to identify any significant differences in EMG variance within subjects. A significant difference was identified ( $F(3.62, 264.13) = 5.48; p < 0.001$ ) between core and the community video clips ( $p < 0.001$ ) suggesting significantly more levator labii activation in response to the core video clip than community video. A paired samples t-test was conducted to identify differences in mean EMG activity between baseline video and community video with results supporting significantly more levator labii activity among the baseline video clip when compared to the community clip ( $t(94) = 3.70; p < 0.001$ ).

Behavioral avoidance (as measured by time spent watching the video) was demonstrated among 9.3% of participants watching the community video clip. A paired samples t-test was computed to determine any significant differences in behavioral avoidance between the community video clip and core, animal reminder, contamination, autonomy, and divinity; results indicate significantly fewer participants avoided the community video clip than core ( $t(106) = 3.10; p < 0.01$ ) and animal reminder ( $t(107) = 2.56; p < 0.05$ ).

*Hypothesis 3: Within the moral domain, the autonomy video clip will elicit elevated anger ratings on the MDES relative to other emotions, increase in heart rate, increase in skin conductance, and no activation of the levator labii.*

In order to determine the strongest emotion elicited (as measured by MDES) while watching the autonomy video clip, a paired samples t-test was computed. Significantly more

anger was measured than any other emotion (all  $p$ 's < 0.001), which was consistent with measurement on the SUDS. A paired samples t-test assessing disgust and anger as rated on SUDS demonstrated significantly more anger evoked than disgust ( $t(107) = 4.88; p < 0.001$ ).

In order to assess variance in heart rate between all video clips, a doubly MANOVA with Greenhouse-Geisser correction was conducted and indicated significant differences ( $F(3.17, 142.43) = 2.63; p < 0.05$ ) between the autonomy video clip and both the core ( $p < 0.05$ ) and divinity ( $p < 0.01$ ) clips. A paired samples t-test was conducted to identify any significant difference in mean heart rate while watching the autonomy video and baseline video. Results indicated an overall significant decrease in mean heart rate when exposed to the autonomy video ( $t(65) = 4.05; p < 0.01$ ) when compared to baseline, contrary to hypotheses.

When examining skin conductance variance among participants, no significant difference was found when comparing the autonomy video clip to all other clips, including baseline.

A doubly MANOVA was conducted with a Greenhouse-Geisser correction to identify significant differences in EMG variance among all video clips. Similar to the community video clip, a significant difference was identified ( $F(3.62, 264.13) = 5.48; p < 0.001$ ) between core and the autonomy video suggesting significantly more levator labii activation in response to the core video clip ( $p < 0.01$ ). A paired samples t-test was conducted to identify differences in mean EMG activity between autonomy and baseline video clips. Again, similar to the community video clip, results support significantly less levator labii activity in response to the autonomy video than baseline ( $t(95) = 3.49; p < 0.01$ ).

Behavioral avoidance (as measured by time spent watching video) was demonstrated among 5.6% of participants offered to view the autonomy video clip. A paired samples t-test was computed to determine any significant differences in behavioral avoidance between the

autonomy video clip and core, animal reminder, contamination, community, and divinity. Results indicated significantly fewer participants avoided the autonomy video clip than core ( $t(106) = 4.19; p < 0.001$ ) and animal reminder ( $t(107) = 3.46; p < 0.01$ ).

*Hypothesis 4: Within the moral domain, the divinity video clip will elicit elevated disgust ratings on the MDES relative to other emotions, decrease in heart rate, increase in skin conductance, activation of the levator labii, and avoidance.*

MDES was utilized when computing a paired samples t-test to identify the strongest emotion evoked; results indicate anger was the strongest emotion when compared to all seven other emotions (all  $p$ 's  $< 0.001$ ); however, disgust was the second strongest emotion evoked when compared to the remaining six emotions (all  $p$ 's  $< 0.001$ ). These findings were consistent with a paired samples t-test computed using the SUDS. Although both disgust and anger were elicited following the video clip, participants endorsed significantly higher ratings of anger than disgust ( $t(107) = 3.54; p < 0.01$ ).

A doubly MANOVA was conducted with a Greenhouse-Geisser correction to assess any significant difference in heart rate variance between the divinity clip when compared to all other video clips; results indicate a significant difference ( $F(3.17, 142.43) = 2.63; p < 0.05$ ). A pairwise comparison identified significantly more variance when viewing the community video clip when compared to the divinity clip ( $p < 0.01$ ). A paired samples t-test was conducted to compare overall heart rate means between divinity video clip and baseline; no significant difference was found ( $t(64) = 1.34; p = 0.19$ ).

When examining skin conductance variance among participants, no significant difference was found when comparing the autonomy video clip to all other clips, including baseline.

In order to identify any significant differences in EMG variance within subjects among all video clips, a doubly MANOVA was conducted with a Greenhouse-Geisser correction and significance was identified ( $F(3.62, 264.127) = 5.48; p < 0.001$ ). Similar to the community and autonomy video clips, a significant difference was identified between core and the divinity video clips ( $p < 0.001$ ) suggesting significantly more levator labii activation in response to the core video clip than divinity video. A paired samples t-test was conducted to identify differences in mean EMG activity between the divinity video and baseline. Results indicate no significant difference.

Behavioral avoidance (as measured by time spent watching video) was demonstrated among 9.3% of participants that were offered to view the divinity video clip. A paired samples t-test was computed to determine any significant differences in behavioral avoidance between the divinity video clip and core, animal reminder, contamination, community, and autonomy; results indicate significantly fewer participants avoided the divinity video clip than core ( $t(106) = 3.30; p < 0.01$ ) and animal reminder ( $t(107) = 2.28; p < 0.05$ ).

#### *Post Hoc Analyses*

Six logistic regression analyses were conducted to test the predictive ability of self-report measures of disgust sensitivity (DSR; TDDS) on subjective disgust ratings in response to disgust video clips in accordance with appropriate subscales and specific domains of disgust video clips (e.g., DSR – core subscale ability to predict disgust response to core video clip). Results indicated all appropriate subscales, DSR-core, DSR-animal reminder, DSR-contamination, TDDS-moral, significantly predicted disgust response to core, animal reminder, contamination, and moral (community, autonomy, divinity) video clips, respectively. Linear regression results can be found in Table 4.

Six additional logistic regression analyses were conducted to identify if DPSS-R total score could accurately predict the disgust response to video clips. Results indicate that DPSS-R total score is a significant predictor of self-reported disgust (SUDS) in response to core, animal reminder, contamination, and moral-divinity video clips. Results can be found in Table 4.

TABLE 4. Linear Regression Using Self-Report Measures to Predict Disgust Ratings to Video Clips

	<i>B</i>	<i>SE B</i>	<i>β</i>
<b>DSR-Core</b>			
Core Clip	2.13	0.30	0.58***
<b>DSR-Animal Reminder</b>			
Animal Reminder Clip	2.06	0.31	0.54***
<b>DSR-Contamination</b>			
Contamination Clip	1.07	0.30	0.33**
<b>TDDS-Moral</b>			
Community Clip	0.09	0.02	0.34***
Autonomy Clip	0.13	0.02	0.50***
Divinity Clip	0.12	0.03	0.38***
<b>DPSS-R – total</b>			
Core Clip	0.12	0.06	0.20*
Animal Reminder Clip	0.19	0.07	0.25**
Contamination Clip	0.15	0.06	0.25*
Moral – Community Clip	0.09	0.07	0.13
Moral – Autonomy Clip	0.11	0.07	0.16
Moral – Divinity Clip	0.19	0.08	0.23*

Note: DSR = Disgust Scale Revised; TDDS = Three Domains Disgust Scale; DPSS-R = Disgust Sensitivity Propensity Scale

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$



#### IV. DISCUSSION

Disgust is considered a basic emotion, that is characterized by revulsion and behavioral avoidance (Ekman, 1992). Disgust is proposed to have four specific domains: core, animal reminder, contamination, and moral; although, the construct of moral disgust is not well-established with the operational definition and measurement of moral disgust somewhat questionable. Although much research has established “moral disgust” as a distinct domain of disgust (Olatunji et al., 2012; Scherer, 1997; Rozin et al., 1994), some researchers consider the use of “moral disgust” as a linguistic response to moral offenses (Bloom, 2004; Schaich Borg, Lieberman, & Kiehl, 2008) and suggest that the word “disgust” is not the same when considering both physical disgust and moral disgust (Yoder, Widen, & Russell, 2016). Despite the controversy, Haidt and colleagues (1997) determined that when participants were asked to nominate acts of disgust, only 25% fell within the core, animal reminder, and contamination domains; the remainder were characterized as falling into a more social or moral domain, including racism, child abuse, hypocrisy, and political parties. Given that moral violations were the primary response when asked to nominate disgust acts, it is important to identify the specific emotional response to these complex situations.

Rozin and colleagues (1999) suggested that disgust plays a distinct role in morality, utilizing Shweder and colleagues’ (1997) proposal that a cluster of emotions, including contempt, anger, and disgust (CAD), are interrelated and demonstrated in response to moral violations. Specifically, Rozin et al. (1999) proposed the moral emotions of contempt, anger, and disgust, correspond with violations of three moral codes: community, autonomy, and divinity,

respectively (Shweder et al., 1997). The current study sought to differentiate the moral domain of disgust from the other more researched areas, in addition to explicating the three specific proposed CAD violations using a multimodal approach. This approach included measuring subjective emotional response, behavioral avoidance, heart rate, skin conductance, and facial muscle activation when exposed to disgust eliciting video clips. The video clips used were previously determined to evoke the expected subjective disgust response in a pilot study, although physiological responses were not measured (Scott & Maack, 2016).

#### *Examination of core, animal reminder, and contamination domains of disgust*

As a means to elucidate the moral domain, it is necessary to understand the cognitive, physiological, and behavioral response to the three relatively well-established domains. When examining the core, animal reminder, and contamination domains within existing literature, there is typically a strong subjective disgust response, observed behavioral avoidance, activation of the levator labii muscle, and mixed results regarding physiological measures (i.e., heart rate; skin conductance; Izard, 1971; Meissner et al., 2011; Olatunji et al., 2008; Rozin et al., 2008), which were somewhat consistent with findings from the current study. For the current study, as expected, disgust was the primary emotion subjectively reported on the MDES for the core, animal reminder, and contamination video clips. Additionally, when comparing all six disgust videos clips, the core and animal reminder video clips elicited significantly more avoidance, as 21.3% (core) and 18.5% (animal reminder) of participants, either did not start the video or discontinued the video early. Further, when comparing the core, animal reminder, and contamination videos clips to baseline, there was significant EMG activity measured among the core video clip. The aforementioned results were mostly hypothesized; however, physiological data in the current study was mixed.

When examining skin conductance, which is an indicator of arousal (e.g., fear, anger, disgust, embarrassment), there was no significant change across all three video clips when compared to baseline. Given the strong disgust response self-reported, this may suggest that, consistent with Fernandez and colleagues (2012), disgust may not result in such an intense sympathetic response, but more of a passive behavioral response. Further, it was hypothesized that there would be a significant decrease in heart rate when watching the video clips. Although there was a decrease in heart rate among all three videos when compared to baseline, only a significant decrease was found in response to the animal reminder and contamination video clips. Existing research has suggested a response consistent with parasympathetic activation, characterized by a decrease in heart rate (Fernandez et al., 2012; Kreibig et al., 2013; McKay & Tsao, 2005; van Overveld et al., 2009). However, the autonomic nervous system response to disgust stimuli is equivocal as, several researchers reported finding that supports an increase in sympathetic activation (Prkachin et al., 1999; Vrana, 1993) or a mixed physiological response to disgust stimuli, suggesting a complex emotional response (de Jong et al., 2011; Rohrman & Hopp, 2008).

#### *Community violations elicitation of contempt*

Community violations within the moral domain are characterized as an individual not upholding his/her duty within a community (Rozin et al., 1999). The current study utilized a National Geographic exposé on dog fighting to promote the proposed emotional response, contempt. Previous research has found contempt to be difficult to measure (Matsumoto & Ekman, 2004; Wagner, 2000), which was demonstrated in the current study. Results indicated that anger was the primary emotional response elicited subjectively when viewing the community violation video, contrary to previous research suggesting comparable amounts of

disgust and anger elicited (Plutchik, 2001; Prinz, 2007). Although it was proposed that the community video clip would result in increased heart rate, increased skin conductance, activation of the levator labii, and behavioral avoidance, this was not supported in the current study. Overall, there were no significant changes between baseline and the community video, except among heart rate. The current study demonstrated a decrease in heart rate when watching the video, which was not hypothesized, but is suggestive of a disgust response (Fernandez et al., 2012; Kreibig et al., 2013; McKay & Tsao, 2005; van Overveld et al., 2009). Research examining heart rate response when exposed to disgust video clips is limited, but this finding does highlight the difficulties of explicating moral disgust and accurately measuring contempt. When attempting to measure contempt, which is proposed to be a blend of disgust and anger, it might be suggested that disgust is the physiological response, as indicated by decreased heart rate, but anger is the cognitive and behavioral response. Further research is necessary to better understand this emotional response.

#### *Autonomy violations elicitation of anger*

Similar to community violations, the emotional response to autonomy violations are just as complex. Since autonomy violations are characterized by infringing upon the rights or freedoms of another person, Rozin and colleagues (1999) propose anger as the primary emotion elicited, although an interaction of both anger and disgust is suggested. In the current study, a two-minute video showcasing domestic violence was used which is an appropriate example of an autonomy violation; however, given the nature of the stimulus, likely did not elicit the strong aggressive approach behavior posited by previous research (Ernulf & Immala, 1987; Giner-Sorolla & Chapman, 2017; Olatunji & Sawchuk, 2005). Although participants' primary subjective response was anger, overall, there was no change among skin conductance, nor was

the hypothesized increase in heart rate demonstrated. On the contrary, a significant decrease in heart rate was measured. This may be due to the passive nature of the video, whereas an aggressive approach would not logically make sense. Additionally, in the video, physical violence was only present in the last 30 seconds of the two-minute clip, which may have not been enough time for an overall increase in heart rate.

#### *Divinity violations elicitation of disgust*

The third code within the moral domain, divinity, focuses on an individual as a spiritual entity (Shweder et al., 1997). A violation would include an act that disrespects the sacredness of God, which is similar to the current study's divinity stimulus (Rozin et al., 1999). The current study utilized a video clip that showcased an individual lighting a match and burning a Bible. Although the current study hypothesized a response similar to the more established domains (core, animal reminder, contamination), that was not supported. The primary emotion subjectively reported was anger and there was no significant change in heart rate, skin conductance, levator labii activation, or behavioral avoidance.

Previous research has found that the traditional "disgust face" has been measured in response to divinity violations; however, it is also suggested that divinity violations are largely determined by culture and religious orientation (Rozin et al., 1999). When examining overall subjective disgust responses in the current study, the divinity video clip endorsed the lowest amount of disgust among all six video clips and lowest amount of anger among all moral video clips. The current study was conducted on a university campus among young adults with an average age of 19; additionally, approximately 25% of participants identified as either not religious (e.g., agnostic/atheist) or practicing a religion that does not employ use of a Bible (e.g.,

Hinduism; Buddhism). This could be suggestive of low salience of divinity as a moral matter, especially when utilizing a burning Bible video.

### *Limitations*

There are several limitations to the current study worth noting. First, this study is limited by a small sample size, as many participants' physiological data (heart rate, skin conductance, facial muscle activation) was not recorded due to equipment malfunction and/or researcher error. Although the total participants necessary to detect a moderate effect size was 87 and overall, there were 108 participants enrolled in the study, several participants' data was either not recorded or not used in analyses due to significant outliers. Specifically, when measuring heart rate in response to the six video clips, between 63 and 69 participants' data was utilized in analyses. Additionally, between 80 and 87 participants' data was examined among the variable, skin conductance.

Given that there was no significant variance in skin conductance among all video clips, it is also likely that there was some sort of physiological equipment malfunction when measuring this variable, or frequent researcher error in placing the electrodes accordingly. Previous research has cited skin conductance as a standard measure of autonomic arousal (Bradley et al., 2001; Cuthbert et al., 2000; Meissner et al., 2011), so lack of significance might suggest a major error. However, one study conducted by Fernandez and colleagues (2012) reported no change in skin conductance when participants were exposed to disgust evoking videos, in contrast to an increase when viewing videos eliciting anger or fear. Researchers suggested that these findings were due to the passive behavioral response of disgust (i.e., avoidance; Fernandez et al., 2012), especially when considering emotions, such as anger or fear, where a more active behavioral response would be appropriate. Future research would benefit from examining skin conductance alongside

other emotion eliciting video clips, including anger, fear, and amusement, supplemented with other physiological, cognitive, or behavioral measures.

Another limitation important to note is the use of heart rate as the primary mode to measure autonomic nervous system activation. Previous research has been mixed regarding physiological activation, suggesting primary parasympathetic activation (Öst et al., 1984; Kreibitz et al., 2013; van Overveld et al., 2009), primary sympathetic activation (Ottaviani et al., 2013; Prkachin et al., 1999; Vrana, 1993), and, also, a coactivation of a sympathetic and parasympathetic response (de Jong et al., 2011; Rohrman & Hopp, 2008; Ottaviani et al., 2013) when exposed to disgust stimuli. Overall, the current study has demonstrated a decreased heart rate in response to disgust video clips, although there was no significant change in response to the core and divinity video clips. In the future, it would prove helpful if other forms of physiological measurement, including blood pressure or saliva production, were employed to get a clearer picture of autonomic arousal.

Additionally, utilizing video clips or in vivo stimuli that produce a well-defined emotion would likely produce a clearer physiological response; however, that is incredibly difficult to employ. In the current study, there was some overlap between domains among several video clips to a small degree. For example, the surgical removal of a cyst (animal reminder) might also overlap into the contamination domain when considering the chances of infection when undergoing surgery. Another example might include the vomit video clip (core) overlapping with the contamination domain (ingesting another person's vomit) and both moral-autonomy and moral-community violations (peers offering pressure for one participant to engage in the experience and ingest vomit).

Lastly, the nonclinical sample of college students might have also played a role in willingness to participate in the study, as well as the emotional response to the various video clips. For the participants, incentive to fully engage in the current study was lacking. Although participants received course credit for completing the study, they were informed that they had the right to refuse any part of the study without penalty. As a result, individuals could easily decline to watch the videos for reasons other than experiencing disgust. Additionally, students qualitatively disclosed that given their interest in human anatomy, some videos did not evoke any emotional response, or perhaps evoked a blend of emotions including amusement.

### *Conclusion*

The present study contributes to limited research examining moral disgust as a distinct domain of disgust. Strengths of the study include a multi-modal approach utilizing subjective ratings, behavioral avoidance, facial response, and physiological reactions to assess the relations between moral disgust violations (community, autonomy, divinity) to core, animal reminder, and contamination domains of disgust. Although some research has suggested that the use of “disgust” in response to moral violations is a linguistic technicality (Bloom, 2004; Schaich Borg et al., 2008), the current study further solidifies the concept of moral disgust as its own unique disgust domain. Results from the present study suggest that moral disgust elicits an emotional response indicative of a mixed emotion, but still maintains the traditional disgust response. When analyzing the moral domain, heart rate variance was characteristic of a disgust response and disgust was subjectively reported in response to the video clips; however, it was evident that additional emotions were elicited, as well. Specifically, anger was also subjectively reported, minimal behavioral avoidance was measured, no significant skin conductance changes occurred, and there was no significant facial muscle activation present. This further supports the



complexity of moral disgust as a domain within the emotion, disgust, in addition to the importance in continuing to utilize physiological measurements to accurately gauge an emotional response.

Future research might clarify moral disgust with the utilization of additional physiological measures, such as corrugator facial muscle activation to better identify other emotions present (e.g., anger). Additionally, the utilization of saliva and blood pressure would allow a more accurate reading of autonomic nervous system activation, rather than relying on heart rate variance and skin conductance. Clarification of other emotions elicited would also be helpful when considering future studies; however, this can be difficult, as there is substantial overlap among emotional responses to salient stimuli. Additionally, the utilization of video clips proved beneficial when eliciting salient emotions, although future research would benefit from better delineating between domains.

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## VITA

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#### Education

- Doctor of Philosophy, Clinical Psychology** Expected 2019  
**University of Mississippi, Oxford, MS**  
Dissertation (defended April 2019): *Explicating moral disgust utilizing physiological indexes*  
Major Advisor: Danielle Maack, Ph.D.
- Master of Arts, Psychology** 2013  
**American University, Washington, DC**  
Thesis: *Fear, disgust, and avoidance in blood-injection-injury phobia when exposed to threatening stimuli*  
Major Advisor & Thesis Chair: Michele Carter, Ph.D.
- Bachelor of Arts, Psychology** 2010  
**Arkansas Tech University, Russellville, AR**  
Graduated *Magna cum Laude*  
Major: Psychology  
Minor: Criminal Justice

#### Licenses/Certifications

Provisionally Certified Mental Health Therapist (Jurisdiction: MS)  
Examination for Professional Practice of Psychology (EPPP)  
*Passed at the Doctoral Level: August 2016*

#### Clinical Experience

- Clinical Psychology Internship: Health Track** July 2018 – Present  
*Major Rotation III: PTSD Clinical Team*
- Duties include providing individual and group therapy to veterans presenting with PTSD in outpatient and residential settings. Primary approach to individual psychotherapy includes Prolonged Exposure.

*Minor Rotation II: Neuropsychology*

Supervisor: Jennifer Paulson, Ph.D.

- Administered, scored, interpreted, and prepared integrative neuropsychological reports in response to diverse referral questions, including Spinal Cord Stimulator (SCS) evaluations, neurocognitive disorders, ADHD evaluations, and TBI assessment.
- Provided individualized feedback using values-based approach.

*Major Rotation II: IMPACT Pain Clinic*

Supervisor: Daniel Broderick, Ph.D.

- Facilitated groups among veterans with chronic pain focusing on healthy sleep, ACT for pain management, stress management, and healthy GI functioning.
- Provided individual treatment using biofeedback under direct supervision, in addition to individual therapy focused on healthy behavior, IBS/GI functioning, and sleep improvement.

*Minor Rotation I: Inpatient*

Supervisor: Kristen Viverito, Psy.D.

- Designed, implemented, and facilitated groups focusing on healthy sleep, chronic pain, and physical activity among veterans presenting with serious mental illness in inpatient setting.
- Provided individual therapy to veterans on both acute and chronic inpatient settings with the intent to transition to outpatient treatment and development of suicide prevention plans.
- Attended daily meetings with interdisciplinary teams to promote veteran care.

*Major Rotation I: Primary Care Behavioral Health*

Supervisor: Tisha Deen, Ph.D. & Amanda McCorkindale, Psy.D.

- Conducted brief assessments, provided consultation, and implemented solution-focused interventions using evidence-based practices among veterans presenting with various difficulties in a primary care setting.
- Facilitated groups focusing on healthy behaviors and weight management
- Completed training and received certification in Primary Care Mental Health Integration implementation

*Didactics and Seminars*

- Attended and participated in weekly seminars focused on professional issues, case conceptualization, scholarly didactics, and diversity issues.
- Attended bi-weekly didactics focused on topics related to neuropsychology.

**In House Therapist**

July 2017 – June 2018

*Communicare: Community Mental Health Center, Senatobia, MS*

Supervisors: Dixie Church, LMFT and Scott Gustafson, Ph.D.

- Conducted intake assessments, developed treatment plans, reviewed and updated annual paperwork, facilitated substance abuse Intensive Outpatient Program (IOP) groups, and provided individual therapy to underprivileged clients presenting with mood/anxiety disorders, substance use disorders, SMI, and personality disorders.

**Group Co-Facilitator**

May 2017 - September 2017

*The Exchange Club Family Center, Memphis, TN*



Supervisor: Amy Gallimore, LPC

- Conducted intake assessments, updated paperwork for mandated group members, developed parent training and anger management plans, and facilitated parent training groups.

**Graduate Assessor**

February 2016 - May 2017

*University of Mississippi Psychological Services Center*

Supervisor: Shannon Sharp, Ph.D.

- Provided comprehensive psychological evaluations to assess for learning disabilities, Attention-Deficit/Hyperactivity Disorder, mood/anxiety disorders, and personality disorders among elementary, middle school, and high school students for DeSoto County school district and college students at the University of Mississippi.

**Psychological Assistant**

December 2015 - July 2017

*Delta Autumn Consulting, LLC, Oxford, MS*

Supervisor: John Young, Ph.D.

- Administered and scored psychological measures and performed psychosocial interviews to assist in determination of appropriateness for bariatric surgery or opioid appropriateness for chronic pain patients.
- Prepared integrative reports, under the supervision of Dr. Young, for medical offices.

**Clinical Research Assistant**

September 2015 - August 2017

*St. Jude Children's Research Hospital, Memphis, TN*

Supervisors: Heather Conklin, Ph.D. and Jane Schreiber, Ph.D.

- Assisted with data collection, data entry, and interpretation of various neuropsychological studies, specifically those examining long-term cognitive effects of brain tumor treatment.
- Administered, scored, interpreted, and prepared integrative neuropsychological reports for children with sickle cell disease (SCD).

**Process Group Leader**

August 2012 - August 2014

*College Living Experience, Rockville, MD*

Supervisor: Scott Hykin, Psy.D.

- Facilitated focus group sessions under supervision to assist with transitioning to a college environment and achieving independence.
- Addressed and improved student social, conversational, and stress management skills.

**Social Activities Coordinator**

August 2011 - August 2014

*College Living Experience, Rockville, MD*

Supervisor: Scott Hykin, Psy.D.

- Developed and implemented social skills curriculum designed to stimulate social interactions and generalize social skills in college students struggling with a wide range of disabilities.
- Planned, organized, and led a national trip to Seattle and an international trip to Ireland for all six College Living Centers nationwide.

**Mentor**

August 2010 - August 2014

*College Living Experience, Rockville, MD*

Supervisor: Scott Hykin, Psy.D.

- Assessed and implemented individually tailored interventions to support college students with a wide range of disabilities, including Autism Spectrum Disorders, ADHD, anxiety disorders, and learning disabilities.

## Publications

Olivier, T.W., Bass, J.K., Ashford, J.M., Beaulieu, R., **Scott, S.M.**, Schreiber, J.E., Palmer, S., Mabbott, D.J., Swain, M.A., Bonner, M., Franks, R., Chapeiski, M.L., Evankovich, K.D., Armstrong, C.L., Knight, S., Wu, S., Onar-Thomas, A., & Conklin, H.M. (in press). Cognitive implications of ototoxicity in pediatric patients with embryonal brain tumors. *Journal of Clinical Oncology*.

Peterson, R.K., Ashford, J.M., **Scott, S.M.**, Wang, F., Zhang, H., Bradley, J.A., Merchant, T.E., & Conklin, H.M. (under review). Predicting parental distress among children newly diagnosed with craniopharyngioma. *Journal of Pediatric Blood and Cancer*.

**Scott, S.M.**, Ashford, J., & Conklin, H. (2017). Amelioration of cognitive late effects using computerized interventions: Returning results to families. *Neuro-Oncology Practice*, npx029, <https://doi.org/10.1093/nop/npx029>

Srinivasan, S., Tinkle, C.L., **Scott, S.M.**, Li, Y., Gajjar, A., Conklin, H., Merchant, T.E., & Farr, J.B. (2017). Neurocognitive outcomes and dosimetric correlates in central nervous system germ cell tumors. *International Journal of Radiation Oncology\*Biophysics\*Physics*, 99(2). E572.

Lack, C.W., Sullivan, M.A., **Scott, S.M.**, & Beck-Xaysuda, L. (2010). To attribute or not to attribute, that is the post-traumatic question. In P. Anninos, M. Rossi, T.D. Pham, C Falugi, A. Bussing, & M. Koukkou (Eds.), *Recent Advances in Clinical Medicine* (pp. 174-179). Istanbul, Turkey: WSEAS Press.

**Scott, S.M.** Maack, D.M., & Young, J. (in preparation). Bible burning, dog fighting, and partner violence: Understanding the concept of moral disgust using video clips.

## Professional Presentations

### *Symposium Presentations*

Tinkle, C.L., Srinivasan, S., **Scott, S.M.**, Li, Y., Gajjar, A., Conklin, H., Merchant, T.E., & Farr, J. (2017, June). *Neurocognitive outcomes and dosimetric correlates in central nervous system germ cell tumors: The St. Jude experience*. Symposium presented at the 5<sup>th</sup> International CNS Germ Cell Tumor Symposium, Columbus, OH.

Wickenhauser, M., **Scott, S.M.**, Zhao, M., Tynes, B., & Maack, D.J. (2017, April). *Disgust and its relation to fight, flight, freeze tendencies*. In D.J. Maack (Chair), Ew, Gross, and Yuck! Symposium presented at the 4<sup>th</sup> Annual Conference on Psychological Science, Oxford, MS.

Zhao, M.S., Maack, D.J., Tynes, B. L., **Scott, S.M.**, Pineau, D., & Young, J. (2015, November). *Individual differences in the utility of safety behaviors and disgust domains as predictors*. In M.

S. Zhao (Chair), Exploring safety behavior usage: cognitive and behavioral avoidance and impact across psychopathology. Symposium presented at the 49th annual convention of the Association for Behavioral and Cognitive Therapies, Chicago, IL.

### *Oral Presentations*

**Scott, S.M.** & Maack, D.J. (2018, April). *Exploring the relationship of moral and sexual disgust using video clips*. Presented at the 5<sup>th</sup> Annual UM Conference on Psychological Science, Oxford, MS.

**Scott, S.M.** & Conklin, H. (2017, June). *Neurocognitive outcomes after treatment for central nervous system germ cell tumor*. Presented at St. Jude Children's Research Hospital, Department of Psychology Rounds, Memphis, TN.

**Scott, S.M.** & Maack, D.J. (2017, November). *That's disgusting! Moral disgust as a concept*. Presented at the University of Mississippi, Three-Minute Thesis competition finals, Oxford, MS.

**Scott, S.M.** & Conklin, H. (2016, August). *Returning research results to families following computerized intervention for amelioration of cognitive late effects*. Presented at St. Jude Children's Research Hospital, Department of Psychology Rounds, Memphis, TN.

**Scott, S.M.**, Tynes, B.L., Zhao, M.S., Pineau, D. & Maack, D.J. (2016, April). *Bible burning, dog fighting, and partner violence: Understanding the concept of moral disgust through the use of video clips*. Presented at the 3<sup>rd</sup> Annual UM Conference on Psychological Science, Oxford, MS.

**Scott, S.M.** & Beck, L. (2009, April). *Posttraumatic stress and attributions in college students exposed to a tornado*. Presented at the 23rd annual Arkansas Symposium for Psychology Students, Siloam Springs, AR.

### *Poster Presentations*

Hamblin, E., **Scott, S.M.**, & Maack, D.J. (2018, April). *The perception of moral disgust and physical disgust among individuals identifying as religious: An understanding of disgust responses through the use of video clips*. Poster presented at the 5<sup>th</sup> Annual UM Conference on Psychological Science, Oxford, MS.

Peterson, R.K., Ashford, J.M., Merchant, T.E., Bradley, J.A., **Scott, S.M.**, Wang, F., Zhang, H., & Conklin, H.M. (2017, October). *Predicting parental distress among children newly diagnosed with craniopharyngioma*. Poster presented at the 37<sup>th</sup> annual convention of National Academy of Neuropsychology (NAN), Boston, MA.

Olivier, T.W., Bass, J.K., Ashford, J.M., Beaulieu, R., **Scott, S.M.**, Schreiber, J.E., ... Conklin, H.M. (2017, October). *Examination of ototoxicity and language-based neurocognitive outcomes in patients diagnosed with pediatric medulloblastoma*. Poster presented at the 37<sup>th</sup> annual convention of National Academy of Neuropsychology (NAN), Boston, MA.

- Scott, S.M.**, Ashford, J.M., Clark, K.N., Martin-Elbahesh, K., & Conklin, H. (2017, October). *Returning research results: Caregivers' reactions following computerized cognitive training among childhood cancer survivors*. Online poster presented at the 49<sup>th</sup> annual convention of the Congress of the International Society of Paediatric Oncology (SIOP), Washington, DC.
- Srinivasan, S., Tinkle, C.L., **Scott, S.M.**, Li, Y., Gajjar, A., Conklin, H., Merchant, T.E., & Farr, J. (2017, September). *Neurocognitive outcomes and dosimetric correlates in central nervous system germ cell tumors*. Poster presented at the annual meeting of the American Society for Radiation Oncology (ASTRO), San Diego, CA.
- Scott, S.M.**, Tynes, B.L., Zhao, M.S., Pineau, D., Wickenhauser, M., Sapp, B., & Maack, D.J. (2016, October). *Bible burning, dog fighting, and partner violence: Is moral disgust a real construct? Piloting a multi-method assessment of moral disgust*. Poster presented at the 50th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), New York, NY.
- Zhao, M., Maack, D. J., Tynes, B., **Scott, S.M.**, Pineau, D., Sapp-Spence, B., & Wickenhauser, M. (2016, October) *Disgust domains and fear of contamination predict safety behavior usage in an analogue sample*. Poster presented at the Association for Behavioral and Cognitive Therapies (ABCT), New York, NY.
- Pineau, D., **Scott, S.M.**, Tynes, B., & Maack, D. (2016, October). *What anxiety lies beneath? Anxiety sensitivity mediates the relation between behavioral inhibition and emotion dysregulation*. Poster presented at the 50th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), New York, NY.
- Hari, C., **Scott, S.M.**, & Maack, D.J. (2016, April). *Trauma-related thoughts and beliefs: Role moral disgust, scrupulosity, and race play in emotional response*. Poster presented at the 3<sup>rd</sup> Annual UM Conference on Psychological Science, Oxford, MS.
- Tynes, B. L., Maack, D. J., Zhao, M., **Scott, S.M.**, & Young, J. (2015, November). *Scrupulosity, Trauma, and Disgust, Oh my! Assessing the potential relation between trauma symptoms, religiosity, and moral disgust*. Poster presented at the 49th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), Chicago, IL.
- Scott, S.M.**, Maack, D.J., Tynes, B., Zhao, M., Pineau, D., & Young, J. (2015, November). *That's disgusting! Understanding the concept of moral disgust through the use of video clips*. Poster presented at the 49th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), Chicago, IL.
- Zhao, M., **Scott, S.M.**, Tynes, B., Pineau, D., Young, J., & Maack, D. (2015, November). *Individual differences in emetophobic symptoms: Anxiety Sensitivity predicts emetophobic symptoms above and beyond difficulties with emotion regulation*. Poster presented at the 49th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), Chicago, IL.

Zhao, M., Maack, D.J., Lightsey, B., **Scott, S.M.**, & Young, J. (2014, November). *Further delineating the relationship between disgust sensitivity and contamination fear: The mediating role of emotion dysregulation*. Poster presented at the 48th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), Philadelphia, PA.

**Scott, S.M.** & Carter, M. (2013, November). *Fear, disgust, and avoidance among blood-injection-injury phobics exposed to threatening stimuli*. Poster presented at the 47th annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), Nashville, TN.

White, J., **Scott, S.M.**, & Lack, C.W. (2010, April). *Relationship of fundamentalism, religiosity, and intelligence*. Poster presented at the annual meeting of the Southwestern Psychological Association, Dallas, TX.

**Scott, S.M.**, Beck, L., & Lack, C.W. (2009, November). *Posttraumatic distress and attributions in college students exposed to a natural disaster*. Poster presented at the 43rd annual convention of the Association for Behavioral and Cognitive Therapies (ABCT), New York, NY.

**Scott, S.M.**, McCoy, L., Gudbaur, A., Morgan, K., & Gordon, C. (2008, April). A comparison of classroom features by students and professors. Poster presented at the 24th annual Arkansas Symposium for Psychology Students, Jonesboro, AR.

## Research Experience

### **Explicating Moral Disgust Utilizing Physiological Indexes**

ADEPT Lab, University of Mississippi

2015 - present

Supervisor: Danielle Maack, Ph.D.

- Prepared in depth literature review on topic of disgust and physiological response to emotions
- Designed and implemented a study measuring the physiological response, avoidance, and self-report emotions in response to distressful videos
- Trained research assistants on study protocol

### **Retrospective Study of Effects on Cognition Following Proton Therapy**

St. Jude Children's Research Hospital

2016 - 2017

Supervisor: Heather Conklin, Ph.D.

- Developed germ cell database following conclusion of radiation treatment among survivors of pediatric brain tumors
- Reviewed psychological reports for data input
- Assisted with assessment scoring and interpretation

### **Returning Research Results to Families Following Computerized Cognitive Training**

St. Jude Children's Research Hospital

2015 - 2017

Supervisor: Heather Conklin, Ph.D.

- Developed survey for families' reaction to results following computerized intervention study for survivors of pediatric brain tumors
- Prepared summary of results for families and disseminated information
- Analyzed data and wrote a scientific paper detailing conclusions

### **Optimizing Extinction: The Effect of Standardizing Disgust and Anxiety Stimuli on Emotional Habituation**

SITH Lab, University of Mississippi

2014 - 2017

Supervisor: John Young, Ph.D.

- Conducted study protocol for research participants (self-report measures, computer task)
- Trained research assistants on study protocol
- Coordinated follow-up sessions for participants

### **Disgust and Anxiety**

ADEPT Lab, University of Mississippi

2014 - 2016

Supervisor: Danielle Maack, Ph.D.

- Conducted study protocol for research participants (structured interviews, self-report measures, and behavioral tasks)

### **Exploring the Domains of Disgust**

ADEPT Lab, University of Mississippi

2014 - 2015

Supervisor: Danielle Maack, Ph.D.

- Prepared in depth literature review on topic of moral domain of disgust
- Administered self-report measures and recorded behavioral avoidance of disgust eliciting videos
- Trained research assistants on study protocol

### **Fear, Disgust, and Avoidance in Blood-Injection-Injury Phobia when Exposed to Threatening Stimuli**

Anxiety Disorders Lab, American University

2010 - 2013

Supervisor: Michele Carter, Ph.D.

- Designed, implemented, analyzed, and defended thesis to examine fear and disgust towards animal-reminder disgust and injection stimuli following exposure to either injection or mutilation pictorial stimuli
- Administered and scored the Anxiety Disorders Interview Schedule IV (ADIS) to classify participants as BII phobic or non-phobic

### **Implicit Associations of Fear of Positive Evaluation among Socially Anxious College Students Under Threats and No-Threat Conditions**

Anxiety Disorders Lab, American University

2010 - 2011

Supervisor: Michele Carter, Ph.D.

- Assisted with data collection, in which deception was used
- Trained in administering Implicit Association Task as a tool for unbiased collection of data

### **Posttraumatic Stress Symptoms and Attributions in College Students Exposed to a Natural Disaster**

Psychology Dept., Arkansas Tech University

2008 - 2009

Supervisor: Caleb Lack, Ph.D.

- Designed and implemented a study examining posttraumatic stress symptoms and related attributions among college students that were recently exposed to a tornado
- Recruited subjects, administered self-report measures, and analyzed data

### **Relationship Between Protestant Fundamentalism, Religiosity, and Intelligence**

Psychology Dept., Arkansas Tech University

2008 - 2009

Supervisor: Caleb Lack, Ph.D.

- Administered the Wechsler Abbreviated Scale of Intelligence (WASI) to college-age participants, scored, and assisted in data analysis

### **Experimental Psychology Laboratory**

Psychology Dept., Arkansas Tech University

2007

Supervisor: Jason Warnick, Ph.D.

- Designed and implemented a study examining effective teaching methods
- Recruited participants, analyzed data, and wrote a paper detailing conclusions

## Editorial Activities

### **Ad hoc reviewer**

*Neuro-Oncology Practice*

## Professional Memberships and Appointed Positions

Arkansas Psychological Association (ArPA)

2018 - present

American Psychological Association (APA)

2018 - present

Association for Behavioral and Cognitive Therapies (ABCT)

2009 - 2018

*Student Ambassador*

2016 – 2018

## Honors and Achievements

Three Minute Thesis Competition Finalist, University of Mississippi

2016

Mellon Grant recipient, American University

2011 - 2012

Psi Chi National Honor Society, President, Arkansas Tech University

2009 - 2010

Order of Omega National Honor Society, Arkansas Tech University

2008 - 2010

Gamma Sigma Alpha National Honor Society, Arkansas Tech University

2008 - 2010

National Society of Collegiate Scholars, Treasurer, Arkansas Tech University

2007 - 2010

Dean's Honor Roll, Arkansas Tech University

2006 - 2010

University Scholarship, Arkansas Tech University

2006 – 2010

Schwan's Home Services Academic Scholarship, Arkansas Tech University

2006 - 2008

## Teaching Experience

### **Guest Lecturer: Abnormal Psychology**

University of Mississippi

Fall 2014 and Fall 2015

### **Guest Lecturer: Industrial Organizational Psychology**

*University of Mississippi*

Fall 2015 and Spring 2017