

## **Disgust, Anxiety, and Political Learning in the Face of Threat**

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### ABSTRACT

Emotions feature prominently in political rhetoric and media frames, and have potent effects on how people process information. Yet, existing research has largely overlooked the influence of disgust, which is a basic emotion that leads people to avoid contamination threats. We illustrate how disgust may impede learning, as compared to the more commonly studied emotion of anxiety. Disgust and anxiety are natural reactions to many kinds of political threats, but the two emotions influence political engagement in different ways. This study investigated the distinctive effects of disgust in a series of experiments that manipulated information about the outbreak of an infectious disease. People who felt disgusted by a health threat were less likely to learn crucial facts about the threat and less likely to seek additional information. Thus, disgust has the counterintuitive effect of decreasing public engagement in precisely those situations where it is most critical.

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Emotions are central to our understanding of political behavior because they provide a motivational force behind participation, learning, and attitude change (Huddy, Mason, and Aarøe 2015; Marcus, Neuman, and MacKuen 2000; Valentino et al. 2011). Yet emotions are more than a matter of individual psychology. “They also depend,” Huddy (2004, 802-3) writes, “on larger forces at work within politics and the media.” Elites strategically employ emotional appeals to persuade citizens to support particular policies or candidates (Jerit 2004; Jerit, Kuklinski, and Quirk 2009; Lupia and Menning 2009), and emotions occupy a central place in the frames journalists use to construct news stories (e.g., Iyengar 1991).

Recent outbreaks of infectious disease provide a vivid illustration of how people’s emotions and the political world may interact. One recent study, lamenting the public hysteria of the 2014 Ebola outbreak, concluded that “an *informed, activated public* is of utmost importance in protecting the health of the public” (Ratzan and Moritsugu 2014, 1215; emphasis added). But how does an “informed, activated public” come about? Paul and Sherrill (2015, 3) point to the government and mass media: “State-citizen communication ensures that the public correctly understands the risks associated with the outbreak and knows how the disease is transmitted. Information campaigns can reduce public anxiety while keeping the population educated about what to do if the disease spreads.”

We argue that the specific emotions evoked by media coverage—in particular, whether the emotion is primarily disgust versus anxiety—influence how people respond to a health threat and determine whether an “informed, activated public” emerges in a time of crisis. Anxiety is a natural reaction to many threats reported by the mass media (Albertson and Gadarian 2015). But recent epidemics, some of which involve gory symptoms or animal-to-human transmission, may also evoke feelings of *disgust* (also see Halkjelsvik and Rise 2015). Disgust and anxiety are

natural reactions to many health threats, but as shown in this study, they have different consequences for the public's response and different implications for the quality of public opinion.

In line with emerging research on the effects of discrete emotions (Banks and Valentino 2012; Huddy, Feldman, and Cassese 2007; Nabi 2003), our study involves multiple experiments in which we independently manipulated disgust and anxiety. Examining these emotions together is vital because previous research on anxiety has tended to involve situations with low levels of disgust, thereby obscuring our understanding of both emotions. In the analyses reported below, we replicated established findings for anxiety, particularly in conditions in which disgust is minimal. We also show, however, that disgust and anxiety have opposing effects. Anxiety causes people to seek out information as a method for coping with a threat, while disgust motivates avoidance and reduces one's responsiveness to new information. Taken together, our results have important implications for how governments and organizations communicate with citizens in times of crisis, as well as for illuminating political behavior on an array of other issues. Our study also extends scholarly work on the emotion of disgust, which has focused almost exclusively on policy attitudes (e.g., Clifford and Piston 2016; Clifford and Wendell 2016; Kam and Estes 2016; Smith et al. 2011).

### **The Nature of Disgust and How it Differs from Anxiety**

Disgust operates as part of a behavioral immune system that protects us from pathogens (Curtis, de Barra, and Aunger 2011; Oaten, Stevenson, and Case 2009). Objects that elicit disgust include body products (such as mucus or vomit), spoiled food, gore, and rodents, insects, and animals associated with the spread of disease (Haidt, McCauley, and Rozin 1994; Tybur et al. 2013; Tybur, Lieberman, and Griskevicius 2009). Because the biological purpose of disgust is

to protect a person from contamination (Curtis, de Barra, and Aunger 2011), the primary behavioral manifestation of this emotion is avoidance and physical distancing (Rozin, Haidt, and McCauley 2008). The political importance of disgust has become apparent in recent years, with studies showing that when people perceive a pathogen threat, they become prejudiced with regard to a range of social groups, such as members of the LGBT community and those who are obese, mentally ill, homeless, or have physical disabilities (e.g., Clifford and Piston 2016; Inbar, Pizarro, and Bloom 2012; Park, Faulkner, and Schaller 2003). As we elaborate in the next section, the distinctive action tendencies of disgust have implications for attention, information search, and learning.

#### *Disgust Motivates Avoidance and Interferes with Learning*

Disgust ought to affect learning in several ways, including immediate effects on attention and information processing, as well as downstream effects on the ongoing willingness to engage with the topic. At the most immediate level, emotional arousal leads to heightened attention to the stimulus and to goal-relevant information (e.g., Gable and Harmon-Jones 2010a; Kaplan et al. 2016; Levine and Edelman 2009).<sup>1</sup> Focusing specifically on disgust, research has shown that this emotion directs attention toward the source of arousal (Cisler et al. 2009; van Hooff et al. 2013, 2014; Xu et al. 2015). Or, in Strohminger's (2014, 482) words, "disgust seems to transfix and amplify our attention to these objects." In one study, for example, disgusted people were faster than non-disgusted people to recognize stimuli representing cleanliness (Vogt et al. 2011). Moreover, above and beyond fear, disgust enhances memory for the eliciting object, an effect that cannot be accounted for by arousal alone (Chapman et al. 2013; Croucher et al. 2011). Based

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<sup>1</sup> "Goal relevance" relates to the repertoire of behaviors used for regulating an emotion.

upon this literature, an object that induces disgust should increase retention of information related to the source of the emotion (H1), which in this study might include graphic details about the symptoms of a disease.

Yet cognitive resources are limited. As a result, emotional events may generate enhanced memory for an event's core features, but *poorer* memory for other, incidental features (Levine and Edelstein 2009, 844; see also Valentino et al. 2008). In particular, high-motivation emotions such as disgust lead to attentional narrowing and decreased attention to peripheral information (Gable and Harmon-Jones 2010b). Disgusting stimuli can even degrade recall of information encountered immediately *prior* to the stimuli (Rubenking and Lang 2014). As a result, while disgust may improve memory of the source of emotional arousal, it will impair recall of information that is not the primary elicitor of disgust (H2). In the context of an infectious disease, the result might be worse memory for other crucial facts (e.g., how to avoid infection).

Beyond the immediate effects of disgust on attention and recall, there is evidence that the *anticipation* of disgust may cause people to avoid particular situations. In the field of health communications, this anticipatory reaction has been related to the delay of medical treatment that is expected to be disgusting (Reynolds et al. 2014). Similarly, writing about the 2014 Ebola outbreak, Casey observed that “[disgust] also may keep [people] from listening to further information and instead encourage cognitive distance from the disgusting topic” (2015, 7). Although this claim is consistent with the theoretical literature on disgust, there has been little empirical investigation of the effect of disgust on information processing and political cognition. We expect that a person who feels disgusted about a threat will avoid the source of disgust and new information about the topic (H3).

While disgust should lead to avoidant behavior, this relationship might depend on the presence of a threat. Research has shown that in completely safe environments, disgust can increase curiosity and interest. People can enjoy negative sensations—even those they find disgusting—as long as the feelings are “framed as unreal, thus providing a protective frame or distance from the aversive material” (Woody and Teachman 2006; also see Rozin et al. 2013). Without the perception of danger, “all that is left is the thrill of novelty or sensation” (Strohming 2014, 487). Consequently, our expectation that disgust will decrease information-seeking is clearest when an object is perceived as threatening. Insofar as the effect of disgust varies across levels of threat or anxiety, we may even observe a negative interaction between the two emotions (e.g., disgust depresses information search, but only at high levels of anxiety).

#### *Anxiety Promotes Engagement*

Anxiety is a reaction to the perception of threat, particularly a threat to a person’s well-being that is uncertain and outside of their control. Diseases that involve personal injury or death and that spread rapidly across populations can be potent sources of anxiety. One of the most robust patterns associated with anxiety is increased information-seeking (e.g., Brader 2005, 2006; Brader, Valentino, and Suhay 2008b; Gadarian and Albertson 2014; Marcus, Neuman, and MacKuen 2000; Valentino et al. 2008a, 2009). Anxious individuals cope with the emotion by directing attention to the source of the threat. An early elaboration of this relationship comes from Affective Intelligence Theory (AIT; Marcus, Neuman, and MacKuen 2000). According to this perspective, anxious people engage in systematic processing and are receptive to new ideas. Based upon AIT and subsequent research, exposure to an anxiety-provoking story about a health threat should cause people to seek out information about the topic (e.g., Tausczik et al. 2012).

The consequences of anxiety for learning and knowledge are less clear. Some research finds that anxious people seek out new information rather than rely on partisan cues (Brader 2006). However, other studies have shown that anxiety is associated with biased information-processing (Eysenck 1992; Mathews 1990; Mogg et al. 1990), and that anxious people disproportionately seek out, recall, and agree with threatening news (Gadarian and Albertson 2014). Likewise, although there is some evidence that anxiety is associated with learning (MacKuen et al. 2010; Valentino et al. 2008), other work has shown that anxiety results in worse cognitive function, in terms of recalling politically relevant facts (Huddy et al. 2005).

### *Summary and Overview of Studies*

Disgust and anxiety are common reactions to health threats. Yet they have different antecedents in terms of the information that causes the emotional response, as well as contrasting consequences for public opinion. Disgust is expected to enhance recall of information that elicits the emotion but interfere with attention to other facts. Disgust also undermines ongoing information search, while anxiety should promote engagement and information seeking. Thus, the two emotions have different implications for the quality of public opinion. Our hypotheses about the countervailing effects of anxiety and disgust were tested in two experimental studies using a large national sample of voting-age adults as well as a convenience sample of students.<sup>2</sup>

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<sup>2</sup> We also describe the results of a small pilot study at the conclusion of our first study.

## Study 1: Data and Design

### *Sample and Design*

Our first study consisted of an experiment embedded in a national survey of adults. The study ( $N = 1,000$ ) was administered by YouGov from December 14 to 21, 2015.<sup>3</sup> After answering some background questions, respondents in all conditions were told they would read an excerpt about a recent public health issue (which in reality was a fictitious disease). The excerpt was designed to look like a news story with a headline (“Recently Discovered Infectious Disease May Reach the U.S.”), author, and two paragraphs of text. The topic of the story was a new disease called Tugela River Virus (TRV), and the text stated that the World Health Organization had recently identified three cases of TRV among people traveling on a plane from Paris, France. Across all conditions, TRV was described as attacking the body’s immune system and causing fatigue. Two additional facts—that the virus has no cure and is spread person-to-person—were constant across conditions as well. Within the text, we manipulated levels of disgust and anxiety in a 2 x 2 design. This allowed us to test the independent effects of anxiety and disgust on our outcomes, and to explore whether the effect of disgust is clearest in the presence of a threat (specifically in the case of information search).

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<sup>3</sup> YouGov uses a matching algorithm with respect to gender, age, race, and education to produce an internet sample that closely approximates the demographic makeup of known marginals for the general population of the United States from the U.S. Census Bureau’s 2008 American Community Survey. The completion rate for our study (which lasted 15 minutes and was approved by the Human Subjects Committee at Stony Brook University HS# 680601) was 30%.



Disgust was manipulated through the description of TRV's symptoms. In the *Low Disgust* conditions, the symptoms were described as very painful but not disgusting (severe headaches and debilitating joint pain), and "Luke," a victim of TRV who was featured in the story, was described as spending time in the hospital. By contrast, in the *High Disgust* conditions, the symptoms were bloody diarrhea and pus-filled boils, and Luke was described as being confined to the toilet. These referents were selected not only for their ability to elicit disgust, but also for the typical type of information a person might encounter while reading about a disease.

Anxiety was manipulated by changing passages related to the likelihood of spread and the lethality of TRV. In the *Low Anxiety* conditions, TRV was depicted as having a low likelihood of spread (e.g., "requires prolonged contact to contract the disease") and victims were described as making a full recovery. In the *High Anxiety* conditions, subjects read that TRV could be transmitted before a person is showing symptoms and that some infected people might have taken flights to the U.S. Although less than 10% of the text changed across conditions, a pretest shows that both manipulations were successful in generating the target emotion.<sup>4</sup> An open-ended question at the end of the survey indicated that the level of suspicion about the

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<sup>4</sup> The manipulations were pretested with 474 subjects recruited from MTurk. The *High Disgust* conditions created stronger feelings of disgust than the *Low Disgust* conditions ( $p < .0001$ ) but did not significantly affect levels of anxiety ( $p = .21$ ). The *High Anxiety* conditions created higher levels of anxiety ( $p < .001$ ) but also modestly higher levels of disgust ( $p = .01$ ). Although this latter effect was unexpected, it is common for emotional manipulations to affect more than just the target emotion (e.g., Searles and Mattes 2015).

fictional disease was low (1%;  $n = 10$ ) and that suspicion did not vary significantly across conditions ( $p = .58$ ).

### *Measures*

As a manipulation check, we gauged subjects' feelings of disgust (disgusted, grossed out, repulsed;  $\alpha = .93$ ) and anxiety (afraid, anxious, worried;  $\alpha = .92$ ) towards TRV. Following the emotion items, subjects were asked three questions about facts that had been presented in the article. Two of the facts (existence of a cure, how TRV spreads) appeared in all conditions. The third question asked respondents to select which symptoms were characteristic of TRV (from a list of seven). One of the options (fatigue) was present in all conditions and thus should have been selected as a correct response by all respondents. Two of the response options were in the text of the article only in the *Low Disgust* conditions (headaches, joint pain) and another two were shown only in the *High Disgust* conditions (boils, diarrhea). The remaining answer choices were placebos that were not mentioned in any of the conditions (fever, warts).

Following the knowledge section, information search was measured in multiple ways. As our key outcome measure, we asked respondents whether they would like us to send them more information about the disease. If they responded affirmatively, they were asked to choose from a list of seven topics (e.g., affected regions, susceptible populations, mortality rate). We view the information request as a behavioral measure because an affirmative response is more costly than typical survey responses (i.e., respondents expected their email to be shared with the researchers and to begin receiving messages about the topic; Brader, Valentino, and Suhay 2008). All respondents were then asked to rate their likelihood of looking up more information about TRV and discussing the disease with friends or family (both on a five-point scale).

## Study 1: Empirical Results

We begin by analyzing the emotional responses to the manipulations. Exploratory factor analysis shows that the six measures of disgust and anxiety load cleanly onto two separate factors (see the Supporting Information for details). As a further test of whether the manipulations had the expected effect, we report changes in emotion according to standardized factor scores by experimental condition. As expected, the *High Disgust* condition increased feelings of disgust ( $\Delta = 0.28$ ;  $t(984) = 4.53$ ,  $p < .001$ ) but did not affect anxiety ( $\Delta = 0.08$ ;  $t(984) = 1.25$ ,  $p = .21$ ). The *High Anxiety* condition slightly increased levels of anxiety, but this difference is not statistically significant ( $\Delta = 0.09$ ;  $t(984) = 1.43$ ,  $p = .15$ ). The anxiety treatment did not affect self-reported feelings of disgust ( $\Delta = 0.01$ ;  $t(984) = 0.16$ ,  $p = .87$ ). Thus, our disgust manipulation was successful, while the impact of the anxiety manipulation was more ambiguous. Nevertheless, our successful pretest (see note 4), in which emotional response was measured directly after the treatment, bolsters our confidence in the anxiety manipulation.

### *Knowledge*

Our first expectation was that disgust will cause a person to focus on the source of the emotional reaction, increasing memory of the associated information (H1). We tested this hypothesis by comparing levels of recall for the two manipulated symptoms across disgust conditions (while collapsing them across the *High Anxiety* conditions).<sup>5</sup> Recall that in the *High Disgust* conditions, the symptoms included boils and diarrhea, whereas in the *Low Disgust*

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<sup>5</sup> Analyses in which we predict knowledge outcomes with logit models and dummy indicators for *High Disgust* and *High Anxiety* are shown in the Supporting Information. We did not expect an interaction between disgust and anxiety when it came to knowledge, nor did we find one.

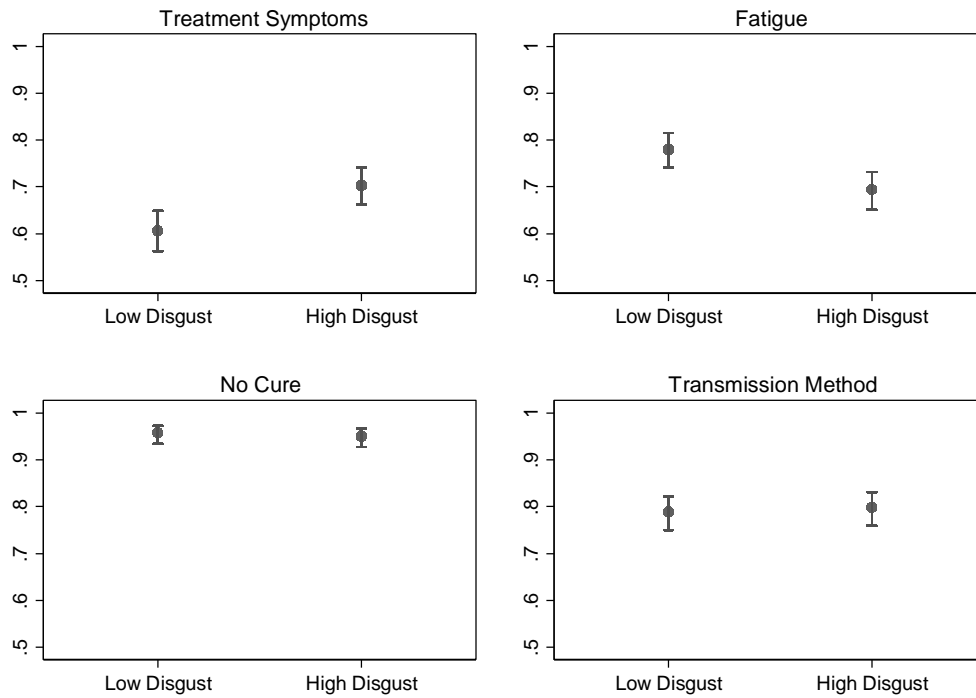
conditions, the symptoms were joint pain and headaches. The top left panel of Figure 1 shows the percentage of respondents who remembered both symptoms presented in their treatment condition (along with 95% confidence intervals). Consistent with H1, respondents were more likely to recall both symptoms when the information was disgusting ( $\chi^2(2) = 10.35; p < .01$ ). This effect was substantial, with respondents in the *High Disgust* condition about ten percentage points more likely to remember both symptoms than respondents in the *Low Disgust* condition (70% versus 61%). The findings support our expectation that people who feel disgusted will fixate on the source of emotional arousal.

Our second hypothesis predicts that disgust will interfere with the processing of other information. We tested this hypothesis by comparing recall of a non-disgusting symptom, fatigue, which was present in all experimental conditions (see top right panel of Figure 1). In the *Low Disgust* conditions, 78% of respondents correctly recalled fatigue as one of the symptoms, but this figure dropped to 69% within the *High Disgust* conditions ( $\chi^2(1) = 9.63, p < .01$ ). H2 was also tested by examining recall of two general facts about the disease (no cure, method of transmission). Memory for both facts was extremely high: 95% correctly stated that there is no cure for TRV, while 79% knew that it is spread by person-to-person contact. Consequently, the *Disgust* manipulation did not significantly affect recall of either fact (see bottom row of Figure 1;  $ps > .63$ ). Overall, the disgusting symptoms were more easily recalled than the non-disgusting symptoms, and there was evidence that the presence of disgusting symptoms interfered with retention of information about the mundane symptom (fatigue).<sup>6</sup>

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<sup>6</sup> Neither condition significantly affected respondents' tendency to select the two placebo symptoms that were not present in the article ( $ps > .31$ ).

Figure 1. The Effects of Disgust on Factual Recall (Study 1)



*Note.* Plots depict the proportion of correct responses across *Low* and *High Disgust* conditions (while collapsing across *Anxiety* conditions) with 95% confidence intervals. Hypothesis 1 predicts that people in the *High Disgust* condition will have higher recall for facts related to the treatment (top left panel). Hypothesis 2 predicts that people in the *High Disgust* condition will have lower levels of recall for other information appearing in the news story (shown in the remaining three panels).

In contrast to the distinct pattern of effects for disgust, the *High Anxiety* treatment had no influence on knowledge. Anxiety did not affect recall of the fatigue fact ( $\chi^2(1) = 0.57; p = .45$ ) or the two manipulated symptoms ( $\chi^2(2) = 1.16; p = .56$ ). Anxiety also had no effect on recall of the method of transmission ( $\chi^2(1) = 0.35; p = .56$ ) or the lack of a cure ( $\chi^2(1) = 1.34; p = .25$ ). These null findings are notable given that the facts were related to the threat posed by the disease (e.g., spread, symptoms). However, given the weakness of the anxiety manipulation in Study 1, we cannot make strong claims about the relationship between anxiety and learning.

### *Information Search*

Our third hypothesis predicts that people who feel disgusted about a public health threat will be less likely to seek out new information about the topic than those who do not feel disgusted. We tested this expectation across four items. Our key outcome consists of a question asking respondents if they would like us to send them more information about the disease, and overall 27% of respondents answered affirmatively. In looking at the effects for the *High Anxiety* and *High Disgust* conditions, there is modest support for our expectations.<sup>7</sup> Respondents in the *High Anxiety* condition were more likely to request information ( $\chi^2(1) = 3.02; p = .08$ ) and those in the *High Disgust* conditions were less likely to request information, though this latter effect is not statistically significant ( $\chi^2(1) = 0.96; p = .33$ ). We find a similar pattern when examining the amount of information requested, with the effects of *Anxiety* and *Disgust* both directionally consistent, but not statistically significant ( $t(989) = 1.63, p = .10; t(989) = 0.54, p = .59$ , respectively). Neither *Anxiety* nor *Disgust* significantly affected self-reported likelihood of looking up information ( $t(991) = 0.44, p = .66; t(991) = 1.01, p = .31$ ), though there is some evidence that *Disgust* reduced intention to discuss the topic ( $t(984) = 1.96, p = .05$ ).<sup>8</sup>

These largely null effects may be the result of the two emotions working in opposite directions in the *High Disgust, High Anxiety* condition. Indeed, our expectations for disgust are clearest when a person also feels threatened. In the absence of threat, people may express a

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<sup>7</sup> The Supporting Information shows the results of a model with indicators for each factor as well as the interaction between the two.

<sup>8</sup> The anxiety manipulation did not affect the likelihood of discussing TRV ( $t(984) = 0.47, p = .64$ ). Chi-square tests were used for dichotomous outcomes; *t*-tests were used on the other items.

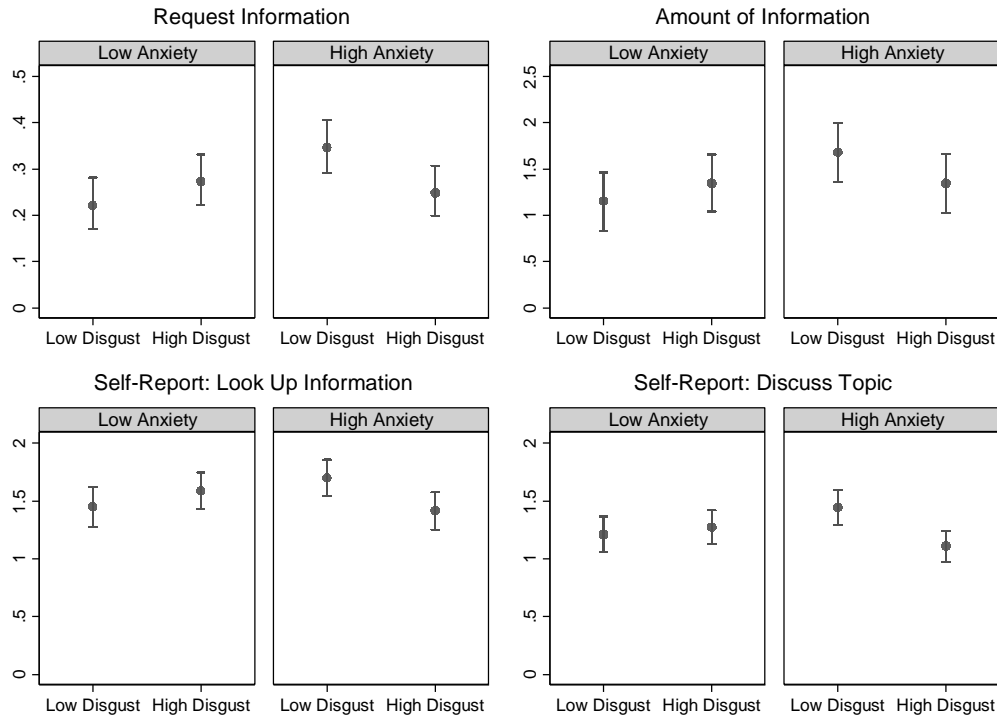
morbid curiosity about disgusting objects (Rozin et al. 2013; Strohminger 2014). We investigate this possibility in our next series of analyses in which we examine information search across all four conditions separately.

Figure 2 displays each outcome across all four conditions, along with 95% confidence intervals. We begin by examining the effects of *Disgust* among only the *High Anxiety* conditions (comparing the two rightmost estimates for each dependent measure in Figure 2). Beginning with the first outcome (“Request Information”), *High Disgust* reduces the likelihood of requesting information in the *High Anxiety* conditions by ten percentage points ( $\chi^2(1) = 5.88, p = .02$ ). *High Disgust* also decreases the amount of information requested ( $t(511) = 1.43, p = .15$ ) and reduces intentions to look up information ( $t(513) = 2.51, p = .01$ ) and to discuss the issue ( $t(509) = 3.23, p < .01$ ). In full models including interactions between the *High Disgust* and *High Anxiety* conditions (reported in the Supporting Information), there is a significant negative interaction between the two treatments ( $p$  values range from .01 to .03), indicating that the effect of disgust is strongest at high levels of anxiety.

Anxiety, on the other hand, had the expected effects only at low levels of disgust (i.e., in the *Low Disgust* conditions). Here the key comparison is between the first and third estimate for each dependent measure in Figure 2. The *High Anxiety* manipulation increased requests for information ( $\chi^2(1) = 9.20, p < .01$ ) and the amount of information requested ( $t(483) = 2.30, p = .02$ ). It also led to an increase in the self-reported likelihood of looking up further information ( $t(486) = 2.11, p = .04$ ) and discussing the topic ( $t(481) = 2.10, p = .04$ ). Thus, our findings are

consistent with past research on the effects of anxiety on information search, but only in conditions with low levels of disgust.<sup>9</sup>

Figure 2. Effects of Disgust and Anxiety on Information-Seeking (Study 1)



Note: Plots in the top two panels represent the probability of requesting information (top left) and the amount of information requested (top right) in each experimental condition. The bottom two panels represent the self-reported likelihood of looking up information (bottom left) and discussing the topic with friends and family (bottom right). See text for details on question wording. Error bars depict 95% confidence intervals.

<sup>9</sup> We obtained similar results in a smaller pilot study that was run in advance of Study 1 (details reported in the Supporting Information). Employing measures that were similar to Study 1, respondents from the pilot study were more likely to request information in the *High Anxiety* conditions (43%) than in the *Low Anxiety* conditions (24%;  $p < .01$ ). The disgust manipulation had the opposite effect, reducing the probability of information search from 41% to 28% ( $p < .05$ ). The interaction between the two emotions was negative but not statistically significant (possibly because of an inability to detect that relationship in a small sample).



### *Summary of Results from Study 1*

The findings of Study 1 were largely consistent with our expectations. Disgust caused increased recall of information tied to the source of disgust. However, it disrupted the processing of information not directly related to the emotional response, but still critical to understanding the disease. Likewise, when it comes to the search for additional information, disgust generated a qualitatively different reaction than did anxiety—one of avoidance rather than engagement.

It was notable that anxiety increased information search only in the absence of disgust. This unexpected pattern might be due to a weak anxiety treatment, and a stronger manipulation may have produced a more robust information seeking effect. That said, our results are more consistent with the literature than they might initially appear. For the most part, previous research on anxiety has involved situations with low levels of disgust. Thus, the conventional wisdom about anxiety—in particular, its role in stimulating information search—seems most apt for contexts with few or no disgust elicitors.

## **Study 2: Data and Design**

### *Sample and Design*

Study 1 illustrated several heretofore unknown effects of disgust on political cognition. The purpose of Study 2 was to establish the robustness of these effects in an experiment that employed different stimuli, outcomes, and subjects. Instead of featuring a fictional disease, in Study 2 we took advantage of the threat posed by a real disease in a particular region of the United States. We also changed the method of manipulating disgust by priming it with images, which allowed us to keep the text constant across conditions. Finally, Study 2 included additional measures of factual recall to provide a stronger test of our first and second hypotheses.

In our second study, 748 students were recruited from the University of Houston.<sup>10</sup> Respondents were asked to read a short article about a recent (and locally relevant) public health issue, dengue fever. Due to the smaller sample (and concerns related to statistical power), we focused on the effects of disgust in a substantively important context: namely, a disease that posed a personal threat. Rather than manipulating anxiety, Study 2 featured a high level of threat across conditions. The treatment described how the climate in Houston is ideal for the spread of dengue, how the disease can spread unnoticed, and that there is currently no vaccine. We manipulated two aspects of the imagery associated with the text in a 2 x 2 design, keeping the text identical across conditions.

Our primary manipulation consisted of the presence (or absence) of three disgusting images, a common method for inducing disgust (e.g., Schnall et al. 2008). The images displayed symptoms of dengue fever; however, this information also was included in the text. This design feature increased our confidence that any effects of the images were produced by manipulated disgust rather than by some other mechanism. We also independently randomized the presence of a map displaying the parts of the world where dengue is likely to spread (this information was provided in the text).<sup>11</sup> The *Map* condition allowed us to investigate whether *any* image affects the retention of information, even one that does not elicit emotion. A separate pretest showed

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<sup>10</sup> The 15-minute study was administered November 11-19, 2016, and it was approved by the University of Houston Committee for the Protection of Human Subjects (#STUDY00000090).

<sup>11</sup> The placement of the images in the text was randomized within each condition.

that the *Disgust* condition increased feelings of disgust, while the *Map* condition had no effect on self-reported emotions.<sup>12</sup>

### *Measures*

Respondents were asked four factual knowledge questions about the disease, preceded by an item asking them to commit to not looking up answers (Clifford and Jerit 2016). The correct answers to each question were included in the text of all conditions. The first three questions were not directly related to the disgust treatment and asked about the percentage of victims who never experience symptoms, the areas affected by dengue (Mexico, South America, Africa), and how long the symptoms typically last. The last question asked respondents to select the symptoms of dengue out of a list of eight options. Some of the correct answers were disgusting and linked to the treatment images (rash, bleeding), while some were not disgusting and not linked to the images (headache, fever, joint pain). Three response options were incorrect and not mentioned in the text (seizure, difficulty breathing, and nausea).

Next, we gauged the motivation to seek new information about dengue, using two behavioral measures and two self-reports. First, respondents were told that a local organization was hosting an information session on the university campus and were asked if they would like to be sent information about the event. If respondents requested information, they were asked to provide their email address. Second, respondents were asked if they would like to learn more about dengue and were told that if they selected “yes,” more information would be provided on

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<sup>12</sup> The *Disgust* condition increased feelings of disgust (1.9 vs. 2.7;  $p = .02$ ) but not anxiety (2.3 vs. 2.4;  $p = .72$ ). The *Map* condition did not significantly affect disgust (2.5 vs. 2.0;  $p = .20$ ) or anxiety (2.6 vs. 2.0;  $p = .13$ ).

the next page.<sup>13</sup> Third, respondents were asked how likely they would be (in the next seven days) to look up more information about dengue and to talk about dengue with family or friends. Thus, we had two behavioral measures of information search, as well as two traditional self-report items. Respondents also rated their emotions regarding dengue on three dimensions: disgust (disgusted, grossed out, revulsion;  $\alpha = .78$ ), anxiety (anxiety, nervous, worry;  $\alpha = .76$ ), and anger (angry, hateful, resentful;  $\alpha = .88$ ) (Harmon-Jones et al. 2016).

### **Study 2: Empirical Results**

Exploratory factor analysis of the emotion items generated three factors corresponding to disgust, anxiety, and anger (details shown in the Supporting Information). We report changes in standardized factor scores as a manipulation check. As expected, the *Disgust* treatment increased feelings of disgust ( $\Delta = 0.48$ ;  $t(744) = 7.15$ ,  $p < .001$ ), but it did not significantly affect feelings of anxiety ( $\Delta = 0.10$ ;  $t(744) = 1.43$ ,  $p = .15$ ) or anger ( $\Delta = 0.06$ ;  $t(744) = 0.89$ ,  $p = .37$ ). The *Map* condition did not significantly affect disgust, anxiety, or anger ( $ps > .45$ ).

#### *Knowledge*

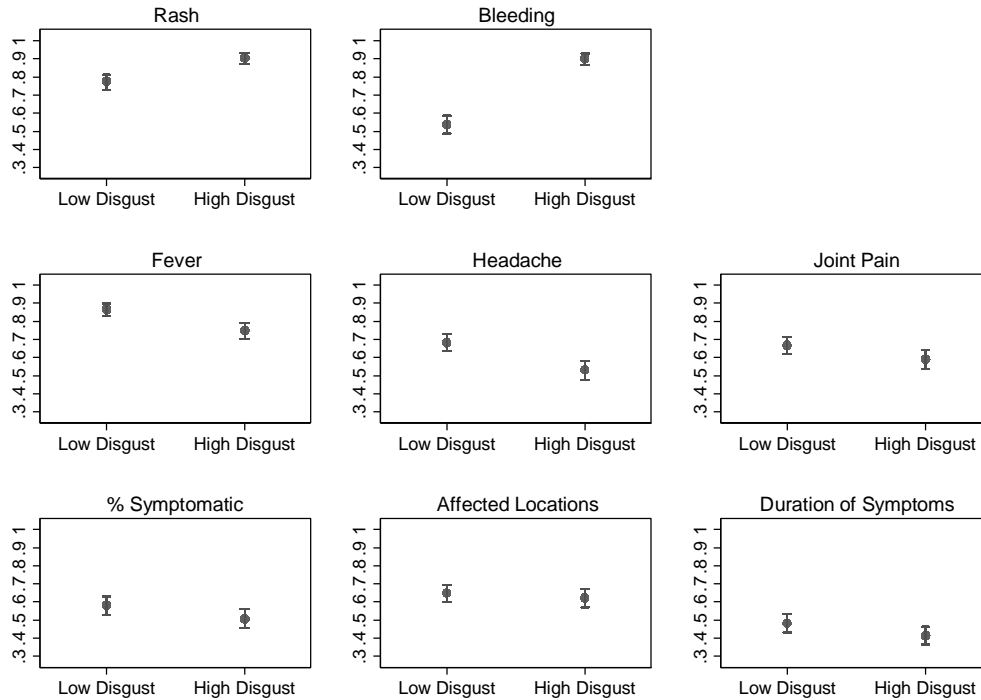
All experimental conditions included the same information about dengue, including the percentage of victims who experience symptoms, the regions of the world affected by the disease, the duration of symptoms, and the symptoms themselves. Respondents read about five symptoms of dengue, two of which were disgusting (rash, bleeding of the eyes and gums) and were shown in both the treatment images and the text. Three other symptoms were not disgusting and were portrayed only in the text (fever, headache, joint pain). Levels of recall for each fact are

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<sup>13</sup> Respondents answering “yes” were shown a brief description of how to avoid mosquito bites.

shown in Figure 3, along with 95% confidence intervals, broken down by experimental condition.

Figure 3. Effects of Disgust on Factual Recall (Study 2)



*Note.* Plots depict the proportion correct across *Low* and *High Disgust* conditions. Error bars depict 95% confidence intervals. Hypothesis 1 predicts that people in the *High Disgust* condition will have higher recall for facts related to the treatment (top row). Hypothesis 2 predicts that people in the *High Disgust* condition will have lower levels of recall for other information appearing in the news story (second and third rows).

According to our first hypothesis, respondents in the *High Disgust* condition will fixate on the symptoms contained in the images, leading them to have better recall for the symptoms relative to people in the *Low Disgust* group (see top row of Figure 3).<sup>14</sup> Consistent with this expectation, respondents in the *High Disgust* condition were 14 percentage points more likely

<sup>14</sup> We collapse across the *Map* condition because we did not expect it to affect our outcome measures, nor do we find any evidence that it did.

than those in the *Low Disgust* group to recall the rash symptom (91% vs. 77%;  $\chi(1)^2 = 24.12$ ,  $p < .001$ ). They were also 36 percentage points more likely to recall the bleeding symptom (90% vs. 54%;  $\chi(1)^2 = 120.65$ ,  $p < .001$ ).

The second hypothesis predicts that respondents in the *High Disgust* will be *less* likely to remember the other (i.e., non-disgusting) symptoms than people in the *Low Disgust* group (see middle row of Figure 3). And indeed, the former were significantly less likely to remember the fever symptom (75% vs. 87%;  $\chi(1)^2 = 16.98$ ,  $p < .001$ ), headaches (53% vs. 68%;  $\chi(1)^2 = 18.64$ ,  $p < .001$ ), and joint pain (59% vs. 67%;  $\chi(1)^2 = 4.87$ ,  $p = .03$ ). We can also test this Hypothesis 2 with the three general facts about the disease that were not themselves disgusting or closely related to the disgust-eliciting images (shown in the bottom row of Figure 3). In the *Low Disgust* condition, 58% correctly recalled the percentage who experience symptoms (labeled “% Symptomatic” in Figure 3), while only 51% did so in the *High Disgust* condition ( $\chi(1)^2 = 3.94$ ;  $p < .05$ ). Respondents in the *Low Disgust* condition were slightly more likely to recall the three regions of the world that have been affected by dengue (65% vs. 62% in the “Affected Locations” graph), but this difference is not statistically significant ( $\chi(1)^2 = 4.14$ ;  $p = .25$ ). Finally, respondents in the *Low Disgust* condition were slightly more likely to recall the duration of the symptoms (48%) than were respondents in the *High Disgust* condition (41%;  $\chi(1)^2 = 3.69$ ;  $p = .06$ ). Overall, respondents exposed to the images of disgusting symptoms were less likely to remember other symptoms of dengue and slightly less likely to retain general information about the disease.

An alternative explanation is that the presence of *any* image draws respondents’ attention towards the information contained in the image and away from the text (i.e., the image, not the emotion, is responsible for the effects presented in Figure 3). We test this explanation with the

second manipulated factor: the presence or absence of a map displaying the parts of the world affected by dengue. Contrary to this alternative account, presence of the map did not affect recall of any fact, including the information conveyed by the image. More specifically, exposure to the map image did not affect recall of the areas affected by the disease (62% vs. 65%;  $\chi(1)^2 = 0.79, p = .85$ ), the percentage of victims experiencing symptoms (55% vs. 53%;  $\chi(1)^2 = 0.25, p = .62$ ), the duration of symptoms (48% vs. 42%;  $\chi(1)^2 = 2.70, p = .10$ ), or recall of any of the symptoms (all  $ps > .30$ ). The consistent null findings of the map condition rule out the concern that *any* image impedes learning (thereby bolstering our confidence that effects in Figure 3 are the result of induced disgust).

Another possible explanation is that the disgust treatment reduced knowledge of particular facts because people did not want to look at the images and quickly moved on to the next page of the survey. However, we find no evidence to support this concern. Time spent viewing the treatment page was indistinguishable across conditions ( $t(745) = 0.52, p = .60$ ).

### *Information Search*

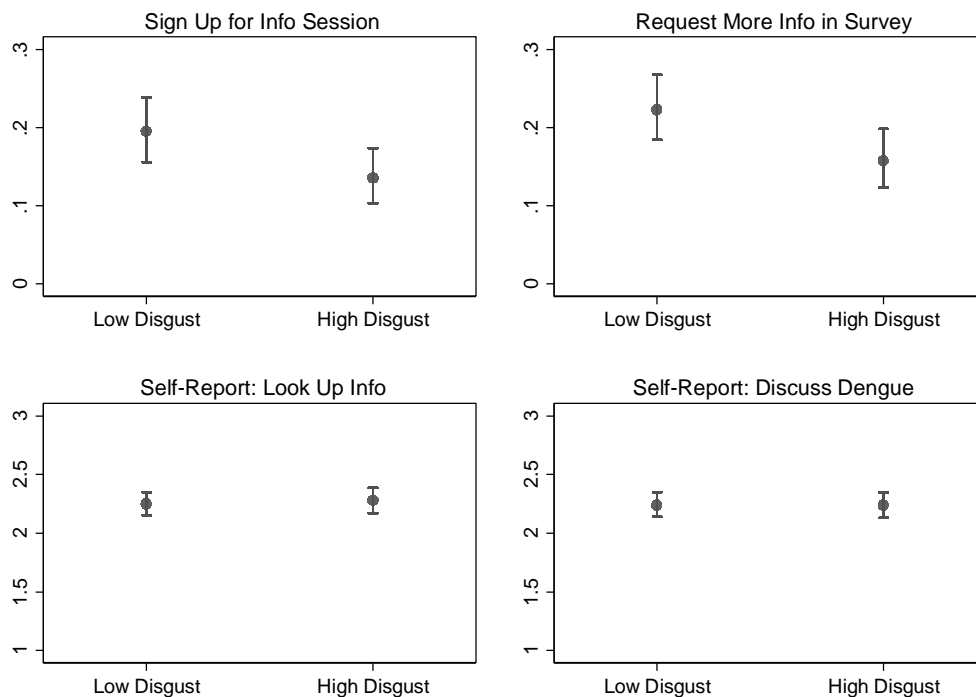
We investigated information search with four items (shown in Figure 4). Starting with the behavioral measures, respondents in the *High Disgust* condition were significantly less likely to sign up to receive information about a campus information session on dengue (top left of Figure 4; 14% vs. 20%;  $\chi(1)^2 = 4.91, p = .03$ ).<sup>15</sup> The disgust treatment also significantly decreased the rate at which respondents requested to see more information about Dengue within the survey (top

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<sup>15</sup> Ninety-eight percent of those who indicated they wanted to learn about the information session also provided an email address. Results are similar if email provision is the outcome (13% vs. 19%;  $\chi(1)^2 = 5.42, p = .02$ ).

right of Figure 4; 16% vs. 22%;  $\chi(1)^2 = 5.32, p = .02$ ). There is a different pattern, however, for the self-reported likelihood of looking up more information and discussing the topic with friends or family. Contrary to our expectations, the *High Disgust* manipulation did not affect either self-reported information search (bottom left of Figure 4;  $t(746) = 0.38, p = .70$ ) or discussion (bottom right of Figure 4;  $t(746) = 0.09, p = .93$ ). Thus, we find support for Hypothesis 3, but only when examining the behavioral outcomes.<sup>16</sup>

Figure 4. Effects of Disgust on Information-Seeking (Study 2)



*Note:* The top two panels depict the probability of signing up for the information session (top left) and requesting more information within the survey (top right) in each experimental condition. Error bars represent 95% confidence intervals. The bottom two panels represent the self-reported likelihood of looking up information (bottom left) and discussing the topic with friends and family (bottom right). See text for details on question wording.

<sup>16</sup> The *Map* condition did not affect any of our measures of information search ( $ps > .26$ ).



Overall, our findings are consistent with Study 1 even though we manipulated disgust using methods different from those used in the first study and used a real disease for which there likely had been some pretreatment exposure. The disgust treatment increased recall of symptoms that were central to the manipulation, but decreased recall of non-disgusting symptoms and even some background information about the disease. The disgust treatment also significantly reduced interest in learning about the topic, though only according to our behavioral measures of information search.

### **Conclusion**

Emotions are a motivational force behind citizens' interactions with politics in domains as varied as political engagement, policy attitudes, and information processing (e.g., Albertson and Gadarian 2015; Brader, Valentino, and Suhay 2008; Valentino et al. 2011). The emotions we experience on a day-to-day basis are shaped both by current events, such as terrorism or economic downturns, and by the manner in which these events are framed in the media. Indeed, politicians regularly “compete over the emotional agenda” (Albertson and Gadarian 2015, p. xxi) and seek to “tap the power of emotion” (Gross 2008, 170) in support of their goals. Studying the impact of discrete emotional states, as well as the content that elicits these emotions, is crucial to understanding political behavior and mass-elite interactions.

We contribute to this literature by providing some of the first evidence regarding the influence of disgust on political information processing. Our findings show that when threatening events also induce feelings of disgust—as they might in the case of an infectious disease—citizens disengage from the topic and become unwilling to learn more about it. Across the two studies reported here, people who felt disgusted by a disease were less likely to request additional information from the researchers, less likely to read additional information during the

study, and less likely to request information about an upcoming local event on the health threat. Researchers have long suggested that disgust motivates the “turning away of attention” (Nabi 1998, 472); our study demonstrates the maladaptive consequences of this reaction in the political world.

In addition to providing some of the first evidence regarding the effect of disgust on information search, our study sheds new light on the effect of anxiety. Because previous research has examined the influence of anxiety in isolation from other emotions, we know little about the potential countervailing effects of other emotions (but see Huddy, Feldman, and Cassese 2007). Yet, many threats can be potent elicitors of anxiety *and* disgust, depending on the characteristics of the topic and how it is covered by the media. Our findings suggest that disgust leads to avoidant behavior primarily in the presence of threat, working in a manner opposite that of anxiety. Thus, disgust has the counterintuitive effect of decreasing public engagement in precisely those situations where it might be most critical.

In addition to affecting the willingness to learn about a disease, disgust influences the type of information individuals will retain when exposed to it. When disgust elicitors were present, either in textual or graphic depictions of symptoms, respondents fixated on the facts tied to the disgust elicitors, improving memory for that specific information. Yet this increase in recall came at a cost. Respondents made to feel disgust were less likely to recall other important facts about the disease, particularly its other symptoms. In this sense, disgust can be a barrier to a well-informed public.

Taken together, our findings highlight the challenges facing organizations tasked with communicating with the public. One of the most effective ways to control the spread of an infectious disease is to convey information about symptoms and methods of transmission (e.g.,

Roche and Muskavitch 2003). But how do health organizations convey information that may be regarded as disgusting without at the same time adversely affecting the public's willingness to learn about the disease? Even more important, are public health organizations inherently at cross purposes with the media, which may have an incentive to dramatize individual cases (Dudo, Dahlstrom, and Brossard 2007), potentially leading to an emphasis on disgust-inducing imagery?

Generalizing beyond the topic of infectious disease, we might expect similar challenges on issues dealing with personal health or stigmatized social groups. For example, vaccination (Clay 2016) and genetically modified foods (Clifford and Piston 2016) both trigger feelings of disgust. Disgust is also a common reaction to social groups that are perceived as a pathogen threat, including members of the LGBT community (Miller et al. 2017), immigrants (Aarøe, Bang Petersen, and Arceneaux 2017), racial and ethnic outgroups (e.g., Navarrete and Fessler 2006), and homeless people (Clifford and Piston 2016). In those contexts, disgust may be an obstacle to perspective-taking and learning about other groups/cultures—two common methods for countering prejudice and intolerance (e.g., Stephan and Finlay 1999). The present study illustrates the theoretical and empirical benefits when researchers focus on the effects of discrete emotions. While there is still much to learn about how the public responds to contemporary events and issues, there is growing evidence that discrete emotions such as disgust play an important role.

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