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ARTICLE

The implications of self-reported and physiologically measured disgust sensitivity for climate change risk perception

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Abstract

This study examines the relationship between disgust sensitivity and climate change risk perceptions, using both self-reported and psychophysiological measures of disgust sensitivity. We find that disgust sensitivity is connected to climate change risk perception, although results are far weaker with physiological measures than with self-reports. Results consequently suggest that the connection may stem more from cognitive and expressive factors than implicit biological impulses. Given theoretical functions of disgust, these findings offer valuable insights regarding the structure of environmental attitudes and heterogeneity in the effects of science and environmental communication.

Keywords

Environmental communication; Risk communication

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1 ▪ Introduction

Disgust is an emotional response that cues humans to avoid pathogenic threats [Oaten et al., 2009; Schaller & Park, 2011]. Although the direct scope of these threats is relatively narrow, research suggests that disgust tends to over-generalise and respond even to stimuli that are only tangentially related to pathogens. Thus, disgust shapes not only how we process information related to pathogens but also a broader range of attitudes and behaviours [Aarøe et al., 2016; Rozin et al., 2000]. Here, we report results from a study that examines the impact that individual variation in sensitivity to disgust may have on attitudes about the environment and discuss the implications it offers for the heterogeneity in effects of science and environmental messaging.

More precisely, we explore how disgust sensitivity relates to climate change risk perceptions. The potential association between disgust sensitivity and climate change risk perceptions is of both theoretical and practical significance. Theoretically, climate change has direct implications for infectious diseases and public health, which should provoke disgust responses; disgust sensitivity may accordingly influence climate change risk perceptions. Practically, if disgust sensitivity plays a role in climate change risk perceptions, it may help explain individual-level variation in the effects of environmental messaging related to climate change, especially when messages explicitly incorporate a 'disgust' factor.

In the sections that follow, we begin by outlining disgust sensitivity generally and discussing the connections between disgust sensitivity and environmental attitudes. We then describe our study, designed to consider the degree to which disgust sensitivity exogenously predicts climate change risk perceptions by measuring disgust in two ways: (1) self-reported survey measures (as is more typical in the field), and (2) psychophysiological responses to photos. In line with prior work, we find evidence of a correlation between self-reported disgust sensitivity and environmental attitudes. Using the physiological measure of disgust sensitivity, results are in the same direction but not statistically significant. In the concluding section, we consider what these findings might suggest about the nature of the association between disgust sensitivity and environmental attitudes, and the insights they provide into how disgust might shape the processing of climate change messages.

1.1 ▪ *Disgust as a defensive mechanism*

Disgust is an emotion central to pathogen avoidance. The disgust response is a key mobilising force for the behavioural immune system (BIS), a suite of unconscious and automatic psychological mechanisms that humans have evolved to function as a first line of defence against disease [Schaller, 2006]. When faced with cues indicating the presence of potential pathogens, the BIS creates disgust reactions which prompt people to take action to avoid the potential pathogen threat [Oaten et al., 2009; Tybur et al., 2013].

Although the primary function of the BIS is responding to pathogen threats, the system does not respond directly to actual infection risk but instead to cues that signal a potential risk of infection [Murray & Schaller, 2016]. These cues are imperfect indicators, but the consequences of the BIS failing to detect a real infection risk tend to be much greater than the consequences of it miscategorising an innocuous object as infectious. Thus, the BIS tends to err on the side of caution, miscategorising many stimuli as pathogenic even when they pose no real pathogen risk [Ackerman et al., 2018; Murray & Schaller, 2016]. False

alarm or not, these non-pathogenic stimuli can activate the BIS and ultimately shape an individual's responses toward a broad range of cues. In the modern world, some of these false alarms are driven by social cues such as appearance, age, and occupation [Duncan & Schaller, 2009; Haidt & Graham, 2007; Rozin et al., 2000; Wirtz et al., 2016].

Although everyone experiences states of disgust, there is also significant individual-level variation in people's dispositional sensitivity to disgust [Fournier et al., 2021; Petersen, 2019]. This variation in individual propensities of experiencing disgust is known as disgust sensitivity [e.g., Inbar et al., 2009; Tybur & Karinen, 2018]. Variations in disgust sensitivity are associated with a broad range of health-related and political issues, including support for food safety regulations [Kam & Estes, 2016], attitude towards genetically modified food [Scott et al., 2016; Townsend, 2006], risk perceptions towards the Ebola outbreak [Yang & Chu, 2018], public health [Clifford & Wendell, 2016], and social trust and out-group attitudes [Aarøe et al., 2017].

Not all these kinds of disgust responses are necessarily the same. The sense of disgust created by the BIS is often referred to as "physical" disgust (sometimes "core" or "pathogen" disgust) and is elicited by "certain foods, animals, and body products, particularly those associated with garbage and waste" in defence of pathogenic threats [Olatunji et al., 2012, p. 206]. However, as noted above, disgust is connected to a wide range of social phenomena beyond just pathogens [e.g., Aarøe et al., 2017]. Disgust is not just physical, and existing literature recognises several other forms of the emotion. Typologies vary, but one common element is a distinction between physical disgust and moral disgust [e.g., Rozin et al., 2000; Tybur et al., 2009; Abitan & Krauth-Gruber, 2015; Olatunji et al., 2012]. Where physical disgust is focused on pathogens and waste, moral disgust is induced by "transgression of social norms and moral values" [Abitan & Krauth-Gruber, 2015, p. 473], which "motivates the avoidance of social norm violators" [Olatunji et al., 2012, p. 206]. While physical and moral disgust share some common physiological correlates, the root causes and fundamental functions of the two disgust are different [see Abitan & Krauth-Gruber, 2015, for further discussion]. We focus exclusively on physical disgust below, given our interest in the connection between the behavioral immune system and dispositions towards pro-environmental behavior. In the discussion, however, we reflect on potential connections to moral disgust.

1.2 ▪ *Disgust and predispositions to pro-environmental behavior*

As described above, the protective function of disgust connects it closely to people's attitudes about health and public health. This connection may also extend to environmental issues. Climate change has direct implications for public health in general and pathogen threats in particular. Increasing climatic hazards are suggested to exacerbate the spread of pathogenic diseases that pose a threat to public health. This happens by, for instance, increasing temperatures and changing of precipitation, resulting in the expansion of areas conducive to pathogen transmissions such as malaria, dengue, ticks, fleas, and more [Martens et al., 1995; Mora et al., 2022]. Some of these implications are relatively diffuse, of course, but media coverage of climate change regularly highlights its consequences for health and the spread of infectious disease [Hart & Feldman, 2014; King et al., 2019]. Indeed, climate messaging focused on human health is particularly persuasive to many people [Dasandi et al., 2022; Maibach et al., 2010]. This body of work provides a strong

theoretical basis to speculate that disgust sensitivity may be important for understanding how people develop attitudes about the environment. To provide more direct empirical evidence about this dynamic, we now turn to the substantial body of research connecting general health-related attitudes to pro-environmental values.

Health consciousness tends to be positively associated with pro-environmental behaviours [Dursun et al., 2016; Shimoda et al., 2020; Ture & Ganesh, 2012]. Indeed, the strength of this relationship is comparable to — or even greater than — the relationship between environmental behaviours and more explicitly environmental attitudes, suggesting that health consciousness captures something important and distinct from other environmental attitudes [Dursun et al., 2016; Shimoda et al., 2020; Ture & Ganesh, 2012]. Concerns about the health impacts of environmental issues are also strongly related to both pro-environmental attitudes [Qader & Zainuddin, 2010] and behavioural intentions [Baldassare & Katz, 1992; Séguin et al., 1999], and people are more persuaded by environmental messages when those messages highlight health consequences [Myers et al., 2012].

Many of these health attitudes are at least tangentially related to disgust sensitivity [or components of disgust sensitivity such as contagion threat; see, e.g., Olatunji et al., 2004]. Importantly, past work also suggests that disgust sensitivity itself is related to environmental attitudes, albeit mainly in work focusing on perceived vulnerability to disease (PVD), which conceptually represents only one part of disgust sensitivity [see, e.g., Duncan et al., 2009]. Prokop and Kubiatko [2014] have argued for an evolutionary approach to understanding variation in environmental attitudes, for instance: "if the behavioural immune system reacts sensitive when disease threat increases, then people more vulnerable to diseases should also express stronger environmental concerns, because environmental pollution influences human health" (p. 4). Their analyses of survey data found that adolescents who scored higher on the germ aversion component of PVD reported more pro-environmental attitudes. Extending this work, Jiang et al. [2021] find that cueing people with information about human vulnerability to infectious diseases makes them more willing to engage in pro-environmental behaviour.

Anderson and Zebrowitz [2020] have proposed a more complex relationship between disgust sensitivity and environmental attitudes in which partisanship moderates the relationship between PVD and support for climate change policy. Their results, based on a U.S. sample, suggest that PVD is positively associated with support for climate change policies amongst Republicans. Democrats, on the other hand, exhibit high levels of support for climate change policy regardless of PVD. This effect of PVD, conditional on partisanship, is in line with research focused on the impact of disgust sensitivity in other policy domains [Fournier et al., 2021].[1]

Although Prokop and Kubiatko [2014], Jiang et al. [2021], and Anderson and Zebrowitz [2020] focus on vulnerability to disease, rather than disgust sensitivity more generally, there appears to be good reason to expect that disgust sensitivity is associated with environmental attitudes. We reconsider these connections below, with the same motivating logic suggested by Prokop and Kubiatko [2014]: many environmental issues have implications for public health; given that climate change creates pathogenic threats, and disgust functionally

1. Research on the association between disgust sensitivity and a broad range of political issues is also in line with work connecting disgust sensitivity to political ideology [e.g., Tybur et al., 2010; Inbar et al., 2012].

protects us from those threats, people high in disgust sensitivity may be particularly concerned about the threats posed by climate change.

Of course, the consequences of climate change are not all pathogenic, and many of the mechanisms that link broad environmental changes to public health are somewhat indirect or opaque. Given the salience of health themes in media coverage of climate change, we believe that disgust should nonetheless play a role in environmental attitudes. Moreover, we emphasise again that disgust and the BIS overgeneralise — they also respond to many stimuli that are *not* explicit pathogen threats [Ackerman et al., 2018; Murray & Schaller, 2016]. Even if only a few aspects of climate change are directly related to pathogen threats, these may be enough to make disgust-sensitive people especially alarmed by climate change. Accordingly, we believe that disgust sensitivity may be connected to concern about climate change, not just because of the consequences of climate change for pathogen threat, but because of the growing literature connecting disgust sensitivity with a broad range of environmental attitudes and behaviours.

2 ▪ Objectives and hypotheses

The objective of our study is to further investigate the possibility that disgust sensitivity is associated with climate change risk perceptions. We focus on climate change risk perceptions for three reasons. First, climate change is generally considered a "wicked" and pressing environmental issue, so we regard attitudes related to climate change as especially important outcomes to consider. Second, risk perceptions are pivotal to pro-environmental attitudes and behaviours in various contexts, including climate change [Mumpower et al., 2016; Spence et al., 2011; van Valkengoed & Steg, 2019]. Third, disgust is primarily a response to a potential infection risk, which makes perceived risks of climate change a likely outcome in the environmental domain.

Importantly, we capture disgust sensitivity in two ways, using both self-reported measures and psychophysiological reactions to photo stimuli. To our knowledge, all existing research in the environmental domain has focused on self-reported measures to capture disgust sensitivity and related constructs. We provide a conceptual replication of that work, capturing explicit expressions of disgust using survey questions. However, the existing theoretical argument about disgust sensitivity and the BIS considers disgust as an automatic and implicit emotional response. Explicit self-reported measures may either miss or mask the "non-conscious and non-reportable" [Cacioppo et al., 2007, p. 2] physiological reactivity signalling disgust. Indeed, past work identifies important differences in self-reported versus physiological measures of disgust sensitivity, suggesting that self-reported feelings of disgust may be as dependent on cognitive responses and social norms as they are on actual felt disgust [see e.g., Balzer & Jacobs, 2011; Smith et al., 2011]. In other words, people's experience of disgust depends first on their automatic and implicit emotional response, then on how they interpret this response cognitively; and existing work suggests that explicit self-report measures reflect (to some extent, if not primarily) the latter component.

As outlined above, past findings indicate that both variants of disgust sensitivity matter for a range of social and political attitudes. Our inference, informed by the existing literature, is that the physiological experience of disgust may be more helpful in explaining some attitudes, while self-reported disgust — reflecting some combination of physiological

experience and socially-learned beliefs about the appropriateness of reporting disgust in different contexts — may be more helpful in others. Our expectation is that the two measures will be positively correlated, but only modestly so, given work on the differences between self-reported and physiological disgust.[2] We do not have strong *a priori* expectations about which version of disgust sensitivity will be most correlated with environmental attitudes. We nevertheless believe that differences will be instructive: to the extent that climate change risk perceptions are driven by deep-seated predispositions towards disgust, we expect to find a strong correlation with the physiological measure; if the physiological measure is weakly correlated but the self-reported measure is strongly correlated, then the connection between disgust and environmental attitudes may be more attitudinal and expressive than biological.

Our hypotheses are as follows:

H1: Self-reported disgust sensitivity will be positively associated with higher risk perceptions of climate change.

H2: Physiological disgust sensitivity will be positively associated with higher risk perceptions of climate change.

The confidence with which we are able to reject the null hypothesis for H1 versus H2 will indicate the degree to which connections between disgust sensitivity and environmental attitudes are primarily attitudinal or biological. Additionally, in the Appendix, we include exploratory analyses that examine potential interactions between disgust sensitivity and partisanship, motivated by Anderson and Zebrowitz [2020].

3 ▪ Methods

3.1 ▪ *Procedure*

This study was approved by the Institutional Review Board at the University of Michigan (HUM00161198). The study was conducted as part of a larger collaborative project combining several investigations into a single data collection effort. We discuss below the components of the data collection relevant to our investigation, but where necessary, we outline the broader context.

Participants of the study were recruited via convenience sampling between April 11, 2019 and April 19, 2019, with an eye towards building a sample large enough to detect small to moderate effect sizes in line with past work focused on psychophysiological measures. Potential participants were either approached by the researcher in public spaces, emailed through university mailing lists, or referred to by prior participants. Recruitment was initiated by asking their willingness to participate in an experiment about public affairs that would approximately take 30 minutes in a nearby lab space. Only adults 18 or older were eligible to participate in the study.

Upon arriving at the lab space in which the experiment was conducted, the participant was given a brief introduction about the procedure. To reduce any anxiety or uncertainty about

2. For additional work that considers various approaches to capturing disgust sensitivity, see, e.g., Tybur et al. [2014], Kahan and Hilgard [2016], Karg et al. [2019], Chinn and Hasell [2021], Mustafaj et al. [2022] and Rohrmann et al. [2008].

the physiological measurement, the participant was further informed that nothing will hurt or shock, and all they need to do is watch the photographs being shown. Then, they were given time to read and complete the informed consent form. After they completed the informed consent form, they were given $10 cash in advance as compensation. Then, the participant was asked to turn off any electronic devices, including their mobile phones or smartwatches and reminded that they may discontinue their participation at any point in time they may wish to do so.

Next, the participant was guided to a separate room to be seated in front of a desktop. Rooms were in a tightly controlled, quiet lab in a large building on campus. All respondents were exposed to the same lighting and temperature conditions. Small finger-band electrodes were strapped on the index and middle fingers of the participant's non-dominant hand. When the participant indicated that they were ready, the researcher asked the participant to put on headphones for noise-cancelling purposes and started the photo array with a verbal note that it would start with a black screen and the photos would appear after a minute. The researcher exited the room as the black screen started.

Following the 1-minute black screen, participants were exposed to an array of photographs. The photos were presented one at a time in random order. Each photograph was shown for 8 seconds, followed by a 10-second interstimulus interval (a blank grey screen). As part of the photo array, participants were shown 4 disgust-inducing photographs (e.g., a man visibly vomiting into a toilet) and 4 neutral photographs (e.g., an empty basket on the ground) from the International Affective Picture System [IAPS; see Bradley & Lang, 2007; Codispoti et al., 2001].[3]

Once the photo array was finished, the researcher re-entered the room to remove the sensors from the participant and switch the desktop computer from the photo array to the survey. The researcher again exited the room as the survey started. After the survey, the participant was then given the opportunity to provide feedback and were debriefed. A written debrief with further specific information was provided upon request.

3.2 ▪ *Participants*

Our sample consisted of 80 participants — a small sample by survey-research standards, but a relatively large sample for work involving in-lab psychophysiological measures.[4] 70% of our participants were between the ages of 18 and 24, 26.3% were between 25 and 34, and 3.8% were between 35 and 44. 60% of the participants were women, and given our sampling procedure, all had at least some years of college education. 52.5% were White, 21.3% Asian, 17.5% Hispanic, and 6.3% Black or African American.

3. The photos also included 4 threat inducing photographs and 4 positive photographs from the IAPS. Appendix Table 3 lists the photo descriptions and IAPS picture numbers for all photos used in the experiment. 4 male headshots from the Chicago Face Database [Ma et al., 2015] were also included in the photo array for a separate project that will not be discussed here.
4. Physiological studies often use a relatively small sample size because physiological data collection is expensive and time-intensive. Indeed, our sample size (n = 80) is relatively sizable for this type of physiological study. Note also that the nature of physiological data means that our data are measured over time and across stimuli. We thus have observations from 80 individuals, but each of those 80 observations includes 100s of seconds of physiological responses. In some instances, modeling the data as a time-series panel estimation produces many more 'cases' used in the analyses. In this instance, we have focused on simpler individual-level models — but the measurement of the physiological variables reflects averages over minutes of observation, and thus more accuracy than we might find in a typical survey item.

3.3 ▪ *Measures*

We offer brief descriptions of our primary measures below. Additional details about question wordings and response options can be found in the Appendix.

3.3.1 ▪ *Self-reported disgust sensitivity*

For self-reported disgust sensitivity, we depended on a previously validated pathogen disgust sensitivity scale [Olatunji et al., 2012]. Among the Three Domains of Disgust Scale [TDDS; Olatunji et al., 2012], we implemented the pathogen domain as it is most relevant to the theoretical interest of this study. The index consists of 7 items that ask participants to rate how disgusting they perceive a described situation to be, on a 7-point scale. The 7 described situations were: (a) stepping on dog poop, (b) sitting next to someone with red sores on their arm, (c) shaking hands with a stranger who has sweaty palms, (d) seeing some mould on old leftovers in the refrigerator, (e) standing close to a person who has body odour, (f) seeing a cockroach run across the floor, and (g) accidently touching a person's bloody cut. The 7 items were averaged into a single index that ranges from 0 to 1 (mean = 0.48, SD = 0.19, Cronbach's α = 0.75). Figure 1A shows the distribution of self-reported disgust sensitivity.

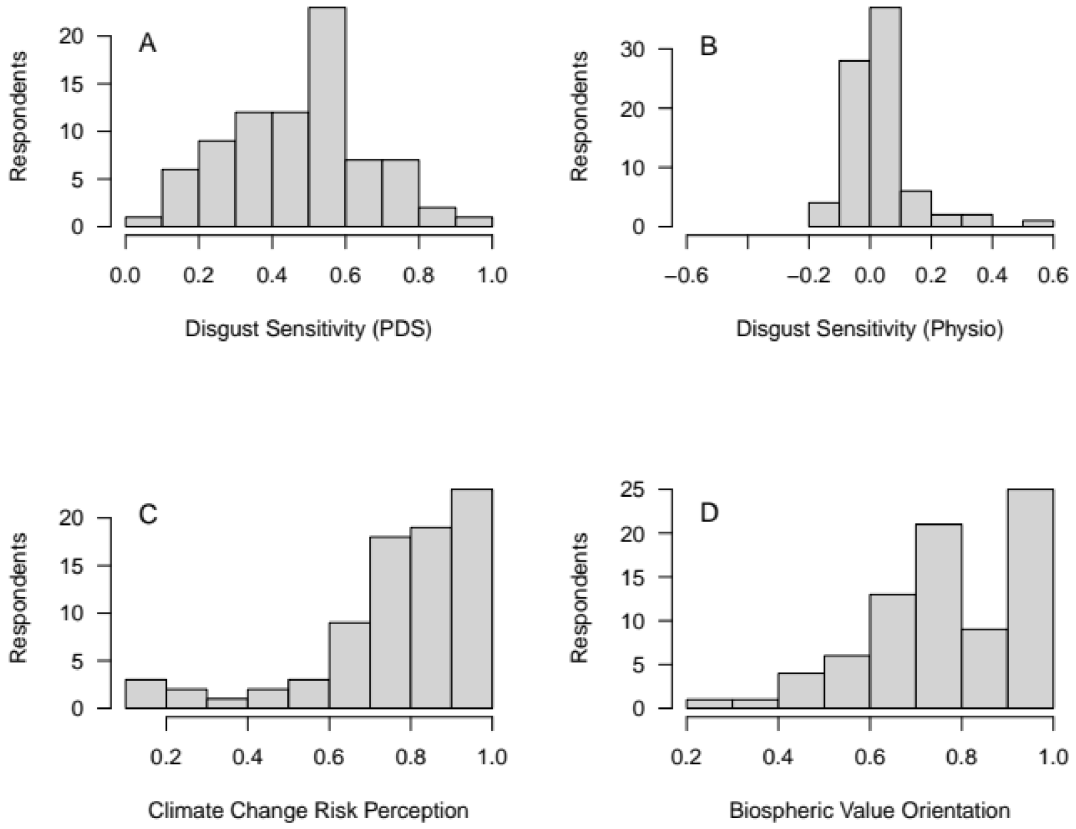

Figure 1. Distributions of Self-Reported Disgust Sensitivity, Physiologically Measured Disgust Sensitivity, Climate Change Risk Perception, and Biospheric Value Orientation.

3.3.2 ▪ *Physiologically measured disgust sensitivity*

We measured physiological disgust sensitivity by capturing changes in participants' skin conductance in reaction to a series of IAPS photos. In capturing and processing the physiological data, we followed procedures in line with previous work using skin conductance to capture physiological activation. The raw signal is captured at 256th of a second using a physiological encoder from Thought Technologies and purpose-built software used in prior work [e.g., Fournier et al., 2021; Ploger et al., 2021; Soroka et al., 2019]. The raw signal is smoothed using a rolling average, with slightly larger weights attributed to the middle three values, removing some of the 'noise' in the series but retaining some of the impact of outlying values. The series is then 'downsampled' to one-second intervals, further smoothing the series. This procedure is in line with previous work using skin conductance to capture physiological activation [see especially the methodological appendix to Soroka et al., 2019].

Physiological disgust sensitivity was estimated by the difference between mean skin conductance when a participant was viewing disgusting photos (e.g., a cockroach sitting on pizza) and the mean skin conductance when they were viewing neutral photos (e.g., an empty basket) (mean = 0.03, min = -0.19, max = 0.52, SD = 0.11).[5] Different participants have different baseline skin conductance levels; using skin conductance during neutral photos focused our measure on within-respondent differences in reactions to disgusting versus neutral photos.[6] Descriptions of the photos used are included in Appendix Table 3.

Figure 1B shows the distribution of physiological disgust sensitivity. Note the rather different distribution of the variable, relative to the self-reported measure shown in Figure 1A. Even so, the two measures are correlated at 0.273 (p = 0.014).

3.3.3 ▪ *Climate change risk perceptions*

Climate change risk perceptions were measured with 7 items adapted from a previous study [van der Linden, 2015]. Respondents were asked how serious they thought the impacts of climate change were to themselves (e.g., "How serious of a threat do you think climate change is to you personally?"), to society (e.g., "In your judgment, how likely is it that climate change will have very harmful, long-term impacts on our society?"), and also to the wider world and natural environment (e.g., "How serious of a threat do you think climate change is to the natural environment?"), on a 7-point scale. The 7 items were averaged into a single index of climate change risk perceptions that ranges from 0 to 1 (mean = 0.77, SD = 0.21, Cronbach's α = 0.91). Figure 1C shows the distribution of this climate change risk perception measure.

3.3.4 ▪ *Biospheric value orientations*

Biospheric value orientations are an important precursor to environmental attitudes and behaviours [e.g., de Groot & Steg, 2008; Stern et al., 1999; van der Werff et al., 2013]. While

5. Inspection of the skin conductance signals suggests 8 respondents for whom the sensors may not have been providing reliable data. We do not immediately exclude those respondents here; rather, we report results with all respondents and note differences when we exclude these respondents.
6. We will not go into much detail on the measurement of disgust sensitivity using skin conductance, but note that there is a robust literature on the subject. In addition to the work cited above, see e.g., Smith et al. [2011] and Balzer and Jacobs [2011].

risk perceptions will vary over time and context, value orientations appear to be rather stable over the course of an individual's life [Stern et al., 1995]. We thus also accounted for biospheric value orientations in our study as a control variable, using 4 items developed from a previous study [de Groot & Steg, 2008]. The items asked how strongly respondents support or oppose the following four "guiding principles" in the participant's life: (a) respecting the Earth, (b) protecting the environment, (c) preventing pollution, (d) unity with nature. The 4 items were each measured on a 7-point scale and were later combined into a single index of biospheric value orientations that ranges from 0 to 1 (mean = 0.77, SD = 0.18, Cronbach's α = 0.92). Figure 1D shows the distribution of biospheric value orientations.

3.3.5 ▪ *Partisanship*

Partisanship has been increasingly associated with environmental attitudes and behaviours [e.g., Smith et al., 2024]; some prior work also suggests that the influence of disgust sensitivity is conditional on partisanship [e.g., Anderson & Zebrowitz, 2020; Fournier et al., 2021]. We accordingly capture the political partisanship of participants using the standard branching "party identification" question from the American National Election Survey (details are included in the Appendix). In the models below, we recode the 7-point variable into a 0–1 scale (M = 0.27, SD = 0.28; ranging from 0 = "Strong Democrat" to 1 = "Strong Republican"). Our sample is heavily skewed toward the left of the ideological spectrum: there are 49 Democratic identifiers (21 strong identifiers and 28 weak identifiers), 22 independent and "other" identifiers (11 of whom lean toward the Democratic party and 11 of whom are "true" independents), and 9 Republican identifiers (3 strong identifiers, and 6 weak identifiers). We approach our data keeping this heavily skewed distribution in mind. Indeed, while we include exploratory tests of the moderating effects of partisanship in the Appendix, we do not include them in the main text, given their reliance on so few Republican identifiers.

3.3.6 ▪ *Demographics*

The following socio-demographic variables were included as controls throughout the analyses: gender (dummy coded, where 1 = women), age, and education (categorical ranges recoded from 0 to 1; details included in the Appendix). Although we briefly interpret the estimated effects of these variables, we regard them primarily as controls; that is, our interest is in the estimated effect of disgust sensitivity controlling for the effect of socio-demographics.

4 ▪ Results

Tables 1 and 2 show results from hierarchical ordinary least squares (OLS) regression models, examining climate change risk perception as a function of disgust sensitivity, first on its own, then adding demographics and biospheric value orientations, then adding partisanship. Table 1 shows results for the self-reported measure of disgust sensitivity; Table 2 shows results for the physiological measure of disgust sensitivity.

Results in Table 1 indicate a strong correlation between self-reported disgust sensitivity and climate change risk perceptions. Model 1 shows a significantly positive association between self-reported disgust sensitivity and climate change risk perceptions, and the association is

Table 1. Climate Change Risk Perception and Self-Reported Disgust Sensitivity.

	(1)	(2)	(3)
Self-Reported Disgust Sensitivity	0.266*	0.314**	0.277**
	(0.123)	(0.117)	(0.087)
Gender		0.055	0.058+
		(0.045)	(0.034)
Age		0.207	0.123
		(0.212)	(0.157)
Education		-0.051	-0.024
		(0.111)	(0.082)
Biospheric Value Orientation		0.418**	0.325**
		(0.128)	(0.096)
Party ID			-0.463***
			(0.059)
Constant	0.644***	0.268*	0.477***
	(0.063)	(0.119)	(0.092)
Observations	80	80	80
R^2	0.056	0.219	0.576

+p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

Table 2. Climate Change Risk Perception and Physiological Disgust Sensitivity.

	(1)	(2)	(3)
Physiological Disgust Sensitivity	0.344	0.413*	0.206
	(0.216)	(0.207)	(0.161)
Gender		0.060	0.061+
		(0.046)	(0.036)
Age		0.141	0.082
		(0.217)	(0.167)
Education		-0.057	-0.033
		(0.113)	(0.087)
Biospheric Value Orientations		0.416**	0.317**
		(0.131)	(0.101)
Party ID			-0.459***
			(0.063)
Constant	0.759***	0.413***	0.616***
	(0.024)	(0.102)	(0.083)
Observations	80	80	80
R^2	0.031	0.187	0.528

+p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

robust to the inclusion of demographics and partisanship in Models 2 and 3. We consequently reject the null for H1.

There are hints of a positive association between gender and climate change risk perceptions in Model 3 (p = 0.09) but demographics otherwise have no discernible effect. The coefficient for biospheric value orientations, included in Model 3, indicates that increasing scores on

this variable were associated with increasing scores for climate change risk perceptions. Partisanship is strongly negatively associated with climate change risk perceptions in Model 3, as expected given that high values of this variable indicate Republican identification (and in spite our rather skewed sample where partisanship is concerned).

Results are quite different in Table 2, now examining physiological disgust sensitivity. Here, the bivariate Model 1 shows no relationship between physiological disgust sensitivity and climate change risk perceptions. The coefficient for physiological disgust sensitivity is positive and significant in Model 2, but nonsignificant when partisanship (again strongly negatively related to climate risk perceptions) is added in Model 3. A cautious interpretation of these results suggests that we cannot confidently reject the null for H2.

5 ▪ Discussion

This study has examined how disgust sensitivity is associated with climate change risk perceptions. We found strong evidence that self-reported disgust sensitivity is connected to climate change risk perceptions (H1). We found only weak, statistically nonsignificant hints that the same is true for physiological disgust sensitivity (H2), however.

The strong association between self-reported disgust sensitivity and climate change risk perceptions is consistent with previous empirical findings [Anderson & Zebrowitz, 2020; Prokop & Kubiatko, 2014]. And, where previous work focused on relationships between PVD and pro-environmental attitudes in general, our study extends that body of work by demonstrating that these relationships hold when we focus on disgust sensitivity and perceptions about the risks of climate change. The result is robust to the inclusion of control variables known to have strong relationships with environmental attitudes (e.g., biospheric value orientations and partisanship). Our findings thus indicate that disgust sensitivity may help explain individual differences in climate change risk perceptions.

We do not find the same robust connections between physiological disgust sensitivity and climate change risk perceptions. This may be a simple issue of measurement error. Psychophysiological signals are difficult to capture accurately [Soroka et al., 2019], and even when accurately captured, skin conductance captures the level of physiological arousal to disgusting photos, not disgust itself. To be clear, we did focus on individual differences in responses to clearly defined categories of images (i.e., disgusting images compared to neutral images), and by using IAPS photos that have been repeatedly used in past physiological research, we tried to ensure that the images we used were primarily disgusting [Bradley & Lang, 2007; Lang et al., 1997]. Some prior work nevertheless expresses concern about the degree to which the IAPS photos can be used to reliably elicit discrete emotional responses [cf. Libkuman et al., 2007; Mikels et al., 2005]. We thus regard our physiological measure as the best approach given the extant literature, but we accept that it may provide only an approximate indication of physiological disgust sensitivity.

Alternatively, our results may reflect genuine differences in the “contents” of disgust sensitivity measured physiologically rather than through self-reports [Balzer & Jacobs, 2011; Olatunji et al., 2012; Smith et al., 2011]. In that instance, our results could indicate that the associations between disgust sensitivity and climate change risk perceptions are more driven by attitudinal associations than by deep-seated predispositions. Additionally, although our measure focused on physically disgusting situations, responses to these questions tend

to be modestly correlated with measures of moral disgust [e.g., Olatunji et al., 2012; Tybur et al., 2009]. Given that climate change is increasingly viewed as not only an issue of sustainability and health but also one of justice and equity [Carman et al., 2025; IPCC, 2023], our self-report measure could be capturing an underlying predisposition to moral disgust that makes people more concerned about climate change because of its moral and ethical implications rather than its pathogenic consequences.

The differences in relationships between the self-reported and physiological measures of disgust sensitivity may also be linked to an even more basic distinction. Generating any sort of attitude or perception about climate change is a complex cognitive exercise. Accordingly, climate change risk perceptions may inherently be more closely connected to the explicit, cognitive, self-reported version of disgust (regardless of its 'contents') than to the automatic, physiological BIS. Some environmental catastrophes (e.g., beached whales) may easily elicit disgust from the BIS, but it seems probable that the influence of that automatic response stops at short-term behaviour and evaluations of other proximate attitude objects (e.g., sea creatures, the beach); expecting that automatic response to directly and unconsciously shape beliefs about climate change, the fundamental cause of many modern environmental catastrophes, may be asking too much. Ultimately, more work is needed to help us better understand when and why the effects of self-reported disgust sensitivity differ from the effects of physiological disgust sensitivity, and particularly to explore how physiological disgust maps onto different subtypes of self-reported disgust.

In sum, our study adds to the growing body of evidence that health concerns are an important component of environmental attitudes. We take a somewhat broader approach than previous work, showing that the underlying construct of disgust sensitivity — which has been theorised to function as an emotional response that cues humans to avoid pathogenic threats — relates to climate change risk perceptions. At the same time, we find that this relationship is nuanced. Self-reported disgust sensitivity is clearly connected to climate change risk perceptions, but physiological disgust sensitivity is more ambiguous. Existing theoretical explanations linking disgust to environmental attitudes rest heavily on the idea that this relationship is automatic, driven by biological responses and the behavioural immune system. Our null (albeit suggestive) findings with the physiological measure indicate that this explanation may be incomplete: some, perhaps most, of the connection between disgust and environmental attitudes seems to be driven by explicit, cognitive processes that may be learned or socialised, rather than by automatic biological processes.

That the connection between disgust sensitivity and environmental attitudes may hinge on cognitive rather than biological processes does not change the potential relevance of disgust in environmental messaging. If some people are systematically more concerned about the prospect of disgusting situations, then they may be particularly responsive to messaging focusing on the environmental implications of oil spills or algae blooms, a possibility underscored by work on the value of climate messaging focused on health [Dasandi et al., 2022; Maibach et al., 2010]. The potential effectiveness of disgust-based climate messages is especially important given past findings that disgust may be particularly connected to environmental attitudes for Republicans, who tend to be more sceptical of climate messaging [Anderson & Zebrowitz, 2020; see our exploratory analyses of partisanship interaction in the Appendix]. We accordingly emphasise the pressing task of science and environmental communication research to further our understanding of the processing of disgust-based environmental messages, and to explore if this strategy can be used to build support for environmental action and climate policy.

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A ▪ Materials, procedures, and additional analyses

Self-reported disgust sensitivity

"Please rate how disgusting you find the concepts described below"

1. "Stepping on dog poop"
2. "Sitting next to someone with red sores on their arm"
3. "Shaking hands with a stranger who has sweaty palms"
4. "Seeing some mold on old leftovers in the refrigerator"
5. "Standing close to a person who has body odor"
6. "Seeing a cockroach run across the floor"
7. "Accidentally touching a person's bloody cut"

[Response options: Not at all disgusting, Not too disgusting, Slightly disgusting, Somewhat disgusting, Moderately disgusting, Very disgusting, Extremely disgusting]

Physiological disgust sensitivity

Table 3. IAPS photos used in the study.

Affect	*IAPS code*	*Image content*	*Mean response per image (SD)*
disgust	3059	an open wound	0.03 (0.16)
	7380	a cockroach sitting on pizza	0.00 (0.18)
	9300	a toilet full of vomit	0.01 (0.18)
	9325	a person visibly vomiting into a toilet	0.02 (0.14)
neutral	7010	an empty basket	-0.03 (0.14)
	7030	an iron	-0.01 (0.10)
	7040	a dustpan	-0.01 (0.17)
	7080	a fork	0.00 (0.19)

Climate change risk perception

1. "How concerned are you about climate change?"
   [Response options: Not concerned at all, Slightly concerned, Somewhat concerned, Moderately concerned, Very concerned]
2. "In your judgment, how likely is it that you will experience a serious threat to your health or overall well-being during your lifetime as a result of climate change?"
   [Response options: Not likely at all, Slightly likely, Somewhat likely, Moderately likely, Very likely]

3. “How serious of a threat do you think climate change is to you personally?”
   [Response options: Not serious at all, Slightly serious, Somewhat serious, Moderately serious, Very serious]
4. “In your judgment, how likely is it that climate change will have very harmful, long-term impacts on our society?”
   [Response options: Not likely at all, Slightly likely, Somewhat likely, Moderately likely, Very likely]
5. “How serious of a threat do you think climate change is to the natural environment?”
   [Response options: Not serious at all, Slightly serious, Somewhat serious, Moderately serious, Very serious]
6. “How serious do you think current impacts of climate change are around the world?”
   [Response options: Not serious at all, Slightly serious, Somewhat serious, Moderately serious, Very serious]
7. “How serious do you think the impacts of climate change are for the United States?”
   [Response options: Not serious at all, Slightly serious, Somewhat serious, Moderately serious, Very serious]

Biospheric value orientation

“Please indicate how strongly you support or oppose the following values as guiding principles in your life.”

1. “Respecting the Earth”
2. “Protecting the environment”
3. “Preventing pollution”
4. “Unity with nature”

[7-point response scale with end- and mid-points labeled: Strongly oppose, Neutral/Not important, Strongly support]

Gender

“What is your gender?”

This variable was included as an open-text response in the survey, and recoded into a binary variable equal 1 for respondents who identified as female.

Age

“What is your age?”

[Response options: 18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, 85 or older]

The final variable is included as an interval-level variable, ranging from 0 (18–24) to 1 (55–64).

Note: There were no participants who responded that they were 65 or older.

Education

"What is your education level?"

[Response options: Less than high school, High school graduate, Some college, 2-year degree, 4-year degree, Professional degree, Masters and/or Doctorate]

The final variable is included as an interval-level variable, ranging from 0 (High school graduate) to 1 (Masters and/or Doctorate).

Note: There were no participants who responded that they had received less than high school education.

Political partisanship

Partisanship was measured using the standard, 7-point branching structure:

1. "Generally speaking, do you think of yourself as a Democrat, a Republican, an Independent, or what?"
   [Response options: Democrat, Republican, Independent, Other]
2. *If Democrat or Republican was selected*: "Would you call yourself a…"
   [Response options: Strong Democrat/Republican, Not very strong Democrat/Republican]
3. *If Independent or Other was selected*: "Do you think of yourself as closer to the…"
   [Response options: Republican Party, Democratic Party, Neither]

The final variable is coded from 0 (Strongly Democratic) to 1 (Strongly Republican)

Interactions between partisanship and disgust sensitivity

As noted in the text, some prior work suggests that the association between disgust sensitivity and policy attitudes is moderated by partisanship. Models in Table 4 add an interaction between partisanship and disgust sensitivity. The first column shows results using self-reported disgust sensitivity, and the second shows results using physiological disgust sensitivity. We include these results here due to the limited number of Republican identifiers in our sample. We view the results that follow as useful preliminary tests of the possibility that effects of disgust sensitivity are moderated by partisanship; but we do not have enough Republicans in our sample to be confident in the generalisability of these results.

The coefficient for self-reported disgust sensitivity in column 1 captures the association between self-reported disgust sensitivity and climate change risk perceptions amongst strong Democratic identifiers. That coefficient is nearly 0, and statistically nonsignificant. The interaction coefficient captures the differences in the impact of self-reported disgust sensitivity as participants move to the right politically, however, and here we see a strong positive coefficient. Figure 2 illustrates the estimated association between self-reported disgust sensitivity and climate change risk perceptions across strong Democratic versus strong Republican identifiers. 95% confidence intervals are wider for Republicans, given our sample characteristics. But a difference across Democratic and Republican identifiers is evident: Democrats score relatively high on climate change risk perceptions regardless of

Table 4. Climate Change Risk Perception Regressed on Self-Reported (column 1) and Physiological (column 2) Disgust Sensitivity.

	(Column 1)	(Column 2)
Disgust Sensitivity	0.089	-0.060
	(0.125)	(0.253)
Gender	0.040	0.044
	(0.034)	(0.037)
Age	0.126	0.083
	(0.154)	(0.166)
Education	-0.029	-0.036
	(0.080)	(0.086)
Biospheric Value Orientation	0.354***	0.334**
	(0.095)	(0.101)
Party ID	-0.744***	-0.460***
	(0.148)	(0.063)
Party ID * Disgust S.	0.658*	1.153
	(0.318)	(0.850)
Constant	0.550***	0.618***
	(0.097)	(0.083)
Observations	80	80
R^2	0.600	0.540

+p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001

their self-reported disgust sensitivity; Republicans, in contrast, show a positive association between disgust sensitivity and climate change risk perceptions. Note that this effect resembles what we have seen in prior work by Anderson and Zebrowitz [2020].

The same dynamic is not evident in column 2 of Table 4, focused on physiological disgust sensitivity. Figure 3 illustrates the trend of this statistically nonsignificant relationship.

Our inference is that self-reported disgust sensitivity *may* matter more for Republicans, who tend to see climate change as less of a priority for the country, than it does for Democrats, who tend to be already highly alarmed by climate change. This finding would be consistent with past work, and it presents an important possibility where environmental communication is concerned. In the U.S., progress toward climate policy is largely constrained by Republican opposition. If disgust is a factor that can mitigate — or at least counterbalance — partisan scepticism, it may be that pro-environmental messages emphasising the disgusting implications of climate change can reach the people currently most opposed to climate policy. We cannot be confident in these results based on our sample, but we believe there is evidence here that would justify further research along these lines.

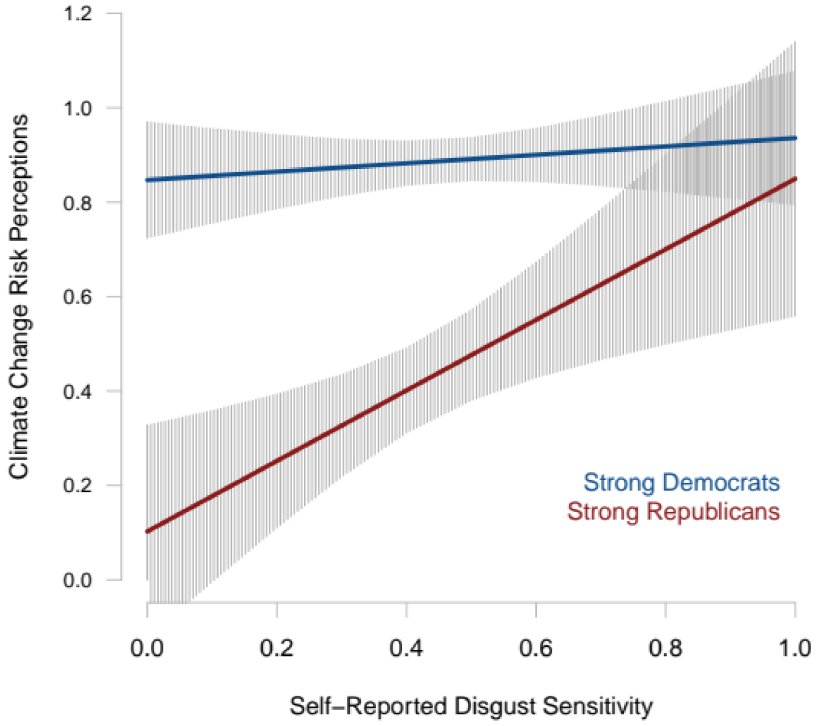

Figure 2. Climate Change Risk Perception, Self-Reported Disgust Sensitivity, and Partisanship.

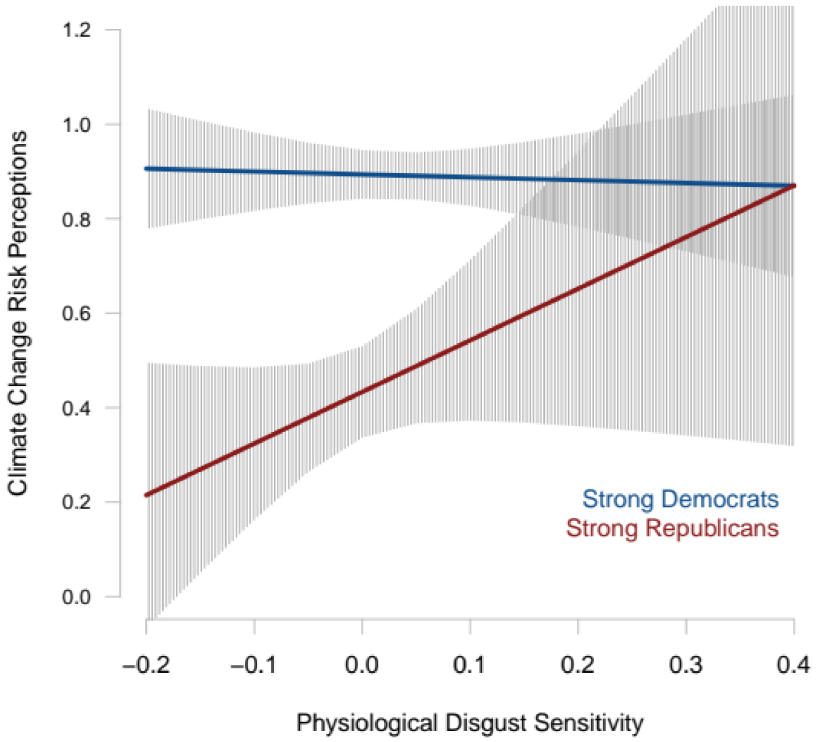

Figure 3. Climate Change Risk Perception, Physiological Disgust Sensitivity, and Partisanship.

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