We're not of the same feather: Disgust sensitivity and reduced perceived similarity to unknown others

Sari Mentser[a],*, Ravit Nussinson[b]

[a] *The Open University of Israel & The Hebrew University of Jerusalem, Israel*
[b] *The Open University of Israel & University of Haifa, Israel*

ABSTRACT

Perceptions of interpersonal similarity are accompanied by attraction and bonding, often leading to physical contact. Given that physical proximity to social beings increases the odds of catching infectious diseases, we propose a reverse relationship, whereby sensitivity to the presence of pathogens results in perceiving unfamiliar others as less similar to oneself. Four studies involving 980 participants and operationalizing others in three different ways confirm that individual differences in propensity to feel disgust (i.e., react emotionally to potential sources of pathogens in the environment) are associated with perceptions of interpersonal similarity to strangers. Study 1 showed that individuals who score higher in disgust sensitivity perceive themselves as less psychologically similar to visually displayed social targets. Study 2, using vague descriptions of hypothetical figures, found that high-disgust-sensitivity participants tend to assume that others' personal preferences contrast with their own. Study 3 demonstrated that the disgust–dissimilarity association holds for prototypical members of social groups. Finally, Study 4 confirmed that this link reflects pathogen-related (above and beyond sexual or moral) disgust. In all studies, controlling for participants' gender, religiosity, and illness recency did not change the results. We discuss our findings and propose novel directions for future research.

1. Introduction

Human beings are similar and different at the same time. We all share the same basic physiology and anatomy, fundamental needs, and repertoire of experienced emotions. Along with these resemblances, each individual has her own unique amalgamation of personal qualities, an exclusive specification that can never be replicated. Crucially, people may regard others in light of either how they are distinct from the self or what they have in common. But what determines whether someone focuses on characteristics that distinguish her from others or on features that connect her to them?

In this study we propose individual differences in propensity to feel disgust, reflecting an avoidance of pathogens, as an antecedent of interpersonal similarity perceptions. We suggest that individuals prone to experience disgust are cognitively tuned to detect discrepancies between themselves and unfamiliar others as a form of prophylactic protection against infection. Understanding the link between pathogen aversion and similarity perceptions may expose the role played by contamination threat in shaping people's social cognition.

1.1. Disgust as a behavioral immune system

Since the dawn of humankind, people have been challenged by the need to protect against infection (Inhorn & Brown, 1990). Toward this end, they (like other species) are equipped with two kinds of sophisticated systems—physiological and psychological. The former is a reactive suite of systems designed to detect the presence of pathogens within the body and eliminate them by mobilizing physiological responses. The latter, now known as the behavioral immune system (BIS), is a proactive system composed of mechanisms that inhibit contact with pathogens in the first place (Schaller, 2006, 2011, 2016; Schaller & Park, 2011). An important component of the BIS is the affective response of disgust—a basic emotion that automatically activates a strong avoidance response.

Disgust has evolved as a disease-avoidance mechanism (Oaten, Stevenson, & Case, 2009), effectively inhibiting human adults from contacting a range of reliable sources of pathogens (e.g., feces, vomit, spoiled food, fleas, and organic decay). The emotion appears to be universal (Curtis, Aunger, & Rabie, 2004; Curtis & Biran, 2001), but is thought to be evoked more intensely in people who might bear higher costs from contracting disease (e.g., women generally, and women in

the first trimester of pregnancy in particular; Al-Shawaf, Lewis, & Buss, 2018; Druschel & Sherman, 1999; Fessler, Eng, & Navarrete, 2005). Individuals chronically differ in the extent to which they tend to experience disgust in the face of potentially contaminating stimuli (e.g., Haidt, McCauley, & Rozin, 1994). This stable personality trait is associated with avoidance tendencies that reduce the chances of catching infection (Shook, Thomas, & Ford, 2019; van Overveld, de Jong, & Peters, 2010).

Research on disgust, like research on the BIS more broadly, has uncovered remarkable effects on social behavior. In particular, groups of people characterized by physical traits that heuristically connote disease—including the obese, the elderly, people with facial deformities, and individuals with physical disabilities—are frequently subject to stigmatization and social exclusion, especially by individuals who have reason to be worried about infection (Duncan & Schaller, 2009; Kurzban & Leary, 2001; Park, Faulkner, & Schaller, 2003; Park, Schaller, & Crandall, 2007; Ryan, Oaten, Stevenson, & Case, 2012). Disgust sensitivity and disease salience also promote ethnocentrism and xenophobia, presumably as protection against the different hygiene and food-preparation routines practiced by foreigners (Faulkner, Schaller, Park, & Duncan, 2004; Navarrete, Fessler, & Eng, 2007).

Interestingly, recent evidence suggests that BIS activity shapes social behavior even toward targets lacking any sign of sickness. It has been argued that while social beings reap rewards from proximity to others, such proximity also increases the odds of catching any diseases they *might* carry. Hence, distancing the self from others is adaptive in the presence of a contamination risk (Murray & Schaller, 2016). For example, Park (2015) found that disgust sensitivity toward human contaminants increased the magnitude of participants' personal space. Taking a historical perspective, Murray and colleagues (Murray, Fessler, Kerry, White, & Marin, 2017) showed that the higher the prevalence of historical disease within a society, the less its members engage in physical contact during greetings and in romantic kissing. Finally, the apparent existence of a pathogen threat weakens consumers' interest in secondhand, but not new, products (Huang, Ackerman, & Sedlovskaya, 2017). Thus, a motivation to avoid infectious disease results in reduced direct and indirect physical contact even with apparently healthy others.

Beyond spatial distance, pathogen threat also increases psychological distance from others in the social world. For instance, a cross-cultural study found that regional disease prevalence was negatively associated with the personality traits of extraversion and openness to experience (which might include openness to novel social interactions), pointing to a "psychological barrier" against sociality (Schaller & Murray, 2008). Similar findings were obtained in a study that examined the effect of disease-threat vs. no-threat primes on self-perceptions of personality at the individual level (Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010). Furthermore, an elevated threat of pathogen exposure seems to lead individuals to down-regulate their interest in affiliation, such that they score lower on a measure that captures the need to belong (Sacco, Young, & Hugenberg, 2014). Last, individual differences in pathogen disgust are associated with lower levels of generalized social trust (Aarøe, Osmundsen, & Petersen, 2016).

1.2. Perceived interpersonal similarity

Similarity is a fundamental dimension of cognitive processing, extracted spontaneously and effortlessly. As William James put it: the "sense of sameness is the very keel and backbone of our thinking" (James, 1890/1950, p.459; see Markman & Gentner, 2005; Mussweiler, 2014). Consequently, humans automatically compare themselves to social targets surrounding them, evaluating the extent to which they are similar or dissimilar to them. These perceptions may not fully correspond with objective measures of similarity, but such subjective impressions exert strong social effects—even stronger than those exerted by objective measures (e.g., Curry & Kenny, 1974; Selfhout, Denissen,

Branje, & Meeus, 2009; Tidwell, Eastwick, & Finkel, 2013).

Social psychologists have repeatedly affirmed that interpersonal similarity constitutes a powerful mechanism that bonds individuals together, encouraging social interactions and establishing new interpersonal relationships. Among the most documented effects of perceived similarity is its positive influence on interpersonal attraction (Byrne, 1961; Byrne, Griffitt, & Stefaniak, 1967; see Montoya, Horton, & Kirchner, 2008 for a review). Another rich body of literature stresses the role of perceived similarity in promoting various positive attitudes and behaviors toward others, including cooperation (e.g., Fischer, 2009; Riolo, Cohen, & Axelrod, 2001; Wilson, DeRue, Matta, Howe, & Conlon, 2016), feelings of compassion (Oveis, Horberg, & Keltner, 2010), and willingness to help (Karylowski, 1976). Similarity further bolsters empathic concern (Krebs, 1975), trust (Singh, Tay, & Sankaran, 2017), and reciprocity (Mussweiler & Ockenfels, 2013), all of which contribute to building stable social relationships. Bonding associated with interpersonal similarity is driven even by superficial, non-diagnostic commonalities such as a shared birthday, similar music preferences, or similar food consumption (Boer et al., 2011; Miller, Downs, & Prentice, 1998; Woolley & Fishbach, 2017).

A direct result of bonding is increased willingness to be in physical proximity with someone. Intuitively, human experience tells us that bonding and its corollaries—attraction, willingness to cooperate, and willingness to help—shrink the amount of space that people need between themselves and another person to feel psychologically comfortable. This intuitive observation is supported by studies linking interpersonal similarity perceptions with physical proximity preferences. Several studies have found that students prefer to sit next to same-sex and same-race fellows (Campbell, Kruskal, & Wallace, 1966; Clack, Dixon, & Tredoux, 2005; Koen & Durrheim, 2010). This similarity-based aggregation is also found for superficial commonalities that do not depend on prominent social group membership. For instance, in one study participants reported they would sit, and actually sat, closer to others who were similar to themselves even in ephemeral aspects of physical appearance, such as wearing glasses (Mackinnon, Jordan, & Wilson, 2011).

But if indeed "birds of a feather flock together," then perceptions of similarity to strangers might have a darker side—promoting the transmission of infections. To reduce the odds of contamination, unfamiliar individuals should be deemed to be dissimilar from the self, preventing the formation of social bonds with potential disease-carriers.

1.3. The present research

We suggest that cost–benefit considerations lead some individuals—namely, those who experience stronger reactions to contaminating stimuli—to become more tuned to processing dissimilarities between themselves and unacquainted others. Focusing on dissimilarities might prevent disgust-sensitive persons from drawing the rewards associated with greater perceived similarity, but would also provide protection against its downstream risks. We conducted four studies to test the proposed disgust–similarity association. In Study 1 we assessed self-reported perceived similarity to unfamiliar targets using images of faces with no accompanying information. In Study 2 we investigated similarity perceptions indirectly by comparing individuals' personal preferences with the preferences they attributed to a stranger vaguely described to them. Study 3 probed perceived similarity to prototypes of different social categories using a pictorial measure. The last study was designed to further explore the specific source of disgust that drives the effect. The study hypothesis was determined prior to data collection.

2. Study 1

Our first study tested the hypothesis using a well-validated measure of disgust sensitivity and a task designed to assess perceived

psychological similarity to visually displayed targets. In addition to these focal variables, we collected background data on several variables previously associated with BIS activation and disgust sensitivity, namely gender, religiosity, and having recently experienced illness. Many studies have demonstrated gender differences in the propensity to feel disgust, such that women are reliably more disgusted by disgust-eliciting stimuli than men (Al-Shawaf et al., 2018; Druschel & Sherman, 1999). In addition, highly religious individuals tend to be more disgust-sensitive (Berger & Anaki, 2014; Haidt et al., 1994; Inozu, Ulukut, Ergun, & Alcolado, 2014; Olatunji, Tolin, Huppert, & Lohr, 2005). Last, people who were recently ill have been shown to exhibit hyperactivity of the BIS (Miller & Maner, 2011). Because of these well-established relationships, we included analyses controlling for these variables also in Studies 2–4.

2.1. Method

2.1.1. Participants and procedure

In all our studies we determined sample size a priori based on power analyses conducted using G*Power (Faul, Erdfelder, Buchner, & Lang, 2013). We assumed a small-to-medium effect ($\rho = 0.2$) in a two-tailed test. The analyses suggested we should recruit 191 participants in order to achieve 80% power and 314 participants to achieve 95% power. We therefore collected data from about 200–300 respondents in each study, increasing the sample size from study to study to increase our power. In all studies participants provided informed consent. In the current study, 192 Israeli students (153 females) were recruited through a crowd-sourcing platform (*Panel4all*) and received monetary compensation. The study was introduced to participants as investigating intuitive information processing and comprised two tasks. In the first task (entitled "intuitive processing of everyday information"), participants completed the Disgust Scale–Revised (DS-R; Haidt et al., 1994, modified by Olatunji et al., 2007). In the second task (entitled "intuitive processing of social information"), they reported their perceived similarity to other individuals. Demographics were collected at the end of the study. In all four studies, all measures, conditions, and data exclusions are reported.

2.1.2. Measures

2.1.2.1. Disgust Scale–Revised (DS-R).
The scale consists of 25 items assessing sensitivity to a range of disgust elicitors. Participants first indicate their agreement with 13 statements (e.g., "It bothers me to hear someone clear their throat full of mucus") on a 5-point Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Then, they rate how disgusting they find 12 potentially disgusting experiences (e.g., "You are walking barefoot on concrete, and you step on an earthworm") on a scale from 0 (*not disgusting at all*) to 4 (*extremely disgusting*). We used the Hebrew version of the scale translated by Berger and Anaki (2014). The scale's construct and external validity were confirmed in a heterogeneous Israeli sample. Like the translators, we omitted two items due to religious considerations.

2.1.2.2. Perceived interpersonal similarity.
We used a revised version of the task developed by Nussinson, Seibt, Häfner, and Strack (2010, Study 1). Participants first read a set of instructions, which explained that recent studies in social psychology suggest people can extract preliminary information about the "psychology" of unfamiliar others by merely observing their faces. A series of 28 black-and-white pictures of young white faces (half females) were then presented in a fixed order. In each trial, a picture of a target person was first displayed, followed after three seconds by a scale which appeared underneath the photo. Participants' task was to quickly and intuitively indicate how psychologically similar they were to the person in the picture on a scale from 1 (*not at all similar*) to 11 (*very similar*). A perceived similarity index was computed by averaging across ratings.

2.1.2.3. Illness recency and religiosity.
Following Miller and Maner

Table 1
Descriptive data and correlations between variables measured in Study 1.

Measure	M	SD	α	2	3	4	5
1. DS-R	2.82	0.64	0.89	−0.281**	0.138	−0.062	−0.058
2. Perceived similarity	3.67	1.45	0.92		−0.077	0.040	−0.063
3. Religiosity	3.60	2.49				−0.100	−0.165*
4. Illness recency	3.81	2.04					0.187**
5. Age	25.45	2.88					

* $p < .05$.
** $p < .01$.

(2011), participants indicated the last time they had suffered from a cold by selecting from the following response options: 1—*today*, 2—*a couple days ago*, 3—*a week ago*, 4—*a couple weeks ago*, 5—*a month ago*, 6—*a few months ago*, and 7—*a year or more ago*. Participants further indicated how religious they were on a scale from 0 (*not at all religious*) to 7 (*very religious*).

2.2. Results and discussion

Descriptive statistics, Cronbach's alpha and correlations between continuous variables are reported in Table 1. Full data for all four studies are available at https://osf.io/b7dkp/.

As we predicted, regressing perceived similarity onto participants' disgust sensitivity yielded a significant negative effect, such that the more sensitive to disgust participants were, the lower their reported psychological similarity to the displayed social targets, $\beta = -0.281$, $t = -4.041$, $p < .001$, CI for b [-0.946, -0.325]. We further employed a multiple regression predicting similarity perceptions from sensitivity to disgust while controlling for gender, religiosity, illness recency, and their two-way interactions with disgust (controlled variables were centered prior to computing the interaction terms). The effect of disgust sensitivity remained significant in this broader model, $\beta = -0.302$, $t = -3.765$, $p < .001$, CI for b [-1.050, -0.328]. In addition, a disgust × religiosity interaction emerged, $\beta = -0.171$, $t = -2.433$, $p = .016$, CI for b [-0.426, -0.044]. Simple slopes analysis revealed that highly religious participants (1 SD above the sample's mean) exhibited a stronger negative association between disgust sensitivity and similarity perceptions than those who were less religious (1 SD below the mean); $\beta = -0.463$, $t = -4.324$, $p < .001$, CI for b [-1.542, -0.576] for the more-religious and $\beta = -0.140$, $t = -1.384$, $p = .168$, CI for b [-0.775, 0.136] for the less-religious participants. No additional effects were obtained (see Table 2).

Thus, our first study provides initial support for the hypothesis that individual differences in emotional reactions to potential sources of pathogens are associated with differences in perceived similarity to others. We did not expect but found an interaction between religiosity and disgust. This might simply be a type-I error, or it may indicate that the hypothesized effect is indeed stronger in more-religious people—-perhaps because they are more prone to feel disgust, as found in previous studies (Berger & Anaki, 2014; Haidt et al., 1994; Inozuet al., 2014; Olatunji et al., 2005). Further studies will reveal whether this interaction replicates.

3. Study 2

In our second study we sought to expand the generalizability of our findings by administering a measure that captures similarity perceptions without requiring participants to directly reflect on them. To do so, we asked participants about their preferences in various domains and then instructed them to assume the preferences of a person vaguely described to them. We hypothesized that the greater respondents' disgust sensitivity, the less they would attribute similar preferences to

Table 2
Similarity/difference perceptions as a function of disgust sensitivity – Results across studies.

Study (N)	Predictor	Model 1			Model 2		
		β	t	p	β	t	p
1 (192)	DS-R	*−0.281*	*−4.041*	*< 0.001*	*−0.302*	*−3.765*	*< 0.001*
	Gender				−0.083	−0.982	0.327
	Religiosity				−0.046	−0.636	0.526
	Illness recency (IR)				0.027	0.385	0.701
	DS-R × Gender				−0.072	−0.873	0.384
	DS-R × Religiosity				−0.171	−2.433	0.016
	DS-R × IR				−0.055	−0.781	0.436
2 (210)	DS-R	*0.161*	*2.360*	*0.019*	*0.166*	*2.279*	*0.024*
	Gender				0.078	0.922	0.358
	Religiosity				−0.087	−1.240	0.216
	Illness recency (IR)				0.074	1.043	0.298
	DS-R × Gender				0.067	0.816	0.416
	DS-R × Religiosity				0.068	0.973	0.332
	DS-R × IR				−0.043	−0.603	0.547
3 (278)	DS-R	*−0.191*	*−3.175*	*0.002*	*−0.194*	*−2.742*	*0.007*
	Condition	0.104	1.736	0.084	0.110	1.682	0.094
	DS-R × Condition	0.017	0.290	0.772	0.008	0.120	0.905
	Gender				−0.074	−1.075	0.284
	Religiosity				0.076	1.120	0.264
	Illness recency (IR)				0.002	0.024	0.981
	DS-R × Gender				0.024	0.348	0.728
	DS-R × Religiosity				0.020	0.300	0.764
	DS-R × IR				0.038	0.571	0.569
4 (300)	Pathogen disgust	*−0.167*	*−2.750*	*0.006*	*−0.173*	*−2.812*	*0.005*
	Sexual disgust	−0.100	−1.631	0.104	−0.107	−1.459	0.146
	Moral disgust	−0.112	−1.920	0.056	−0.108	−1.847	0.066
	Gender				0.016	0.260	0.795
	Religiosity				−0.003	−0.053	0.957
	Illness recency (IR)				−0.055	−0.968	0.334

Note. DS-R = Disgust Scale–Revised; Hypothesized effects in *italics*. All tests are two-tailed.

others; in other words, the greater would be the dissimilarity between the self-reports and attributed preferences.

3.1. Method

3.1.1. Participants and procedure

A crowdsourcing company offering a small financial reward (*HaMidgam*) collected data online from 221 students in Israeli universities (187 females). Nine respondents who failed to form an impression of the target figure and indicated a "neutral" preference in all questions were excluded from the analyses. Two additional respondents were excluded as they displayed extremely low variance (≤ 1) in their ratings on the DS-R. The study was again introduced as exploring intuitive information processing. At the outset of the study participants completed the DS-R. Then, they reported on their own preferences. Following that, they read about a hypothetical figure and reported on what they assumed to be that person's preferences. Last, they filled in a demographic questionnaire.

3.1.2. Measures

3.1.2.1. Perceived preference dissimilarity. We used a slight modification of a task developed by Ames, Mor, and Toma (2012). Participants were first presented with 18 self-preference questions, each contrasting two options (e.g., "Do you prefer espresso coffee to tea?"), and indicated their response on a 5-point scale adapted for each item (e.g., "Strong preference for espresso coffee" to "Strong preference for tea"). Next, participants read a description of a hypothetical figure of the same gender as the participant, and were asked to form an impression of him/her. The description appeared to provide information but actually painted an ambiguous picture of the target. On the next page, participants judged the target's likely preferences on the same 18 items noted above. For each item, we computed the absolute difference between a participant's own preference and the preference

attributed to the target. The total differences across items served as our preference (dis)similarity index.

3.1.2.2. Disgust scale–revised, illness recency, and religiosity. Same as in Study 1.

3.2. Results and discussion

Zero-order correlations and descriptive data for this study are summarized in Table 3.

Disgust sensitivity scores and preference dissimilarity indices were submitted to a linear regression predicting the latter from the former. As hypothesized, the more disgust-sensitive the participants were, the more they assumed the target's preferences were dissimilar to their own, β = 0.161, $t = 2.360$, $p = .019$, CI for b [0.321, 3.576]. This association was unaffected by broadening the model to include demographic variables and their interactions with disgust, β = 0.166, $t = 2.279$, $p = .024$, CI for b [0.271, 3.745] (see Table 2 for full results).

In sum, Study 2 provides additional support for our hypothesis. Measuring (dis)similarity perceptions using an indirect measure, we obtained results that mirror the findings in our first study.

Table 3
Descriptive data and correlations between variables measured in Study 2.

Measure	M	SD	α	2	3	4	5
1. DS-R	2.62	0.62	0.86	0.161*	0.140*	−0.098	−0.265**
2. Preference dissimilarity	26.63	7.49			−0.063	0.049	−0.112
3. Religiosity	2.46	2.34				−0.120	−0.143*
4. Illness recency	4.60	1.79					−0.012
5. Age	26.25	3.47					

* $p < .05$.
** $p < .01$.

4. Study 3

The objective of our third study was twofold. First, to test whether temporary salience of a contamination threat produces the same effect as do chronic individual differences in disgust sensitivity, we primed the participants with either a contamination threat or a control threat in addition to measuring their sensitivity to disgust. Second, in this study we sought to investigate whether the disgust–dissimilarity association applies not only to perceptions of specific individuals, but to perceptions of abstract social entities as well. To do this, we asked participants to evaluate their similarity to prototypical members of several professions.

4.1. Method

4.1.1. Participants and procedure

Two hundred seventy-eight Israeli students (179 females) participated online via a survey service (*Panel4all*). Participants were presented with three tasks, each framed as pertaining to intuitive information processing. The first task was used to temporarily induce disease-related vs. disease-unrelated threat. The second task gauged psychological similarity perceptions using a new instrument (detailed below). The third task assessed individual differences in disgust sensitivity. Demographic questions were included at the end.

4.1.2. Disease-threat prime

In a task entitled "intuitive processing of visual information," participants were asked to watch a series of 17 slides and rate their efficiency in conveying an educational message. The slideshow was adopted from Prokosch, Gassen, Ackerman, and Hill (2019) and was a modified version of the manipulation developed by Faulkner et al. (2004). Participants were assigned to either a disease-threat or control-threat condition. In the disease condition, the slides reminded participants of various ways in which diseases are transmitted (e.g., a slide labeled "How chickenpox is spread" featured a short description of chickenpox transmission mechanisms alongside two photos of red blisters). In the control condition, the slides dealt with fatal accidents or physical dangers unrelated to disease (e.g., a slide labeled "Proceed carefully: Hundreds of people are injured every year falling down the stairs" featured a picture of a man tumbling down a steep staircase).

4.1.3. Measures

4.1.3.1. Perceived interpersonal similarity.
Participants indicated similarity perceptions to prototypical members of eight professions: a professor, a singer, a school principal, a painter, a tour guide, a tennis player, a social worker, and a lawyer. In each trial, participants were asked to think for a moment about the attributes and lifestyle of a prototypical member of the profession displayed. For the response scale, we used an adapted version of the Inclusion of Other in the Self (IOS) scale developed by Aron, Aron, and Smollan (1992). Respondents were presented with seven pairs of circles varying in their degree of overlap, such that the first pair of circles (presented at the top) did not overlap at all while the seventh pair (at the bottom) almost completely overlapped. Participants were informed that greater overlap reflects greater similarity between themselves and the target of judgment.

4.1.3.2. DSR, illness recency, and religiosity.
Same as in Study 1.

4.2. Results and discussion

Table 4 presents means, standard deviations, Cronbach's alphas, and zero-order correlations between all measures.

We carried a multiple regression predicting similarity perceptions from disgust sensitivity, the experimental condition (coded 0 for control-threat and 1 for disease-threat), and the disgust × condition interaction term. Replicating the results of our previous studies, DS-R

Table 4
Descriptive data and correlations between variables measured in Study 3.

Measure	M	SD	α	2	3	4	5
1. DS-R	2.74	0.62	0.87	−0.178**	0.292**	−0.072	−0.137*
2. Perceived similarity	2.48	0.88	0.69		0.021	0.035	−0.084
3. Religiosity	3.07	2.47				−0.086	−0.129*
4. Illness recency	4.22	1.76					−0.009
5. Age	26.73	3.93					

* $p < .05$.
** $p < .01$.

scores significantly predicted perceived similarity, such that greater sensitivity to disgust was accompanied by less reported similarity to the prototypical professionals, $\beta = -0.191$, $t = -3.175$, $p = .002$, CI for b $[-0.440, -0.103]$. By contrast, neither the priming condition effect $\beta = 0.104$, $t = 1.736$, $p = .084$, CI for b $[-0.024, 0.389]$ nor the disgust × condition interaction $\beta = 0.017$, $t = 0.290$, $p = .772$, CI for b $[-0.089, 0.120]$ were significant. As in the previous studies we also tested a broader model controlling for demographic variables (i.e., participant's gender, religiosity, illness recency, and the paired interactions with disgust sensitivity). As can be seen in Table 2, disgust sensitivity was the only significant predictor of similarity perceptions $\beta = -0.194$, $t = -2.742$, $p = .007$, CI for b $[-0.473, -0.077]$.

This study reproduces the results of Studies 1 and 2 using stimuli representing people in the abstract (in the form of prototypical members of social groups) as opposed to specific representations of individuals. Unlike the chronic effect, temporarily inducing contamination-threat vs. control-threat did not yield differences in similarity perceptions. This may reflect the fact that some of the stimuli included in the control-threat slide were highly threatening, vividly presenting serious injuries and tragic death. Previous research has shown that anxiety, sadness, and avoidance orientations promote a local style of processing (Derryberry & Reed, 1998; Gasper & Clore, 2002), and thereby reduce perceptions of interpersonal similarity (Nussinson et al., 2010). The lack of a priming effect in this study could thus be due to lessened similarity perceptions in *both* the experimental conditions.

5. Study 4

From our studies thus far, it is evident that disgust sensitivity is correlated with various forms of dissimilarity processing. A question remains, however, as to whether the effect is specifically driven by the pathogenic risk associated with unfamiliar people, or whether it reflects psychological distancing of strangers due to other reasons. To start answering this question, we tested the effect of disgust by pathogens while controlling for the effects of related individual differences, namely, sexual and moral disgust.

Tybur, Lieberman, and Griskevicius (2009) theorized that disgust evolved to motivate behavioral solutions to three distinct adaptive problems: avoiding disease-causing agents; avoiding behaviors or sexual partners likely to reduce reproductive success; and avoiding individuals likely to inflict social costs on ingroup members. In the process of validating their model, they developed a scale that taps individual differences in three forms of disgust that correspond to these three behavioral solutions. We reasoned that if pathogens play a distinct role in tuning the human cognitive system toward focusing on interpersonal dissimilarities to strangers, then pathogen disgust should predict similarity perceptions above and beyond the other two domains.

5.1. Method

5.1.1. Participants and procedure

Participants were 300 Israeli adults (228 females) who completed

the study online via *Panel4all* in return for a small monetary reward. The procedure was identical to that of Study 1 except that sensitivity to disgust was assessed using the Three Domains of Disgust Scale (TDDS; Tybur et al., 2009).

5.1.2. Measures

5.1.2.1. Three Domains of Disgust Scale (TDDS). Participants were asked to rate 21 items describing potentially disgusting concepts on a scale from 0 (*not at all disgusting*) to 6 (*extremely disgusting*). Each item was designed to primarily reflect one of the three domains: pathogen disgust (e.g., "Accidentally touching a person's bloody cut"; 7 items), sexual disgust (e.g., "Hearing two strangers having sex"; 7 items), and moral disgust (e.g., "Deceiving a friend"; 7 items). The instrument was translated from English into Hebrew by two native Hebrew speakers highly proficient in English. Their translation was then refined by a professional language editor. Internal reliabilities were satisfactory (> 0.73) and intercorrelations between the factors were modest (range: 0.22–0.37).

5.1.2.2. Perceived interpersonal similarity, illness recency, and religiosity. Same as in Study 1.

5.2. Results and discussion

Descriptive statistics, internal consistencies and correlations between continuous variables are reported in Table 5.

We conducted a multiple regression entering pathogen disgust, sexual disgust, and moral disgust as predictors and similarity perceptions as the dependent variable. The analysis revealed that pathogen disgust uniquely explained a portion of the variance in similarity perceptions, $\beta = -0.167$, $t = -2.750$, $p = .006$, CI for b [-0.435, -0.072], while the effect of sexual disgust was insignificant $\beta = -0.100$, $t = -1.631$, $p = .104$, CI for b [-0.240, 0.022], and the effect of moral disgust was marginally significant $\beta = -0.112$, $t = -1.920$, $p = .056$, CI for b [-0.332, 0.004]. These results remained virtually unchanged when controlling for gender, religiosity, and illness recency: pathogen disgust was the sole significant predictor of perceived similarity $\beta = -0.173$, $t = -2.812$, $p = .005$, CI for b [-0.447, -0.079] (see Table 2 for full statistics).

In sum, all three domains of disgust show a trend of negative associations with perceptions of psychological similarity to others, indicating that a shared essence of all disgust domains (possibly, an avoidance orientation) is linked with finding little commonality with strangers. Nevertheless, only pathogen-related disgust predicts similarity perceptions above and beyond the other domains. This finding supports our proposal that being worried about disease-causing pathogens is associated with a psychological defense mechanism which limits proximity to others.

6. General discussion

Four studies demonstrated an association between chronic individual differences in disgust sensitivity and perceived (dis)similarity

to unacquainted social targets. This association is consistent across measures of disgust sensitivity (the DS-R and TDDS) and perceived similarity operationalizations: easily-disgusted individuals report less psychological similarity to others encountered as images of faces (Studies 1 and 4) and as prototypical members of different social groups (Study 3); and they assume others' preferences are dissimilar to their own (Study 2). The association also holds whether disgust sensitivity is measured before (Studies 1, 2, and 4) or after (Study 3) perceived similarity, and whether perceived similarity is measured directly (Studies 1, 3, and 4) or indirectly (Study 2).

Considerable research has revealed how the threat of contamination shapes perceptions, attitudes, and behaviors toward social beings in the presence of disease-connoting cues (e.g., Miller & Maner, 2012; Park et al., 2003). More recent findings suggest that fear of pathogens leads people to treat unfamiliar others as if they were potentially infectious even when they have no apparent visual cue of sickness (e.g., Park, 2015). Our study continues this line of research, showing that disgust sensitivity is associated with finding little commonality between oneself and unknown others—a construal of the self as differentiated. This form of psychological distance may function to minimize one's physical closeness to unknown others, ensuring one stays clear of harmful pathogens transported by persons with whom one is unacquainted.

Our findings may shed light on basic cognitive processes underlying previous findings on BIS activation and attitudes toward disease-connoting individuals. The BIS literature tends to focus on social groups whose members are markedly different from the self, such as minority groups. Our studies point to greater dissimilarity perceptions among individuals who are naturally more pathogen-averse (i.e., easily disgusted). Lower similarity perceptions are linked with negative attitudes toward different groups, even to the point of dehumanization (Greenhalgh & Watt, 2014; McDonald et al., 2017; Miranda, Gouveia-Pereira, & Vaes, 2014). Thus, lower perceived similarity could partially explain why highly disgust-sensitive individuals tend to exhibit stronger opposition toward social groups such as gays, older adults, obese people, and those who suffer from physical disabilities (Duncan & Schaller, 2009; Inbar, Pizarro, Knobe, & Bloom, 2009; Park et al., 2003; Park et al., 2007).

While we stress the role of pathogen-avoidance motivation in driving the disgust–similarity association, it is important to note that in three out of four studies we measured disgust sensitivity in general, rather than pathogen disgust in particular. Moreover, in our fourth study we find that although pathogen disgust predicts similarity perceptions when sexual and moral disgust are controlled, the latter two types of disgust tend to negatively associate with similarity perceptions as well. This finding may imply that non-pathogenic aspects of disgust could also lead to reduced similarity perceptions of unfamiliar people. For example, it is assumed that one function of disgust is to avoid interactions with individuals who might impose costs on oneself (i.e., those engaging in immoral acts; Tybur et al., 2009). Strangers, whether or not carriers of disease, are mostly individuals who have yet to have the opportunity to prove their moral innocence. Thus, people who are sensitive to moral disgust might perceive strangers as threatening, and therefore focus on features distinguishing them to keep these people

Table 5
Descriptive data and correlations between variables measured in Study 4.

Measure	M	SD	α	2	3	4	5	6	7
1. Pathogen disgust	4.19	0.97	0.73	0.366**	0.219**	−0.228**	0.166**	−0.086	0.006
2. Sexual disgust	3.59	1.35	0.83		0.249**	−0.189**	0.480**	−0.086	−0.214**
3. Moral disgust	4.82	1.01	0.84			−0.173**	0.082	0.031	−0.022
4. Perceived similarity	3.79	1.47	0.93				−0.091	−0.036	−0.084
5. Religiosity	2.51	2.25						−0.024	−0.151**
6. Illness recency	4.45	2.08							0.067
7. Age	27.33	4.19							

** $p < .01$.

psychologically distant.

While our study focuses on *interpersonal* similarity, disgust sensitivity is also associated with reduced perceptions of similarity more broadly—that is, perceiving less similarity between non-social targets. A recent study showed that disgust sensitivity and BIS activity decreased the tendency to perceive similarities between pairs of neutral stimuli that have nothing to do with illness (Nussinson, Mentser, & Rosenberg, 2018). It has been argued that attending to how a stimulus deviates from or is dissimilar to a prototype stored in memory is adaptive when facing contamination risks, because many infectious objects (e.g., a rotten apple) are morphologically different from benign examples of that object (e.g., a fresh apple). Thus, the reduced inclination to perceive interpersonal similarity exemplified in the present research may reflect, in part, a more general tendency to focus on dissimilarities. However, we believe our findings of psychological distance in social contexts also reflect the fact that human beings are clearly and unambiguously a source of potential infection.

Our study lends support to the hypothesis that *chronic* individual differences in BIS activation covary with similarity perceptions while providing no support for an equivalent effect of *temporal* activation: In Study 3, making the threat of disease salient did not alter participants' perceptions of similarity to others. We suggest this might be due to the threatening control condition used in the study. One may wonder, however, whether priming disgusting versus neutral stimuli would result in differences in similarity perceptions.

If reduced interpersonal similarity perceptions reflect a wish to restrict the formation of new social ties, we might expect highly disgust-sensitive individuals to prefer solo activities over ones that involve meeting new people. In addition, disgust may affect various psychological mechanisms of social bonding, such as mimicry, emotional contagion, behavioral assimilation, social synchrony, and coordination. Disgust may further play a role in forms of anti-social behavior, such as opting for competition over cooperation and being less willing to reciprocate. The BIS could influence these processes directly or indirectly via its effect on perceived similarity. For example, disgust sensitivity may directly affect the tendency to behaviorally assimilate to the typical behavior of a primed target (see Nussinson et al., 2010; Schubert & Häfner, 2003), or it could do so indirectly, by affecting perceived similarity to the target, which affects assimilation in turn. All these potential implications are worth further examination.

Another possible direction for future research involves the link between disgust sensitivity and perceived similarity to familiar and significant others. Previous research has shown that the association between pathogen disgust and perceived social distance (measured as linguistic distance) is moderated by the target's group affiliation: Using a parasite prime, Reid et al. (2012) found that higher disgust sensitivity was associated with greater perceived distance from outgroup members but smaller perceived distance from ingroup members. This discrepancy is assumed to reflect a suspicion that members of outgroups are likely to harbor novel pathogens. Similarly, close others pose less infection risk since the physiological immune system has already developed ways to cope with pathogens one has previously encountered. Moreover, it is traditionally close family members who nurse those who are ill and unable to take care of themselves. Thus, in contrast to the pattern seen in the present study, with strangers, disgust sensitivity may actually correlate positively with perceived similarity to likely caregivers and close others.

In sum, taking an adaptationist view, we suggest that disgust sensitivity renders people more prone to perceive unacquainted people as psychologically dissimilar. Our findings may offer a partial cognitive basis for previous findings associating activation of the BIS with prejudice toward various outgroups. Our findings also join other recent findings showing that activation of the BIS diminishes the need to affiliate, and suggest that activation of the behavioral immune system results in more distant cognitive construal of unfamiliar individuals. Finally, they may have implications for a plethora of social behaviors

known to be honed by perceived similarity to the social target. Future research may want to examine the possibility that our findings are moderated by familiarity of the social target, as well as to examine higher-order implications of our effects for social cognition and social behavior.

Declaration of competing interest

None.

Acknowledgements

Data availability

The data associated with this research are available at https://osf.io/b7dkp/.

Funding

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