# Demographic influences on disgust: Evidence from a heterogeneous sample

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## ABSTRACT

In this study we examined the construct and external validity of the Disgust Scale Revised (Olatunji, Williams, et al., 2007), in a large heterogeneous sample ($N = 1427$). In addition, we investigated the role of demographic variables on disgust's sensitivity. The findings reveal that the DS_R adheres to the three-factor structure (i.e., Core disgust, Animal-Reminder Disgust, and Contamination-Based Disgust), signifying the validity of the DS_R in a heterogeneous sample. Moreover, gender was found to have a large effect on DS_R score, while the effects of other demographic variables, such as religion, political view, education and age, were exceptionally modest. These results indicate that demographic variables, excluding gender, do not directly influence disgust's sensitivity. Rather, these variables mainly modulate the context in which disgust is elicited.

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## 1. Introduction

Disgust is a basic emotion, with clear behavioral, physiological, expressive, and qualia components (Levenson, 1992; Rozin, Haidt, & McCaully, 2000; Rozin, Haidt, & McCaully, 2008; Tolin, Woods, & Abramowitz, 2006; Tracy & Randles, 2011). The origins and functions of disgust are claimed to be varied; one possible source is a food-rejection mechanism (Rozin et al., 2008). A second potential source is a mechanism of contamination and disease prevention (Curtis, de Barra, & Aunger, 2011). In addition, it has been claimed that the emotion in humans has an additional psychological role which may exceed its original purpose (Rozin et al., 2000, 2008). Specifically, disgust is involved in several psychopathologies such as animal and blood-injury-injection phobias, eating disorders, sexual dysfunctions, and obsessive–compulsive disorder (Olatunji, Lohr, Sawchuk, & Tolin, 2007; Olatunji & McKay, 2009; Tolin et al., 2006). Finally, studies have found disgust to be an integral part of inter-group attitudes, prejudice, and discrimination, and may be a tool in dehumanization of out-group members (Haslam, 2006; Hodson & Costello, 2007; Inbar, Pizarro, Knobe, & Bloom, 2009; Navarrete & Fessler, 2006).

As a result of the importance and extensive implications of disgust, several measures of the emotion were developed,

including the Disgust and Contamination Questionnaire (Haidt, McCauley, & Rozin, 1994), the Disgust Emotional Scale (Walls & Kleinknecht, 1996), the Looming of Disgust Questionnaire (Williams, Olatunji, Elwood, Connolly, & Lohr, 2006), and the Disgust Propensity and Sensitivity Scale (Cavanagh & Davey, 2000; Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). One of the most frequently used and validated questionnaires of disgust assessment is the Disgust Scale (DS; Haidt et al., 1994). The questionnaire consists of 32 items which are separated into eight sub-domains of disgust; food (found unfit to be consumed), animals (which are associated with dirty conditions), body products (most of the bodily solid and fluid extractions, including scents, etc.), sex (mainly deviant sexual behavior), body envelope violations (breaches revealing blood and tissue), death (and its products), hygiene (as commonly used), and sympathetic magic (stimuli which are non-infectious by themselves but resemble or came in contact with infectious stimuli).

In addition to disgust assessment, the DS_R has shown correlation with psychopathological disorders such as spider phobia (e.g., de Jong & Muris, 2002), blood and injury phobia (Cisler, Olatunji, & Lohr, 2009; Olatunji, Smits, Connolly, Willems, & Lohr, 2007; Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000), eating disorders (Troop, Murphy, Bramon, & Treasure, 2000), anxiety (Thorpe, Patel, & Simonds, 2003), neuroticism (Druschel & Sherman, 1999), food neophobia and nausea frequency (Björklund & Hursti, 2004), schizoid and dependent personality (Quigley, Sherman, & Sherman, 1997) and obsessive–compulsive disorder (Mancini, Gragnani, &

D'Olimpio, 2001; Olatunji, Sawchuk, Lohr, & de Jong, 2004; Olatunji, Williams, et al., 2007).

The original DS questionnaire was based on a two-factor model of disgust (Rozin et al., 2000). The first was Core disgust, a mechanism which elevates awareness about disease and oral incorporations of dangerous materials, comprised of the sub-domains of food, animals, and body products. The second factor was Animal-Reminder, a mechanism which elevates awareness to human animalistic nature, comprised of the sub-domains: sex, body-envelope violations, death, and hygiene.

Recently, the DS was revised to increase its item adequacy, factor structure, reliability, and validity in psychopathological studies (Olatunji et al., 2007). The Disgust Scale-Revised (DS_R) is comprised of fewer items (27 items), which are rated on a 5-point Likert scale. Furthermore, the DS_R has a better factor structure. It contains the DS original factors (Core disgust and Animal-Reminder) as well as a third factor, Contamination-Based Disgust, which contains items related to dangers of contamination. The three-factor model was validated in eight different countries (Olatunji, Moretz, et al., 2009), thus extending its external validity beyond the cultural environment where it was originally developed.

Despite the usefulness of the DS and its revised version, the DS_R, both scales were constructed, examined, and refined mainly with samples of a young, and largely female, student population, which limits the external validity (Henrich, Heine, & Norenzayan, 2010). The few studies which have used a substantially large sample drawn from the general population (Fessler, Arguello, Mekdara, & Macias, 2003; Haidt et al., 1994; Thorpe et al., 2003) did not examine the new version (i.e., the DS_R) and its factors. Moreover, current studies do not provide sufficient data on how these disgust sensitivity measures are influenced by demographic factors (Olatunji, Moretz, et al., 2009; Simpson, Carter, Anthony, & Overton, 2006). The importance of demographic variables on disgust modulation cannot be underestimated; age (Kim, Ebesutani, Young, & Olatunji, 2013; Quigley et al., 1997), political opinions (Inbar, Pizarro, Iyer, & Haidt, 2012; Inbar et al., 2009), education (Haidt et al., 1994), and religiosity (Haidt et al., 1994; Hunsberger & Jackson, 2005; Olatunji, Tolin, Huppert, & Lohr, 2005) were all found to be related to disgust. In sum, the DS_R applicability to a more heterogeneous sample, and the influence of demographic variables on disgust sensitivity, as measured in the DS_R, is yet to be determined.

The present study had two main goals; first, to examine the DS_R goodness of fit in a heterogeneous sample in three models. All three models were tested in the past as a part of the tool's development (Olatunji et al., 2007). This examination was done by a confirmatory factor analysis (CFA) for three alternate models; a conservative uni-dimensional model (containing all items under one factor), a two-dimensional model (Rozin et al., 2000), and a three-factor model (Armstrong, Olatunji, Sarawgi, & Simmons, 2010; Olatunji et al., 2007).

Our second purpose was to explore the influence of demographic variables such as gender, age, education, political orientation, and religiosity on the DS_R general score and its factors' scores in a heterogeneous sample. This was conducted with a set of multiple stepwise regressions in which demographic variables were entered in the first step and their interactions in the second step.

## 2. Materials and methods

### 2.1. Participants

All participants were Israeli Jewish citizens who agreed to participate in the study and were not offered any compensation. Prior to analysis several types of participants were excluded; (1) participants who reported an unlikely answer in the two 'catch' items (e.g., "would you rather eat a piece of fruit or a piece of paper", Olatunji et al., 2007, $N = 97$), (2) participants who left any of the items unanswered ($N = 128$), and (3) pregnant women which were reported to show heightened levels of disgust ($N = 2$; Fessler, Eng, & Navarrete, 2005). After the removal of these participants the analysis was conducted on all remaining participants ($N = 1427$, 54% women). Religiosity and political orientation were initially measured using a three-level scale ranking (religiosity: (3) very religious [orthodox], (2) religious [observant], (1) non-religious [secular]), political orientation: (1) right-wing [conservative], (2) center, (3) left-wing [liberal].

Participants mean age was 33.18 years (range 12–85, SD = 12.6) with mean education of 14.36 years (range 6–28, SD = 2.33). Average religiosity level was between secular to observant (M = 1.44, SD = 0.7), and political views were between political center to right wing (M = 1.9, SD = 0.79). Participants were approached by the first author at various locations such as shopping centers, transport hubs, and government offices.

### 2.2. Instruments

#### 2.2.1. DS_R Hebrew version

The DS_R was translated to Hebrew by a bilingual native speaker and was translated back to English by a different bilingual native translator in order to compare the two forms. This process was iterated until the form translation was satisfactory. Two important adjustments were made; First, common Hebrew synonyms of the words "cockroach" and "maggots" were added, in brackets, in the Hebrew version of the items. Second, during administration of the DS_R religious participants have remarked on two specific items. First, on item number 1: "*I might be willing to try eating monkey meat, under some circumstances*", they noted that this meat may or may not elicit disgust, but it is also non-Kosher according to Jewish dietary laws. Second, for item 27: "*As part of a sex education class, you are required to inflate a new unlubricated condom, using your mouth*" some orthodox participants reported they have only a vague idea of what a condom is (as they did not study sex education in school or had not been exposed to such information). Therefore both items were removed from the analysis. General DS_R reliability score was found to be acceptable (Cronbach's alpha = 0.79).

## 3. Results

### 3.1. Model comparison

A confirmatory factor analysis (CFA) goodness-of-fit examination of DS_R data was conducted using the AMOS program (Arbuckle, 2006) and SPSS. Two measures were calculated; the root mean square error of approximation (RMSEA), with values between .08 and .05 indicating an acceptable fit and values under .05 indicating a good fit (Browne & Cudeck, 1992; McDonald & Ringo Ho, 2002). In addition, we have examined the comparative fit index (CFI) representing the extent to which the model of interest is better than the independent model. Values that approach a value of 1 indicate an acceptable fit (Bentler, 1990). The analyses revealed that the three-factor model fits the data better than the one-factor ($\chi^2(3) = 236.9$, $p < .01$), and two-factor ($\chi^2(2) = 168.7$, $p < .01$) models (Table 1). The three factors were highly and significantly intercorrelated ($r_{Core, \ Animal\text{-}Reminder} = .56$; $r_{Core, \ Contamination} = .48$; $r_{Contamination, \ Animal\text{-}Reminder} = .39$; all $p < .001$). In addition, we conducted a congruence coefficient estimation for item factor loading, between the three-factor model in this study and in Olatunji et al.

**Table 1**
Three DS_R models examined in study 1.

| Model tested | $\chi^2$ | df | CFI | RMSEA |
|---|---|---|---|---|
| One-factor | 1414.3 | 230 | 0.800 | 0.060 |
| Two-factor | 1346.1 | 229 | 0.811 | 0.058 |
| **Three-factor** | **1177.4** | **227** | **0.839** | **0.054** |

*Note.* $N = 1427$; RMSEA – Root-Mean-Square Error of Approximation; CFI – The Comparative Fit Index.
The best fitting model is indicated in boldface.

(2007) Study 1. The fit was found to be moderate and significant ($\varphi = .699$, $p < .001$; Salkind, 2010).

### 3.2. Demographic modulations

Due to the significance of the three-factor model of the DS_R, we examined the correlations between demographic variables, DS_R general score and its three factors' scores (Table 2). All demographic variables showed significant correlations with disgust sensitivity. Based on these results a hierarchical multiple stepwise regression analysis was conducted, with DS_R factors and general score as dependent variables (the regression's final step is given in Table 3). The regression contained all demographic variables in the first step and demographic interactions in the second step. Stepwise probability for entry was set at a significance level of $p < .01$ and F change significance was set at $p < .001$. Due to the large sample size, variables with beta coefficients that were smaller than 0.05, were omitted after the regression.

The results indicate an effect of all demographic variables (age, education, religion, gender and political view) on the general DSR score and two of the three factors, albeit to different extents. However, apart from a large effect of gender (see Table 4) all other demographic variables modulation of DS_R variance was rather small. Specifically, the demographic variables explained 16% of general DS_R variance, 11% of Animal-Reminder-disgust variance, and 8% of Contamination-disgust variance. Only gender explained Core disgust variance (13%).

## 4. Discussion

In the present study, we examined the DS_R's construct and external validity and its relationship to demographic variables, using a large heterogeneous sample. Our results show that these validities of the DS_R, an important tool for disgust sensitivity assessment, are high. The DS_R, in its three-factor model, was found applicable not only in an additional country and language (Olatunji et al., 2009), but also as a valid tool to examine disgust in the general population. Past studies that examined disgust sensitivity focused on a thin sector of the general population, mainly student populations (Henrich et al., 2010). Thus, the present study

**Table 3**
DS_R factors and general score regression by demographic variables.

| | General score | | | Core score | | |
|---|---|---|---|---|---|---|
| | B | SE B | $\beta$ | B | SE B | $\beta$ |
| Constant | 2.85 | .09 | | 2.70 | .10 | |
| AG | – | – | – | .003 | .002 | .07** |
| GE | −.44 | .02 | −.38*** | −.45 | .03 | .36*** |
| ED | −.02 | .01 | −.09*** | – | – | – |
| Rel | .10 | .02 | .12*** | .06 | .02 | .07** |
| | Animal reminder score | | | Contamination score | | |
| Constant | 3.41 | .13 | | 2.20 | .14 | |
| AG | −.004 | .002 | −.075** | .01 | .002 | .13*** |
| GE | −.39 | .04 | −.27*** | −.45 | .05 | −.25*** |
| ED | −.03 | .01 | −.10*** | – | – | – |
| Rel | .14 | .03 | .12*** | −.10 | .04 | −.08** |
| Po | – | – | – | −.12 | .03 | −.11*** |

*Note.* **$p < 0.01$, ***$p < 0.001$. Ag – Age, Rel – Religion, Ge – Gender, Ed – Education, Po – Political Orientation. $N = 1427$. General score $R^2 = .16$, $F(3,1428) = 89.1$, ($p < 0.001$). Core score $R^2 = .14$, $F(3,1428) = 78.36$ ($p < 0.001$). Animal-Reminder $R^2 = .11$, $F(3,1428) = 44.84$, ($p < 0.001$). Contamination $R^2 = .09$, $F(3,1428) = 33.39$, ($p < 0.001$) for step1; $\Delta R^2 = .01$, ($p < 0.001$).

**Table 4**
Gender differences in disgust.

| | Gender | Mean | Std. deviation | T |
|---|---|---|---|---|
| General DS_R | Female | 2.56 | 0.53 | 14.79*** |
| | Male | 2.14 | 0.55 | |
| Core | Female | 2.62 | 0.56 | 14.59*** |
| | Male | 2.17 | 0.61 | |
| Animal-remainder | Female | 2.61 | 0.68 | 10.47*** |
| | Male | 2.22 | 0.73 | |
| Contamination | Female | 2.29 | 0.93 | 8.97*** |
| | Male | 1.88 | 0.79 | |

*Note.* $N$ male $= 660$; $N$ female $= 767$. ***$p < 0.001$.

further supports the DS_R external validity as a tool for clinical diagnosis and an experimental tool for disgust research.

Our finding of the three-factor model applicability in a wide heterogeneous sample is supported by the findings of Petrowski et al. (2010), who have examined the Questionnaire for the Assessment of Disgust Sensitivity (QADS) in a large heterogeneous sample. Although the QADS is not identical to the DS_R the authors have obtained a high fit for the three-factor model originally suggested by Olatunji et al. (2007). Specifically, the QADS was comprised of a (a) Core factor, containing disgust of oral rejection, body secretions, spoilage, and poor hygiene, (b) an Animal-Reminder factor, containing disgust of death, and deformation, and (c) a Contamination factor, containing disgust of poor hygiene, spoilage body secretions, and oral rejection.

The demographic variables examined in this study highlight several contributions to disgust sensitivity variance. Gender, which was found in previous studies to be a major contributor to DS and

**Table 2**
DS_R scores and demographic correlations.

| | General DS | Core | Animal-Reminder | Contamination | Age | Education | Religion |
|---|---|---|---|---|---|---|---|
| General DS | 1 | | | | | | |
| Core | .886** | 1 | | | | | |
| Animal-Reminder | .827** | .556** | 1 | | | | |
| Contamination | .687** | .484** | .394** | 1 | | | |
| Age | −.095** | −.106** | −.143** | .082** | 1 | | |
| Education | −.091** | −.065* | −.124** | −.012** | .249** | 1 | |
| Religion | .113** | .061* | .133** | .088** | −.180** | −.097** | 1 |
| Political Orientation | −.086** | −.030 | −.102** | −.098** | .171** | .199** | −.435** |

*Note.* **$p < 0.01$ *$p < 0.05$.

DS_R variance (Druschel & Sherman, 1999; Olatunji, Sawchuk, Arrindell, & Lohr, 2005; Olatunji et al., 2007), explained most of the DS_R general score (14%). Women were also found to be significantly more sensitive than men in all three factors. This gender difference in disgust sensitivity may be explained by several sources. First, taking the evolutionary perspective of disgust's role as a disease prevention mechanism, disgust may be more pronounced in women due to their role as offspring carriers (Curtis, Aunger, & Rabie, 2004). Second, several investigators (Druschel & Sherman, 1999) point to the important role of personality characteristics in disgust sensitivity, and the possible function of gender as a moderator between personality and disgust. The authors examined the relationships among DS, personality features (measured with the Big Five personality scale [NEO-Personality Inventory-Revised; Costa & McCrae, 1992]) and gender. Results indicated that DS is related to openness to experience, agreeableness, conscientiousness, and neuroticism. Gender may moderate this relationship as women tend to be more neurotic (Lynn & Martin, 1997).

Religion was found to explain a small portion of the DS_R general score (1.4%), with higher religiosity levels indicating higher levels of disgust sensitivity. These results questions previous findings that religion has a role in disease prevention (Fincher & Thornhill, 2008). These authors claimed that religion promotes three anti-contagion behaviors: in-group assortative sociality, out-group avoidance and limited dispersal. Such behaviors lead to intergroup boundaries which limits pathogen dispersal. Additionally, one study that examined the relationship between religiosity and disgusting stimuli, found that fears from pathogens is positively related to personal commitment to religion (Oum, 2011). However, both studies did not directly examine the relationship between disgust sensitivity and religiosity, as in the present study.

Education explained just 1% of general DS_R score, with higher levels of education associated with less disgust. Education's effect on disgust stemmed, in the present study, from the modulation of Animal-Reminder, which may point to a higher acceptance of human animalistic nature in educated participants, leading to reduction in disgust scores. Yet, the low contribution of education to disgust undermines earlier findings by Haidt et al. (1994), which found higher disgust ratings in low-educated sample. It emphasizes the fact that disgust is a basic general emotion which is not easily affected by years of schooling.

Previous studies have found lower levels of disgust in the elderly (e.g., Quigley et al., 1997). One possible explanation for this finding is the increase in emotion regulation across the life span, with the elderly better controlling their disgust reactions (Gross et al., 1997). In our study, however, age was only a small modulator of Contamination-disgust, explaining 1% of its variance, with older participants yielding lower disgust scores. In the DSR general score age was non-significant in explaining disgust sensitivity variance. However, our present findings are compatible with the work of Petrowski et al. (2010), who have also found that the QADS was unaffected by the participants' age.

Finally, our analysis found a surprisingly small significant effect of political orientation on Contamination score. These results are incompatible with Inbar, Pizarro, & Bloom (2009) and Inbar et al. (2012), which showed higher levels of disgust in people with conservative opinions. The rather small contribution of political orientation to disgust in the present study may stem from the fact that in the Israeli population there is a high correlation between religion and political orientation, as religiously oriented political parties tend to have a right-wing agenda. Thus, some of the variance explained by religion may be attributed to political orientation, as evident in the medium–high correlation we obtained between these two variables ($r = -0.37$, $p < 0.001$).

In sum, although the results highlight the different effects of demographic variables on disgust sensitivity, most demographic factors, apart from gender, did not have a prominent effect on disgust sensitivity. One explanation may be that demographic elements do not modulate levels of disgust per se as much as they impact the context in which disgust is activated. For example, the dietary differences in Jewish and Hindi religions caused the variation in subjective disgust evoked in devotee's response to a potential consumption of "forbidden animals"; Jews who consume beef are repelled from pork consumption, while the vice versa applies for non-vegetarian Hindus. However, the level of religious devoutness may only slightly modulate the intensity of that subjective disgust. This emphasizes the importance of cultural context in studies conducted with translated versions of the DS_R.

In addition to their role in disgust context, demographic and cultural variables may also interact with innate factors. Recent studies point to the culture-gene coevolution that influences human behavior. Specifically, cultural values modulate social behavior, thus reducing risk factors and maintaining group member health. For example, Chiao and Blizinsky (2010) found that cultural values, such as individualism/collectivism, buffer genetically susceptible populations from increased prevalence of affective disorders. In addition, Fincher, Thornhill, Murray, and Schaller (2008) found a strong relationship between collectivism and pathogen prevalence across 29 nations, promoting the role of culture in pathogen avoidance.

In conclusion, the present results emphasize the importance of validating disgust-related assessment tools in the general public, thus obtaining a broader insight of their applicability in measuring normal and psychopathological behavior. The three-factor model of the DS_R is an applicable tool with a high construct and external validity. In addition, most demographic variables, apart from gender, do not greatly modulate disgust sensitivity. Rather, demographic variables, most likely, create some of the diverse contexts in which disgust is evoked, without modulating the intensity of the subjective disgust sensitivity. For example, if a secular Jewish individual turns to embrace Orthodox Judaism his general disgust sensitivity remains at the same level. However, certain types of foods that were appealing to him in the past would now be considered disgusting, because of religious dietary prohibitions, and he would refrain from eating them.

## Acknowledgements

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