International Journal of Psychological Research
ISSN: 2011-2084
ijpr@usbmed.edu.co
Universidad de San Buenaventura
Colombia

Settineri, Salvatore; Mucciardi, Massimo; Leonardi, Valentina; Mallamace, Domenico; Mento, Carmela
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International Journal of Psychological Research, vol. 6, núm. 1, 2013, pp. 21-29
Universidad de San Buenaventura
Medellín, Colombia

INTERNATIONAL JOURNAL OF PSYCHOLOGICAL RESEARCH

RESEARCH ARTICLE

The emotion of Disgust in Italian students: A measure of the Synthetic Disgust Index

La emoción de Repugnancia en los estudiantes italianos: la medida de un índice sintético

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ABSTRACT

Research in the field of emotions has highlighted that men and women differ as regards the perception and reaction to disgust. The aim of our study was to analyse, by means of a questionnaire on disgust, any gender differences regarding this feeling in its various dimensions, viewed both individually and globally. For this purpose a synthetic indicator was developed to evaluate the expression of disgust and identify any individual differences. The sample of 1587 subjects were given a questionnaire on disgust that contained items to elicit disgust. Statistical analysis was performed on the items and on the scores via a synthetic indicator, the Synthetic Disgust Index (SDI).The analysis revealed a different trend in different types of disgust for age and sex. In males. The oral disgust and contamination showed a reduction of SDI in the age group between 18 and 39 years ($p<0.05$) and a maximum score in the group of subjects 40-64 years. In females the maximum score was present in the first group (0-17) for all dimensions of disgust except for disgust for aggressive content ($p<0.05$). The oral disgust and contamination showed a reduction of SDI in the age group between 18 and 39 years ($p<0.05$) with a general tendency to decrease with age.

Key Words:

Emotions, Disgust, Synthetic Disgust Index.

RESUMEN

La investigación en el campo de la emoción ha recalcado que hombres y mujeres difieren respecto a la reacción y percepción de la repulsión. El objetivo de este estudio fue analizar, por medio de un cuestionario de repulsión, algunas diferencias de género respecto a las diferentes dimensiones de este sentimiento, visto tanto de forma global como individual. Con este propósito un indicador sintético fue desarrollado para evaluar la expresión de repulsión e identificar alguna diferencia individual. A los 1587 sujetos de la muestra se les entregó un cuestionario de repulsión que contenía ítems para provocar repulsión. Se realizaron análisis estadísticos de los ítems y puntajes a través de un indicador sintético, la medida del índice sintético de disgusto (ISD). El análisis reveló una tendencia distinta en diferentes tipos de repulsión para la edad y el sexo. En hombres, la repulsión oral y la contaminación mostraron una reducción de ISD en el grupo de edades entre los 18 y 39 años ($p<0.05$) y una puntuación máxima en el grupo de individuos entre 40 y 64 años. En mujeres, la puntuación máxima estuvo presente en el primer grupo (0-17) en todas las dimensiones de repulsión excepto en la repulsión de contenido de agresividad ($p<0.05$). La repulsión oral y la contaminación mostraron una reducción de ISD en el grupo de edades entre los 18 a 39 años ($p<0.05$), con una tendencia general a disminuir con la edad.

Palabras Clave:

Emociones, Repugnancia, Índice Sintético de Repugnancia.

Recibido/Received Febrero 14 de 2013 | **Revisado/Revised:** Marzo 15 de 2013 | **Aceptado/Accepted** Junio 24 de 2013

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1. INTRODUCTION

The function of disgust ranges from protecting the body from offensive objects such as human and animal waste, to distancing oneself from reminders of one's animal nature, to concerns about protecting the bodysoul from contagion (Rozin, Haidt, & McCauley, 2000).

Darwin defined disgust as a primary emotion referred to something revolting, in relation to the sense of taste, as actually perceived or vividly imagined (Darwin, 1872). In addition, the concept of disgust can be expanded to involve violation of body borders at points other than the mouth (Rozin, Fallon, 1987). This concept of disgust can be further elaborated to include: human-animal origin disgust; interpersonal contamination; aggressivity and moral disgust such as sexual aspects.

From an evolutionary perspective, disgust is seen as a difensive mechanism protecting the organism from contamination by pathogens. Stimuli that become associated with disgust are often avoided due to concerns over possible infection, contamination, and disease acquisition (Angyal, 1941; Fallon & Rozin, 1983). Examples of contamination seem to follow the magical law of contagion "Once in contact, always in contact" and the law of similarity that suggests safe object may be rejected if they resemble a threat- relevant disgust elicitor in some way (Olatunji & Sawchuk, 2005). Feces is probably the universal primal disgust, and the spread from feces to other body products and other entities (germs, small animals) that reminds our animal origin represents an important domain of disgust (Rozin, Haidt & McCauley, 2008). Several studies have given importance to contamination disgust in relation to bloody- injection- injury fears, changes in disgust sensitivity across the menstrual cycle and specific phobias (Fessler & Navarrete, 2003; Olatunji et al., 2009; Olatunji et al., 2005 Sawchuk et al., 2002; Van Overveld, 2011;). The prevalence of disgust in females and sensitivity to it have also been studied in relation to phobias, above all ones relating to blood, injections and wounds. Both female gender and sensitivity to disgust are positive predictors of phobias.

Disgust (literally- bad taste) has been defined in terms of a food related emotion. The prototypical objects of disgust have been identified as waste products of the human and animal body but extend to biological substances such as blood, saliva, sweat and hair. Disgust centres around the holes in the body (Rozin et al., 2008). Most of the disgusting body products e.g. bad breath and halitosis emanate from holes, and the holes are also foci for disgust sensitivity (Settineri et al., 2010). Various studies have linked physical disgust to moral disgust. Resulted showed that taste perception significantly affected moral judgment such that physical disgust (induced via a bitter taste) elicited feeling of moral disgust (Eskine, Kacinik & Prinz, 2011; Von dem Hagen et al., 2009). In common parlance moral transgressions "leave a bad taste in the mouth" implies a link between moral disgust and more primitive forms of disgust related to toxicity and disease. We tested directly the primitive oral origin of moral disgust by searching for similarity in the facial motor activity evoked by gustatory distaste (elicitated by unpleasant tastes), basic disgust (elicitated by photographs of contaminants) and moral disgust (elicitated by unfair treatment in an economic game) (Chapman, Kim, Susskind & Anderson, 2009; Rozin, Haidt & Fincher, 2009).

In several studies, disgust has been conceptualized as a specific reaction to something that is offensive to the self because of its nature origin (Fallon & Rozin, 1983). Disgust may therefore be related to socio-moral processes by affirming our unique humanity (Rozin, Haidt & McCauley, 1999). Moral disgust operates to protect and preserve social order, and historically, has been largely shaped by religious and legal institutions. Miller (1997) nominates the vices of hypocrisy, betrayal, cruelty, and fawning as the principal vices that elicit disgust, but the expansion of disgust into the socialmoral domain involves different issues (Haidt, Rozin, McCauley & Imada, 1997) like racism, child abuse, incest, and recently, homosexuality (Olatunji & Sawchuk, 2005). In particular, disgust may be socially engineered rather than biologically prepared, functioning to marginalize homosexuals and other minoritary groups from the normative group (Nussbaum, 1999), also through aggressive behaviours (Ernulf & Immala, 1987). These variables are disgusting stimuli influenced by culture and

individual differences. Numerous studies have highlighted the prevalence of the feeling of disgust in females. In their study on individual differences in sensitivity to disgust, Haidt, McCauley and Rozin (1994) underline that the best predictor of sensitivity to disgust is gender. Substantially differences emerged for the domains of body products, animals and while they were smaller in the domains of hygiene and sex. In the same study, sensitivity to disgust was correlated with specific personality traits linked to this emotion as a defence.

Other authors have confirmed this finding. Druschel and Sherman (1999) also identified variables that affect sensitivity to disgust in both females and in personality traits, supporting the theory that there are dimensions of a normal adult personality that are linked to this sensitivity. The findings relating to gender in this study were consistent with previous research and it emerged that sensitivity to disgust is present in certain characteristics, namely neuroticism and conscientiousness, demonstrating that the reaction to a disgust stimulus rather than being a defence against a biological threat is, instead, the product of socio-cultural conditioning and psychological functioning.

A study by Chentsova-Dutton and Tsai (2007) which analysed the biological (gender) and social (ethnic) differences of primary and secondary emotions showed that women manifest more evident emotional behaviours than men. However, this gender difference was not found to be significant for some emotions, disgust among them. Gender differences regarding power, status and social role affect the emotional response to a given situation (Brody, 1997; Grossman & Wood, 1993).

Emotions do not differ between different ethnic groups, because the social roles of men and women are unaltered in the various groups. This upholds the notion that biological and social factors influence emotional response (Brody, 1993; Eagly, 1987; Wood, & Eagly, 2002). Collignon et al. (2010) studied gender differences in the processing and expression of feeling, disgust and fear in particular. The results showed women to be better able to recognize and express emotions. The fact that some gender differences appear very early in life suggests that biology may play a role when it is hardly possible that they have been shaped by socialization and experience (Baron-Cohen, 2003; Hines & Alexander, 2008; McClure, 2000).

On the basis of these observations, we decided to investigate gender differences regarding this feeling of disgust in its various dimensions, viewed both individually and globally. For this purpose a synthetic indicator was developed to evaluate the expression of disgust and identify any individual differences.

2. METHOD

2.1. Participants

A sample of 1587 subjects was taken from the town of Messina (676 males and 911 females). Subjects were contacted by medicine students of Messina University Hospital, who asked relatives and neighbors to voluntarily answer the questionnaire. We excluded from the study 71 people who did not answer to gender and age. The age range of participants was between 10 to 90 (M=40 and SD=16.1). More details of the demographic features of the sample are presented in Table 1. Moreover, the questionnaire was approved by the ethics committee of the University of Messina, Italy (Number 1815/09).

Table 1. *Demographic features of the sample (n=1587)*

Variable	Sample
Gender	
Male	676 (42.6%)
Female	911 (57.4%)
Age	
Mean (SD)	40 (16.1)
Range	10-90
Ethnicity	
Italian	1587 (100%)
Education	
Primary school	32 (2.0%)
Middle school	289 (18.2%)
High school	785 (49.5%)
Graduates	190 (12.0%)
(undeclared)	*291 (18.3)*
Employment status	
Employed	401 (25.3%)
Not employed	838 (52.8%)
Retired	58 (3.7%)
(undeclared)	*290 (18.3%)*

2.2. Procedure/ measures and reliability analysis

Subjects were asked to complete a questionnaire on disgust. The disgust scale is a measuring instrument of degree of reaction to disgust when evoked by mental images that potentially elicit it, the items were created from the theoretical construct of Miller's work (1997). The original questionnaire included questions of a general nature about age, gender, education, the type of food and smells that respondents found disgusting and 50 questionnaire items in the form of statements. For each of these, subjects were instructed to indicate to what extent they agreed or disagreed by assigning a score from 1 to 10. Each item was designed to evoke mental images eliciting disgust: e.g. "the sight of vomit really disgusts me", "smelling the bad breath on a person nearby". Of the overall items scale, the internal consistency as reflected in Cronbach's alpha was 0.93 and the split-half reliability was 0.88. Test-retest reliability was evaluated for 54 subjects asked to fill out the questionnaire for a second time. The 54 subjects filled out the questionnaire for the second time 4–6 days after the first time. Overall, the agreement between the first and the second set, related to test-retest measures intraclass correlation coefficient, was 0.74 and results was good.

2.3. The SDI (Synthetic Disgust Index)

In this work we use an alternative approach at the factor analysis. Our idea is to create a synthetic indicator to evaluate the expression of disgust and identify individual differences. In relation to measures applied to the scale, was constructed the SDI (Synthetic Disgust Index).

Now, we show its construction and related measures.

Given "k" items with a score x varying between 1 (minimum score attributed to disgust) and 10 (maximum) gives the following formula to be applied to each subject:

$$SDI_i = \frac{M_i(k)-1}{9} - \frac{\sigma_i(k)}{M_i(k)\sqrt{k-1}} \qquad (1)$$

with $M_i(k) = \frac{\sum_{j=1}^{k} x_j}{k}$ being the mean scores given by subject "i" for k items

and $\sigma_i(k) = \sqrt{\frac{\sum_{j=1}^{k}\left[x_j - M_i(k)\right]^2}{k}}$ being the standard deviation of the scores given by subject "i" for k items.

The underlying idea of the SDI was to create a summary and normalized score that was able to differentiate between subjects based on the variability of their replies. As can be seen from, formula (1), the indicator score grows as disgust increases while, for the same mean value $M_i(k)$, it decreases as the variability of responses increases. This allows better differentiation between subjects who present the same mean score and allows them to be ranked according to the variability of their responses. In strictly mathematical terms, the indicator falls between $-1 \le SDI \le +1$, with values close to 1 in the case of maximum disgust and near 0 in the case of minimum disgust. Negative values, although rarely seen empirically, can arise when a low mean score for disgust co-occurs with high variability between the various items. (e.g. $x_1 \ldots\ldots x_{k-1} = 0$ and $x_k = 1$). More precisely, given $M_i(k) > 0$ and $\sigma_i(k) \ge 0$ and the maximum score on the scale of 10, the cut-off point that discriminates between a positive (negative) SDI score is given by the following:

$$SDI > 0 \Leftrightarrow 0 \le \sigma_i(k) < 0.78 M_i(k)\left[M_i(k)-1\right] \quad (2)$$
$$(SDI \le 0 \Leftrightarrow \sigma_i(k) \ge 0.78 M_i(k)\left[M_i(k)-1\right])$$

From formula 2 it can be seen that that it would be difficult for a subject to present a variability of more than $0.78 M_i(k)\left[M_i(k)-1\right]$. Thus negative SDI scores are rare exceptions.

3. RESULTS

The questionnaire was given to a sample of 1587 subjects (676 males and 911 females). Prior to analysing the responses to the SDI, an analysis of the respective averages for gender and age range was performed in relation to each item of the disgust questionnaire.

The content analysis of the items, has identified four types of disgust related to oral (e.g. “Nausea after getting drunk”, ” Smelling bad breath on a nearby person”), aggressive (e.g.” Witnessing an execution”, “Acts of violence against animals”), contamination (e.g. “A woman’s sanitary towel/tampon in a public toilet”, “Squashing an insect”) and sexual content (e.g. “The sight of pornographic magazines”, “Seeing homosexuals having sex”). Next, for each type of disgust was calculated the SDI (SDI_oral, SDI_cont, SDI_aggr and SDI_sex) to evaluate gender differences (Table 2) and differences through age classes (Table 3).
The Mann-Whitney U test was used to compare groups, since the assumptions of normality and homogeneity of variance were not met. The significance level for the statistical tests was at $p< 0.05$ verified with the Monte Carlo method (with 10,000 samples) and Bonferroni corrections. The calculations are performed with SPSS ver. 13.0. This analysis brought a number of interesting points to light.

Overall the results showed that a gender difference is present for all classes of disgust with a significant SDI score in the female subjects involved (table 2).

Table 2. *SDI related to disgust and sex classes (total sample)*

Sex		SDI_oral	SDI_aggr	SDI_cont	SDI_sex
M	Mean	.5438*	.4317*	.4876*	.1599*
	N	676	676	676	676
	SD	.24862	.28835	.28553	.44737
F	Mean	.6112*	.5440*	.5456*	.2980*
	N	911	911	911	911
	SD	.24048	.28169	.28471	.43845
Total	Mean	.5825	.4962	.5209	.2391
	N	1587	1587	1587	1587
	SD	.24617	.28983	.28641	.44738

*Significant difference at the p<0.05 (two-tailed)

Table 3. *SDI related to disgust and age range*

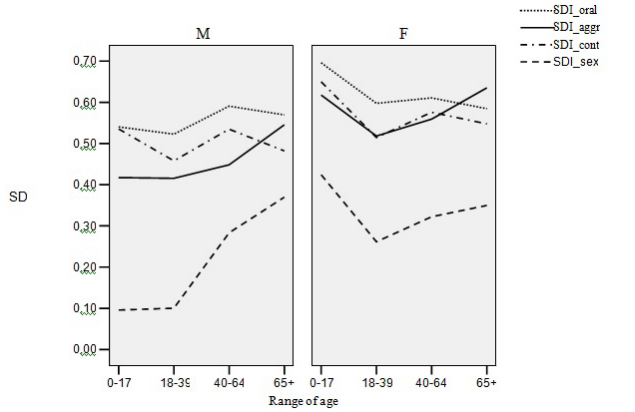
Age range	Sex		SDI_oral	SDI_aggr	SDI_cont	SDI_sex
0-17	M	Mean	.5403*	.4170*	.5352*	.0956*
		N	89	89	89	89
		SD	.23667	.28678	.27170	.47529
	F	Mean	.6960*	.6175*	.6498*	.4242*
		N	105	105	105	105
		SD	.19816	.25317	.22249	.43572
	Total	Mean	.6246	.5255	.5972	.2734
		N	194	194	194	194
		SD	.22967	.28647	.25222	.48193
18-39	M	Mean	.5226*	.4154*	.4579*	.1001*
		N	385	385	385	385
		SD	.25063	.28775	.29987	.44284
	F	Mean	.5974*	.5180*	.5144*	.2613*
		N	556	556	556	556
		SD	.24360	.28932	.28806	.44106
	Total	Mean	.5668	.4760	.4913	.1954
		N	941	941	941	941
		SD	.24910	.29291	.29411	.44862
40-64	M	Mean	.5905	.4481*	.5347	.2831
		N	158	158	158	158
		SD	.25063	.29083	.26257	.41585
	F	Mean	.6107	.5591*	.5758	.3221
		N	211	211	211	211
		SD	.24168	.27837	.28893	.41558
	Total	Mean	.6020	.5116	.5582	.3054
		N	369	369	369	369
		SD	.24542	.28867	.27833	.41558
65+	M	Mean	.5694	.5454	.4819	.3698
		N	44	44	44	44
		SD	.22927	.26764	.23065	.39410
	F	Mean	.5844	.6351	.5476	.3496
		N	39	39	39	39
		SD	.25414	.19867	.28819	.46771
	Total	Mean	.5764	.5876	.5128	.3603
		N	83	83	83	83
		SD	.23990	.24058	.25976	.42770

*Significant difference at the p<0.05 (two-tailed)

The analysis in different age groups revealed a different trend in different types of disgust. In males. the oral disgust and contamination showed a reduction of SDI in the age group between 18 and 39 years ($p<0.05$) and a maximum score in the group of subjects 40-64 years. The disgust toward aggressive content and sex objects instead showed a different trend with an increase in the SDI progressively increasing with age ($p<0.05$) with a higher score in partecipants over 65 years. In females the maximum score was present in the first group (0-17) for all dimensions of disgust. except for disgust for aggressive content ($p<0.05$). The oral disgust and contamination showed a reduction of SDI in the age group between 18 and 39 years ($p<0.05$) with a

general tendency to decrease with age; instead, as in the male subjects, the disgust toward aggressive content and sex object tends to increase with age (Fig. 1).

Figure 1. *Trends in types of disgust in relation to sex and age.*



4. DISCUSSION

Our study aimed to investigate the differences regarding disgust in relation to gender and age and to focus on the types of disgust where the greatest divergences arose. The various dimensions of disgust were analysed through the synthetic index SDI that enabled disgust to be investigated not only in relation to the overall average of responses but above all in relation to their variability.

Types of disgust that we investigated concerned the disgust toward oral, aggressive, moral and contamination objects.

As disgust can be considered a primary emotion, his goal is not only in relation to the feeling, but also to the object that elicits (Phillips, 1998). A series of variables show that the oral object (food) is more in the first half of life with a difference between males and females and it highlights a decrease with age (Fig.1). This finding could be interpreted as a smaller role for the dynamic removal of what is inserted through the mouth. The predisposition toward rejected objects is different between males and females and, in particular, provides a peak in women in adolescence and a decline at the age of young adults (18-39 y.o.) in both sex (Fig.1). Gender differences explain the results in the literature about the dynamics towards the food and all that concerns its alterations (bad breath, rotting foods) (Rozin & Fallon, 1987). The gender difference could be explained in light of the meaning of the relational significance of oral content, present more in women than in men, and how this information affects the etiopathogenesis of eating disorders, prevalent in females in early adolescence (Davey & Chapman, 2009).

Even the items related to aggressive content show an increase in the removal of the object and then a parallel development of moral value. In both sexes, in relation to the age group there is less disgust toward the aggressive object for young adults, then an increase in values in the group over 65 years (Tab.3). In women, the index has a total SDI scores higher than the male, with the predominance in the group fewer than 18 years and over 65 years (Fig.1). Our results show a greater intolerance of women to violence that could provide a possible explanation for the lowest crime rate in women than in men (Bennett, Farrington & Huesmann, 2005).

The fear of contamination is present in both sexes with the same trend, but is overall higher in women (Fig. 1). Adolescents (under 18 years) present the greater SDI score (,5352 in males and ,6498 in males, $p<0.05$) followed by the middle-aged adults (40 -64 years). The data on gender differences in disgust contaminaton could provide additional data in the line of research that studies the importance of factors such as biological sex and age as a mediator between disgust sensitivity and the onset of specific phobias or OCD-fears related contamination. (Arrindell, Mulkens, Kok & Vollenbroek, 1999; Olatunji et al. 2006; Sawchuk et al., 2002).

In the group characterized by items related to the sexual object, in both sexes total SDI scores are lower than the SDI to all the other dimensions of disgust. Furthermore, in males this trend is more evident in the first half of life; in women this SDI score is evident in the age group between 18 and 39 years, while it has the highest score in the teens. In both genders after age 40, detachment from dangerous object (represented by sexual practices that violate the personal integrity) tends to increase gradually until a comparable SDI over

65 years. This result could be read in a different key to the meaning attributed to sex at different stages of life and especially in its reproductive function and preservation of the species prevalent in the second half of life.

5. CONCLUSION

The emotion of disgust declines, while maintaining the same moodly experience, the need for preservation of species in relation to the tasks that are asked for the male and female roles and generational groups that can be reported. We need to understand negative representations in respect of the taste of which the term “disgust“ is antithetical: they can help us to understand why the effect of violence is perceived differently by men and women and why serves sexuality as other emotions with which the familiar is very impressive, as about the contamination in the etiopathogenesis of disorders of anxious-phobic spectrum. This study, as providing broad age groups, suggests the role played by emotion disgust in the process of development and identification of personality.

The variables used in the study are not universal, but mostly of the western world, in fact, the danger of the object is given by the stimulus that elicits rather than by the intrinsic biochemical response and it says the close relationship between emotion and disgusting object’s representation. A further limitation is the fact that it is possible that other factors may contribute to generate disgust, including cognitive impairment that the method does not include but which could play a role in the change of disgust in several age classes, particularly in the adaptive function of the body over time.

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