



Original Article

Physiological and behavioral responses to strangers compared to friends as a source of disgust

Ming Peng^a, Lei Chang^{a,*}, Renlai Zhou^{b,c}^a Department of Educational Psychology, The Chinese University of Hong Kong, Hong Kong, China^b Beijing Key Lab of Applied Experimental Psychology, School of Psychology, Beijing Normal University, Beijing, China^c State Key Laboratory of Cognitive Neuroscience and Learning (Beijing Normal University), Beijing, China

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ABSTRACT

Known as the source effect, feelings of disgust have been found to differ depending on the source of the disgusting material, with that emanating from oneself and familiar others eliciting less disgust than that of strangers. We tested the source effect on self-report of disgust feelings (Study 1), physiological response in heart rate (Study 2), and behavioral response in terms of approach–avoidance movement (Study 3). The results showed significantly higher levels of disgust feelings, more reduced heart rates, and faster avoidance behavior when processing disgusting material associated with strangers compared to that of familiar persons. Together these findings support the evolutionary view that disgust, as part of the human behavioral immune system to drive avoidance from disease-carrying agents, will likely be activated more intensely and quickly in response to unfamiliar as compared to familiar conspecifics who carry common germs more defensible by our shared physical immunity.

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1. Introduction

Communicable diseases have posed formidable threats to the survival of animal species. To promote adaptive responses to potential disease, humans and other animals have developed sophisticated physical and behavioral immune systems to fight diseases both inside and outside the body. The human behavioral immune system is particularly well developed that is characterized by the acute emotion of disgust to drive disease-averse behaviors (Neuberg, Kenrick, & Schaller, 2011). Because diseases are imperceptible to the naked eye, the behavioral immune processes are not sensitive to diseases *per se* but are elicited by morphological and olfactory cues that heuristically connote the presence of diseases (Case, Repacholi, & Stevenson, 2006; Curtis, 2007). Examples of morphological indicators include decaying waste, open wounds displaying suppuration and blood, and waste products (Curtis & Biran, 2001). Other heuristic cues are conspecifics whose appearance deviates from the norm (Curtis & Biran, 2001). Research has shown that the behavioral immune system that is often mediated by the feeling of disgust responds to such bodily deviations as deformity, amputation (Haidt, McCauley, & Rozin, 1994), and blemished skin (Stevenson & Repacholi, 2005), and by such norm-deviating individuals as the disabled (Park, Faulkner, & Schaller, 2003), the disfigured (Ackerman et al., 2009; Rumsey, Bull, &

Gahagan, 1982), the obese (Park, Schaller, & Crandall, 2007), and the elderly (Duncan & Schaller, 2009).

The disgust felt towards some of these potential sources of disease should differ depending on the extent to which an individual is already exposed to them. Common germs shared by people living together are less harmful to an individual than foreign germs carried by strangers because one is more likely to have developed antibodies against the former than the latter. People living together or having frequent contact with one another develop common microbial flora (Stevenson & Repacholi, 2005), and this reduces the disgust which would otherwise be felt towards disease elicitors (Stevenson & Repacholi, 2005). Because individuals living in close proximity develop similar antibodies, interactions between them generally pose less risk of disease transmission than interactions between biologically related individuals who do not live together (Navarrete & Fessler, 2006; Fincher & Thornhill, 2012). Because of a potentially different immunity against familiar versus unfamiliar diseases, the behavioral immune system is expected to respond differently by activating more or less disgust towards those potential disease bearers who are either unfamiliar or familiar to the individual.

Known as the source effect, feelings of disgust have been found to differ depending on the source of the disgusting material, with the self and familiar others eliciting less disgust than strangers (Curtis, Aunger, & Rabie, 2004). Stevenson and Repacholi (2005) reported increased levels of disgust and negative affect when body malodors emanated from a stranger rather than from oneself. The source effect was especially pronounced when the participants perceived a higher risk of disease transmission (Stevenson & Repacholi, 2005). A recent

* Corresponding author. Department of Educational Psychology, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong. Tel.: +852 2609 6936; fax: +852 2603 6921.

E-mail address: leichang@cuhk.edu.hk (L. Chang).

study identified the source effect when comparing strangers with parents, partners, friends, and acquaintances (Bužeková & Išová, 2010). When associated with these four categories of familiar people, participants found bodily secretions, sexual conduct, hygiene, and violations of the body envelope to be less disgusting. The most illuminating finding comes from a study that investigated mothers' reactions to their infant's disgust elicitors such as vomit, urine, and feces (Case et al., 2006). Mothers regarded their own baby's fecal smell as less disgusting than that from someone else's baby. This source effect was sustained when mothers were given concealed samples of their own baby's feces-soiled diapers and those of someone else's baby. However, mothers have also been found to prefer the smell of their biological children over that of their stepchildren (Weisfeld, Czilli, Phillips, Gall, & Lichtman, 2003), suggesting a biological rather than an exposure effect.

However, these few studies have only used self-reports of disgust even though emotions are registered both by subjective and physiological representations (Stark, Walter, Schienle, & Vaitl, 2005; Weinberger, Schwartz, & Davidson, 1979). Results based on explicit subjective reports may also be tempered by social desirability concerns (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005), whereas physiological expressions of emotions can be more accurately studied. Because disgust is related to the parasympathetic system (Ekman, Levenson, & Friesen, 1983; Levenson, 1992), it is associated with a reduced heart rate (Woody & Teachman, 2000). Several studies have documented decreased heart rates that were associated with the subjective feelings of disgust (Boiten, 1996; Ekman et al., 1983; Lang, Greenwald, Bradley, & Hamm, 1993; Prkachin, Williams-Avery, Zwaal, & Mills, 1999; Stark et al., 2005). The reduced heart rate is a precursor anticipating and preparing for adaptive behavior which the emotion is intended to drive. An evolutionary investigation of emotion should also examine such functional outcomes which, in the case of disgust, are behavioral withdrawal and avoidance of diseases. Reduced heart rate, feelings of disgust, and avoiding and withdrawing behavior represent a series of adaptive responses set in motion by the behavioral immune system to fight a pathogen before it enters the body (Neuberg et al., 2011). The purpose of the present study was to test the source effect of disgust by examining both self-report, as a subjective expression of disgust, and heart rate, as a physiological expression of disgust, and the approach–avoidance movement which is expected to be functionally driven by the experience of disgust. These aspects have hitherto been neglected by researchers.

2. Study 1: Self-Report

The purpose of this study was to replicate the previous findings (Stevenson & Repacholi, 2005; Case et al., 2006) that participants reported less disgust when the source of the disgusting material was someone they knew rather than someone they did not know.

2.1. Participants

A total of 56 students (27 females, average age = 19.52, $SD = 0.71$) from a university in central China participated in the study. They were randomly assigned to one of two experimental conditions, namely, the familiar group, or the stranger group.

2.2. Disgust stimuli

Thirty disgusting sentences (e.g., someone looks for the key in vomit; someone urinates in the swimming pool) and 30 neutral sentences (e.g., someone takes a taxi home after work; someone walks in the park after supper) were used in the study. These sentences were rated on a 6-point scale by an independent group of 27 students not involved in the main study. The average disgust score for the neutral

sentences was 0.43 ($SD = 0.65$) and, for the disgusting sentences, 4.09 ($SD = 1.12$). The difference between these two types of sentences was statistically significant ($t_{26} = 16.97, p < 0.001$).

2.3. Familiar Group vs Stranger Group

Half of the participants ($n = 28$) were randomly assigned to the familiar group and the other half were assigned to the stranger group ($n = 28$). In these two groups, a participant was required to rate the 30 neutral and the 30 disgusting statements as though they were stated either by someone the participant was close to and familiar with (familiar group) or someone who was a total stranger to the participant (stranger group). The Subjective Closeness Inventory (SCI; Berscheid, Snyder, & Omoto, 1989), a two-item inventory that measures relationship closeness (from 0 = not at all close to 10 = very close) and the Inclusion of Other in the Self Scale (IOS; Aron, Aron, & Smollan, 1992), an one-item pictorial measure of relationship closeness (from 1 = least close to 7 = most close), were used to verify relationship closeness between the participant and his or her chosen target person. The average score of the two SCI items was 7.98 ($SD = 1.54$) and 7.83 ($SD = 1.77$), and the average IOS score was 5.52 ($SD = 1.15$). According to the literature, SCI reaching 7.5 (Schug, Yuki, & Maddux, 2010) and IOS reaching 4.5 (Weidler & Clark, 2011) suggest close relationships. Our results exceeded these required levels, suggesting a high degree of closeness between a participant and the person the participant is thinking of. For the stranger group, participants were asked to think of a name that was not the same as that of anyone they knew. All participants complied.

2.4. Procedure

After arriving at the testing site, a participant was asked to think of a person similar in age to themselves who was either very close (familiar group) or who was a total stranger (stranger group) to the participant and then to enter the person's name into the computer. For the stranger group, participants were asked to use a name that was not familiar to them and was not that of anyone they knew. The participants were then asked to rate the 60 sentences on an 11-point scale that ranged from -5 to 5 indicating the extent of negative or disgust (-5 to 0) to positive feeling (0 to 5). With a mixed order of presentations, the 60 statements appeared on the computer screen one by one with the participant's chosen name as the subject of each statement. After rating the 60 sentences, participants in the familiar group answered the SCI and IOS, as discussed above.

2.5. Results and discussion

A 2 (familiar group vs stranger group, between participants) \times 2 (disgusting vs neutral sentences, within participants) mixed ANOVA yielded a significant interaction effect ($F_{1, 54} = 4.09, p = 0.04, \eta_p^2 = 0.07$). Whereas there was no significant difference between the stranger group ($M = 2.35; SD = 1.68$) and the familiar group ($M = 2.28; SD = 1.85; t_{54} = 0.17, p = 0.87$) for the neutral sentences, there was a significant difference for the disgusting sentences between the stranger group ($M = -2.76; SD = 1.09$) and the familiar group ($M = -1.63; SD = 1.80; t_{54} = -2.85, p = 0.006$).

Consistent with previous studies (e.g., Stevenson & Repacholi, 2005; Case et al., 2006), these results confirm the source effect on felt disgust. As an adaptation to ward off diseases, the arousal of the disgust emotion differs depending on the carrier of the potential disease. Strangers, who are more likely than familiar conspecifics to carry diseases for which one has not acquired immunity, should thus elicit a stronger disgust emotion to ward off potentially more dangerous germs. If such a source effect exists, it should be more directly observed in our physiological response compared to our verbal expression of disgust.

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