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My baby doesn't smell as bad as yours The plasticity of disgust

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Abstract

Disgust is a powerful behavioral adaptation, which confers the advantage of reducing the risk of pathogen infection. However, there are situations in which disgust at core elicitors (e.g., feces) must be modulated in the service of other goals (e.g., caring for a close kin). In Study 1, mothers of infants completed a self-report questionnaire about their reactions to changing their baby's feces-soiled diaper compared with the diaper of someone else's baby. In Study 2, mothers of infants were presented with a series of trials in which they smelled concealed samples of their own baby's feces-soiled diaper and those of someone else's baby. In addition, labels were used to identify the source of the sample (correctly labeled, mislabeled, or no label). Both studies provide evidence suggesting that mothers regard their own baby's fecal smell as less disgusting than that from someone else's baby. Furthermore, labeling had relatively little influence on this effect, and the effect persisted when social desirability was controlled.

Keywords: Disgust; Odor; Disease avoidance; Diapers; Source effect; Evolution

1. Introduction

Diseases caused by infectious agents are a powerful selective force, which have been responsible for modifying our physiology (Curtis & Biran, 2001). Disgust may represent a

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behavioral adaptation that is enlisted along with physical (e.g., closing orifices), chemical (hydrochloric acid in the stomach), and biological (e.g., gut flora) protection as a defense against microbial attack (Curtis et al., 2004; Curtis & Biran, 2001; Hart, 1990, Stevenson & Repacholi, 2005; see also Davey, 1994, Rozin et al., 2000).

Although disgust might serve as a protective behavioral guard against exposure to infection, there are many circumstances in which disgust must be tempered or modulated. For example, a mother's disgust at her baby's feces has the potential to obstruct her ability to care for her baby and may even affect the strength of the bond she has with her baby. Similarly, in maintaining our own hygiene and in day-to-day contact with family, close friends, and sexual partners, we are invariably confronted with such disgust elicitors. In addition to presenting an obstacle to close relationships and, indeed, sexual reproduction, disgust toward elicitors associated with a close family member would be less effective at reducing disease risk because close family members often share common microbial flora (Curtis et al., 2004; Curtis & Biran, 2001).

From an evolutionary perspective, disgust toward elicitors associated with an unfamiliar person should be greater than when the source is the self or close family. We shall refer to this hypothesized pattern as the *source effect*. Several commentators have suggested that such a source effect is unlikely to exist for disgust elicitors (e.g., Miller, 1997; Royzman & Sabini, 2001), yet few studies have empirically addressed this question. One line of research on interpersonal preferences for armpit odor (see Levine & McBurney, 1986 for review) reveals that we have a preference for our own body odors and those from close kin (e.g., McBurney et al., 1977; Porter & Moore, 1981; Russell et al., 1983; Schleidt & Hold, 1982). Prior exposure to the odor has been identified as the main mechanism responsible for this enhanced accuracy (Kaitz & Eidelman, 1992). However, more recent research has shown that mothers more accurately identify and prefer the smell of their biological children but not the equally encountered smell of their stepchildren, suggesting that biological relatedness might be conveyed in body odors (Weisfeld et al., 2003).

Although the research on body odor provides evidence for a source effect, there are several reasons why body odor is a poor exemplar of a disgust elicitor. First, unpleasant, axillary odor is perceived to be associated with positive masculine traits such as activeness, strength, and intelligence (McBurney et al., 1977). Second, people tend to attribute stronger body odors to men and weaker odors to women, regardless of the true gender of the source (Doty, 1981). Third, the axillary region is involved in the secretions of chemicals implicated in sexual communication (i.e., pheromones; Doty, 1985). Accordingly, the research on body odors may not extend to more prototypical disgust elicitors.

A recent series of self-report studies using vignettes and a smell diary provided more direct support for the source effect (Stevenson & Repacholi, 2005). Although these findings are limited in that they were derived from hypothetical scenarios and recalled experiences, they provide preliminary support for a source effect in determining reactions to disgust elicitors, and they suggest that the main mechanism responsible for this effect is frequency of exposure.

In the present studies, we reasoned that a mother's care for her infant is inextricably linked to frequently encountered disgust elicitors (e.g., vomit, urine, and feces) and that disgust to

such elicitors represents an obstacle to care. Confining our investigation to feces, an unambiguous core disgust elicitor, we expected mothers to demonstrate a source effect when rating their disgust at changing baby diapers.

2. Study 1: mothers and babies questionnaire

In Study 1, mothers of infants completed a questionnaire concerning their reactions to changing their baby's diaper and changing the diaper of someone else's baby. We expected that participants would rate someone else's baby's diaper as more disgusting than that of their own baby.

2.1. Method

2.1.1. Participants

Forty-two mothers of infants aged between 6 and 18 months were recruited to complete a "Baby smell questionnaire." Twenty-seven of the mothers (aged 26–40 years), all of whom were primarily responsible for their infant's care, reported that in addition to their own baby, they had changed a feces-soiled diaper of someone else's baby.

2.1.2. Questionnaire

Each mother completed the questionnaire and then mailed it back to the investigator. Apart from demographic information, baby's diet, and type of diaper used, participants rated their reactions to the last time they changed their baby's diaper on four 7-point scales (*didn't feel sick* to *felt very sick*; *didn't feel disgusted* to *felt very disgusted*; *indifferent to the smell* to *found the smell very bad*; *could tolerate the smell* to *found the smell intolerable*). These four ratings were combined to produce a composite measure of disgust (Cronbach's α=.74). If participants indicated that the smell of their own children's feces-soiled diaper had changed since their first baby, they rated how this smell had changed using the same four ratings (e.g., they make me feel more disgusted now; agree, unsure, disagree). After completing the questions about their own baby, participants were asked whether they had ever changed the feces-soiled diaper of someone else's baby (yes, unsure, no) and when this last occurred. Finally, participants rated their reactions to the last time they changed the feces-soiled diaper of someone else's baby using the same four scales described above. Again, these four ratings were combined to produce a composite disgust measure (Cronbach's α=.90).

2.2. Results

2.2.1. Baby's diet

Ratings of diapers from babies mainly eating solid foods (M=1.78, S.D.=0.75) did not differ from ratings of diapers from babies who were on a combination of solids and milk (M=1.72, S.D.=0.77), t<1.

2.2.2. Own versus someone else's baby

As predicted, mothers rated the smell of their own baby's feces-soiled diaper less disgusting (M=1.74, S.D.=0.75) than the feces-soiled diaper of someone else's baby (M=3.31, S.D.=1.62), $t(26)=5.46$, $p<.001$. Ratings of their own baby's diaper and those of someone else's baby's diaper were significantly correlated, $r(27)=.48$, $p<.01$. Interestingly, all of the mean ratings of the diapers were below the midpoint of the scale, suggesting that mothers perceive feces-soiled diapers only mildly disgusting.

2.2.3. Ratings of exposure

Sixty-four percent (n=27) of all participants (N=42) reported that since the birth of their first baby, their reactions to their baby's feces-soiled diapers had changed. Specifically, these participants were more likely to agree than disagree that soiled diapers now smelled less bad, $\chi^2(1)=12.67$, were more tolerable, $\chi^2(1)=13.37$, made them feel less sick, $\chi^2(1)=16.33$, and made them feel less disgusted, $\chi^2(1)=13.37$, all p values <.01. This suggests that disgust toward feces, in general, abates with exposure (domain-general habituation).

2.3. Discussion

The results of Study 1 suggest that mothers find changing someone else's baby's feces-soiled diaper more disgusting than changing their own baby's diaper (the source effect). This is consistent with Stevenson and Repacholi's (2005) findings that core disgust elicitors associated with those with whom we share close relationships are less disgusting than those associated with strangers. In addition, the results suggest that the more exposure a mother has to changing diapers, the less disgusting it is.

The questionnaire method used in Study 1 was limited in its scope to address a cognitive labeling account of the source effect. Furthermore, participants' retrospective judgments about the quality of feces-soiled diapers may have been inaccurate and influenced by self-presentation or socially desirable responding (even if the mother does find her own baby's diaper disgusting, she may not want to admit this). Thus, a more objective test of the source effect was devised.

3. Study 2: diaper experiment

Study 2 presented mothers with actual feces-soiled diapers. We hypothesized that the source effect would emerge even when mothers are blindly presented with the odor of their own baby's diaper and the diaper of another baby. However, we also expected that the label identifying the source of the odor might contribute to the source effect. Specifically, we expected that mothers would rate fecal odors labeled as deriving from their own baby as less disgusting than those labeled as coming from another baby—regardless of the actual source of the diaper. Finally, we also attempted to control for socially desirable responding.

3.1. Method

3.1.1. Participants

Thirteen mothers (M=32.62 years, S.D.=3.64) of infants between 6 and 24 months of age were recruited to participate in a "Baby smell study." All of the mothers were primarily responsible for their infant's care and reported that they had changed a feces-soiled diaper of someone else's baby. The average age of the donor infants was 14 months, and the age of the infant who provided the control diaper was 16 months. All babies were healthy and eating solid food.

3.1.2. Design

A 2 (stimulus source: own baby vs. someone else's baby)×3 (stimulus label: no label vs. correctly labeled vs. mislabeled) repeated measures design was used. Stimulus source involved presenting participants with a feces-soiled diaper from their own baby or from someone else's baby. On presentation, the source of the diapers was correctly labeled, mislabeled, or given no label at all. The dependent measures were ratings on four 7-point scales (*no smell* to *very intense smell*; *didn't feel sick* to *felt very sick*; *didn't feel disgusted* to *felt very disgusted*; *indifferent to the smell* to *found the smell very bad*). Using the same measures, retrospective ratings of the last time mothers changed their baby's feces-soiled diaper and the diaper of someone else's baby were also obtained. In addition, two individual difference measures were administered: a general self-report of disgust sensitivity (Haidt et al., 1994) and a standard measure of the tendency to give socially desirable responses (Crowne & Marlowe, 1960).

3.1.3. Materials and procedure

Participants completed the consent form and the social desirability questionnaire before attending the experimental session. They were instructed to obtain a feces-soiled diaper from their baby within the 12-h period before the experiment and place it in a snap-lock plastic bag and to avoid using scented products. Essentially, the same procedure was used to collect the diaper from the 16-month-old baby who donated the comparison diapers. However, in an attempt to preserve the odor of the comparison diapers, they were stored in a refrigerator at approximately 4°C. These diapers were removed from refrigeration 2 h prior to testing, and a new sample was obtained from the comparison baby every 3 to 4 days over the course of the study. At the experimental session, the participant's sample and that obtained from the comparison baby were each placed into identical buckets (6 l capacity) in an area concealed from the participant. Each bucket was lined with a scentless plastic bag and had been modified so that there was a portal (8 cm in diameter) placed in the lid. Lifting the small plastic lid of the portal revealed a perforated plastic cup, which was attached to the lid of the bucket. This prevented participants from seeing the contents of the bucket, while allowing the odor to be sampled.

Participants smelled and rated the practice trial (a bucket containing mothballs) and then completed three pairs of trials. Each trial comprised one bucket containing their own baby's diaper and another bucket containing someone else's baby's diaper. On one trial, the source of

the diaper was not identified. On the remaining two trials, the experimenter correctly identified or misidentified the source of the diaper by placing an adhesive label on the lid of the bucket displaying either the participant's baby's name or "someone else's baby." The presentation order was randomized within pairs of trials, as was the order of the correctly identified, misidentified, and unidentified (blind) trials. After completing the experimental trials, participants rated their reaction to the last time they changed their own baby's feces-soiled diaper and the diaper of someone else's 6- to 18-month-old baby. Finally, participants completed the Disgust scale (DS; Haidt et al., 1994).

3.2. Results

3.2.1. Approach to analysis

Odor intensity has been found to affect hedonic evaluations of axillary odors, so that the greater the intensity of the odor is, the less pleasant it is perceived (Doty et al., 1978). In the present study, we attempted to control for intensity ratings by entering them as a covariate in the analyses. However, disgust and intensity ratings of the diapers were almost identical. Intensity ratings were thus omitted from the analyses, and the composite of the three remaining ratings of the diapers comprised the principle measure of disgust (Cronbach's α=.88–.96 for each pair of stimuli). Finally, we attempted to control for the effects of social desirability by entering social desirability scores as a covariate in the analysis.

3.2.2. The source effect

Mean composite disgust ratings for the source of the diapers by the label condition are displayed in Fig. 1. These means show a clear source effect. A planned analysis using GLM repeated measures, with social desirability scores entered as a covariate, tested the simple effects of the source of the diaper and the label used. There was a main effect for source of the diaper so that regardless of whether the stimuli were correctly labeled, mislabeled, or given no label, mothers rated their own baby's soiled diaper as less disgusting than someone else's baby's diaper, $F(1, 11)=6.79$, $p<.03$. However, this source effect was most pronounced in just two of the label conditions. Specifically, mothers rated their own baby's diapers as less disgusting than someone else's baby on the blind trials, $F(1, 11)=8.33$, $p<.02$, and on the trials where the diapers were correctly labeled, $F(1, 11)=5.35$, $p<.05$. This source effect disappeared on the mislabeled trials, $F(1, 11)=.51$, $p>.5$, ns. There were no main effects for the type of label used.

3.2.3. Social desirability

Mothers may have been reluctant to admit that they find their baby's diaper disgusting, hence inflating the source effect. A series of correlations was conducted between the composite disgust ratings (using difference scores: someone else's baby diaper minus own baby's diaper) and social desirability scores to determine how self-presentation affected ratings. Contrary to expectations, higher social desirability scores were associated with a reduced source effect on the blind trials, $r(13)=-.70$, $p<.01$, and the correctly labeled trials, $r(13)=-.66$, $p<.02$. Interestingly, this relationship was reversed for the mislabeled trials,

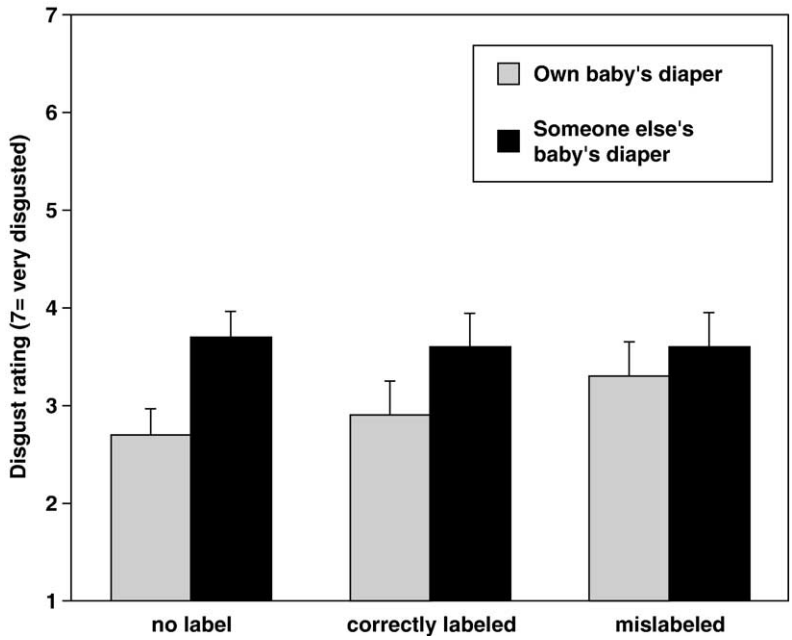

Fig. 1. Mean composite disgust ratings (and standard error) by diaper source and label condition in Study 2.

where higher social desirability scores were associated with an enhanced source effect, but this correlation did not reach significance, $r(13)=.42$. Together, these results suggest that mothers high in social desirability tempered their disgust ratings when they believed that the diaper was from someone else's baby.

3.2.4. Retrospective ratings and other measures

Retrospective ratings of the last time mothers changed their own baby's feces-soiled diaper indicated less disgust ($M=2.53$, S.D.=1.01) than when they changed someone else's 6- to 18-month-old baby ($M=4.25$, S.D.=1.57), $t(12)=4.36$, $p<.01$. (There were missing data for one participant.) This replicated the findings of Study 1. Most interesting, the source effect for retrospective ratings was significantly correlated with the source effect for blind trials ($r=.72$, $p<.01$) and correctly labeled trials ($r=.77$, $p<.01$) but not for mislabeled trials. Thus, there was a strong correspondence between retrospective judgments and ratings of the actual diapers, but mislabeling appears to have interfered with this relationship. Again, social desirability scores were negatively correlated with the obtained source effect for these retrospective ratings, $r(12)=-.78$, $p<.003$, suggesting that those mothers high in social desirability were more likely to rate someone else's baby's diaper more favorably than were mothers low in social desirability.

DS scores (Haidt et al., 1994) were obtained to determine whether only participants who were low in disgust sensitivity were volunteering for the study. The mean rating on the DS ($M=59.75$, S.D.=11.81) was slightly higher (although not significantly higher) than that obtained by Haidt et al.'s (1994) sample of men and women. Thus, our sample appeared to be

as disgust sensitive as other samples. DS scores were not significantly correlated with the source effect. None of the other demographic variables (baby's age, mother's age) emerged as significant correlates of the main dependent measures.

3.3. Discussion

The results of Study 2 demonstrate that when presented with real stimuli, mothers find the smell of their own baby's feces-soiled diaper less disgusting than the feces-soiled diaper from someone else's baby, even when they are blind to the source of the diaper and when their tendency to manage their self-presentation (social desirability) is controlled. There were no significant effects for labeling. Moreover, on the correctly labeled trials, the source effect was not enhanced, as compared with the blind trial. Nonetheless, while labeling does not seem to contribute over and above the stimulus qualities, the pattern of ratings obtained on the mislabeled trials suggests that labeling might interfere with the source effect in some contexts (although this pattern did not reach significance in the present study).

A potential concern with Study 2 is that the comparison diaper (from someone else's baby) was always donated by the same baby and may have been reliably more disgusting than the other diapers. This concern is likely to be unfounded because the comparison diaper was obtained using the same procedure used by mothers to collect their sample before each experimental session and because the baby who supplied the comparison diaper met the same inclusion criteria as the other babies. Although the infant who provided the comparison diaper was 2 months older than the mean age of the other infants, there was no significant correlation between infant age and diaper ratings. Anecdotally, the same experimenter (TC) prepared all materials and found them similarly intense and overpoweringly unpleasant and depended solely on rigorous labeling procedures to prevent any confusion of the materials. Nonetheless, the use of multiple comparison diapers in future investigations would address this potential concern.

4. General discussion

Our intention in conducting this research was to investigate the relationship-specific modulation of disgust. The results of both studies provide evidence of such specificity, namely, the source effect. There are two main explanations that might account for this source effect. As habituation to an unpleasant odor decreases the unpleasantness of the odor (e.g., Cain & Johnson, 1978), one possibility is that a mother's repeated exposures to her baby's diaper might result in selective habituation to the specific odor quality of her own baby's feces-soiled diaper. A second possibility is that familiarity may not reflect exposure history but rather detection of some quality that signals relatedness (cf. Weisfeld et al., 2003).

Although we believe that placing the source effect for disgust within an evolutionary framework accords with current theorizing about the nature of this emotion (Rozin et al., 2000), demonstrating a source effect in itself does not necessitate an evolutionary disease-risk account. It may be that the source effect for disgust is just another exemplar of domain-specific

habituation and that the reduced pathogen risk associated with self and familiar others is serendipitous. Nonetheless, the observation that disgust elicitors (except, of course, moral elicitors) play an important role in microbial transmission for almost all communicable diseases (Curtis & Biran, 2001) suggests an evolutionary account.

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