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Disgust as embodied loss aversion
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ABSTRACT
A quickly expanding literature has examined the link between physical disgust and morality. This article critically integrates the existing evidence and draws the following conclusions: First, there is considerable evidence that experimentally induced disgust and cleanliness influence moral judgment, but moderating variables and attributional processes need to be considered. Second, moral considerations have substantial effects on behavioural concomitants of disgust, such as facial expressions, economic games and food consumption. Third, while disgust involves a conservation concern, it can manifest itself in both liberal and conservative political attitudes. Overall, disgust can be considered to form part of a behavioural loss aversion system aimed at protecting valuable resources, including the integrity of one’s body. Recommendations are offered to investigate the role of disgust more rigorously in order to fully capture its role in moral life.

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KEYWORDS
Morality; embodiment; disgust; cleanliness; loss aversion

Man with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his god-like intellect which has penetrated into the movements and constitution of the solar system—with all these exalted powers—Man still bears in his bodily frame the indelible stamp of his lowly origin.

(Darwin, 1871, p. 492, emphasis added).

On the most fundamental level, morality is concerned with the regulation of the behaviour of individuals in social contexts (e.g., Baumard, André, & Sperber, 2013; Haidt, 2007). Moral norms guide people’s aspirations to be considered valued members of society and the behaviours that are considered permissible in themselves and others. Morality therefore can bring out the best in people, but also the worst. Indeed, trying to predict whether somebody is trustworthy and cooperative, rather than hard-hearted and egoistic, is the primary concern when forming an impression of another
person and is typically done within a matter of milliseconds (Abele & Bruckmüller, 2011; Willis & Todorov, 2006; Ybarra, Chan, & Park, 2001). Given the centrality of the moral dimension, an important question concerns how individuals are judged regarding their moral qualities. Moral categorisation without great effort or the expenditure of cognitive resources would be highly adaptive.

It can be argued that people implicitly conceptualise basic physical experiences in terms of metaphors (Schnall, 2014a). The key concept involved in responses related to disgust, for example, is the notion of the body as a container, with boundaries that need to be maintained and protected. Previous conceptions of disgust have emphasised its evolved role in guarding against physical contamination (e.g., Rozin, 1976; Rozin & Fallon, 1987), but disgust likely also functions more generally to safeguard resources, including those of one’s social group. In particular, in moral contexts, the experience of disgust can be seen to form the basis of a broader loss aversion system, aimed at conserving resources by being acutely aware of their potential loss. In other words, while it has generally been observed that “losses loom larger than gains” (Kahneman & Tversky, 1979), feelings of disgust make potential losses loom even larger.

This article considers evidence that disgust inhibits appetitive behaviours directed at positively valenced stimuli when the potential threat to resources is too great. It therefore results in conservation concerns and preferences for the status quo. These concerns can lead not only to the condemnation of social norm violations but also to efforts at ensuring the fair distribution of resources that facilitate cooperation and trust. Thus, the physicality of human beings’ “lowly origin” identified by Darwin may give rise to a sophisticated moral understanding without much conscious cognitive effort. That process likely has an evolutionary basis that leads it to be shared across cultures. Before outlining further the argument for a behavioural loss aversion system centred around disgust and reviewing its empirical support, a brief historical tour of the study of morality is in order.

**Explaining morality—from the philosopher’s armchair to the psychological laboratory**

Philosophers have long been concerned with the question of how people tell right from wrong. Of particular interest are questions of normative ethics, including how people ought to act, how moral standards are formed and when people apply such standards in judging their own and others’ behaviours. In the grand tradition of moral philosophy, various thinkers have attempted to deduce moral principles that if universally observed would result in exemplary moral behaviour. Immanuel Kant (1788/1997), for example, in his Categorical Imperative proposed that there are absolute,
objective truths within the moral domain that can be discovered by reason. Other philosophers similarly proposed universal rules regarding how people should behave. Using a utilitarian approach, for example, John Stuart Mill noted that each individual ought to do whatever brings the greatest amount of happiness to the largest number of people. In contrast to this rationalist tradition with an emphasis on careful consideration, David Hume emphasised that moral understanding does not originate from reason, but has an affective basis: “Morality is determined by sentiment. It defines virtue to be whatever mental action or quality gives to a spectator the pleasing sentiment of approbation; and vice the contrary” (Hume, 1777/1960, p. 129). Thus, Hume proposed that because humans are sentimental beings, moral decisions cannot be purely derived through reason, and that instead, people need to rely on subjective feelings when deciding between right and wrong.

In more recent times, psychologists have explored how people interpret their own and others’ moral actions in two ways. First, two fundamental dimensions can be extracted from almost any extensive set of interpersonal ratings. Although different labels have been applied to them (Abele & Wojciszke, 2007; Cuddy, Fiske, & Glick, 2008; Judd, James-Hawkins, Yzerbyt, & Kashima, 2005; Paulhus & Trapnell, 2008; Rosenberg, Nelson, & Vivekananthan, 1968), they roughly capture the same underlying constructs: Agency, also called competence, describes the extent to which a person is perceived as assertive and competent, whereas communion, also called warmth, describes the extent to which a person is perceived as friendly and trustworthy. These two dimensions have been shown to be relatively independent (Judd et al., 2005).

Abele and Wojciszke (2014) review three key features of agency and communion: First, the communion dimension generally enjoys a privileged status because it exerts a much greater influence than agency on impression formation (Abele & Bruckmüller, 2011; Reeder & Brewer, 1979; Willis & Todorov, 2006; Ybarra et al., 2001). Second, when judging the character of other people, communion information is given more weight than agency information (e.g., Wojciszke, Bazinska, & Jaworski, 1998). Third, and in contrast, when judging the self, agency information is considered more important (Abele & Wojciszke, 2007). For example, a meta-analysis across eight studies indicated that perceiving oneself as high on the agency dimension has a much higher correlation with self-esteem ($r = .49$) than perceiving oneself as high on communion ($r = .11$; Wojciszke, Baryla, Parzuchowski, Szymkow, & Abele, 2011). This fact poses a fundamental conflict: Evaluations of others prioritise being “nice”, but evaluations of the self do not. This apparent contradiction can be resolved by the strong self-presentational component of the communion dimension: Everybody wants to be seen as a
nice and likable person, and even more so, as a morally good person (Abele & Wojciszke, 2014).

Consistent with that interpretation, the sociability and morality aspects of communion can be distinguished (for a review, see Brambilla & Leach, 2014). Morality is especially diagnostic in impression formation, with people seeking more information on it than on the sociability or competence dimensions (Brambilla, Rusconi, Sacchi, & Cherubini, 2011). Similarly, trustworthiness is processed in faces more quickly than are other qualities (Willis & Todorov, 2006), and is the most preferred personal characteristic in other people (Abele & Brack, 2013). Furthermore, the moral dimension is especially relevant when dealing with members of one’s in-group (Brambilla et al., 2011; Leach, Ellemers, & Barreto, 2007). Thus, people make judgments of morality quickly and effortlessly in an attempt to infer stable behavioural intentions.

A second, separate line of psychological research has examined how moral judgments about specific behaviours are made. Following a rationalist approach akin to that of philosophers such as Kant and Mill, and inspired by Piaget’s seminal contributions on cognitive development, Kohlberg’s (1981) influential work proposed that as children’s cognitive abilities develop, they progress through stages of moral development. His theory, however, had various problems, one of the most significant being that many adults never actually reach the most advanced level of moral reasoning. In contrast to such rational models of moral judgment, more recent approaches that have followed Hume’s insights have become increasingly popular. In particular, the social intuitionist model (Haidt, 2001) suggests that moral judgment is generally the result of gut feelings, similar to other intuitive, automatic judgments. According to this idea, moral judgments follow from quick affective responses that take place largely outside of conscious awareness, and rational arguments appear only later to justify those judgments. Indeed, converging evidence is accumulating to support the conclusion that feelings, in particular those related to the purity of one’s body, are critically involved in moral judgment, as discussed in the current article.

According to this perspective, evaluations of morality reflect affective reactions towards potentially objectionable behaviour and the person engaging in it. The evaluations of individuals and their actions reflect the affective responses they evoke, as is also the case for other objects of judgment (for reviews, see Clore & Schnall, 2005; Schnall, in press; Schwarz, 2012). A negative feeling, even if merely an intuition, may tip the scales towards rejection and social exclusion, as if bad character poses the danger of “rubbing off” by association. If they have an affective basis,
moral evaluations are likely shaped by specific physical sensations grounded in the body, as reviewed next.

**Disgust: staying away from bad substances and bad individuals**

The body’s largest organ, the skin, forms a boundary for the self that provides the potential for contact to the outside world, while also maintaining the distinction between what is “inside” and “outside”. The avoidance of contamination through skin contact or through incorporation via a bodily opening is therefore a key concern, for which disgust plays an essential role. In the context of food, disgust helps solve what has been termed human beings’ “omnivore’s dilemma” (Rozin, 1976). The challenge for omnivorous creatures is to decide what to consume: Although many food items may promise a nutritious and satisfying meal, they also pose a potentially deadly risk if the food is spoilt or poisonous and therefore harmful (Rozin & Fallon, 1987; Rozin, Haidt, & McCauley, 2008). In relation to food and drink, the feeling of disgust signals that a substance either should be avoided or, if ingestion has already occurred, should be expelled. Toxins, in particular, often can be identified by a bitter taste, and as a consequence elicit distaste. An immediate behavioural response related to food therefore consists of spitting it out, or pulling up the nose in disgust to prevent the airflow originating from the contaminant from entering the nasal cavity (Susskind et al., 2008). In addition to the avoidance of toxins that might be ingested by mouth, disgust also guards against the touching of potentially contaminated surfaces and therefore parasites and pathogens that might be spread by contact, thus avoiding potential infection and disease (Curtis, Aunger, & Rabie, 2004; Curtis & Biran, 2001; Oaten, Stevenson, & Case, 2009; Schaller & Duncan, 2007; Tybur, Lieberman, Kurzban, & DeScioli, 2013).

More generally, disgust forms part of what can be considered the *psychological immune system*—a motivational system involving behaviours aimed at protecting the body from infection that also influences social interactions (Murray & Schaller, 2016; Schaller & Duncan, 2007). A disgust motive has been proposed that is concerned with the “avoidance of sick others, ‘off’ foods, disease vectors, and pathogen contamination” (Aunger & Curtis, 2013, p. 54). Thus, feelings of disgust may inhibit risky behaviours that pose a danger to one’s health. Indeed, ethnographic work across cultures (Curtis & Biran, 2001) points to a high level of consistency in reported elicitors of disgust, with the most commonly listed ones concerning bodily secretions such as faeces, vomit, sweat, spittle, blood, pus and sexual fluids. Of those, faeces are particularly dangerous, because they can transmit over 20 infections involving bacteria, viruses and protozoa, especially when ingested as part of contaminated food. Similarly, fluids
exchanged via the genitals during copulation constitute another high-risk source of contamination (Curtis & Biran, 2001). An experimental study showed that people were much more disgusted by stimuli that could lead to the transmission of infectious disease, compared to stimuli involving no such danger (Curtis et al., 2004). Thus, disgust may communicate a potentially dangerous social situation and therefore makes health concerns salient. The behavioural immune system follows a “smoke detector” principle (Murray & Schaller, 2016). That is, it operates in a highly conservative manner, detecting the smallest signs of danger, even at the risk of a false alarm, since a missed alarm is substantially more costly than a false one. The smoke detector principle thus involves a cost-benefit consideration such that potential food sources and interactive partners are passed up if the risk of infection is too great.

Beyond the basic body-based function, it has been proposed that the disgust system has been co-opted for use in the social domain when referring to the revulsion that people report when confronted with immoral behaviours that violate social norms (Rozin et al., 2008). Although it may be that using the term “disgust” when talking about issues relating to the moral domain is merely a convenient figure of speech (Nabi, 2002), a growing body of evidence suggests that this is not the case, and that feelings of disgust not only relate to physical contamination but also extend to perceived moral contamination.

The effect of induced disgust on moral judgment

An extensive literature based on the affect-as-information framework (e.g., Schwarz & Clore, 1983) has shown that emotional feelings can influence a wide range of affective, cognitive and perceptual judgments (for reviews, see Clore & Schnall, 2005; Clore et al., 2001; Schnall, in press; Schwarz, 2012). In general, positive feelings reflect liking and approval of a judgment object, whereas negative feelings reflect a lack thereof. One direct way of probing the role of disgust in morality is therefore to test whether experimentally induced physical disgust can cause a sense of moral disgust. An important requirement for studies testing causal links between feelings and judgments, however, is that participants must not interpret the induced incidental feeling as connected to a given judgment at hand. In other words, experimental manipulations of feelings and other embodied states are effective only as long as the elicited feeling remains in the background, unattended until participants are asked evaluative questions that require them to consult how they feel. Becoming focally aware of the affect undermines its informational value, making its influence on judgments disappear (e.g., Schnall, Abrahamson, & Laird, 2002; Schwarz & Clore, 1983). Experimental situations therefore need to be engineered to keep
participants from parsing their experience and tracing incidental feelings back to their true source. Whereas mild happiness and sadness have been studied extensively, “mild disgust” is almost a contradiction in terms, because disgust typically involves intense feelings of repulsion that ensure immediate withdrawal from the offending source.

In early work, Wheatley and Haidt (2005) used hypnosis to induce disgust and test its influence on moral judgment. They gave a post-hypnotic suggestion to highly hypnotisable participants to experience a flash of disgust to an otherwise neutral word (“take” or “often”). These words with disgust associations were then sometimes contained in short moral judgment vignettes. In two experiments, the presence of a hypnotic disgust word led participants to more strongly condemn moral transgressions. Although this work supported the basic premise of a causal link between physical and moral disgust, it was important to substantiate this phenomenon with experimental manipulations other than hypnosis and to expand on the finding.

Using a range of disgust inductions, my colleagues and I set out to address a number of additional issues beyond the main question of whether physical disgust can influence moral disgust (Schnall, Haidt, Clore, & Jordan, 2008). In particular, we tested whether incidental disgust influences judgments only about norm violations that elicit physical disgust or whether this effect is more general. We also asked whether the experiential or cognitive component of induced disgust was more central. Finally, we investigated whether other negative emotions such as sadness also change moral judgments or whether there is something special about disgust.

Our first attempt at testing the link between disgust and moral judgments in a pilot study likely failed because it was too blatant in producing disgust (Schnall et al., 2008). With the cover story that we were interested in how people work on multiple tasks at the same time, we purported to study how people attend to various sources of information, and in particular, how they “perceive tactile stimuli during task engagement”. Undergraduate students at the University of Virginia were asked to roll up their sleeves to retrieve small objects (e.g., a marble) from the bottom of a tall jar filled with a concoction of canned creamed corn, collard greens (a type of vegetable) and chocolate pudding. Control participants were given the same task using a container of water instead. No effect of disgust on the moral judgments was observed. In hindsight, we realised that having participants place their non-dominant hand—which after the task was visibly covered in a brownish, slimy substance—on a plastic placemat while they completed the moral judgment questionnaire with their other hand was not exactly a subtle way of inducing disgust.

It therefore was essential to devise a more appropriate manipulation, so for the first experiment in this series we turned to a commercially available
novelty product, namely a spray that when dispensed releases hydrogen sulphide, a component of flatulence. The field study took place in an outdoor setting on the Stanford University campus, which allowed the experimenter to administer the fart spray onto the bag lining a trash bucket placed out of sight from the participant. To ensure that the bad smell was neither too subtle nor too strong, we administered two types of dosages of the spray. In the “mild-stink” condition, four sprays were applied to the plastic bag inside the trash bucket; in the “strong-stink” condition, eight sprays were applied to the bag. In the control condition, no fart spray was used.

Students were recruited for the experiment as they were passing through the area and were randomly assigned to one of the three conditions. While seated at a table approximately 6 ft from the trash bucket participants completed a questionnaire with four moral dilemmas. Two of them had been pre-tested to elicit physical disgust in a different sample and involved asking participants for their support for the legalisation of marriage between first cousins and for the approval of sex between first cousins. Two other dilemmas described scenarios that did not elicit physical disgust, namely approval of a person’s decision to drive rather than walk the short distance to work and approval of a studio’s decision to release a documentary that used interviews without prior consent.

A manipulation check administered immediately after participants had completed the moral judgments showed that those in the “strong-stink” condition reported significantly greater levels of disgust than participants in the “mild-stink” condition; somewhat unexpectedly, however, the latter did not differ from the control condition. For moral judgments, we averaged the four items into a reliable composite and found a significant difference between the conditions (see Table 1 for means). Post-hoc tests further

Table 1. Means (and standard deviations) for moral vignettes by condition (Schnall, Haidt et al., 2008, Experiment 1). N = 120.

<table>
<thead>
<tr>
<th>Vignette</th>
<th>Control</th>
<th>Mild-stink</th>
<th>Strong-stink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marriage</td>
<td>2.93</td>
<td>2.20*</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>(1.49)</td>
<td>(1.07)</td>
<td>(1.30)</td>
</tr>
<tr>
<td>Sex</td>
<td>2.67</td>
<td>1.90*</td>
<td>2.40</td>
</tr>
<tr>
<td></td>
<td>(1.53)</td>
<td>(0.93)</td>
<td>(1.69)</td>
</tr>
<tr>
<td>Driving</td>
<td>5.48</td>
<td>4.98</td>
<td>4.95</td>
</tr>
<tr>
<td></td>
<td>(1.36)</td>
<td>(1.48)</td>
<td>(1.38)</td>
</tr>
<tr>
<td>Film</td>
<td>3.45</td>
<td>3.03</td>
<td>2.63*</td>
</tr>
<tr>
<td></td>
<td>(1.52)</td>
<td>(1.58)</td>
<td>(1.13)</td>
</tr>
<tr>
<td>Mean</td>
<td>3.75</td>
<td>3.15**</td>
<td>3.18**</td>
</tr>
<tr>
<td></td>
<td>(0.88)</td>
<td>(0.69)</td>
<td>(0.79)</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, pairwise comparison to control by Tukey’s HSD test.
Minimum and maximum scores for each item were 1 and 7. High scores indicate permissibility; low scores indicate moral condemnation.
showed that participants in the “mild-stink” \( (d = 0.76) \) and “strong-stink” \( (d = 0.68) \) conditions judged the transgressions as less permissible than control participants. We also examined the level of condemnation of the vignettes that had been constructed to elicit disgust compared to those that did not and found that the disgustingness of the scenarios did not moderate the effect of the disgust induction on moral judgments. Thus, we confirmed that inducing physical disgust can lead participants to misattribute their experience as relevant to moral judgment. These results thus supported both the social intuitionist model that affective intuitions can have a causal role on moral judgment (Haidt, 2001) and the more general notion underlying the affect-as-information approach (e.g., Schwarz, 2012; Schwarz & Clore, 1983) that people can be induced to interpret affective feelings as informative in a range of judgment contexts. Thus, beyond replicating the findings from Wheatley and Haidt (2005), our study also suggested that the effect of the disgust manipulation was not moderated by whether the description of the dilemmas invoked physical disgust. However, because the disgusting vignettes were not highly disgusting, this was only a tentative conclusion that required further evidence.

Of additional relevance, disgust is, by definition, a very physical emotion, because it involves protecting the body from potentially harmful contamination. Although everyone has a need to safeguard the integrity of the body, some people may experience more of a desire to do so than others: They are high in what has been termed “disgust sensitivity” (Haidt, McCauley, & Rozin, 1994). Some people are also more sensitive to their bodily sensations than others, and such individual differences can influence whether people infer emotional feelings from these sensations. Indeed, some people report feeling happy when they are induced to put on a smile, whereas others do not (Laird & Crosby, 1974). This difference in response to bodily cues is stable over time and consistent across a wide variety of feelings and situations (e.g., Duclos & Laird, 2001; Schnall et al., 2002; Schnall & Laird, 2003).

For example, Schnall et al. (2002, Study 1) tested the moderating role of bodily sensitivity with respect to women’s premenstrual mood changes. Female undergraduate students at Clark University reported their daily moods over 2 months in a study that ostensibly concerned daily mood variations in relation to external stimuli. Embedded among health-related questions concerning sleep, exercise and eating patterns was an item asking whether the woman was menstruating that day. Participants also completed the extent to which they felt angry, confused, happy, anxious, sad, depressed, energetic and irritable. In an independent procedure, we administered a task intended to capture whether somebody is sensitive to bodily cues, in particular, those originating from the musculature involved in facial expressions. Participants were asked to close their eyes and adopt a smile or
a frown and observe how doing so made them feel. It was explained that some people report experiencing feelings consistent with their expressions, while others do not, and that neither way of responding was better than the other, because we were simply interested in what group they might belong to. Then the women completed emotion rating scales that assessed, among other items, how happy, or sad, respectively, they felt. Depending on their reported feelings, participants were classified into those that were relatively responsive to facial feedback, and those who were not.

Multivariate analyses of variance were conducted to compare each woman’s mood ratings of days during her premenstrual weeks with days during the other weeks, with each of the approximately 60-day serving as an observation. When quantifying the magnitude of this mood change via the effect size measure eta-squared ($\eta^2$), women who reported deriving emotional meaning from their facial expressions showed greater premenstrual mood changes ($M = 0.22, SD = 0.10$) than women who did not ($M = 0.12, SD = 0.02$). Presumably, hormonal changes coinciding with the menstrual cycle were interpreted in emotional ways, resulting in altered moods, but this was only the case for women who were generally sensitive to their bodily cues.

Thus, in subsequent studies testing the influence of induced disgust on moral judgment, we included an individual difference variable capturing the extent to which a person is sensitive to various bodily sensations, namely the Private Body Consciousness (PBC) scale (Miller, Murphy, & Buss, 1981), which includes items such as “I can often feel my heart beating” and “I’m very aware of changes in my body temperature”. Schnall, Haidt et al. (2008, Experiment 2) furthermore used a different disgust manipulation by inviting participants to a testing room that was set up in a trailer unit near the psychology department at the University of Virginia and was prepared to be either dirty and disgusting or not. We expected that experimentally induced disgust would make moral judgments more severe, but that this effect would be especially pronounced for participants who were more attentive to their own physical sensations, as indicated by a high level of PBC.

We also constructed a different set of vignettes following pilot testing of items selected from a set by Greene, Sommerville, Nystrom, Darley, and Cohen (2001). Three of them involved physical disgust: Dog (cooking and eating one’s dead dog after it died of natural causes), Plane Crash (killing a terminally ill plane crash survivor to avoid starvation) and Kitten (using a kitten for sexual arousal). Another three vignettes had content unrelated to disgust: Wallet (keeping money inside a found wallet), Resumé (putting false information on a resumé in order to get a job) and Trolley (switching the tracks of a trolley to kill one workman instead of five). When they reported to the trailer, participants in the disgust condition were confronted
with a testing room that was set up to look disgusting: An old chair with a torn and dirty cushion was placed at a desk that had various stains and was sticky. On the desk there was a transparent plastic cup with the dried up remnants of a smoothie and a pen that was chewed up. Next to the desk was a trash can overflowing with garbage including greasy pizza boxes and used-looking tissues. We infer that the experimental set-up was realistic from the fact that the custodial staff servicing the trailer spontaneously disposed of the experimental furniture during a major clean-up several weeks after the study had been completed. For the no-disgust condition, the same desk was used, but it was covered up with a clean white tablecloth. A new chair was provided, and none of the disgusting objects were present. A new and unchewed pen was provided for completion of the questionnaires.

We predicted that primarily participants who were generally sensitive to their bodily sensations, as indicated by scoring highly on the PBC scale, should be influenced by the disgust induction. Indeed, there was a significant interaction for condition and PBC, $F(1, 39) = 5.29, p < .03, \eta^2 = 0.12$, with planned comparisons indicating that participants high on PBC in the disgust condition perceived the transgression described in the vignettes as more wrong than participants in the no-disgust condition, $F(1, 39) = 5.51, p < .02, d = 1.13$ (see Figure 1 for means). In contrast, for participants low on PBC, ratings of moral condemnation did not differ between the two conditions. There was no three-way interaction and no interactions involving vignette content, suggesting that disgust influenced moral judgment similarly for both disgust and non-disgust vignettes. However, there was no main effect for condition, and the manipulation check that assessed

![Figure 1. Judgments of wrongness of moral actions, as a function of PBC and condition (Schnall, Haidt et al., 2008, Experiment 2). N = 43.](image)
emotional feelings after participants’ moral judgments did not find any significant group differences in self-reported disgust.

Because the first two experiments used somewhat unusual emotion inductions, we attempted to replicate the findings using a more established manipulation. Following Schwarz and Clore’s (1983) method, the third experiment in this series asked half the participants to write about an event from their past that had made them feel physically ill or sick to the stomach, because it had involved seeing or touching something physically disgusting. No such instructions were given to participants in a control condition. To probe the role of subjectively reported feelings more directly, we measured emotional feelings at the beginning and end of the experiment. Furthermore, whereas the earlier experiments had been conducted in the United States, this experiment was conducted in the United Kingdom, namely at the University of Plymouth. We observed the same pattern as in the previous experiment, namely, a significant interaction between condition and PBC, $F(1, 61) = 4.49, p < .04, \eta^2_p = 0.07$ (see Figure 2 for means), with no significant main effects. Planned comparisons further indicated that for participants high in PBC those in the disgust condition reported marginally higher moral condemnation than participants in the control condition, $F(1, 61) = 3.10, p < .08, d = .53$. For participants low on PBC, the disgust manipulation once again had no effect. Although these experiments had supported our basic predictions regarding the role of disgust in moral judgment, we did not have any other negative comparison condition.

A final experiment therefore included sadness. Students at the University of Plymouth watched film clips previously shown (Lerner, Small, & Loewenstein, 2004) to elicit disgust or sadness. A control group watched a neutral film clip. The disgust condition involved a scene from

![Figure 2](image)

**Figure 2.** Judgments of wrongness of moral actions, as a function of PBC and condition (Schnall, Haidt et al., 2008, Experiment 3). $N = 65$.  

---

5.5  
6.5  
7  

[Perfectly OK] - [Extremely Wrong]

High  
Low  

**Disgust**  
**No Disgust**
Trainspotting in which the protagonist reaches into a filthy toilet, the sadness condition involved a scene from The Champ in which the protagonist dies and the control condition involved a scene from the nature documentary Planet Earth about whales. No main effects appeared other than for gender, indicating that women generally gave stricter moral judgments. We took into account PBC, and a marginally significant interaction with condition was obtained, $F(2, 104) = 2.70, p < .07, \eta_p^2 = 0.05$, while there was no main effect of condition (see Figure 3 for means). Planned comparisons showed that high-PBC participants in the disgust condition gave significantly higher ratings than did those in the sadness condition, $F(1, 104) = 4.68, p < .03, d = 0.71$, and there was a similar trend for the comparison with the neutral condition, $F(1, 104) = 1.82, p < .18, d = 0.49$. As in the other experiments, no interaction of PBC, condition or vignette content was obtained, suggesting that the effect was observed regardless of whether or not the morality scenarios themselves involved disgust.

Because some of the critical effects in the individual experiments had been only marginally significant, an aggregated analysis was conducted by computing $z$-scores for moral judgment composite scores and collapsing across the data from the three experiments that had included PBC. There was a significant main effect for condition, $F(2, 210) = 3.06, p < .05, \eta_p^2 = 0.03$, an interaction between PBC and condition, $F(2, 210) = 4.99, p < .008, \eta_p^2 = 0.05$, as well as a significant planned comparison finding higher means for the disgust condition than the control condition for participants high in PBC, $F(1, 210) = 5.58, p < .02, d = 0.62$, but not for those low in PBC. Overall, sensitivity to embodied cues was a key moderator in obtaining the effect, for which the Cohen’s $d$ was medium sized, supporting the notion that disgust is a body-based emotion that depends

![Figure 3. Judgments of wrongness of moral actions, as a function of PBC and condition (Schnall, Haidt et al., 2008, Experiment 4). $N = 122.$](image-url)
for its influence on the extent to which a given person is generally sensitive to bodily sensations.

Our early findings pointed to a certain level of generality regarding the link between physical and moral disgust: Experiences of induced disgust led to harsher moral judgments irrespective of whether the evaluated transgressions involved physical disgust. However, in three out of four experiments, this effect was specific to participants highly sensitive to physical sensations, suggesting that a propensity to respond to feelings of disgust was required. Finally, only disgust showed this effect, whereas another negative emotion, sadness, did not.

**The role of stimulus content and moderating variables**

The findings initially reported in Schnall, Haidt et al. (2008) have been replicated and extended by various other researchers using a wide range of methods (for comprehensive reviews, see Chapman & Anderson, 2013; Russell & Giner-Sorolla, 2013). Various follow-up studies specifically investigated the type of the moral stimuli that could be influenced by disgust manipulations. For example, using the same film clips as Schnall, Haidt et al. (2008, Study 4) to elicit disgust and sadness, Horberg, Oveis, Keltner, and Cohen (2009) replicated our initial finding that disgust had an effect, whereas sadness did not. They further showed that the feelings of disgust that participants experienced when considering vignettes involving purity violations mediated the severity of those judgments, but anger did not. Conversely, anger mediated the severity of judgments involving fairness, whereas disgust did not.

Seidel and Prinz (2013) devised an improved set of vignettes because of the somewhat crude distinction of “involving disgust” Vs. “no disgust” used in Schnall, Haidt et al. (2008). They compared three physical purity violations (e.g., eating the flesh of a diseased person after a plane crash) to three autonomy violations (e.g., cheating on a tax return). While completing those vignettes participants in the experimental conditions listened to the disgusting sound of a person vomiting, or to anger-inducing sounds, namely jarring, irritating music. Relative to a group of participants who completed the moral judgments in silence, participants listening to disgusting sounds showed greater condemnation that was specific to purity-related moral transgressions, whereas participants listening to irritating sounds showed greater condemnation that was specific to autonomy-related transgressions.

Thus, the evidence on whether induced disgust influences only moral considerations involving physical purity is somewhat mixed, with some studies showing that induced disgust has an effect that is specific to disgusting, purity-related items and other studies showing a broader effect.
However, this pattern might reflect methodological differences. Monin and Oppenheimer (2014) noted that the number of stimuli has tended to be small in research on moral judgment. Indeed, moral vignettes that are comparable on many different dimensions are difficult to construct because by definition they involve complex social dilemmas. Comparability across stimuli is one potential problem. In addition, the influence of any experimental manipulation of disgust might wear off over time, which limits the number of items that can be administered. Although several vignettes are typically administered (i.e., as within-subjects designs), with relatively small numbers of stimuli, statistical power to detect an effect might be low. One potential solution to this problem would be to employ stimulus sampling, using a large set of stimuli across a sample of participants in which each individual receives only a subset, thus allowing stimuli to be treated as a random factor in statistical analyses (Monin & Oppenheimer, 2014; see also Westfall, Kenny, & Judd, 2014).

Another way of addressing this issue was employed by Van Dillen et al. (2012, Experiment 1), who, rather than using a range of different moral dilemmas with one answer option, used only one dilemma, namely a modified version of the Wallet dilemma previously used in Schnall, Haidt et al. (2008) and asked participants a range of questions from which a scale was created. Participants who had been presented with mildly disgusting sentences (e.g., “When Elise took a bite of her apple, she discovered there was a worm inside”) rated the transgression to be more wrong than participants who had received neutral sentences, resulting in a large effect size of Cohen’s $d = .95$. Thus, using one moral dilemma for which participants answer a number of related questions might be preferable to using several rather heterogeneous moral dilemmas.

Subsequent studies ruled out various potential confounds present in our earlier work (Ong, Mullette-Gillman, Kwok, & Lim, 2014). First, expanding the repertoire of stimuli, participants rated the acceptability of utilitarian decisions in sacrificial dilemmas that maximise benefits for a greater number of people while incurring a cost for specific individuals. For example, participants indicated whether it was acceptable to order a small group of technicians to enter a dangerous nuclear reactor after a catastrophic explosion that threatened the lives of hundreds of thousands of people. Second, instead of the small set of stimuli previously used in Schnall, Haidt et al. (2008), a set of 40 vignettes was developed and pre-tested to avoid susceptibility to potential ceiling effects due to items with highly emotional content (cf. Schnall, 2014b). Third, instead of inducing a feeling of disgust, participants were subliminally primed with masked faces exhibiting disgust while they engaged in a gender-classification task. Each disgust prime was followed by a moral dilemma, therefore ensuring temporal contiguity of the disgust cue while leaving the source of disgust outside of participants’
conscious awareness. A manipulation check at the end of the experiment confirmed that participants were unaware of having seen the disgust faces. Finally, whereas other studies had used participants from Western countries, primarily the United States and Europe, these experiments were conducted with Singaporean samples.

Somewhat counter-intuitively, however, participants who had been primed with disgust faces gave higher ratings of acceptability for the decisions on the sacrificial dilemmas, with a medium-sized effect of $d = 0.53$ (Experiment 1). This effect was furthermore moderated by disgust sensitivity, such that the higher participants scored on it, the more acceptable they found the decisions, $r = .47$. A second experiment followed up on this finding and presented the disgust faces for a longer duration, so that they were visible to participants. Consistent with a misattribution logic, no main effect of the manipulation was observed. However, this study found a similar correlation with disgust sensitivity as in the first experiment, $r = .43$ (Ong et al., 2014), and when it was added as a covariate, there was a medium-sized main effect of condition, with participants in the disgust condition again giving higher ratings of acceptability on the utilitarian dilemmas.

How can these surprising, yet highly consistent findings be explained? One possibility is that the sacrificial dilemmas used by Ong et al. (2014) were very different from the stimuli used in other work. Kahane, Everett, Earp, Farias, and Savulescu (2015) have argued that so-called “utilitarian” judgments, while steeped in a long philosophical tradition that has assumed that they imply a concern for the greater good, may in fact reflect the exact opposite. Indeed, utilitarian judgments are correlated with psychopathy, a personality trait characterised by a lack of moral concern (e.g., Bartels & Pizarro, 2011; Glenn, Koleva, Iyer, Graham, & Ditto, 2010). Kahane et al. (2015) showed that in addition to being significantly positively correlated with a trait measure of psychopathy ($r = .29$), responses on a number of sacrificial dilemmas were actually significantly negatively correlated ($r = -.31$) with responses on questions related to business ethics, for example, disapproving of an executive embezzling money from his company (Kahane et al., 2015, Study 1). Furthermore, new vignettes specifically constructed to capture more fully an impartial sense of utilitarianism of achieving the greatest good for the greatest number of people (e.g., donating money to help disaster victims rather than buying a car or mobile phone) were uncorrelated with traditionally used “utilitarian” vignettes, $r = -.04$ (Study 4). These recent results are consistent with other findings suggesting that utilitarian judgments are associated with a lack of empathic concern (Crockett, Clark, Hauser, & Robbins, 2010) and occur more readily after damage to the pre-frontal cortical areas involved in social emotions (Koenigs et al., 2007). Intriguingly, damage to this area of the brain is also
associated with rejection of more unfair offers on the Ultimatum Game (Koenigs & Tranel, 2007), thus paralleling the findings obtained after disgust inductions (Harlé & Sanfey, 2010; Moretti & di Pellegrino, 2010).

In the context of this research, we can therefore reconsider the finding by Ong et al. (2014), which showed that priming with disgust faces led to higher acceptability ratings of decisions in the sacrificial dilemmas, especially for participants high in disgust sensitivity. Considering utilitarian dilemmas involves a rather detached cost-benefit calculation, with little empathic concern (Crockett et al., 2010). Sacrificing a small number of people in order to save a much greater number of people in times of crisis can therefore be seen as more conservative, and therefore necessary thing to do, and disgust cues facilitate this calculation, especially in people who are habitually prone to experiencing disgust. In other words, disgust leads to a strategy that is aimed at minimising losses in the face of a potentially even greater loss. Sacrificial dilemmas that involve cost-benefit ratios thus need to be considered as different from other types of moral dilemmas, such as the ones initially used in Schnall, Haidt et al. (2008).

Finally, an additional practical issue is that for dilemmas involving physical disgust (e.g., eating your dead pet dog after it died of natural causes), the described situation is engineered to elicit a strong emotional response that is intended to override the competing response that the behaviour in fact does not cause any harm. Importantly, this means that compared to the relatively neutral stimuli typically employed in studies testing the effect of feelings on judgments, extreme stimuli are presented even to participants in the control condition. Room for a potential mean difference is therefore relatively small. Indeed, sometimes participants respond to moral dilemmas that elicit strong emotional responses by selecting the most extreme option (Schnall, 2014b), potentially leading to ceiling effects that limit the ability to reliably assess differences between experimental conditions. For example, participants typically rate eating a dead dog or deriving sexual pleasure from playing with a kitten to be much more wrong than killing one person instead of five in a trolley dilemma (e.g., Schnall, Benton, & Harvey, 2008).

According to this logic, induced disgust should have a greater effect on judgments of relatively neutral stimuli than on more extreme stimuli, especially those that elicit strong emotions such as disgust. Indeed, in their early work Wheatley and Haidt (2005) unexpectedly found that even a neutral vignette was judged to be somewhat morally wrong by about a third of the participants when the word associated with the hypnotic disgust induction was included. Furthermore, a meta-analysis demonstrated that the magnitude of the effect of induced disgust on relatively neutral stimuli was almost twice as large as the effect on morally reprehensible stimuli.
(Landy & Goodwin, 2015), suggesting that the choice of stimuli can critically moderate effects of induced disgust.

Based on the affect-as-information framework (e.g., Schwarz, 2012), we had speculated that in our early pilot study the disgust manipulation might have been too salient, therefore making it unlikely that participants would consider these feelings as relevant in the moral judgment context (Schnall et al., 2008). Furthermore, in our three experiments that used disgust manipulations not involving smell, the predicted effect on moral judgments occurred only for participants who were generally sensitive to bodily sensations, as measured by the PBC scale (Miller et al., 1981). Recent work also found a moderating role of the influence of PBC on political attitudes (Petrescu & Parkinson, 2014). Additional individual difference moderators have been documented, namely attentional control in the context of emotion regulation (Van Dillen et al., 2012), emotional differentiation (Cameron, Payne, & Doris, 2013), mindfulness (Sato & Sugiura, 2014) and disgust sensitivity (Ong et al., 2014). These documented moderating variables not only shed light on the role of individual differences involved in the link between physical and moral disgust but also speak to hypothesised underlying processes.

For example, Van Dillen et al. (2012) investigated the role of emotional regulation strategies related to attentional control. Participants first completed a Stroop colour naming task, then read disgusting sentences and made moral judgments regarding a found wallet. The slower participants were in naming the colours in the Stroop task, the harsher were their moral judgments after having been induced to feel disgust. This was a sizeable effect, leading to a mean difference of over two points on a 9-point scale when comparing participants 1 SD above and below the mean of Stroop interference. In contrast, no such pattern was observed when participants were in a neutral control condition (Experiment 1). This suggests that people who are generally good at inhibiting task-irrelevant information are less influenced by incidental disgust cues while making moral judgments.

An additional experiment (Van Dillen et al., 2012, Experiment 3) showed that participants who were asked to watch disgusting film clips and subsequently elaborate on their feelings by describing them in detail judged an adultery scenario as more wrong than participants who received no such instructions, an effect that was moderated by trait differences in attentional control. Indeed, participants low on attentional control who had been instructed to focus on their emotions showed the identical level of relatively severe moral judgment as participants high on attentional control who simply waited for some time after the disgusting video. Of further interest, following the disgusting film clips and before making the moral judgments this experiment included an additional condition in which participants
played the computer game Tetris, a manipulation intended to prevent them from attending to their feelings. Compared to the emotion elaboration condition those participants found the adultery case much less objectionable, an effect of a substantial magnitude, $d = 2.49$. This finding is remarkable, because all participants were exposed to the same disgust-eliciting, disturbing film clips, namely one depicting a young boy eating faeces, and another the amputation of a limb. Thus, despite identical affective cues participants differed in how they used them, either as a result of personality differences or experimental instructions. Indeed, the reduction in severity of moral judgments as a function of the attentional control manipulation coincided with substantial differences in self-reported disgust on a 7-point scale, with $M = 5.92$ ($SD = 0.89$) for participants who elaborated on their feelings, $M = 4.24$ ($SD = 1.68$) for participants who waited without further instructions and $M = 3.26$ ($SD = 1.67$) for participants who played Tetris. This is consistent with earlier findings suggesting that attentional control, whether as a trait variable or induced in a given situation, plays a critical role in emotion regulation strategies (Van Dillen & Koole, 2007).

**Disgust and the fair distribution of economic resources**

On a broad level, disgust can be construed as an emotion that is concerned with the protection of valuable resources and therefore reflects a conservative strategy towards the maintenance of the value of one’s own body, but it can also include other cost-benefit considerations. In this context, a key question is whether the effects of experimentally induced disgust go beyond moral situations involving threats to the integrity of the body, as reflected by a disease-avoidance motive. Economic games in which participants actually receive a monetary payout according to their decision are relevant here. A series of papers involved the Ultimatum Game, an economic game concerning the fair distribution of money. It involves participants deciding whether to accept or reject proposed offers of a sum (e.g., $10) into fair or unfair splits (e.g., $5 for both parties Vs. $9 for one party, and $1 for the other). If a participant who acts as a responder rejects the offer, then neither party receives any funds. Typically, unfair splits are rejected by responders, a somewhat puzzling finding that has been interpreted to reflect altruistic punishment, because responders are willing to forgo financial rewards presumably in order to convey to the proposer that the unfair offer was unacceptable.

Chapman, Kim, Susskind, and Anderson (2009) explored whether participants spontaneously exhibit a facial disgust response when confronted with unfair offers on the Ultimatum Game. Indeed, when measuring the activity of the *levator labii* muscle that raises the upper lip during a facial disgust expression, participants produced a similar response to the unfair
monetary offers as they produced towards bitter drinks and photos displaying physically disgusting stimuli. Furthermore, both facial disgust and self-reported disgust predicted rejected offers on the game, suggesting an involvement of disgust in decisions involving economic benefits.

Several other papers examined the effect of experimentally induced disgust on Ultimatum Game responses. Interestingly, relative to studies using moral vignettes, studies using economic games have observed substantially larger effect sizes of disgust manipulations. For example, participants who had watched two disgust-inducing films, including the *Trainspotting* clip as used in Schnall, Haidt et al. (2008, Study 4) accepted fewer unfair Ultimatum Game offers than participants who had watched an amusement- or anger-inducing film clip (Harlé & Sanfey, 2010). When offered an unfair share of $10 in the Ultimatum Game, participants in the disgust condition rejected about one-third more offers of $3, roughly two-thirds more offers of $2 and close to twice as many offers of $1 than participants in the anger condition (Harlé & Sanfey, 2010).

Another paper reported even higher rejection of unfair Ultimatum Game offers after participants had viewed disgusting images, relative to participants who had viewed sad or neutral images (Moretti & Di Pellegrino, 2010, Experiment 1): Averaging across unfair splits ($1, $2, $3 for the responder), participants in the disgust condition rejected 84% of such offers compared to participants in the neutral and sad conditions, who rejected 41% and 46%, respectively. Even more strikingly, in this work 73% of participants in the disgust condition rejected at least half of all offers in the entire game, compared to only 20% of the participants in the sad condition, whereas not a single participant in the neutral condition did so. A second experiment replicated the finding of substantially higher rejection rates for the disgust relative to a neutral condition, and importantly, also demonstrated that this only occurred when participants thought that offers had been extended by another person, rather than being generated by a computer (Moretti & Di Pellegrino, 2010). This suggests that declining an unfair offer extended by another person is different from declining an unfair offer from a computer, and that disgust serves a role that is very distinct from that of other negative emotions, in particular, anger.

This raises an important question: Why do participants experiencing disgust give up economic resources, even though disgust should in principle induce a conservative manner of dealing with funds? Moreover, why are rejection rates generally so high, much higher even than for participants experiencing anger (Harlé & Sanfey, 2010), who should be most inclined to reject unfair offers as a means of enforcing altruistic punishment? One possibility relates to the behavioural immune system, which is aimed at avoiding infectious disease during social interaction (Murray & Schaller, 2016). Both papers (Harlé & Sanfey, 2010; Moretti & Di Pellegrino, 2010)
involved participants playing the game with specific opponents, and it is therefore possible that the disgust cues in the context of unfair offers could be attributed to them, suggesting that contact should be avoided. Indeed, touching money that was previously owned by a sick person could provide a means of transmission of disease. If this were the case, then Ultimatum Game rejection rates should be high only in experiments involving disgust for which the source of money is a specific person, but not when the source of money remains anonymous. Indeed, in the work by Harlé and Sanfey (2010), for each trial participants were presented with the photo of the person who ostensibly extended the offer, for whom a cover story suggested it was a specific student at another university. Similarly, in the work by Moretti and di Pellegrino (2010), participants played the game in a room in which the proposer (in reality an actor) sat behind an opaque screen. Again, it therefore appeared as if offers were extended by a specific person. In addition, and as noted above, in their second experiment no effect of disgust was obtained when participants believed that the offers had instead been extended by a computer.

A further paper provides additional evidence that how disgust is perceived in the context of the unfair distribution of economic resources depends on whether it can be attributed to a given individual. Bonini et al. (2011) administered a single trial of a hand-written offer made by an anonymous proposer that suggested a split of 2 Euro for the participant from a 10-Euro sum. Half the participants were tested in a room that was prepared to smell of ammonium sulphide, a smell that many participants spontaneously interpreted to have been emitted by the notoriously faulty sewage system in the town, whereas the other half of participants were tested in the room when no such smell was present. In this case, 65% of participants in the disgust condition accepted the unfair offer, relative to only 51% in the neutral condition. Moreover, participants in the disgust condition actually found the split to be *fairer* than participants in the neutral condition. These findings suggest that disgust leads to the rejection of economic resources only when the source of funds is attributable to a specific person (Harlé & Sanfey, 2010; Moretti & di Pellegrino, 2010). It furthermore illustrates that small methodological details can lead to substantially different outcomes, therefore making it necessary to carefully consider the experimental context that is being created, because it can differentially shape the attributional processes that disgust manipulations might facilitate.

If disgust involves a mindset that is concerned with the maximisation of resources, this might also have an influence in situations that lend themselves to taking advantage of economic resources. Winterich, Mittal and Morales (2014, Experiment 1A) explored the effect of induced disgust on self-interested behaviour. Because prior research (Morales & Fitzsimons,
had shown that exposure to certain consumer products can elicit disgust, participants were asked to evaluate items such as anti-diarrhoea medicine, diapers and incontinence products in the disgust condition. In contrast, the neutral condition involved items such as light bulbs, candles and pens. In one experiment, participants in the disgust condition were more likely to falsely report winning coin flips than participants in the neutral condition. A second experiment used the same *Trainspotting* film clip as used in Schnall, Haidt et al. (2008, Study 4) in the disgust condition, relative to a neutral nature clip. Participants in the disgust condition were almost twice as likely (67%) as participants in the neutral condition (35%) to send a deceptive message to an interaction partner that led to a higher payout for themselves. Similarly, following a memory recall task (as used in Schnall, Haidt et al., 2008, Study 3), participants who had written about a disgusting episode were roughly twice as likely (52%) as participants in the neutral condition (27%) to claim to have solved an unsolvable anagram that resulted in a financial bonus. Similarly, Lim, Ho, and Mullette-Gillman (2015) demonstrated that compared to participants who had been subliminally primed with neutral faces, participants who had been primed with faces exhibiting disgust showed higher rates of cheating on a dice-rolling task, and this effect was moderated by disgust sensitivity, with participants scoring high showing a more pronounced effect than those scoring low, who in fact showed the opposite pattern. These findings suggest that disgust might create a mindset related to resource scarcity, which leads to increased attempts to secure financial benefits even if doing so constitutes dishonest behaviour.

**Cleanliness and morality**

As outlined above, a considerable body of evidence has documented the influence of physical disgust on moral judgment. An additional line of work has examined whether physical cleanliness might have the opposite effect. Schnall, Benton et al. (2008) conducted the first such test. Because the main goal of cleansing behaviours is to rid the body of contaminants (Rozin et al., 2008), we explored whether “washing away” a sense of physical disgust was possible. In other words, whereas our earlier studies (Schnall, Haidt et al., 2008) had shown that inducing disgust leads to harsher moral judgments, we tested whether giving participants a chance to physically cleanse themselves after feeling disgusted would eliminate any subsequent effect on moral judgment. Participants watched the same disgusting film clip from *Trainspotting* as used previously (Schnall, Haidt et al., 2008, Study 4), and then half of the participants were asked to wash their hands with soap and water. To make the experimental setup plausible participants watched the film in one room and then were taken to a different room, a staff room,
which was described as having to be kept clean and tidy, which required
that participants wash their hands before sitting down at the table to
complete the moral judgment questionnaires. As predicted, participants
who washed their hands ($M = 4.73, SD = 0.95$) following the disgusting
film rated each moral dilemma as less wrong relative to participants who
did not wash their hands ($M = 5.43, SD = 0.69$), $F(1, 41) = 7.81, p = .008$,
$d = 0.85$ (see Table 2 for item means), supporting the notion that induced
cleanliness leads to a more lenient way of judging moral transgressions.

An additional study (Schnall et al., 2008, Experiment 1) activated con-
cepts of cleanliness by having participants complete a Scrambled Sentences
Task that required underlining words to form a sentence. In the cleanliness
condition half the sets contained words related to the theme of cleanliness
and purity (e.g., pure, washed, clean, immaculate, pristine) and the other
half contained neutral words; in the control condition all words were neutral.
Participants then rated the same six moral dilemmas used by Schnall, Haidt et al. (2008). As predicted, participants gave lower ratings after the cleanliness priming ($M = 4.98, SD = 1.26$) than after the neutral priming ($M = 5.81, SD = 1.47$), $F(1, 38) = 3.63, p = .06, d = 0.61$ (see Table 3 for item means), presumably because the sense of purity from the priming
was misattributed to the moral judgments.

Two direct replications of Experiment 1 obtained somewhat smaller
effect sizes, with Cohen’s $d$s of 0.47 and 0.48 (Arbesfeld, Collins, Baldwin,
& Daubman, 2014; Besman, Dubensky, Dunsmore, & Daubman, 2013).
Although Johnson, Cheung, and Donnellan (2014) reported a failure to
replicate the effect, a subsequent inspection of their data revealed an
unusually high percentage of participants selecting the extreme value on

### Table 2. Means (and standard deviations) for moral vignettes by condition (Schnall, Benton et al., 2008, Experiment 2). $N = 43$.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Dog</th>
<th>Trolley</th>
<th>Wallet</th>
<th>Plane</th>
<th>Resume</th>
<th>Kitten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand washing</td>
<td>5.33</td>
<td>2.81</td>
<td>4.62</td>
<td>5.38</td>
<td>4.24</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td>(1.88)</td>
<td>(1.08)</td>
<td>(1.53)</td>
<td>(1.80)</td>
<td>(1.67)</td>
<td>(1.18)</td>
</tr>
<tr>
<td>No hand washing</td>
<td>5.73</td>
<td>3.64</td>
<td>5.73</td>
<td>6.05</td>
<td>5.09</td>
<td>6.36</td>
</tr>
<tr>
<td></td>
<td>(0.98)</td>
<td>(1.05)</td>
<td>(1.28)</td>
<td>(1.21)</td>
<td>(1.15)</td>
<td>(1.00)</td>
</tr>
</tbody>
</table>

Response scales ranged from 1 (nothing wrong at all) to 7 (extremely wrong).

### Table 3. Means (and standard deviations) for moral vignettes by condition (Schnall, Benton et al., 2008, Experiment 1). $N = 40$.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Dog</th>
<th>Trolley</th>
<th>Wallet</th>
<th>Plane</th>
<th>Resume</th>
<th>Kitten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanliness priming</td>
<td>5.70</td>
<td>1.85</td>
<td>4.95</td>
<td>6.05</td>
<td>4.65</td>
<td>6.70</td>
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<tr>
<td></td>
<td>(2.39)</td>
<td>(1.50)</td>
<td>(2.35)</td>
<td>(2.39)</td>
<td>(2.28)</td>
<td>(2.49)</td>
</tr>
<tr>
<td>Neutral priming</td>
<td>6.55</td>
<td>2.75</td>
<td>5.45</td>
<td>6.45</td>
<td>5.40</td>
<td>8.25</td>
</tr>
<tr>
<td></td>
<td>(2.52)</td>
<td>(2.38)</td>
<td>(2.86)</td>
<td>(2.56)</td>
<td>(2.26)</td>
<td>(1.48)</td>
</tr>
</tbody>
</table>

Response scales ranged from 0 (nothing wrong at all) to 9 (extremely wrong).
the morality rating scale, thus raising the possibility of a ceiling effect (Schnall, 2014b). Furthermore, Huang (2014) conducted a re-analysis of Johnson et al.'s (2014) data and observed the predicted effect under conditions in which participants were not focally attending to the primed cues, consistent with the notion that when incidental affective cues are too salient, they can be correctly attributed to their true source and therefore lose the potency to influence judgments (e.g., Schwarz & Clore, 1983; Strack, Schwarz, Bless, Kübler, & Wänke, 1993). Huang (2014) subsequently showed that exactly such processes are at work and that scrambled sentences involving cleanliness words only make moral judgments less severe, as shown in Schnall et al. (2008), when participants engaged in processing that made it unlikely that they become highly focused on the primed content. For example, when they were instructed to work quickly and according to their first impression, rather than being concerned with accuracy, the predicted effect was obtained (Huang, Experiment 2). Finally, Kaspar, Krap and König (2015) demonstrated that while moral judgments became more extreme over time for control participants, this effect was eliminated for participants who engaged in hand-washing, as if the cleansing behaviour reset the judgment criterion, similar to other so-called “clean slate” effects that have been documented in the literature (Lee & Schwarz, 2011). In addition, hand-washing led to an increase in pupil size, which was interpreted as indicating downregulation of emotional arousal (Kaspar et al., 2015).

Although the studies reviewed above suggest that cleanliness causes milder moral judgments, other studies found the exact opposite result, namely that cleanliness causes harsher moral judgments (Helzer & Pizarro, 2011; Zhong, Strejcek, & Sivanathan, 2010). Zhong and colleagues (2010) induced cleanliness in participants either by having them cleanse their hands using antiseptic wipes (Study 1) or by asking them to visualise themselves as being clean and fresh (Studies 2 and 3). When they subsequently judged the wrongness of certain moral issues (i.e., abortion, pollution, adultery) participants in the cleanliness conditions gave harsher moral judgments than participants in control conditions. Similarly, Helzer and Pizarro (2011) found that participants who were reminded of physical cleansing by having the experimenter point to a hand sanitizer dispenser at the start of the experiment gave harsher moral judgments towards violations of sexual purity than participants who did not receive such a reminder. A likely explanation for these findings is that the manipulations emphasised the cleanliness of the self, therefore leading to contrast effects in judgment, whereas the clean concepts broadly primed in Schnall, Benton et al. (2008) could more easily be attributed to the moral dilemmas, therefore leading to assimilation effects.
The link between moral considerations and cleanliness has also been extensively demonstrated in research that measured cleanliness as a dependent variable. In a seminal paper, Zhong and Liljenquist (2006) developed a paradigm that involved participants recalling a past moral behaviour or an immoral behaviour. Participants in the latter conditions were more likely to spontaneously complete a word completion task with words related to cleanliness (Experiment 1), rated cleansing products as more appealing than non-cleansing products (Experiment 2) and were twice as likely to select a cleansing wipe over a pen as compensation for having participated in the study (Experiment 3) than participants who had recalled a moral behaviour. Furthermore, engaging in cleansing by using an antiseptic wipe after having recalled the immoral behaviour made it less likely for participants to engage in prosocial behaviour by taking part in a desperate graduate student’s experiment, with only 41% offering to help, compared to 74% of participants who had no opportunity to cleanse themselves (Experiment 4).

As reviewed by Lee and Schwarz (in press), many additional replications and extensions of this work have been reported that point to a close link between morality and physical cleanliness (e.g., Cramwinckel, de Cremer, & van Dijke, 2013; Cramwinckel, van Dijk, Scheepers, & van den Bos, 2013; Denke, Rotte, Heinze, & Schaefer, 2016; Gollwitzer & Melzer, 2012; Jones & Fitness, 2008; Lee & Schwarz, 2010; Lee, Tang, Wan, Mai, & Liu, 2015; Lobel et al., 2015; Reuven, Liberman, & Dar, 2014; Ritter & Preston, 2011; Sheikh, Botindari, & White, 2013; Xie, Yu, Zhou, Sedikides, & Vohs, 2014; Xu, Bègue, & Bushman, 2014). For example, participants who had read brief descriptions and photos of perpetrators of crimes (e.g., drug trafficking; burglary) were more likely to complete ambiguous word stems with words related to disgust and cleanliness and were almost three times more likely to select a cleansing wipe or soap bar over a pen holder than participants who had read neutral descriptions (Jones & Fitness, 2008, Study 1). Furthermore, disgust in relation to rejected religious beliefs was eliminated when participants were allowed to wash their hands after copying the passage (Ritter & Preston, 2011). Similarly, after having been primed with religious content, participants reported greater accessibility of words related to cleanliness, and in a second study, higher desirability of cleansing products (Preston & Ritter, 2012). Participants who shook the hand of a person who told a lie for a relatively small amount of money spent longer washing their hands than participants who engaged in a control condition that involved counting money (Xie et al., 2014, Experiment 1). These findings suggest a close link between physical cleanliness and moral outcomes.

If more broadly disgust reflects a conservation concern resulting in strict cost-benefit calculations in the economic domain, cleanliness might instead
indicate resource abundance and therefore could allow a more generous approach to money. Precisely this has been shown (Liljenquist, Zhong, & Galinsky, 2010). Participants were exposed to an experimental room in which a citrus-scented household cleanser was sprayed. In a one-shot trust game, participants were told that they were in the role of receiver and that a sender had them sent $4, which according to the rules of the game was then tripled to $12. Participants could keep the funds for themselves or return some or all of them to the sender. Participants who were tested with the citrus-fragrance returned a greater proportion of $12 to the sender, namely $5.33 than participants tested in a room with no particular smell ($2.81), thereby exhibiting greater trust and reciprocity (Liljenquist et al., 2010, Experiment 1). A subsequent experiment further showed that when exposed to a clean smell, participants indicated greater interest in volunteering for a charity and more willingness to donate money. These effects remained robust when controlling for both positive and negative affects, suggesting a role of cleanliness that occurred above and beyond specific emotions (Liljenquist et al., 2010, Experiment 2). Similarly, while participants who had watched disgusting films engaged in more cheating towards an interactive partner (Winterich et al., 2014, Experiment 1B), this effect was eliminated for participants who subsequently were primed with the concept of cleanliness (Winterich et al., 2014, Experiment 3). Finally, Florack, Kleber, Busch, and Stöhr (2014) showed that induced cleanliness reduced the well-known endowment effect (Thaler, 1980), namely people’s tendency to hold on to their prized possessions: Participants who washed their hands were much more likely than control participants to part with a received product, namely a juice drink, and were willing to exchange it for a different drink. In sum, this work can be interpreted as cleanliness reflecting a sense of resource abundance, in contrast to disgust, which can be seen as reflecting resource scarcity.

**Manipulating morality and measuring physical disgust**

The findings reviewed so far concern the causal direction of manipulating disgust and cleanliness and examining consequences on moral outcomes, including fairness-related economic behaviour. Further evidence regarding the role of disgust in morality comes from investigations of whether moral considerations relate to behavioural concomitants of disgust, such as facial expressions or behavioural responses regarding taste and food consumption. In an early investigation we tested whether people spontaneously exhibit emotional responses when considering a variety of moral behaviours and whether these responses would predict people’s subsequent evaluations of those behaviours (Cannon, Schnall, & White, 2011). More specifically, we used electromyography to measure facial muscle activity
while participants were listening to a number of morally praiseworthy behaviours or morally reprehensible behaviours relating to different types of moral content. Moral foundations theory (Graham, Haidt, & Nosek, 2009; Haidt & Joseph, 2007) proposes five classes of moral concerns. These include the two most frequently studied issues of ensuring fairness and preventing harm. Furthermore, the theory proposes a key role for people’s desire to protect the purity of their body by condemning actions associated with physical contamination. In addition, individuals are said to attempt to protect the rights of their social group, as captured by the ingroup foundation, and aim to maintain order within society by obeying social hierarchies, as captured by the authority foundation.

One possible outcome was that transgressions across all five of these foundations would result in the same negative affective response. An alternative was that different categories of moral transgression would evoke differential affective responses. As noted above, Chapman et al. (2009) showed that being confronted with unfair offers on the Ultimatum Game led to increased activity of the levator labii muscle involved in disgust, so we tested whether this finding would generalise to a wider range of fairness transgressions such as cheating, discrimination and stealing. In contrast, moral anger or outrage often occurs simultaneously with disgust but is a distinct emotional response that can be elicited specifically by immoral behaviours that result in harm (e.g., Gutierrez & Giner-Sorolla, 2007). Similarly, self-rated anger, but not disgust, has been shown to predict moral judgments of vignettes containing fairness violations (Horberg et al., 2009). Thus, facial anger, but not disgust, may be elicited when thinking about behaviours that harm others. Based upon these previous findings, Cannon et al. (2011) predicted that there would be specific associations between different emotions and different moral concerns. Because a range of affective responses were of interest, we measured the activity of three muscles while participants were thinking about moral behaviours. Muscle activity was recorded from the inner brow (corrugator supercilii: knits brow when frowning and is indicative of negative affect), cheek (zygomaticus major: pulls up corner of mouth when smiling) and nose (levator labii: raises upper lip during facial disgust expression).

Not only was negative affective muscle activity expected to be higher in response to moral transgressions, but a highly specific relationship between muscle activity and judgments was anticipated: Violations of purity and fairness were expected to evoke greater disgust facial activity; and in addition, this activity was expected to predict the severity of subsequent moral judgments about these behaviours. In contrast, facial anger should predict the severity of judgments about harm. We made no specific predictions
about facial responses to behaviours relating to the in-group or authority foundations.

Students at the University of Plymouth were recruited for a study that ostensibly involved measurements of frontal brain activity, for which electrodes were attached to the face. In the first block of the experiment, participants listened to 90 statements about positive and negative moral behaviours, and after each statement a slide was presented for 4 s that asked participants to “Please think about this behaviour”. These instructions were intended to have participants merely consider the moral behaviours while not necessarily evaluating them. In contrast, in the second block of the experiment, they made moral judgments for those same behaviours by indicating how positive or negative this behaviour was, on a scale from $-3$ (very negative) to $+3$ (very positive). The stimuli comprised 45 positive and 45 negative behaviours relating to the five moral foundations and included items such as these: “Someone meditates to keep her mind free of impure thoughts” Vs. “Someone eats in the same place she goes to the bathroom” for purity; “Someone demonstrated in a civil rights rally” Vs. “Someone cheated in a game of cards” for fairness; “Someone showed compassion to those in need” Vs. “Someone pinched a baby’s nose until it cried” for harm; “Someone gave his seat on the bus to an elderly person” Vs. “Someone was disobedient to all authority figures” for authority; and “Someone skipped lunch to work on a team project” Vs. “Someone gossiped about a friend at work” for in-group.

The results showed that when considering another person behaving in a way that violates accepted moral standards, individuals spontaneously expressed different facial expressions depending on the type of violation that was committed (see Figure 4 for means). As predicted, relative to participants’ baseline facial activity, transgressions that involved the risk of contamination of the body or spirit resulted in a strong facial expression of disgust involving the levator muscle, $t(37) = 3.68, p = .001, d = 1.20$. Disgust was also exhibited during fairness violations such as cheating, stealing and discriminating against others, $t(37) = 3.13, p = .003, d = 1.00$, in line with earlier findings that unfairness on the Ultimatum Game elicits a disgust expression (Chapman et al., 2009). The presence of a disgust response to purity and fairness transgressions was predicted by models of sociomoral disgust (e.g., Rozin et al., 2008), suggesting that these two moral categories are closely related. In contrast, when participants considered transgressions that involved harming others, they exhibited activity for the corrugator muscle, which is involved in frowning as part of an anger expression, $t(37) = 2.40, p = .02, d = 0.79$. No disgust or anger responses occurred to transgressions committed against one’s social group or against authority.
A key goal of this work was to test whether the affective responses spontaneously elicited when considering moral situations would predict subsequent moral judgments of the actors in those situations. Additional analyses therefore examined the relationship between muscle activity while thinking about these behaviours the first time that they were encountered (Block 1) and the subjective moral judgments about these behaviours (Block 2). Overall, there was a negative relationship between moral judgments and muscle activity, such that higher levator ($r = -0.23$) and corrugator ($r = -0.30$) activation was linked to more negative moral judgments.

Figure 4. Average muscle activity and moral judgments for behaviours covering the five moral foundations (Cannon et al., 2011). $N = 38$.

Muscle activity was recorded during the 4 s following exposure to stimuli in Block 1 while participants were instructed “Please think about this behaviour”. For each statement, a change score was calculated by subtracting the average muscle activity from the 500-ms period immediately before listening to the behaviour from the muscle activity while thinking about the same behaviour. Moral judgments were collected in Block 2 following a second exposure to each behaviour.
However, this relationship again depended on the type of behaviour under consideration, with facial disgust significantly correlating with moral judgments about purity ($r = -0.72$) and fairness ($r = -0.45$) and frowning correlating with moral judgments about purity ($r = -0.56$) and harm ($r = -0.59$). Interestingly, greater positive facial affect was associated with more positive evaluations of behaviours relating to in-group concerns ($r = 0.42$). Thus, not only did individuals form disgust and anger facial expressions in response to certain immoral behaviours, but the amount of facial muscle activity elicited predicted how serious they perceived these violations to be. This study provided some of the first evidence of affective facial muscle activity in response to a broad range of moral concerns by demonstrating that when people consider moral situations, facial affect and moral judgment go hand in hand.

Another paper provided an important extension and replication of this work (Whitton, Henry, Rendell, & Grisham, 2014) because it further explored the distinct contributions of induced disgust and anger in moral and non-moral judgment contexts. Participants in the disgust condition watched a film of a person repeatedly vomiting, whereas participants in the anger condition were asked to recall a vivid episode of anger from memory. Participants then viewed 25 images of moral violations (e.g., a boy punching another boy; a Ku Klux Klan member dancing around a burning cross), another 25 images of negative images without any moral connotation (e.g., a burning car; Siamese twin babies joined at the head) and 25 neutral images (two men talking; a boy playing chess) while their facial activity was recorded. Participants in the disgust condition showed greater levator labii activity towards moral images than negative images, which still produced a higher response than neutral images, but no such pattern was obtained for the anger condition. Similarly, trait differences in propensity to experience disgust, but not anger, predicted levator labii activation. Thus, these findings support the specialised relationship between disgust and moral content, while anger plays no such role.

Other work has also shown a link between moral issues and subsequent disgust responses. For example, Christian participants who had been asked to hand copy an excerpt from the Qur’an or Richard Dawkins’ book *The God Delusion* subsequently rated a tart lemon-flavoured drink as more unpleasant and disgusting than participants who had copied a neutral text (Ritter & Preston, 2011). Similarly, participants who read about moral transgressions rated diluted Gatorade to be less appealing than participants who had read about altruistic behaviours (Eskine, Kacinik, Webster, & Tsakiris, 2012). Furthermore, relative to participants who had watched a video of a neutral work interaction, participants who had watched a manager wrongfully accusing an employee reported more intense taste when
asked to sample Marmite as a bitter stimulus and Sunny D, a strawberry-flavoured juice drink, as a sweet stimulus (Skarlicki, Hoegg, Aquino, & Nadisic, 2013).

Additional research also investigated behavioural implications of disgust when considering moral transgressions. As a food-based emotion disgust inhibits the consumption of potentially tainted food and drink (Rozin et al., 2008). Thus, if moral transgressions elicit a physical disgust response, then subsequent oral consumption should be reduced. Indeed, participants who had been told that a film clip showing an older woman and a young man depicted an incestuous relationship between a mother and her son reported higher feelings of disgust and consumed less chocolate milk (which they also reported enjoying less) while watching the film than participants who had watched the film with instructions that it was a romantic relationship (Chan, Van Boven, Andrade, & Arieli, 2014, Experiment 1). An additional experiment replicated the finding obtained by Cannon et al. (2011) of spontaneously produced disgust expressions while exposed to morally wrong behaviour. Chan et al. (2014, Experiment 3) asked participants to listen to a radio broadcast describing the London Interbank Offered Rate scandal that involved banks engaging in fraudulent activities to manipulate interest rates or a modified neutral version of the broadcast or some classical music. Participants who listened to the broadcast about the scandal reported feeling more disgusted, produced more facial disgust and drank less chocolate milk than participants who listened to the neutral sound clips. Thus, the effect was not only specific to a norm violation in the sexual domain but also extended to a norm violation in the fairness domain. Furthermore, consumption was reduced not only for chocolate milk, a positively valenced stimulus, but also for water, a neutral stimulus: A further experiment showed that participants who wrote a story about somebody stealing a car or cheating on an exam drank less water while writing the story than participants who wrote about a neutral event (Chan et al., 2014, Experiment 2). These studies suggest that when confronted with moral transgressions participants experience disgust, which in turn inhibits the consumption of otherwise desirable food and drink.

**Political conservatism Vs. conservation concerns**

In addition to experimental studies involving disgust and morality, individual differences in disgust sensitivity have been shown to be positively correlated with endorsement of negative attitudes towards political issues, in particular, those involving violations of physical purity (Inbar, Pizarro, & Bloom, 2009). In Inbar et al.’s first study, US participants recruited from an online participant panel completed eight items taken from the Disgust Sensitivity Scale (Haidt et al., 1994), such as “I try to avoid letting any
part of my body touch the toilet seat in a public restroom, even when it appears clean” and “You take a sip of soda and then realise that you picked up the wrong can, which a stranger had been drinking out of”, and then indicated their political orientation on a scale anchored from “Very Liberal” to “Very Conservative”. While there was a significant correlation between political attitude and disgust sensitivity, $\beta = .22$, members of the Republican party ($M = 2.66$) actually did not differ in their disgust sensitivity from members of the Democratic party ($M = 2.56$). In a second study, participants first indicated political orientation, then completed the entire Disgust Sensitivity Scale and subsequently reported agreement with ten political issue statements, such as: “A woman should have the right to choose what to do with her body, even if it means getting an abortion”, “Homosexuals should have the same right to marriage as anyone else” and “Federal tax cuts have been worth it, because they have helped strengthen the economy by allowing Americans to keep more of their own money”. Disgust sensitivity predicted self-reported political orientation, $\beta = .27$. When looking at the political moral issues, disgust sensitivity predicted ratings on three out of ten items, namely abortion ($\beta = .36$), gay marriage ($\beta = .35$) and tax cuts ($\beta = .39$).

However, a key issue with this line of work is, first, its correlational nature, raising the possibility that variables apart from disgust sensitivity might play a role. Indeed, Inbar et al. (2009, Study 1) found that religious affiliation also significantly predicted conservatism, and the magnitude of this effect ($\eta^2 = 0.04$) was similar to that of disgust sensitivity ($\eta^2 = 0.05$). Second, the Disgust Sensitivity Scale is typically administered before the political and moral issues. For example, in Inbar et al. (2009)’s Study 1 participants first completed the disgust scale. Thinking about those items likely induced disgust in participants (as in Van Dillen et al., 2012), which could subsequently have influenced political orientation. Although Study 2 administered the item measuring political orientation before the disgust scale, the latter came before the political issues and therefore could have shaped them. Similarly, Brenner and Inbar (2015) tested a large sample of participants in the Netherlands and assessed the relationship between disgust sensitivity and political statements, but again the former was measured immediately before the latter, making it possible that feelings of disgust were induced before participants completed the political judgments. Because there was no control condition it is not known whether the observed correlational effect was due to disgust sensitivity as a trait, or to disgust having been induced as a state before political issues were assessed.

It is therefore possible that when disgust is induced or made salient such as when completing the Disgust Sensitivity Scale (Haidt et al., 1994), this might induce a conservation concern that can manifest itself in more strict responses to political issues involving purity violations (e.g., abortion, gay
marriage, as in Inbar et al., 2009), or fairness violations (e.g., taxation). Being conservative might therefore not only protect the body from perceived violations but also reflect a general desire to conserve resources. Thus, one possibility is that physical disgust makes salient concerns related to limited resources, including their conservation and fair distribution, while not necessarily being tied to a specific political orientation.

Petrescu and Parkinson’s (2014) findings speak to precisely this notion. Going beyond Inbar and colleagues’ correlational findings, they experimentally tested whether incidental disgust has a causal influence on political attitudes. In their first experiment, participants were presented with disgusting photos (e.g., a toilet) taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008) and then asked to complete the Left Vs. Right Scale (Evans, Heath, & Lalljee, 1996) that measures views on economic equality and fairness (e.g., “Government should redistribute income from the better off to those who are less well off”). Participants rated their agreement with the statements on a scale from 1 (strongly disagree) to 5 (strongly agree). Compared to participants who had viewed sad photos ($M = 3.04$), participants who had viewed disgusting photos ($M = 3.51$) showed more agreement with liberal values. No such effect was found for Libertarian-Authoritarian items (e.g., “For some crimes, the death penalty is the most appropriate sentence”). Importantly, there was no main effect on PBC, which had also been assessed.

A second experiment repeated the same paradigm while also measuring disgust sensitivity, which turned out to be uncorrelated with both left–right and Libertarian-Authoritarian political judgments. As in their earlier experiment, there was no main effect of PBC. Without the inclusion of PBC there was only a marginally significant main effect of condition. When entering PBC as moderator, however, participants high in PBC who were in the disgust condition reported substantially stronger left-wing attitudes ($M = 3.75$) than those in the sadness condition ($M = 2.79$). Again, no effect occurred for Libertarian-Authoritarian items. This finding replicates the earlier finding by Schnall et al. (2008) that an induction of disgust interacted with PBC to produce an effect on a morally relevant outcome variable, while the effect is much weaker or absent without it.

In a third experiment, Petrescu and Parkinson (2014) further examined the critical question of the role of both state and trait disgust on political attitudes using the same paradigm as the earlier two experiments while adding a short version of the classic C-scale (Wilson & Patterson, 1968). It assesses participants’ social conservatism and consists of three subscales: conventional morality, intolerance and punitiveness. Participants also rated their political orientation on a scale from 1 (extremely liberal) to 7 (extremely conservative), similar to the work by Inbar and colleagues (2009). Replicating the findings from the two previous experiments, disgust
induction on its own had only a marginal effect on liberal attitudes. When adding PBC as moderator, the effect once again became more pronounced, with high-PBC participants in the disgust condition reporting more liberal attitudes on the Left–Right scale than those in the control condition, while there was no effect for low-PBC participants. Importantly, the pattern of effects was identical for the single-item indicator of political affiliation, with high-PBC participants reporting themselves to be more liberal in the disgust condition than in the sadness condition, but no such effect being observed for the low-PBC participants.

By contrast, induced disgust on its own had no effect on the conservatism scale, the Libertarian-Authoritarian items or the 1-item measure of political orientation. Furthermore, while disgust sensitivity was positively correlated with the conservatism scale, it was not correlated with economic attitudes or the 1-item political orientation measure. These findings therefore provide compelling evidence that disgust sensitivity on its own is not necessarily related to political orientation. In contrast, momentary feelings of disgust did have a strong link to political attitudes, but in exactly the opposite direction to what was found in earlier work (Inbar et al., 2009): Disgust led to more liberal attitudes related to fairness compared to a sadness condition, and this effect was magnified for people who were generally in touch with their bodily sensations. This suggests a counter-intuitive possibility, namely that rather than being an emotion that makes people punitive and harsh, disgust may sometimes achieve precisely the opposite: It makes salient that resources are scarce and should be shared fairly rather than being squandered, thus making people conservative, albeit not necessarily in a political sense. This interpretation is consistent with the findings involving utilitarian judgments (Ong et al., 2014), for which participants induced to feel disgust, and those high in disgust sensitivity, were more likely to follow strict cost-benefit calculations when determining whether to sacrifice a small number of people for the benefit of a great number of people.

Methodological considerations for future research

This article offered a review of evidence concerning the link between physical disgust and moral outcomes. However, the various studies used a substantially different set of methods and future research would do well to consider these methodological differences. In particular, a number of limitations should be addressed to provide more rigorous tests that go beyond the research conducted to date.

First, different disgust manipulations have paid relatively little attention to the specific content of disgust. In particular, a distinction can be made between disgust elicitors involving human bodily products and secretions
such as faeces, vomit, blood and sexual fluids and bodily odours such as those arising from flatulence, on the one hand, and non-human elicitors such as spoilt food, on the other hand. The former elicitors are perceived to be especially disgusting (Curtis et al., 2004; Curtis & Biran, 2001), because they increase the risk of contracting an infectious disease. It is therefore possible that disgust inductions that involve human substances are more easily attributed to a specific person’s moral transgressions than non-human disgust elicitors, but this conjecture needs to be empirically tested.

Second, as noted above, a limitation of many studies involving moral judgment is that the experimental stimuli typically consist of vignettes that are themselves likely to elicit strong disgust even in control conditions. Thus, while disgust is induced as a between-subjects manipulation, disgust content is also present in the stimuli used to assess the outcome measure, namely moral judgment. In other words, some disgust may be induced even in comparison conditions that do not involve a disgust manipulation, which limits the range of responses for which potential group differences can be observed. This may explain the smaller effect sizes obtained for moral judgment in relation to economic games such as the Ultimatum Game. Future studies therefore should examine the amount of disgust contained in materials constituting the dependent measures, and if necessary, control for such content differences. Moreover, different studies on moral judgment used different types of moral vignettes, and it appears that utilitarian judgments involving sacrificial dilemmas (e.g., Ong et al., 2014) capture fundamentally different processes than vignettes that do not contain utilitarian considerations (e.g., Horberg et al., 2009; Schnall, Haidt et al., 2008, 2008; Seidel & Prinz, 2013; van Dillen et al., 2012). Thus, moral outcome measures need to be carefully selected.

Third, a number of variables including PBC (Petrescu & Parkinson, 2014; Schnall, Haidt et al., 2008), attentional control (Van Dillen et al., 2012), emotional differentiation (Cameron et al., 2013), mindfulness (Sato & Sugiura, 2014) and disgust sensitivity (Lim et al., 2015; Ong et al., 2014) have been shown to moderate the effect of induced disgust on moral judgment. However, many studies did not take those variables into account; nor were they included in a recent meta-analysis aimed at establishing the effect of disgust on morality (Landy & Goodwin, 2015; see also: Schnall, Haidt, Clore, & Jordan, 2015). Future work therefore should assess the role of those and other moderators in order to more fully capture predicted effects. Furthermore, instead of a limited number of vignettes, a stimulus-sampling approach (Monin et al., 2014; Westfall et al., 2014) could be used, thus expanding the generalisability of the findings. Indeed, an extensive standardised set of moral vignettes has been developed (Clifford, Iyengar, Cabeza, & Sinnott-Armstrong, 2015) that might prove fruitful for further investigations.
Fourth, although there is considerable evidence for the effects of induced disgust and induced cleanliness on moral outcomes, both types of studies have typically included neutral control conditions. It is therefore likely that the magnitude of observed effects would be larger if disgust and cleanliness were both included as experimental inductions in the same experiment. Indeed, because Schnall, Haidt et al. (2008) and Schnall, Benton et al. (2008) used some of the same experimental stimuli, this prediction can be readily tested. When including only the disgust conditions of the former three experiments and comparing them to the cleanliness conditions of the latter two experiments, the main effect of condition is highly significant without taking into account the moderating role of PBC, $F(1, 127) = 17.90$, $p < .00004$, $d = 0.83$, suggesting that experiments with neutral control conditions tend to underestimate true effect sizes. Thus, comparison conditions need to be carefully considered.

**Conclusion: disgust as embodied loss aversion**

Disgust is the emotion that protects the body from physical contamination (Augner & Curtis, 2013; Rozin et al., 2008). It is especially pronounced towards human bodily secretions that could transmit infectious disease (Curtis et al., 2004), therefore curtailing social contact when it could be too costly. Because one’s body is the ultimate limited resource and harm needs to be avoided at all costs disgust operates in a highly conservative manner, alerting one to possible danger even at the expense of a false alarm (Murray & Schaller, 2016). Indeed, when in doubt, it is better to “be on the safe side” and forgo social interactions or food consumption rather than take a risk.

Going beyond the maintenance of a healthy body, in the social realm disgust leads people to be more cautious towards those who might have broken accepted norms (e.g., Horberg et al., 2009; Schnall, Haidt et al., 2008; Seidel et al., 2013; van Dillen et al., 2012). Similarly, violations of social norms including those relating to the purity of the human body but also those involving fairness, elicit disgust responses, such as facial expressions (e.g., Cannon et al., 2011; Chapman et al., 2009), heightened taste and olfactory sensitivity (Skarlicki et al., 2013) and reduced consumption of otherwise desirable drinks (Chan et al., 2014). Importantly, disgust’s role not only involves perceived moral transgressions but also extends to cost-benefit calculations aimed at maximising potential gains while minimising potential losses: Induced disgust leads people to be especially concerned with fairness and economic equality (Petrescu & Parkinson, 2014). Disgusted participants prefer a small loss of life over a much greater one (Ong et al., 2014). Although they take advantage of economic benefits when the opportunity arises (Bonini et al., 2011; Winterich et al., 2014), they pass
up such rewards when the financial transaction implies a risk of potential infection (Harlé & Sanfey, 2010; Moretti & di Pellegrino, 2010).

In sum, disgust can be seen as the embodied activation of the self-protection motive (Alicke & Sedikides, 2009; Campbell & Sedikides, 1999), leading to efforts aimed at ensuring the conservation of a range of self-relevant resources and avoiding their potential loss. Although people are generally more attuned to potential losses than potential gains and therefore are “loss-averse” (Kahneman & Tversky, 1979), disgust appears to make such concerns even more prominent by conveying an acute sense of resource scarcity. Future research might further illuminate the intriguing role played by disgust, a body-based emotion that exemplifies human beings’ lowly physical origin, in Darwin’s words, in shaping sophisticated evaluations and behaviours in the social and economic domains.

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