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**ABSTRACT**

In this article, an account of the architecture of the cognitive contamination system is offered, according to which the contamination system can generate contamination representations in circumstances that do not satisfy the norms of contamination, including in cases of mere visual contact with disgusting objects. It is argued that this architecture is important for explaining the content, logic, distribution, and persistence of maternal impression beliefs – according to which fetal defects are caused by the pregnant mother's experiences and actions – which in turn provide important evidence of the architecture of the cognitive contamination system.

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## 1. Introduction

While disgust has been the focus of a great deal of attention in the philosophy of psychology and moral psychology in the last 40 years, insufficient attention has been paid to the precise nature of contamination thinking.

In this article, I undertake two principal tasks. First, I offer an account of the architecture of the cognitive contamination system according to which the system has the ability to generate two kinds of contamination representations: (a) contamination beliefs, which are sensitive to the norms of contamination; and (b) contamination aliefs, which are generated by disgust and are not sensitive to such norms and so can be *radically promiscuous* in that they can be occasioned through, for example, *mere visual contact* with a disgusting object. Second, I argue that this account of the architecture of the cognitive contamination system is needed to explain why the maternal impression theory arose, and that maternal impression beliefs in turn provide important evidence for this account. The maternal impression theory posited that unsightly marks, deformities, diseases and even immoral behavioral traits in children are caused by the experiences and actions of the pregnant mother.[1]

More specifically, in the first part of this paper, I provide an account of the relationship between disgust and one of the laws of sympathetic magic –

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the law of contagion – in terms of contamination beliefs and contamination aliefs. Based on this characterization, in the second part of the paper I argue that disgust can explain a number of features of the phenomenon of maternal impression beliefs, including: (i) why they have the precise content that they do in terms of the causes and effects of maternal impressions and the mechanisms of mitigating their effects, (ii) why they have reliably appeared across cultures in scientists and the folk alike, (iii) why they tend to occur just when they do within cultures, and (iv) why they have proved surprisingly resistant to rational deflation. I conclude by discussing the best explanation of maternal impression beliefs. I deploy my account of the cognitive contamination system in my explanation of why fear, rather than disgust, has nonetheless been more commonly identified as the cause of maternal impressions, and discuss why a disgust-based explanation is preferable to domain-general explanations.

The relationship between disgust and the maternal impression theory not only illustrates how important present-day psychology and philosophy of psychology are for understanding certain cases in the history of science and medicine – and particularly those where cognitive heuristics have led scientific thinking astray – but also reveals how some cases in the history of science and medicine can provide important opportunities to advance our understanding of certain psychological phenomena.

## 2. Disgust and contamination representations

Disgust is a basic emotion that is characterized by: the physiological concomitants of nausea; feelings of revulsion and of oral incorporation of something offensive; parasympathetic nervous activation; a distinctive facial expression – which includes gaping of the mouth, retraction of the upper lip, and wrinkling of the nose; behavioral avoidance and purification; and contamination representations (Ekman & Friesen, 1971; Levenson et al., 1990; Rozin & Fallon, 1987; Rozin et al., 1994; Rozin et al., 2008; Stark et al., 2005; for an account of disgustingness, see Doran, in press).

Disgust is thought to have evolved from the distaste response (Rozin & Fallon, 1987) to defend us from physical contaminants – and in particular pathogens (Curtis & Biran, 2001) – as well as moral, social and spiritual contamination (Rozin et al., 2008).

One of the central features of disgust is that it obeys the magical law of contagion, according to which "physical contact between the source and the target results in the transfer of some effect or quality (essence) from the source to the target" (Nemeroff & Rozin, 2000, p. 3). Rozin et al. (1986) showed that dipping a dead, sterilized, cockroach – which is experienced as disgusting – in a glass of juice rendered it disgusting. In fact, the contact of

the juice with the glass intermediary was sufficient to make the glass itself a source of disgust.

Non-disease-based elicitors of disgust, including moral viciousness, have also been shown to be regarded as contaminating. Rozin, Markwith et al. (1994) found that participants displayed a reluctance to wear a freshly laundered jumper that they were told had been briefly worn by a morally vicious individual or someone who had lost their leg in an automobile accident. More recently, and demonstrating the specific link between moral disgust and contamination, Tapp and Occhipinti (2016) found that people were less likely to eat from cutlery that had been used by a moral transgressor, and that this effect was uniquely mediated by feelings of disgust (with no mediation occurring for feelings of sadness and anger).

Importantly, in many of these studies, participants continue to act *as if* the contacted objects are contaminated, despite acknowledging that they pose no danger to them. That is, disgust-induced contamination behavior is in some ways resistant to attempts to override it rationally (Nemeroff & Rozin, 2000, p. 23). Nevertheless, given the sheer number of potential contaminants in our environment, we manage such contamination behaviors in at least three main ways: by directing attention away from potential contaminants (as in the case of the dog owner who doesn't think about where their dog has been when they kiss them); by reframing potential contaminants (as in the case of thinking of moldy cheeses as 'blue' cheeses or mildly decayed beef as 'aged' or 'matured'); or by deploying culturally sanctioned standards for contamination (such as the kosher rule of contamination being constituted by 1 or more parts contaminant to 60 parts non-contaminant) (see e.g. Rozin & Fallon, 1987, pp. 31–2).

We are 'pre-prepared' (Seligman, 1970) for the capacity for representing contamination. This capacity is acquired rapidly in all humans irrespective of variations in physical, social or cultural environments and even under degraded acquisition conditions such as minimal learning trials or the absence of conscious effort (see e.g. Shweder, 1977, p. 638). Indeed, it is thought that this pre-preparation evolved from disgust as part of the suite of cognitive mechanisms that humans have been endowed with to deal with the threat of infection, and that disgust's co-option to deal with interpersonal contaminants permitted the expansion of contamination thinking to these domains too (e.g. Nemeroff & Rozin, 2000, pp. 19, 22).

Notwithstanding these innate constraints, culturally-acquired information is able to shape the cognitive contamination system in certain respects, as evident from the ontogeny of the system. The cognitive contamination system is thought to emerge at around 4-years of age (Siegal & Share, 1990), once children acquire the ability to represent invisible entities. After this, children calibrate their contamination system according to the relevant culturally-transmitted knowledge that they are exposed to.

At first, children tend to think that contamination can occur through mere physical proximity, and that once it has occurred, contamination is irreversible. In at least those cultures where there is a modern scientific understanding of infectious diseases, children come to represent physical actions such as boiling as being able to purify the objects, and increasingly represent physical contact as being necessary for contamination. Springer and Belk (1994) found that 3-4-year-old children were more likely than 7-8-year-olds to think that a fly merely coming close to a glass of juice would make the juice noxious. Similarly, Hejmadi et al. (2004) found that most 4-year-old Indian children rejected a glass of lemonade that had been held by a stranger and tended to reject physical methods of purifying contamination events, whereas 8-year-old children did not tend to reject lemonade that had been held by a stranger, and tended to accept boiling as a method of purification.

Notwithstanding these advances during development, even adults who have acquired the relevant scientific beliefs have been shown to represent mere proximity as sufficient for contamination, at least in certain contexts. Rozin et al. (1992) found that the thought of wearing a new and freshly laundered jumper purchased, though not actually touched, by an individual with AIDS was more unpleasant than the thought of wearing an equivalent jumper owned by a healthy individual. Similarly, Hebl and Mannix (2003) found that people who sat close to obese people were judged less favorably, and Kim and Kim (2011) found that objects which are merely close to a murderer are judged less favorably.

Indeed, in certain cases of psychopathology such as contamination-related obsessive-compulsive disorder (CR-OCD), contamination representations occur frequently in the absence of contact. Individuals with CR-OCD tend to experience a persistent sense of dirtiness by mere *thoughts* of contaminants such as an unwanted kiss from a stranger, being in a toilet, or unacceptable sexual or blasphemous thoughts (Rachman, 1994). This persistent sense of dirtiness produces compulsive self-cleaning behavior, which tends to continue until feelings of "not-quite-rightness" reduce (Wahl et al., 2008) and tends to be resistant to rational disconfirmation: individuals suffering from CR-OCD are able to recognize and declare that their compulsions and actions are irrational – they know that they have not come into physical contact with a contaminant and that their washing behavior would have removed any contaminant that were present in any case (Rachman, 2004, p. 1236). CR-OCD occurs on a continuum of severity and is thought to be the result of abnormal functioning of psychological capacities that are universal in humans (see, Gibbs, 1996, for a review). Specifically, CR-OCD is thought to be caused by a range of factors, including, most prominently: a more reactive disgust system (for a summary of the evidence see Cisler et al., 2009), broad deficits in executive functions (e.g. Snyder et al., 2015), and a

tendency to appraise themselves as being more susceptible to contracting illnesses and thinking that they will be severely affected by them (e.g. Summerfeld et al., 2014). Indeed, some evidence suggests that elevated disgust sensitivity may be crucial among these causes. Deacon and Olatunji (2007), for example, found that disgust sensitivity mediated the relationship between beliefs in contamination likelihood and severity, on the one hand, and contamination behaviors, on the other.

A cognitive contamination system populated by two kinds of contamination representation is best able to make sense of these findings (see Figure 1 for an illustration of the cognitive architecture). The representations of contamination that arise from disgust – and indeed, are proportional in strength to the activation of the disgust system – are what Gendler (2008) calls aliefs, though they may also be accompanied by, or themselves generate, beliefs. As such, they arise automatically, and tend to guide behavior, without an individual assenting to the idea that the object presents a genuine danger of contamination, or even where an individual assents to the contrary proposition.[2] Unlike contamination beliefs, contamination aliefs are promiscuous: they may be generated even when there is no perceived physical contact between the source and recipient. Rather, contamination aliefs obey a looser logic of proximity according to which contamination is attributed to objects that are merely close by. Or, to put it another way, they are generated and give rise to functional outputs in a manner which is insensitive to the norms of contamination – such as the source actually being contaminating, the recipient being sensitive to the source, and there being physical contact between the source and the recipient.

The capacity for contamination aliefs is pre-prepared and emerges early in development. As culturally transmitted norms for contamination are acquired, contamination beliefs come to be constrained by the norms

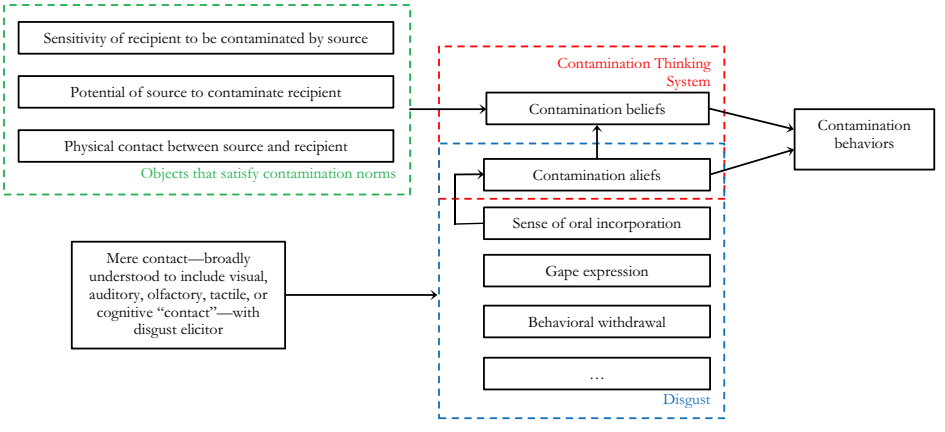


**Figure 1.** An illustration of the architecture of the cognitive contamination system, where arrows represent causal relationships.

prescribed by such knowledge, as do contamination behaviors. As a result, contamination beliefs and aliefs functionally dissociate. However, since contamination aliefs are generated automatically, they continue to tend to give rise to contamination behaviors and exert a pressure toward contamination beliefs even once the capacity for mature contamination beliefs arise.

This architecture also neatly explains how it is that contamination behavior goes wrong in cases of contamination-related obsessive-compulsive disorder, given what we know about the causes of this disorder. In individuals with CR-OCD, their disgust systems generate contamination aliefs more frequently and strongly, even by mere thoughts of contaminants, which give rise to a sense of dirtiness, and produce a tendency to wash. This increased frequency and intensity of disgust system activation itself shapes the representations of the norms of contamination in these individuals, giving rise to beliefs that they are more susceptible to contamination, and will be more severely affected by it. Notwithstanding these modifications, their beliefs about contamination still reflect prevailing norms to an extent, and remain available to central cognitive processes. As a result, in many cases, individuals suffering from CR-OCD are able to recognize and declare that their compulsions and actions are irrational. Yet, due to their deficits in executive function and in particular response inhibition, they face difficulties in bringing their representations of the satisfaction of these norms of contamination to bear on their behavior (including by employing the cognitive strategies for managing contagion behavior outlined by, e.g. Rozin & Fallon, 1987, discussed above). As a result, they tend to persist in their washing behaviors until the sense of dirtiness – which like all affect-based phenomena is subject to adaptation – reduces.

But just how promiscuous are contamination aliefs, even in non-clinical populations? I propose that they are more *radically* promiscuous than has been appreciated until now. In addition to attributing contamination to objects that are merely spatially near to the disgusting object (as demonstrated by e.g. Kim & Kim, 2011), disgust is sufficient to token contamination to distal objects, and indeed, to the individual experiencing the disgust directly – that is to say, independently of any physical contact with the source or any intermediary, or even mere proximity to them.

Some support for the radical promiscuity claim is provided by Jones and Fitness (2008), who found that contemplating moral transgressions made products related to cleanliness more appealing, and Fairbrother et al. (2005), who found that contemplating a non-consensual kiss led to feelings of dirtiness and self-cleaning behaviors even in non-clinical populations. One tempting way of explaining these findings is that merely contemplating disgustingness in the form of moral viciousness makes people alief that they are contaminated, and so increases the desirability of hygiene products and behaviors that would neutralize this contamination. Further support for the

self-contamination interpretation of these findings comes from the fact that disgust itself is thought to involve a sense of oral incorporation (Rozin et al., 2008), even where the disgusting object has not been consumed and indeed where the disgusting object is not something that *could* be consumed. Even morally disgusting stimuli have been shown to give rise to the facial expression characteristic of disgust (Chapman et al., 2009), which is thought to have evolved from the concomitants of gustatory and olfactory rejection (Rozin, Lowery et al., 1994). As disgust has been thought to prevent oral incorporation in an anticipatory manner by giving rise to the physiological concomitants of oral rejection – that is, before oral incorporation has taken place or even where it isn't possible (Rozin & Fallon, 1987) – merely experiencing some of the components of disgust may contribute to a sense of self-contamination (though this may not be sufficient in itself).[3]

This framework is crucial, I propose, for explaining maternal impression beliefs. In turn, where recent findings on the effects of disgust provide some evidence for the radical promiscuity of contamination aliefs, maternal impression beliefs provide important evidence where mere *visual* contact is sufficient for the generation of contamination representations, as well as the structure of the cognitive contamination system generally. In the second part of this paper, I turn to make the case for this.

## 3. The disgust-based explanation of the maternal impression theory

Across history and cultures, it has been believed that unsightly marks, deformities, diseases and even immoral behavioral traits in children are caused by the experiences and actions of the pregnant mother – the so-called maternal impression theory. Indeed, in addition to being present in folk beliefs, the maternal impression theory was prominent in early modern medicine, and even had prominent advocates in Western medicine up until the early 20$^{th}$ century.

Maternal impression beliefs come in two broad kinds. On the one hand, so-called 'maternal imagination' beliefs are those maternal impression beliefs where the cause of a fetus' defect is thought to be the experiences and imaginings of the pregnant women. On the other hand, what might be termed 'maternal action' beliefs are those beliefs where the cause of a fetus' defect is thought to be the action of the pregnant mother, either prenatally or, in some cases, postnatally.

In what follows, I defend two principal claims. First, disgust, and more precisely the radically promiscuous contamination aliefs that it generates, are important for explaining the occurrence of maternal impression beliefs. In the case of maternal imagination beliefs, one important causal route is as follows: Visual exposure of disgusting objects to pregnant women gives rise to contamination aliefs in pregnant women and third-party observers alike

that the pregnant mother and her fetus in turn are contaminated. Similarly, in the case of maternal action beliefs, one important causal route is as follows: Pregnant women's physical contact with disgusting objects or their performance of disgusting actions elicits disgust and contamination aliefs in third party observers that the pregnant mother and her fetus in turn are contaminated.[4] In each case, just as physical contact of a disgusting liquid is represented as contaminating the vessel that contains it in Rozin et al.'s (1986) studies, seeing or doing disgusting things are represented to contaminate the pregnant mother, and as she is the vessel for the fetus, the fetus itself.

In the following sub-sections, I lay out three lines of evidence for this claim: (a), the elicitors of disgust selectively correspond with the causes identified in maternal impression beliefs; (b), the logic of disgust corresponds with the logic of maternal impression beliefs; and (c), disgust elegantly explains the distribution and persistence of maternal impression beliefs. My argumentative strategy is inference to the best explanation: the best explanation of these lines of evidence collectively is that disgust, and the contamination aliefs that partly constitute it, is *important* for the generation of maternal impression beliefs. I stress from the outset, though, that I do not claim that disgust is involved in the generation of every instance of a maternal impression belief (see fn. 4).

The second claim that I defend is that, where a mechanism is invoked, one of the reasons that this typically involves fear and shock rather than disgust is because the norms governing true contamination discussed in §2 are not frequently satisfied in the context of maternal impressions.

### 3.1. The elicitors of disgust correspond with the elicitors of maternal impression beliefs

Maternal impression beliefs have two invariant contents, the causal event and the effect, and less commonly, the mediating mechanism and remedies for mitigating the effect of the maternal impression once it has occurred.

In this sub-section, I focus on the causes and effects identified in maternal imagination beliefs. I show that the main classes of elicitors of disgust selectively correspond with the causes of maternal imagination beliefs. Moreover, I show that in most cases of maternal imagination beliefs, there is a symmetry between the cause and effect, such that the effect of the maternal imagination event resembles the cause, and the effect is itself able to cause further maternal impressions.[5] This is consistent with the law of contagion, according to which the essence of a disgusting object is represented as being transferred to any object that comes into contact with it.[6] I reserve discussion of maternal

action beliefs, including their causes and effects, for the next subsection, as these beliefs are most economically used to illustrate the corresponding logic of maternal impression beliefs and disgust.

It is believed that while the functional outputs of the disgust system are invariant across cultures, the triggers of the disgust system can vary across cultures and epochs to some extent (e.g. Rozin et al., 2008, p. 763). In some cultures, for example, it is permissible to touch corpses during funerals where in others it is forbidden. Notwithstanding this variation, it has been shown that disgust is commonly elicited by the following: foods – particularly decaying or taboo foods; body products – such as mucus, urine, feces, blood (including menstrual blood), and vomit; 'low' animals (e.g. slugs, maggots, rats, snakes); inappropriate sex acts – including taboo practices; 'violations of the ideal bodily envelope' – including injury, gore, surgery, deformity, and even obesity; 'reminders of death' – including contact with dead humans or animals; 'poor hygiene' – including dirt and germs; and moral violations – including deliberate harms and displays of excess (see e.g. Curtis & Biran, 2001; Haidt et al., 1994; Olatunji et al., 2007; Tybur et al., 2009).

Setting aside food and inappropriate sexual actions, which are discussed in the context of maternal action beliefs, these elicitors are responsible for the great majority of causes and effects identified in maternal imagination beliefs.

In terms of cases of those elicitors of disgust that involve violation of the ideal bodily envelope or bodily products (especially blood): the sight of someone with physical deformities or injuries was believed to result in similar deformities or injuries in the unborn child. Roodenburg (1988, p. 710) cites the case of a women who gave birth to a deformed child after seeing a painting of a deformed child with two heads, three arms and four legs that was being paraded through the streets and shown for money. Indeed, in some countries such as Denmark and the US, "freak" shows were prohibited, as were deformed individuals from appearing in public, in order to prevent similarly deformed children from being born (e.g. Rublack, 1996, p. 96). Turner (1714, p. 116) reports the case of a woman giving birth to a child missing a hand after unexpectedly seeing the 'stump' of a beggar on her coach door while pregnant (similar cases are cited by, for example, Ballantyne, 1905, pp. 123 and 124; Roodenburg, 1988, p. 710; Rublack, 1996, p. 95). Fisher (1870, pp. 250, 251, and 265) cites a number of cases where it was believed that a woman gave birth to a child with a hare lip as a result of seeing someone with the same affliction. Roodenburg (1988, p. 710) cites two cases of women who gave birth to children with deformities after seeing the intestines and eyes of cats (who had been run over and beaten to death) hanging out. Christenbery (1911) reports that one of

his patients gave birth to a child with "his left thumb hanging to his hand by a thin pedicle of flesh" after dressing her son's thumb, which was nearly cut off, save for a shred of flesh (pp. 275–6). Dabney (1890, p. 202, citing Parker, 1886) reports the case of a woman who gave birth to a child with film-like abdominal walls after seeing a pig rip its belly open on a projecting fence. Fife (1976, p. 276) records a number of cases where witnessing injury was believed to result in fetal deformities: one woman believed that she had given birth to a child with a blood tumor on its face after witnessing a man hit his wife with the blunt end of a hatchet.

In terms of hygiene- and disease-based elicitors of disgust: in addition to those cases where the cause of the maternal imagination event is a deformity that has been caused by disease, the experience of decay or disease was thought to give rise to fetal conditions resembling these in some way, or indeed, the disease itself in the case of the latter. Pomponazzi (1556/1930, p. 149) records that seeing someone with leprosy was thought to give rise to a child with leprosy. Bondeson (1997, p. 160) notes that epilepsy in children was widely thought to be caused by the pregnant mother witnessing slaughtered animals falling to the floor. Roodenburg (1988, p. 701) and Rublack (1996, p. 96) note that seeing a 'lunatic' or epileptic seizure was believed to lead to the birth of a 'lunatic' or deformed child respectively. Bates (2005, p. 121) cites the case of a women who was believed to have given birth to a child with deformities of the abdomen after seeing the bloated carcass of a horse (see also reminders of death, below). Indeed, Michael de Montaigne (1574/1842, p. 38) argued in favor of the maternal imagination theory of teratology partly on the grounds that it was but a short step from the fact (as it was believed to be in 16$^{th}$ century France) that diseases were transmitted through visual contact.

In terms of animal reminder elicitors of disgust: in addition to the mixed elicitors involving animals along with another kind of elicitor described above, seeing the lower animals that tend to elicit disgust during pregnancy was widely believed to give rise to deformities or marks resembling the animal in question. Roodenburg (1988) notes that seeing apes was thought to give rise to "rough and hairy" children, and that seeing mice and rats was believed to result in the benign hairy nevus (a congenital skin tumor) or other mark (p. 710; see also Ballantyne, 1905, pp. 107–8, 117). Fisher (1870, pp. 246–7) reports that seeing a snake was believed to result in a child with staring eyes and a flickering tongue or snake-shaped birthmark. Ballantyne (1905, p. 110) records the widespread belief that looking at a hare was believed to result in a cleft palate and other deformities, and elsewhere (1891, p. 629) reports a case where the sight of a dead frog was believed to give rise to an

Table 1. The putative causes of maternal impressions, from Dabney (1890).

| Type of object | % | Examples |
|---|---|---|
| Deformities (congenital or acquired) and phenotypic irregularities in others | 38 | Seeing cleft palate, and missing fingers, arms and legs |
| Injury or mutilation to another | 22.8 | Dressing wounds, seeing limbs amputated, witnessing an injury or surgery |
| Injury to self | 6.5 | Burns, piercings, being touched in a firm manner |
| Interaction with low animal | 5.4 | Interactions with rats and rabbits |
| Interaction with non-low animal | 5.4 | Interactions with monkeys and domesticated animals (often threat-based) |
| Disease to another | 3.3 | Seeing someone with 'cancer between eyes' |
| Interaction with dead body | 1.1 | Seeing dead body |
| Other | 4.3 | Seeing personification of devil, prisoner shackled in prison, bald head. |
| No indication of object believed to cause impression | 13 | 'Impression,' 'slight shock' |

anencephalic fetus. Wilson (2002, p. 2) reports the case of a woman giving birth to a child with a leech-shaped blemish after seeing a leech.

In terms of elicitors of disgust that involve reminders of death: a pregnant mother's experience of death was thought to mark the unborn fetus, sometimes in a way which resembles the death in some manner. Rublack (1996, p. 104) notes that the sight of an executed body was believed to cause the birth of sickly and pale children; and Ballantyne (1892, pp. 1029–30) records that the sight of a dead body was thought to mark the baby in some manner.[7] Clapperton (1875, p. 169) cites the case of a mother who witnessed the autopsy of her son, including the removal of his brain, and gave birth to a child with anencephaly.

How common are the different causes of maternal impression and imagination phenomena? One convenient way of establishing this is to examine a sample of reported cases. Dabney's survey of 90 cases of maternal impression phenomena reported in medical journals from 1850–1886 (selected because the reports were detailed and 'credible'[8]) shows that, of the 80 causal events reported in these cases, interacting with deformities and cases of injury or mutilation in some manner accounted for 70% of cases, and the paradigmatic elicitors of disgust (including deformities, injury to others, interactions with low animals, disease in others, and interactions with death) accounted for 81.3% of reported causes (summarized in Table 1).

### 3.2. The logic of disgust corresponds with the logic of maternal impressions

In this sub-section, I focus on the logic that structures maternal impression beliefs, including the conditions under which maternal impressions were believed to arise, and the way in which they were believed to be remedied. I show that the logic of disgust corresponds with the logic of maternal impression beliefs.

In addition to the selective correspondence between the types of elicitors of disgust and causes of maternal impressions, further evidence for the connection between disgust and maternal impression beliefs lies in the fact that the causes of maternal impression beliefs tend to be sensitive to a self-other distinction that is similar to the one present in disgust.

In performing its function of guarding the boundaries of the self, disgust draws a (crude) distinction between self and other, which it uses to determine the potency of the common elicitors of disgust. A glob of my own mucus is ineffective at disgusting me compared with an otherwise identical glob of mucus that belongs to another; and even among things that belong to me, in determining whether something is self or other my disgust system is sensitive to whether the object is physically attached to me, along with its capacity to cross the thresholds of my body (e.g. Miller, 2004). The clean hair on my head does not disgust me, but the self-same hair in my dinner would to some extent. Just as one would expect if disgust were central to the ontogeny of maternal impression beliefs, maternal impression beliefs often tend to be sensitive to a similar self-other distinction. The pregnant women's experience of seeing injuries to others was commonly believed to result in fetal deformities, but the experience of seeing injuries to her own body was not similarly believed to cause deformities in her offspring (Bondeson, 1997, p. 157; note also the low number of cases where injury to the self is identified as the cause in Table 1, especially relative to the likely frequency of such events).

As laid out in §1, studies of contamination thinking have principally focused on physical contact – no doubt as contamination paradigmatically involves such contact – and have indeed demonstrated that chains of contamination can occur via intermediaries. Given this, if disgust is indeed important for generating maternal impression beliefs, we would expect maternal impressions to occur by physical contact – between the disgusting objects and the pregnant women, and between the pregnant woman and the fetus.

Evidence of this is provided by maternal action beliefs, which, furthermore, feature the same correspondences between the causes and effects posited and the elicitors of disgust. Indeed, many of the cases discussed below show that the remaining classes of disgust elicitors not discussed in the context of maternal imagination beliefs in §3.1. specifically correspond with some of the causes of maternal action beliefs.

In the case of touch-based maternal action beliefs: physical contact of a pregnant woman with a range of elicitors of disgust including death, low animals, and disease has been thought to lead to deformities resembling these elicitors in the unborn children. Fife (1976, pp. 276–7) records that it was believed that nursing deformed individuals was thought to result in a child who was similarly deformed, touching corpses was thought to result in

a child who was pale and sickly, touching warm meat after having just killed an animal was thought to risk the viability of the fetus, and being touched by a snake was thought to result in a child with scaly skin and a flicking tongue. Ballantyne (1905, p. 117, citing Van Swieten, 1743) and Fife (1976, p. 276) note that consuming hares was widely thought to result in a cleft palate, touching pigs was believed to result in a child who grunts through its nose, and being touched by a caterpillar or mouse was thought to result in a birthmark resembling a caterpillar or mouse respectively. Paré (1982/1573, p. 42) reports a case where a pregnant woman who held a frog (until dead) was believed to have given birth to a child with cranial deformities resembling frogs as a result. Ballantyne (1891, pp. 629–30) cites cases where being touched by a deformed 'beggar' was believed to have resulted in similar deformities in a child. Maubray (1724, p. 62) points out that it was considered wrong for pregnant women to touch, kiss, hug, or carry in their laps or bosoms, squirrels, dogs, apes and the like, and Boucé (1987) points out that this prohibition seemed to stem from a "repulsion for a quasi-diabolical familiarity with unclean beasts" (p. 93).

Indeed, the transference logic of contamination – and the idea that there can be chains of contamination through intermediaries – is explicit in both some of the mechanisms that were thought to give rise to maternal impressions and those that were believed to remedy maternal impressions. Where a pregnant woman experiences an offensive object or has an excessive longing, it was believed that if she touched some part of her body, the child would have a birthmark depicting that object on the corresponding body part (Bondeson, 1997, p. 160; Ballantyne, 1905, p. 109; Fife, 1976, p. 279). Shaw (1981, p. 241) notes that it was believed that a woman would be likely to have a child with birthmarks on the face if she witnessed an animal being slaughtered while touching her own face. In the case of the latter, Boucé (1987, p. 93) notes that it was commonly believed that a pregnant mother who is impressed through touch was advised to transfer the mark to a more discreet location by wiping the affected part and touching another part.

In the case of maternal action beliefs where the pregnant mother is herself the source of the impression, a range of elicitors of disgust – including sociomoral violations, sexual activity and bodily products – were thought to result in defects resembling these elicitors in her offspring. Bondeson (1997, pp. 160–1) notes that it was thought that a pregnant woman urinating in a churchyard would make her child a bed wetter, stealing would result in a thief, and spilling beer on her clothes would give rise to an alcoholic. Roodenburg (1988) reports that coitus during menstruation was thought to result in a deformed child and that acting "like beasts" in only being interested in the pleasures of the flesh or having intercourse in "deviant" or "unseemly" ways would produce diseased, leprous or deformed children (p. 707; see also, Bondeson, 1997, pp. 164–5). Indeed, Fife (1976, p. 282)

notes that it was believed that merely having intercourse during pregnancy would result in moles on the children – one for every episode of intercourse. Bates (2005, p. 121, citing Fenton, 1569) notes that excessive or "filthy" cravings (such as for food) were believed to result in a baby with a birth mark resembling the objects of those desires or a deformed child (see also Bondeson, 1997, p. 165). In a case that clearly illustrates the idea that the cause of the transference was represented to occur through physical contact of the mother with her child, immoral characteristics were believed to be able to be transferred to a baby through breast-feeding – so-called lactational heredity (Bondeson, 1997, p. 165).

Setting aside the fact that maternal impression beliefs observe a similar self-other distinction to the one that is in operation in disgust, and that maternal impressions are believed to occur via the modality that is paradigmatic of contamination – touch – the hand of disgust is also clearly discernible in the logic of how to remedy impression events in some maternal impression beliefs.

As would be expected if disgust were important in the ontogeny of maternal impression beliefs, some of the methods of coping with the effects of offensive sights involve the same methods that are used to deal with contamination by physical contact with disgusting objects. As we have seen, disgust involves the action tendencies to withdraw from the offending object and purify ourselves. Oldenburg (1672, p. 5000, citing Swammerdam 1672), for example, discusses the case of a woman who, upon seeing a black man, washed her body to prevent her child from becoming black (and believed that the parts of her child that turned out to be pigmented were the parts that she had missed).[9] Indeed, practices of dealing with deformed children more generally manifest the link with disgust: among certain rural communities of the Indian subcontinent, families who beget deformed children are subject to purifying rituals (Shaw, 1981, p. 237, citing Dehragoda, 1978).

### 3.4. Disgust explains the distribution and robustness of maternal impression beliefs

In this sub-section, I turn away from the content of maternal impression beliefs to examine their distribution. Having noted that maternal impression beliefs have proved surprisingly resistant to rational deflation, and that they are culturally universal yet vary between individuals within cultures in systemic ways, I argue that an account of their ontogeny featuring disgust is able to elegantly accommodate this state of affairs.

The doctrine of maternal impression has consistency appeared across cultures and epochs. Maternal impression beliefs occur with surprising regularity of form in (at least) Scandinavian, German, English, South American, North American, Indian, Chinese, Japanese, Eskimo, and

African folklores, and the theory was discussed extensively in the scientific communities of the Netherlands, France, England, the US, and Italy (Bondeson, 1997, pp. 145, 160, 164; Ballantyne, 1905, pp. 105–6; Wilson, 1992, p. 83). As Ballantyne (1905) notes "it may safely be postulated that the belief in the potency of maternal impressions has a geographical distribution corresponding with that of the human race, whilst in the matter of antiquity is coeval with it" (p. 106). Indeed, in light of the fact that maternal imagination beliefs seem to have appeared independently in a number of peoples who are widely separated geographically and culturally, Warkany (1971, pp. 12–13) suggests that such beliefs are innate.

Maternal impression beliefs have also proved to be surprisingly resistant to rational deflation. A number of compelling objections to the idea that pregnant women are able to make impressions on their unborn children through their experiences and actions were raised by natural philosophers and physicians in the 17th, 18th and 19th centuries, even before the acceptance of germ theory and modern scientific understanding of the causes of congenital disorders (see e.g. Lee, 1875, p. 167 for a pithy summary). Among the most decisive are the objections that often only one twin is deformed; and that experiences of causes are much more common than the deformities they were thought to bring about. Fisher (1870, p. 263) puts the latter objection vividly when he notes that "objects disgusting and shocking to behold, distorted cripples, hunchbacks, the eyeless and noseless, the armless and legless, those with great tumors, ulcers and horrid cancers, or covered with frightful scars or leprous scales, annually meet the sensitive sight of pregnant women at all stages of gestation, in all populous cities and towns" and that if these experiences did result in deformities, then after thousands of years of accumulated deformities, a great many more of us would be deformed by now.

Despite absurdities in the theory such as these, the maternal impression theory continued to survive, with Ballantyne (1896, p. 309) noting that 143 articles on the theory appeared in American medical journals between 1839 and 1896 alone – with many asserting their belief in the veracity of maternal impressions even if they could not conceive of a plausible *modus operandi* for them. Indeed, there is evidence that maternal impression beliefs may have persisted amongst some of the folk in the West until recently. Shaw (1981, p. 242), for example, noted that a minority of women endorsed maternal impression beliefs about nevi flammeus, with some reporting that it is caused by contact of the mother with blood during pregnancy.

The disgust-based theory is well placed to explain the ubiquity of maternal impression beliefs, their similarity of content, as well as their resistance to rational deflation across cultures and epochs. As we have seen, disgust is a basic emotion. As a basic emotion, the operation of disgust is to an interesting extent modular (Charland, 1996): it is triggered automatically in the

face of its elicitors, and its internal operation is unaffected by the deliverances of reason. Indeed, in the specific case of disgust, part of the internal operation of disgust involves the generation of contamination aliefs.

In light of these features of disgust, a disgust-based theory of maternal impressions predicts that contamination aliefs will arise in response to the universal elicitors of disgust – such as disease, decay and socio-moral transgressions – in an automatic and mandatory manner in people across cultures, and that the occurrence of these representations will be unaffected by people's beliefs (cf the discussion of contamination-related OCD in §2).

Notwithstanding the cultural universality of maternal impression beliefs, there also seems to be systematic variation in which kind of maternal impression beliefs tend to arise within a population and when. On the one hand, maternal *imagination* beliefs seem most common in the first trimester of pregnancy, and many maternal *action* beliefs seem to have arisen in third-party observers – and principally men – rather than the pregnant women themselves. An explanation of maternal impressions involving disgust is capacious enough to accommodate this variation, in addition to the universality of maternal impressions.

First, Bondeson (1997, pp. 167–8) notes that the majority of the tracts on maternal impressions were written by men, who "often emphasized the spiritual inferiority of womankind and the danger that woman's perverted cravings and emotions during pregnancy could wantonly alter the shape of the foetus conceived in perfection by the man." Similarly, Roodenburg (1988, p. 707) notes that some of the beliefs about socio-moral violations arise from the moralization of sex by doctors and moralists, rather than the experiences of pregnant women.

Cravings as well as actions such as urinating in a churchyard, copulation, and stealing will tend to give rise to disgust in people *other* than the pregnant woman concerned, at least where these actions are appraised as excessive, immoral or impure, but are unlikely to disgust, and therefore give rise to contamination representations in, pregnant women themselves. As such, on a disgust-based explanation of maternal impressions, it is no surprise that maternal impression representations where the causal event is one of the pregnant mother's actions or one of her cravings seem to be more likely to have arisen in people other than the pregnant woman herself.

Second, it was believed that maternal imagination impressions tend to occur early in a pregnancy (see e.g. Clapperton, 1875, p. 169). In his analysis of 135 cases of alleged maternal imagination events recorded in medical journals and monographs, Stevenson (1992) found that in 80 the impressing stimulus was reported as occurring in the first trimester, versus 20 and 13 in the second and third trimester respectively. Similarly, Dabney (1890) assessed 90 cases reported in medical journals between 1850–1886, and

found that 56 of the maternal impressions occurred in the first trimester, versus 13 and 3 in the second and third trimester respectively.

An explanation involving disgust is well placed to accommodate this distribution. Pregnant women become more disgust sensitive in their first trimester, perhaps in order to compensate for the immune suppression that is required to successfully carry a baby – so-called compensatory behavioral prophylaxis (Fessler et al., 2005).[10] As such, pregnant women in their first trimester will be more likely to be disgusted by the relevant sights and alief that they, and their fetuses in turn, have been contaminated.

## 4. Why was fear, rather than disgust, believed to mediate maternal impressions? And, what's the best explanation of maternal impression beliefs?

In this final section, I turn to explain why fear, rather than disgust, was commonly postulated as the mediating mechanism for maternal impressions. For this, I suggest that the distinction between contamination aliefs and beliefs in the cognitive contamination system is important, and that the case of maternal impressions provides evidence of this architecture in turn. Furthermore, I show why the fear-based explanation and other domain general explanations are poorer explanations of the explananda outlined in §3.

It was commonly believed that maternal impressions were caused by the state of fright (see e.g. Wilson, 2002, p. 2, 1992, p. 65). The elephant man John Merrick, for example, believed that his deformities were caused by his mother being frightened by a parading elephant at a fair (Wilson, 2002, p. 14).

There are three plausible reasons why "fright," rather than revulsion, was most regularly invoked as the cause. Firstly, "fright" would have seemed to offer a more plausible explanation according to early modern biology at least. As arousing emotions, fear and surprise were thought to be able to literally move the "animal spirits" ("nervous fluid" and blood), and as a result cause violence to the impressionable fetus (Turner, 1714, as cited in Wilson, 1992, pp. 67–8, see also, 1992, pp. 72–3). Malebranche (1674/1997), for example, thought that a pregnant woman's experience of seeing someone's bones broken on the rack caused her animal spirits to become animated and break her unborn son's bones in the same places and "deprived [him] of sense" (p. 115).[11]

Second, the mechanism suggested by disgust – namely contamination – was unlikely to be believed even if, as I argue here, it was alieved. As I have argued in §1, contamination beliefs are rationally constrained by the following requirements: for the ostensible source of the contamination to actually be contaminating, for the recipient of the contamination to be sensitive to

the source, and for there to be contact between the recipient and source. In the case of maternal impressions, the first two constraints are likely to have often been satisfied, but the third was not. In the case of the sensitivity constraint, for example, the malleability of the fetus compared to the pregnant mother was invoked to justify why maternal impressions did not affect them similarly (e.g. Turner, 1714, p. 120, and Malbranche; Malebranche, 1674/1997, pp. 115–6). Indeed, it is suggestive that in one of the few explanations of maternal impressions in which the (usually unsatisfied) norm requiring physical contact was believed to be satisfied, disgust and contamination is clearly invoked. Quillet (1656/1872) posits that "filthy atoms" flow from ugly objects through the perceiver's "pores" and "descend" on the womb to make the fetus grow "foully" (p. 63).

A third reason why fright might have been believed to be the cause of maternal impressions is that the causes of maternal impression beliefs are likely to have elicited disgust *and fear* – since fear and disgust regularly co-occur (Woody & Teachman, 2000) – and fear and disgust can be difficult to accurately name as such, or distinguish from one another due to our relatively poor introspective acuity.

Arachnophobia provides a clear example of this. Prior to 1990, it was largely thought that the response that underlay the aversion to spiders was fear or anxiety. Early investigations of the aversion asked people to self-report the extent to which they felt "frightened" by spiders (e.g. Bennett-Levy & Marteau, 1984), people commonly reported feeling "frightened" when asked to specify the affective nature of their aversion in an unstructured manner (e.g. Cornelius & Averill, 1983), and prominent early theories of this aversion posited that we are pre-prepared to *fear* such animals because we evolved from mammals who would have been *preyed upon* by these animals (e.g. Öhman, 1986) – where predation is perhaps *the* paradigmatic kind of threat that fear evolved in response to. But, beginning in the late 1980s and early 1990s, a range of evidence which did not rely on people's awareness, or classification, of their own emotional state emerged which suggested that the response underlying the aversion to spiders was at least as much, if not more, based on disgust. To mention a few pieces of such evidence: Arachnophobes respond to spiders with the disgust facial expression (e.g. Vernon & Berenbaum, 2002), and represent them as contaminating (e.g. Mulkens et al., 1996).

Notwithstanding the fact that fear may have accompanied some ostensible maternal impression events, and was appealed to in order to justify maternal impression beliefs generally, it is unlikely that fear is causally responsible for many maternal impression beliefs. Firstly, the majority of the causes identified in maternal impression beliefs are elicitors of disgust and not fear. To give just a few examples: the sight of congenital deformities, bodily injuries to others and the moralization of the 'excessive' desires of

women (with the attendant idea that they express a woman's animal nature) clearly point to disgust rather than fear. Nor does it seem likely that handling dead meat, caressing animals, or stealing cause fear, but these activities seem apt to cause disgust in a pregnant woman or observer. In all of these cases, the threat posed to the pregnant woman and her fetus is not of bodily injury from the outside (as fear is apt to respond to), but rather of contagion and damage from the inside (as disgust is apt to respond to).

Second, setting aside fear's inability to account for the range of causal events specified in maternal impression beliefs, a fear-based account cannot explain the other explananda discussed in §3, concerning the logic, distribution, and persistence of maternal impression beliefs. For example, a fear-based explanation cannot explain why the causes and effects are represented to be symmetrical – the experience of seeing a one-armed 'beggar' was believed to produce a one-armed fetus, rather than a fetus that has been injured in an indiscriminate manner by the animal spirits becoming agitated, as would be expected if fear – and beliefs about its effect – played a role in generating such beliefs. Nor can a fear-based explanation account for the self-other asymmetry we see in maternal impression beliefs. As we have seen, the sight of injuries to a pregnant woman's own body did not tend to lead to maternal impression beliefs, but this is the opposite of what would be predicted on a fear-based account, since such injuries are apt to cause fear. Furthermore, fear cannot make sense of the mechanisms that were believed to deal with exposure to the causal events specified in maternal impression beliefs: washing and wiping are not effective means of dealing with the kind of threat that is posed by fearsome objects. Finally, even though fear is, like disgust, a basic emotion, and so operates in an automatic and mandatory manner, it is not thought to give rise to any cognitive representations that could satisfactorily explain the occurrence of maternal impression beliefs. As such, it is difficult to see how a fear-based explanation of maternal impression beliefs could so elegantly and convincingly explain why maternal impression beliefs have occurred across cultures and epochs, and have proved so resistant to rational deflation.

Many of the same reasons explain why an explanation of maternal impression beliefs involving disgust is preferable to domain-general explanations. It might be argued that maternal impression beliefs are a product of the magical law of similarity, which is thought to be one form of the representativeness heuristic (Kahneman et al., 1982). On this explanation, deformed children resemble deformed adults, and so by the law of similarity it is wrongly inferred that there must be some deeper connection between them in reality. There is some plausibility to this suggestion. It has been shown that magical thinking – such as thinking in accordance with the laws of contagion and similarity – is more likely where control is desired and elusive (Gmelch, 1971), as

surely applies in the case of pregnancy. However, since thoughts about disgusting things also obey the law of similarity (e.g. Rozin & Nemeroff, 1990), evidence for an explanation of maternal impressions beliefs based on similarity is also *ipso facto* evidence for a disgust-based explanation. As such, maternal impression beliefs may in fact be overdetermined: they may arise from both the similarity and contagion functions that disgust operates according to. Importantly though, only an explanation featuring disgust is able to accommodate the other explananda, such as the methods of purification and the self-other logic specified in some maternal impression beliefs.

It might also be proposed that maternal impression phenomena might be explained in terms of the effects of negative affect generally, such as attentional capture, rather than disgust-specific effects, in line with psychological explanations of urban legends (e.g. Fessler et al., 2014; Eriksson & Coultas, 2014) and blood-letting practices (Miton et al., 2015).

Miton et al. (2015), for example, support the idea that disgust, and specifically the attentional-capture it involves, might help to explain the wide distribution of blood-letting practices by showing that stories involving blood-letting as a treatment were more likely to be robustly transmitted in an experiment than stories involving control treatments. While it is likely that some features of negative emotions generally – such as the way that they capture attention – have played a role in the persistence and distribution of maternal impression beliefs, such features underdetermine the content of maternal impression beliefs: attending to and remembering the sight of something that elicits a negative emotion is clearly insufficient for representing that experience as affecting an unborn child in an analogous manner. This central feature, together with, for example, the overrepresentation of disgust elicitors as causes and purification logic, suggests that disgust, and the specific contamination representations it generates, need to be a part of an adequate explanation of maternal impressions.[12]

## 5. Conclusion

In discussions of disgust and contamination thinking, insufficient attention has been paid to the architecture of the contamination thinking system. The occurrence of maternal impression beliefs provides an opportunity to evidence the architecture of the contamination system, and importantly, the *radical promiscuity* of contamination aliefs, and the constraints that contamination norms impose on contamination beliefs. In turn, the account of the contamination system advanced here helps to provide a unified account of the maternal impression theory of teratology, and further clearly demonstrates

how our beliefs, including our scientific beliefs, can be damaged – indeed *polluted* in this case – by our emotions and the cognitive heuristics they support.[13]

## Notes

1. In the following, I largely assume that maternal impression beliefs are false, and therefore to be *explained away*. It is important to be clear from the outset that I do not wish to suggest that the idea that a pregnant mother's experiences can affect the development of her unborn child is *entirely* false. A growing number of studies have shown that a mother's prenatal emotions, and in particular anxiety, can affect her child's brain development and their chances of developing psychopathy (see e.g. O'Donnell et al., 2014). In principle, experiences of disgust might be among the kinds of maternal emotional experiences that could contribute to such pathologies, perhaps particularly to the extent that disgust proneness is linked to anxiety disorders. Notwithstanding this, I assume that maternal impression beliefs – such as those where deformities are caused by single experiences of similar deformities – are clearly false (even if common) and warrant a deflationary explanation. One of my tasks in this article is to provide just such an epidemiology of these beliefs.
2. For a discussion of whether alief can be distinguished from other proposed constructs, such as implicit beliefs, see e.g. Mandelbaum (2013).
3. To return to the discussion of contamination through physical contact with morally disgusting objects (see the discussion of Tapp and Occhipinti, 2016; Rozin, Markwith et al., 1994, above), the cognitive architecture of the contamination system proposed here may also help to cast light on some aspects of the findings that have been proposed to count *against* moral contamination. Kupfer and Giner-Sorolla (2017, reported in Giner-Sorolla et al., 2018; Kupfer & Giner-Sorolla, 2021) found that participants asked to imagine wearing a Nazi armband would prefer to wear the armband under, rather than over, their clothes, and that the majority offered reputation-based reasons for their choice over contamination-based reasons (with 60% of participants responding "not at all" for the latter). One reason for the latter result might be that in asking for *reasons*, which are what participants are willing to rationally assent to, the norms of contamination would have needed to be satisfied for participants to offer contamination-based reasons. Many participants may have found it difficult to rationally endorse the idea that there are such things as 'evil essences' let alone *contaminating* evil essences. And since participants would already imagine touching the armband in putting it on (in either configuration), and contamination is dose-insensitive, it is not clear that differences in choice of armband location would be sensitive to contamination aliefs.
4. It is important to stress that maternal impression beliefs are multiply realizable. Another important causal pathway from disgust to both maternal imagination and maternal action beliefs is likely to be as follows: Visual exposure to newborn children with deformities, diseases and unsightly marks elicits disgust, and contamination aliefs in third party observers, which are reverse engineered into maternal impression beliefs. This is similar to Blondel's (1727) claim that maternal imagination beliefs are the product of the informal fallacy of *ad hoc, ergo propter hoc*. The mere fact that the maternal imagining or action preceded the birth does not, however, seem likely to be sufficient to explain the phenomenon of maternal impression beliefs: as cognitive heuristics that are deployed automatically, contamination aliefs are likely to play an

important role in structuring the beliefs in terms of biasing us toward certain candidate causes and mechanisms. Notwithstanding this, I should not be understood to be defending the claim that a disgust-based mechanism is directly involved in generating *all* maternal imagination beliefs: cultural belief systems such as maternal impression beliefs are subject to processes of elaboration, transmission and justification (see §4), and as such, there are likely to be some causal pathways to generating maternal impression beliefs that do not involve disgust.

5. There does not need to be an effect on the fetus for representations of fetal contamination to occur. This is evident in some arguments that were marshaled by 19th century scientists arguing against the truth of the maternal impression theory: Fisher (1870, p. 263) notes the cases of two pregnant women who exposed themselves to causes of maternal impressions – one by feeding a pig with one leg during pregnancy, and the other by looking at and touching a toad while pregnant – who were pleasantly surprised to give rise to non-marked and non-deformed children.
6. Two of the main ways of conceptualizing what exactly is represented as being transferred in contamination aliefs are that it is mere disgustingness or contaminatingness, or that it is the specific disgusting entity or property that is the source contaminant in a given case – say, the essence of leprosy in the case of alieving contamination when making contact with someone with leprosy. Only the latter implies that the exact causes and effects will be *alieved* as being symmetrical. Discussions of this issue in the literature are not clear as to which conceptualization is preferred. Nemeroff and Rozin (1994), for example, variously characterize the representation of contagion as representing the "transfer of some or all [of the contaminating object's] properties" or the transfer of "some as yet undefined contagious entity" (p. 159). This issue awaits determination, but the existing empirical evidence (such as it is), suggests that contamination aliefs may be conceptually bare, and tend to be cognitively elaborated into contamination beliefs according to an individual's standing concepts. Hejmadi et al. (2004) found evidence that younger children conceive of contamination in terms of a "spiritual" essence, and that material conceptualizations emerge during development. In their work on conceptions of contamination in adulthood – which likely reflect contamination *beliefs* – Nemeroff and Rozin (1994) found evidence that people tend to conceptualize different kinds of contaminants according to different mental models, including a germ model, a physical residue model, and a spiritual essence model.
7. Indeed, for this reason, Rublack notes that gallows were moved out of the center of some settlements (1996, p. 104).
8. For this reason, this sample may over-represent more easily evidenced putative causes.
9. Members of racial minorities would likely have been a source of disgust in the 17th century across Europe (see e.g. Thornhill & Fincher, 2014).
10. The emerging picture of the relationship between disgust sensitivity and pregnancy is complex. In early articulations of the compensatory behavioral prophylaxis hypothesis, it was proposed that disgust sensitivity increases in the first trimester (i.e. behavioral prophylaxis) due to increases in progesterone during that same period, as progesterone has been shown to be involved in dampening the inflammatory immune system, which is thought to function to prevent rejection of the paternal genetic information (e.g. Fessler et al., 2005; Fleischman & Fessler, 2011). However, recently Jones et al. (2018a) did not find that disgust sensitivity (as measured by Tybur et al.'s (2009) Three Domain Disgust Scale) tracks changing levels of progesterone over the course of the menstrual cycles of a large sample of women. It is now thought

that self-report measures of disgust sensitivity may not be sensitive enough to detect changes, that progesterone may not be the mediating mechanism, and that other measures of immunocompetence – such as whether someone has had a recent infection – may be better placed to provide evidence for the compensatory behavioral prophylaxis hypothesis (Fleischman & Fessler, 2018; Jones et al., 2018b). Indeed, recent evidence supports some of these ideas: Milkowska et al. (2019) found that disgust sensitivity in the pathogen domain was higher for women whose immune systems were compromised by high levels of progesterone *and* a recent infection.

11. In discussions of maternal impressions in the 19th century medical literature, it was thought that maternal impressions might affect the development of the fetus through the blood – either through "agitation" of the blood or by disturbing fetal nutrition – rather than through the nerves, as it was known at this time that the nervous systems of the fetus and mother were not connected (see e.g. Lee, 1875). Another popular explanation in the 19th century medical literature was that maternal fright somehow arrested development in an early phase (see e.g. Clapperton, 1875, p. 169).
12. Interestingly, even advocates of such explanations tend to recognize that these features underdetermine the target phenomena (or at least certain features of it). After attributing the original occurrences of blood-letting beliefs to the incidental co-occurrence of an ill person injuring themselves by accident and recovering shortly afterwards, Miton et al. (2015) propose that the beliefs might result from the naïve biological view that good and bad things going in and out of the body strongly influences health, combined with the idea that blood-letting is getting rid of something "bad" that needs to be rejected, which arises from feelings of disgust toward blood.
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## References

Ballantyne, J. W. (1891). Maternal Impressions. *Edinburgh Medical Journal*, *36*(7), 616–624.

Ballantyne, J. W. (1892). A series of thirteen cases of alleged maternal impression. *Edinburgh Medical Journal*, *37*(11), 1021–1024.

Ballantyne, J. W. (1896). Teratogenesis: An inquiry into the causes of monstrosities. *Edinburgh Medical Journal*, *42*(1), 1–12.

Ballantyne, J. W. (1905). *Manual of antenatal pathology and hygiene: The embryo*. William Wood & Co.

Bates, A. W. (2005). *Emblematic Monsters: Unnatural Conceptions and Deformed Births in Early Modern Europe*. Editions B. V. Rodopi

Bennett-Levy, J., & Marteau, T. (1984). Fear of animals: What is prepared? *British Journal of Psychology*, *75*(1), 37–42. https://doi.org/10.1111/j.2044-8295.1984.tb02787.x

Blondel, J. (1727). *The Strength of the Imagination in Pregnant Women Examined*. J Peele.

Bondeson, J. (1997). *A Cabinet of Medical Curiosities*. Cornell University Press.
Boucé, P. G. (1987). Imagination, pregnant women and monsters in eighteenth-century England and France. In G. S. Rousseau & R. Porter (Eds.), *Sexual underworlds of the enlightenment* (pp. 86–100). Manchester University Press.
Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In Bad Taste: Evidence for the oral origins of moral disgust. *Science*, *323*(5918), 1222–1226. https://doi.org/10.1126/science.1165565
Charland, L. S. (1996). Feeling and Representing: Computational theory and the modularity of affect. *Synthese*, *105*(3), 273–301. https://doi.org/10.1007/BF01063560
Christenbery, H. E. (1911). Maternal Impressions. *Journal of the Tennessee State Medical Association*, *3*(10), 274–277.
Cisler, J. M., Olatunji, B. O., & Lohr, J. M. (2009). Disgust, fear, and the anxiety disorders: A critical review. *Clinical Psychology Review*, *29*(1), 34–46. https://doi.org/10.1016/j.cpr.2008.09.007
Clapperton, J. (1875). Maternal Impressions. *The British Medical Journal*, *1*(736), 169–170. https://doi.org/10.1136/bmj.1.736.169
Cornelius, R. R., & Averill, J. R. (1983). Sex differences in fear of spiders. *Journal of Personality and Social Psychology*, *45*(2), 377–383. https://doi.org/10.1037/0022-3514.45.2.377
Curtis, V., & Biran, A. (2001). Dirt, Disgust & Disease: Is Hygiene in our Genes? *Perspectives in Biology and Medicine*, *44*(1), 17–31. https://doi.org/10.1353/pbm.2001.0001
Dabney, W. C. (1890). Maternal Impressions. In J. M. Keating (Ed.), *Cyclopaedia of the Diseases of Children: Medical and Surgical* (Vol. I, pp. 191–216). J.B. Tippincott Company.
Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behavior Research & Therapy*, *45*(9), 2110–2120. https://doi.org/10.1016/j.brat.2007.03.008
Doran, R. P. (In press). Ugliness is in the Gut of the Beholder. *Ergo: An Open-Access Journal of Philosophy*.
Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, *17*(2), 124–129. https://doi.org/10.1037/h0030377
Eriksson, K., & Coultas, J. C. (2014). Corpses, Maggots, Poodles and Rats: Emotional Selection Operating in Three Phases of Cultural Transmission of Urban Legends. *Journal of Cognition and Culture*, *14*(1–2), 1–26. https://doi.org/10.1163/15685373-12342107
Fairbrother, N., Newth, S., & Rachman, S. (2005). Mental pollution. *Behavior Research & Therapy*, *42*(2), 173–189. https://doi.org/10.1016/S0005-7967(03)00108-6
Fessler, D., Eng, S. J., & Navarrete, C. D. (2005). Elevated Disgust Sensitivity in the First Trimester of Pregnancy. *Evolution & Human Behavior*, *26*(4), 344–351. https://doi.org/10.1016/j.evolhumbehav.2004.12.001
Fessler, D. M. T., Pisor, A. C., & Navarrete, C. D. (2014). Negatively-Biased Credulity and the Cultural Evolution of Beliefs. *PLoS ONE*, *9*(4), e95167. https://doi.org/10.1371/journal.pone.0095167
Fife, A. E. (1976). Birthmarks and Psychic Imprinting of Babies in Utah Folk Medicine. In W. D. Hand (Ed.), *American Folk Medicine: A Symposium* (pp. 273–283). University of California Press.
Fisher, G. J. (1870). Does maternal mental influence have any constructive or destructive power in the production of malformations or monstrosities at any stage of embryonic development? *American Journal of Insanity*, *26*, 241–295.

Fleischman, D. S., & Fessler, D. M. T. (2011). Progesterone's effects on the psychology of disease avoidance. *Hormones and Behavior*, *59*(2), 271–275. https://doi.org/10.1016/j.yhbeh.2010.11.014

Fleischman, D. S., & Fessler, D. M. T. (2018). Response to "Hormonal Correlates of Pathogen Disgust". *Evolution and Human Behavior*, *39*(4), 468–469. https://doi.org/10.1016/j.evolhumbehav.2018.03.006

Gendler, T. S. (2008). Alief and Belief. *The Journal of Philosophy*, *105*(10), 634–663. https://doi.org/10.5840/jphil20081051025

Gibbs, N. A. (1996). Nonclinical populations in research on obsessive-compulsive disorder: A critical review. *Clinical Psychology Review*, *16*(8), 729–773. https://doi.org/10.1016/S0272-7358(96)00043-8

Giner-Sorolla, R., Kupfer, T., & Sabo, J. (2018). What makes moral disgust special? In J. Olson (Ed.), *Advances in experimental social psychology* (Vol. 57, pp. 223–289). Academic Press.

Gmelch, G. (1971). Baseball Magic. *Trans-action*, *8*(8), 39–41. https://doi.org/10.1007/BF02908325

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual Differences in Sensitivity to Disgust: A Scale Sampling Seven Domains of Disgust Elicitors. *Personality and Individual Differences*, *16*(5), 701–713. https://doi.org/10.1016/0191-8869(94)90212-7

Hebl, M. R., & Mannix, L. M. (2003). The weight of obesity in evaluating Others: A Mere Proximity Effect. *Personality & Social Psychology Bulletin*, *29*(1), 28–38. https://doi.org/10.1177/0146167202238369

Hejmadi, A., Rozin, P., & Siegal, M. (2004). Once in Contact, Always in Contact. *Developmental Psychology*, *40*(4), 467–476. https://doi.org/10.1037/0012-1649.40.4.467

Jones, A., & Fitness, J. (2008). Moral hypervigilance: The influence of disgust sensitivity in the moral domain. *Emotion*, *8*(5), 613–627. https://doi.org/10.1037/a0013435

Jones, B. C., Hahn, A. C., Fisher, C. I., Wang, H., Kandrik, M., Lee, A. J., Tybur, J. M., & DeBruine, L. M. (2018a). Hormonal correlates of pathogen disgust. *Evolution and Human Behavior*, *39*(2), 166–169. https://doi.org/10.1016/j.evolhumbehav.2017.12.004

Jones, B. C., Hahn, A. C., Fisher, C. I., Wang, H., Kandrik, M., Lee, A. J., Tybur, J. M., & DeBruine, L. M. (2018b). Reply to Fleischman and Fessler's (2018) comment on "Hormonal correlates of pathogen disgust". *Evolution and Human Behavior*, *39*(4), 470–471. https://doi.org/10.1016/j.evolhumbehav.2018.03.010

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge University Press.

Kim, L. R., & Kim, N. S. (2011). A Proximity Effect in Adults' Contamination Intuitions. *Judgement and Decision Making*, *6*(3), 222–229.

Kupfer, T. R., & Giner-Sorolla, R. (2021). Reputation management as an alternative explanation for the "contagiousness" of immorality. *Evolution & Human Behavior*, *42*(2), 130–139. https://doi.org/10.1016/j.evolhumbehav.2020.08.005

Lee, R. J. (1875). Maternal Impressions. *The British Medical Journal*, *1*(736), 167–169. https://doi.org/10.1136/bmj.1.736.167

Levenson, R. W., Ekman, P., & Friesen, W. V. (1990). Voluntary facial action generates emotion-specific autonomic nervous system activity. *Psychophysiology*, *27*(4), 363–384. https://doi.org/10.1111/j.1469-8986.1990.tb02330.x

Malebranche, N. (1997/1674). *The Search After Truth* (T. M. Lennon & P. J. Olscamp, Eds). Cambridge University Press.

Mandelbaum, E. (2013). Against alief. *Philosophical Studies*, *165*(1), 197–211. https://doi.org/10.1007/s11098-012-9930-7

Maubray, J. (1724). *The Female Physician*. James Holland.

Milkowska, K., Galbarczyk, A., & Jasienka, G. (2019). Disgust sensitivity in relation to menstrual cycle phase in women with and without an infection. *American Journal of Human Biology*, *31*(3), e23233. https://doi.org/10.1002/ajhb.23233

Miller, S. B. (2004). *Disgust: The Gatekeeper Emotion*. Analytic Press.

Miton, H., Claidière, N., & Mercier, H. (2015). Universal Cognitive Mechanisms Explain the Cultural Success of Bloodletting. *Evolution and Human Behavior*, *36*(4), 303–312. https://doi.org/10.1016/j.evolhumbehav.2015.01.003

Montaigne, M. (1842/1574). Of the Force of Imagination. In W. Hazlitt & C. Cotton (Eds.), *The Complete Works of Michael de Montaigne* (pp. 29–34). John Templeman.

Mulkens, S. A. N., de Jong, P. J., & Merckelbach, H. (1996). Disgust and spider phobia. *Journal of Abnormal Psychology*, *105*(3), 464–468. https://doi.org/10.1037/0021-843X.105.3.464

Nemeroff, C., & Rozin, P. (1994). The Contagion Concept in Adult Thinking in the United States: Transmission of Germs and of Interpersonal Influence. *Ethos*, *22*(2), 158–186. https://doi.org/10.1525/eth.1994.22.2.02a00020

Nemeroff, C., & Rozin, P. (2000). The makings of the magical mind. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the Impossible: Magical, Scientific and Religious Thinking in Children* (pp. 1–34). Cambridge University Press.

O'Donnell, K. J., Glover, V., Barker, E. D., & O'Connor, T. G. (2014). The persisting effect of maternal mood in pregnancy on childhood psychopathology. *Developmental Psychopathology*, *26*(2), 393–403. https://doi.org/10.1017/S0954579414000029

Öhman, A. (1986). Face the Beast and Fear the Face. *Psychophysiology*, *23*(2), 123–145. https://doi.org/10.1111/j.1469-8986.1986.tb00608.x

Olatunji, B. O., Sawchuk, C. N., de Jong, P. J., & Lohr, J. M. (2007). Disgust Sensitivity and Anxiety Disorder Symptoms: Psychometric Properties of the Disgust Emotion Scale. *Journal of Psychopathology and Behavioral Assessment*, *29*(2), 115–124. https://doi.org/10.1007/s10862-006-9027-8

Oldenburg, H. (1672). An account of some books. *Philosophical Transactions*, *84*(7), 4095–5002. https://doi.org/10.1098/rstl.1672.0032

Paré, A. (1982/1573). *Of Monsters and Marvels*. J. L. Pallister. The Chicago University Press.

Pomponazzi, P. (1930/1556). *On the Causes of Marvelous Natural Effects or On Incantations*. (H. Busson, Trans.) Rieder.

Quillet, C. (1872/1656). *Callipaediae, Or An Art of How to Have Handsome Children ("Several hands", Trans.)*. American Antiquarian Publishing Company, from London editions of 1708-1710.

Rachman, S. (1994). Pollution of the mind. *Behavior, Research & Therapy*, *32*(3), 311–314. https://doi.org/10.1016/0005-7967(94)90127-9

Rachman, S. (2004). Fear of contamination. *Behavior, Research & Therapy*, *42*(11), 1227–1255. https://doi.org/10.1016/j.brat.2003.10.009

Roodenburg, H. W. (1988). The Maternal Imagination. *Journal of Social History*, *21*(4), 701–716. https://doi.org/10.1353/jsh/21.4.701

Rozin, P., & Fallon, A. (1987). A perspective on disgust. *Psychological Review*, *94*(1), 23–41. https://doi.org/10.1037/0033-295X.94.1.23

Rozin, P., Haidt, J., & McCauley, C. (2008). Disgust. In M. Lewis & J. Haviland-Jones (Eds.), *Handbook of Emotions* (3rd ed., pp. 757–776). Guildford Press.

Rozin, P., Lowery, L., & Ebert, R. (1994). Varieties of disgust faces and the structure of disgust. *Journal of Personality and Social Psychology*, *66*(5), 870–881. https://doi.org/10.1037/0022-3514.66.5.870

Rozin, P., Markwith, M., & McCauley, C. (1994). Sensitivity to indirect contacts with other persons. *Journal of Abnormal Psychology*, *103*(3), 495–504. https://doi.org/10.1037/0021-843X.103.3.495

Rozin, P., Markwith, M., & Nemeroff, C. (1992). Magical Contagion Beliefs and Fear of AIDS. *Journal of Applied Social Psychology*, *22*(14), 1081–1092. https://doi.org/10.1111/j.1559-1816.1992.tb00943.x

Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*, *50*(4), 703–712. https://doi.org/10.1037/0022-3514.50.4.703

Rozin, P., & Nemeroff, C. (1990). The Laws of Sympathetic Magic. In J. W. Stigler, R. A. Shweder, & G. Herdt (Eds.), *Cultural Psychology: Essays on Comparative Development* (pp. 205–232). Cambridge University Press.

Rublack, U. (1996). Pregnancy, childbirth and the female body in early modern germany. *Past & Present*, *150*(1), 84–110. https://doi.org/10.1093/past/150.1.84

Seligman, M. E. (1970). On the generality of the laws of learning. *Psychological Review*, *77*(5), 406–418. https://doi.org/10.1037/h0029790

Shaw, W. C. (1981). Folklore surrounding facial deformity and the origins of facial prejudice. *British Journal of Plastic Surgery*, *34*(3), 237–246. https://doi.org/10.1016/0007-1226(81)90001-1

Shweder, R. A. (1977). Likeness and likelihood in everyday thought: Magical thinking in judgements about personality. *Current Anthropology*, *18*(4), 637–658. https://doi.org/10.1086/201974

Siegal, M., & Share, D. L. (1990). Contamination sensitivity in young children. *Development Psychology*, *26*(3), 455–458. https://doi.org/10.1037/0012-1649.26.3.455

Snyder, H. R., Kaiser, R. H., Warren, S. I., & Heller, W. (2015). Obsessive-Compulsive Disorder is Associated with Broad Impairments in Executive Function: A meta-analysis. *Clinical Psychological Science*, *3*(2), 301–330. https://doi.org/10.1177/2167702614534210

Springer, K., & Belk, A. (1994). The role of physical contact and association in early contamination sensitivity. *Developmental Psychology*, *30*(6), 864–868. https://doi.org/10.1037/0012-1649.30.6.864

Stark, R., Walter, B., Schienle, A., & Vaitl., D. (2005). Psychophysical correlates of disgust and disgust sensitivity. *Journal of Psychophysiology*, *19*(1), 50–60. https://doi.org/10.1027/0269-8803.19.1.50

Stevenson, I. (1992). A New Look at Maternal Impressions. *Journal of Scientific Exploration*, *6*(4), 353–373.

Summerfeld, L. J., Kloosterman, P. H., Antony, M. M., & Swinson, R. P. (2014). Examining an obsessive-compulsive core dimensions model. *Journal of Obsessive Compulsive and Related Disorders*, *3*(2), 83–94. https://doi.org/10.1016/j.jocrd.2014.01.003

Tapp, C., & Occhipinti, S. (2016). The essence of crime: Contagious transmission from those who have committed moral transgressions. *British Journal of Social Psychology*, *55*(4), 756–772. https://doi.org/10.1111/bjso.12153

Thornhill, R., & Fincher, C. L. (2014). *The parasite-stress theory of values and sociality: Infectious disease, history and human values worldwide*. Springer.

Turner, D. (1714). *De Morbis Cutaneis: A Treatise of Diseases incident to the Skin*. R. Bonwicke, W. Freeman, J. Tim. Goodwin, M. Walthoe, S. Wotton, J. Manship, R. Nicolson, B. Parker, Tooke, & R. Smith.

Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology*, *97*(1), 103–122. https://doi.org/10.1037/a0015474

Vernon, L. L., & Berenbaum, H. (2002). Disgust and fear in response to spiders. *Cognition & Emotion*, *16*(6), 809–830. https://doi.org/10.1080/02699930143000464

Wahl, K., Salkovskis, P. M., & Cotter, I. (2008). "I wash until it feels right"—The phenomenology of stopping criteria in obsessive compulsive washing. *Journal of Anxiety Disorders*, *22*(2), 143–161. https://doi.org/10.1016/j.janxdis.2007.02.009

Warkany, J. (1971). *Congenital Malformations: Notes and Comments*. Year Book Medical Publishers.

Wilson, P. K. (1992). 'Out of sight, out of mind?': The Daniel Turner-James Blondel dispute over the power of the maternal imagination. *Annals of Science*, *49*(1), 63–85. https://doi.org/10.1080/00033799200200141

Wilson, P. K. (2002). Eighteenth-Century "Monsters" and Nineteenth-Century "Freaks": Reading the Maternally Marked Child. *Literature and Medicine*, *21*(1), 1–25. https://doi.org/10.1353/lm.2002.0014

Woody, S. R., & Teachman, B. A. (2000). Intersection of Disgust and Fear. *Clinical Psychology: Science and Practice*, *7*(3), 291–311. https://doi.org/10.1093/clipsy.7.3.291