

The Development of Food Preferences and Disgust

Tom Simpson

That there are connections between food preferences, disgust and morality should come as no surprise. We show disapproval of certain foodstuffs and actions by labelling them 'disgusting', and such labelling is seen by many folk as sufficient justification for disapproval of the foodstuffs and actions concerned. We make moral and other character judgements based on the foodstuffs people prefer, and do so to the extent that we have a phrase for this: 'you are what you eat'. And we frequently decide whether someone is 'really one of us' by observing what someone claims to find disgusting, and what they do and do not prefer to eat.

That the connections between food preferences, disgust and morality are complex should also be unsurprising. None of the connections mentioned above are indefeasible, and we actively engage in behaviours which seem entirely at odds with such connections. We revel in providing foodstuffs to non-local dining companions which we expect them to find disgusting (e.g., pickled sea slug, monkey brain, marmite), as anyone who has spent enough time in another culture to eat with members of that culture will attest. And we often show more moral approval of someone who tastes and is then disgusted by our local delicacy than we do of someone who refuses to taste it because they (rightly) claim to find it disgusting. Similarly, people 'rubber-neck' at traffic accidents, gory films fill cinema seats, true-crime stories of cannibalism and the like fill bookshop shelves, and millions of TV viewers watch programs which these viewers then claim disgusted them in a variety of ways (and they watch such programs all the way through). The connections between food, disgust and morality therefore seem central to a huge array of human behaviours, and making sense of such connections would provide significant insight into many aspects of human nature and culture.

Moreover, whilst food preferences are ubiquitous in the animal world, both morality and disgust appear to be uniquely human. One might therefore wish to know why this is so, and to what extent these capacities relate to other seemingly unique and fundamental human attributes (e.g., language and theory of mind). Success in such enquiry would, it seems, enable us to understand much about what we, as humans, are.

Enquiry of this kind has long been part of philosophical and other work. Investigation into the connections between emotion and morality is present in the writings of Plato, and such connections have been the focus of much philosophical work since (e.g., Hume; Hare 1981; Urmson 1968). Despite this illustrious history, however, there remains much disagreement over the extent to which reasons or emotions drive our actual moral judgements, and emotivist models of moral judgement continue to provide some resistance against more widely accepted rationalist approaches (e.g., Damasio 1994; Haidt 2001). More particularly, disgust is often thought to provide a paradigmatic instance of an emotion to which moral reasons can be opposed, and so a proper understanding of disgust has the potential to play a crucial role in our explanations of the relations between emotion, reason and morality.

In addition to aiding debate in moral philosophy, a proper understanding of disgust would also serve us well in the fields of aesthetics and of philosophy of mind more broadly construed. Indeed, in the context of the latter field, discussion of emotions appears to have been largely insulated from developments in the philosophy of language and the philosophy of psychology over the past few decades (Griffiths 1997). Depending on how one views the results of such developments, one can consider this insulation a good or a bad thing. However, applying the results of such developments to our understanding of disgust offers one way in which to assess these developments, and to judge the extent to which such insulation is now justified. In general, then, it seems that work on the connections between food preferences, disgust, and morality has played a significant role in much enquiry to date, and that such work also has much to offer across a broad range of investigative domains.

It is therefore perhaps rather surprising how little is currently known about the connections between food preferences, disgust, and morality. Or about the mechanisms which underlie such connections. Or, in particular, about the evolutionary or ontogenetic development of these connections and mechanisms. Paul Rozin and his colleagues lead the field in terms of contemporary psychological research into disgust and food preferences, and their work represents the state of the art for current theorising. Yet Rozin, Jon Haidt and Clark McCauley (2000) conclude their entry on 'Disgust' in the 'Handbook of Emotions' by stating that

In spite of [disgust's] frequent occurrence and general classification as a basic emotion,...there are many unanswered questions. We know very little about the history of disgust...We do not know much about the sequence of events that introduced and expanded disgust over historical time (but see Miller 1997, for the most thorough analysis of this expansion for Western cultures). We do not know whether the acceptance of the theory of evolution, and hence of human continuity with animals, played a role in the development of animal-nature disgust [one kind of disgust—see below]. We do not know how disgust originates in development, nor what the principle causes of differences in disgust sensitivity are, nor why it is the focus of humor (especially in children).

(2000, p. 650)

A search on Philosophers' Index produced precisely one paper focussing on the development of food preferences and disgust (Korsmeyer 2002), a return rate which, even if not exhaustive, shows that there is still not very much contemporary philosophical literature which has this subject as its focus.¹

However, philosophical and psychological work which focuses on these issues is sorely needed. Not only because such issues are interesting in themselves, but also because there has recently been a resurgence in work on moral theory which makes essential reference to disgust as part of the defence of particular models of morality (e.g., Blackburn 1998; Haidt 2001; Knapp 2003; Nichols 2002a,b). Furthermore,

¹ For example, searches on 'food preference', 'food AND disgust' and 'disgust AND development' all get 0 returns, and virtually all returns on 'food AND development' concern food distribution and economic/socio-political development.

much of this work explicitly focuses on the development of moral reasoning, and the claims about disgust made by these authors are correspondingly developmental. However, as these authors readily admit, there is as yet little consensus over how best to understand the development of disgust, nor is there much in the way of agreement with regard to the mechanisms and processes which underwrite such development.

This paper aims to move toward such a consensus, by sketching an account of the mechanisms involved in the development of food preferences and disgust. First, I use the work of Rozin and his colleagues to outline the understanding of food preference and disgust which provides the common basis for virtually all of the work with which current theorists are concerned (section 1). I then introduce Rozin et al.'s proposals concerning the development of the disgust response (section 2), and indicate which aspects of these proposals are to be our primary concern. Then, in section 3, I examine a proposal from Christopher Knapp (2003) that the development of our language capacity can provide a useful model for the development of the disgust response. I show, however, that the development of our disgust response is *not* best thought of as analogous to language acquisition, except perhaps at the most superficial level. I then present my own proposals for the mechanisms which implement the development of our disgust response, and offer some suggestions as to how the details of my account may be further filled in (section 4). Finally (section 5), I return to the relations between food preferences, disgust and morality more generally, and consider how these relations now stand in the light of the model I have proposed.

1. Disgust and Disgust Sensitivity

The evidence that disgust originates from food rejection is compelling. So too is the evidence that there are four distinct (though related) motivations for food rejection, and four equally distinct (though related) kinds of disgust. I will briefly discuss each of these, and a summary of their core properties can be found in Table 1. My summary and table are taken largely from Rozin, Haidt and McCauley (2000), and Rozin, Haidt, McCauley and Imada (1997), and I have omitted most of the references to which these articles refer. Readers who would like further details on either the empirical evidence or the ideas concerned are advised to consult these source articles.

1.1 Non-Disgust Motivations for Food Rejection

The origins of disgust lie with *distaste*. The function of distaste is to protect the body by withdrawing from or ridding the body of an undesirable substance. The elicitors of distaste are undesirable sensory properties, prototypically bitter tastes. Prototypical responses to such properties are the 'gape response', which serves to dispel food from the mouth, and the experience of nausea, which discourages ingestion. The former is certainly present in both newborn infants and in a variety of non-human animals. The latter is also thought to be present in newborn infants and other animals, though empirical confirmation is difficult to obtain. Distaste is also thought to be the only food rejection mechanism present at birth.

During the first 4 years of human life, a second motivation for food rejection develops: *danger*. This motivation is shared to some degree by other animals, and is especially powerful in omnivorous animals such as rats. The function of danger is once again to protect the body from undesirable substances, and 'dangerous' substances are rejected on the basis of *anticipated negative consequences*. That is, a child rejects these substances because she has come to associate certain substances with some kind of negative physiological reaction, either through directly experiencing discomfort upon eating these substances, or from observing others' experiences of substance ingestion.

As one might expect, both of these motivations will be invoked in many instances of food rejection, and much early food rejection will thus be overdetermined to some degree. However, these motivations are clearly distinct, and emerge at different times during human ontogeny.

Finally, sometime after the age of four, children come to reject certain substances for largely conceptual reasons, e.g., for reasons of the *nature, history or origin* of the substance. This *ideational* food rejection thus depends upon a conception of some property of the substance which exists independently of any immediate sensory properties. In some cases this rejection occurs because the child has acquired the knowledge that certain substances are *inappropriate substances*. That is, the child has come to understand that some substances *are not food*, even though these substances do not elicit distaste, and may also cause no harm (e.g., paper, tree bark, sand). Rejection of such substances consists largely in the child simply not categorising the substance as a potential food when she comes into contact with it.

1.2 Disgust

There is, however, a second kind of conceptually driven food rejection: *disgust*. 'Disgusting' substances are also rejected principally due to their nature, history or origin, rather than because they have distasteful or dangerous properties. However, disgusting foods are also often *thought* (by those who are disgusted) to have these properties, even when they do not. Furthermore, whilst disgust typically produces many of the same behavioural responses as these other motivations for food rejection, such as the gape response, bodily withdrawal, and nausea, disgust is also typically and uniquely accompanied by a feeling of 'revulsion'. Disgust, Rozin et al. claim, is therefore qualitatively different from other food rejection motivations with regard to both its elicitors and its output.

Rozin et al. refer to this kind of food rejection as *core disgust*, and define it as "revulsion at the prospect of (oral) incorporation of an offensive object [where] the offensive objects are contaminants" (1997, p. 68). More specifically, they argue (2000, p. 640) that elicitation of core disgust requires:

- (1) a sense of oral incorporation (and hence a linkage with food or eating)
- (2) a sense of offensiveness, and
- (3) contamination potency

For Rozin et al. it is the need for components (2) and (3), together with an accompanying feeling of revulsion, that distinguishes core disgust from other

motivations for food rejection. However, Rozin et al. are not always entirely clear on how they intend we understand the relation between components (1) to (3) and the feeling of revulsion. It seems that for Rozin et al., the occurrence of (1) to (3) is essential for core disgust, and that one will not experience revulsion toward foodstuffs without the occurrence of (1) to (3). However, whilst occurrence of (1) to (3) is also *typically* accompanied by the feeling of revulsion, it may be that such a feeling is *not always* a necessary part of core disgust. That is, perhaps one can, in certain circumstances, be core disgusted without (consciously) experiencing an accompanying feeling of revulsion. For the moment then, the relations between disgust elicitors and the feeling of revulsion remain somewhat unclear, and I will return to these relations once further details of the disgust response have been explored (section 4.4). However, as components (1) to (3) are unequivocally essential for the elicitation of core disgust, I will now elaborate briefly on each of these.

Component (1) derives from the fact that the mouth is the principle way in which material objects enter into the body, and so one might expect a specially dedicated and especially powerful motivational system associated with such a highly personal and extremely risky activity. Indeed, Rozin et al. claim, the dangers of oral incorporation are exactly what are being alluded to by the widespread belief that ‘you are what you eat’, a thought which it seems is implicitly held even by educated American adults (Nemeroff and Rozin 1989).²

The second component of core disgust concerns offensive objects, and such objects are “all animals and their products when considered as food” (1997, p. 68). Almost all food-related disgust elicitors for North Americans are animals or animal products, and almost all cultures consume very few parts or products of a very small number of animal species (and when doing so often take great care to disguise the fact that what is being consumed is animal in origin) (Howell 1986; Simoons 1994; Rozin and Fallon 1987). In addition, animals and their products are cross-culturally the subject of the strongest and the greatest number of taboos, and such taboos typically involve disgust as a motivating and sustaining factor (Fessler and Navarrete 2003). Furthermore, this class of elicitors includes human bodily products such as faeces, vomit, urine and blood, and there is strong cultural and historical evidence that most human bodily products have been and still are the focus of much disgust.³

Finally, core disgust also requires consideration of offensive objects as contaminants. That is, if an offensive object comes into contact with a potential food, that potential food is then immediately rendered offensive, and is thus rejected. This belief appears to be both powerful and near-universal among human adults, and seems to approximate to the ‘sympathetic magic’ law of contagion that: ‘once in contact, always in contact’. Thus adults will typically refuse to consume food any part of which has been in brief contact with a cockroach, and will also reject food they know to have been prepared or bitten by undesirable or disliked persons. Given that unrestrained application of this ‘law’ would render almost everything we might eat or touch disgusting, various personal and cultural ‘framing’ strategies have developed

² For example, US College students were found to attribute boar-like qualities to boar eaters, and turtle-like qualities to turtle eaters (Nemeroff and Rozin 1989).

³ Interestingly, perhaps the only human body product not often, if ever, considered disgusting is tears, and tears are also perhaps the only uniquely human body product (Ortner 1973; also animal-nature disgust, below).

which serve to ‘negate’ this law. For example, many cultures have specific social rules which ‘determine’ the threshold for contamination, but which do not accurately track actual biological properties. Similarly, most individuals employ a strategy of *not* thinking about either the people or conditions present in restaurant kitchens, or the sources or procedures required to provide the animal products they consume. Furthermore, a second ‘law’ of sympathetic magic is that ‘if things resemble each other superficially then they also resemble each other in a deeper way’, and a belief to this affect also seems to be strongly present in adults. Thus adult Americans are reluctant to eat chocolate in the shape of faeces even when they know that the substance is certainly chocolate, and are similarly reluctant to consume a desirable drink which has been in contact with a plastic replica of an insect. A sense of contamination approximating to two of the ‘laws’ of sympathetic magic therefore lies at the heart of the human disgust response.

This then provides an outline of the four motivations for food rejection, and of the distinctions between core disgust and all other motivations. Unlike distaste and danger, core disgust is motivated principally by ideational consideration of the origin or nature of an object. The principle elicitors of core disgust are animals and animal products, and elicitation requires a sense of contamination in addition to conceptualisation of the elicitors as offensive and the thought of oral incorporation. Core disgust also typically involves a feeling of revulsion, usually in addition to the other food rejection responses of bodily withdrawal and ‘gape’. Finally, with respect to the function of core disgust, Rozin et al. suggest that given both the ideational nature of core disgust’s elicitors, and the involvement in core disgust of the ‘laws’ of sympathetic magic, core disgust’s function is not only to protect the body, but also, in some sense, to protect our sense of self (or ‘soul’).

With regard to ontogenetic development, Rozin et al. argue that evidence from food preference studies on young children shows that core disgust emerges in normal human children sometime between 4 and 8 years of age (e.g., Rozin, Hammer, et al. 1986; Rozin et al. 1986). Moreover, Rozin et al. also argue that the emergence of core disgust requires some degree of enculturation. A meta-examination of the case studies of 50 feral children showed that whilst all of these children had food preferences in line with their diet during isolation from human contact, and that such preferences showed evidence of rejection on the basis of distaste, danger and inappropriate substances, none showed any evidence either of disgust or of a sense of contamination (Malson 1964/1972). Despite both the relatively late development of core disgust and the need for enculturation, however, Rozin et al. argue that core disgust is both “the primary and ontogenetically earliest expression of disgust” (1997, p. 69) and also “arguably the strongest form of food rejection” in humans (1997, p. 67).

I will discuss the development of core disgust in greater detail below. However, it will be useful to first complete our outline of the four related kinds of disgust

1.3 Three more kinds of disgust

Whilst core disgust may well be the strongest form of food rejection, objects which elicit core disgust account for little more than one quarter of the things which, for example, US and Japanese subjects claim to be disgusting. The remaining disgust

triggers can be grouped into the following kinds: *animal-nature* disgust, *interpersonal* disgust, and *moral* disgust.

Animal-nature disgust is so called because its elicitors are all properties which function as “reminders of our animal nature” (1997, p. 70). Namely:

- (1) poor hygiene,
- (2) (inappropriate) sexual activities,
- (3) ‘violations of the ideal body envelope’ (e.g., gore, deformity, obesity), and
- (4) contact with death.

The functions of animal-nature disgust are to protect the body and self, to “keep away intimations of our own mortality” (1997, p. 71), and to ‘humanise’ our animal bodies. In other words, animal-nature disgust functions (in both individual development and cultural evolution) to enable humans to develop and sustain the belief that we are qualitatively different from, and indeed superior too, all other members of the animal kingdom. And it does so by enabling us to reject as disgusting any reminders of our animal nature. For Rozin et al., our animal-nature disgust “represents a second evolution of the emotion of disgust” (1997, p. 71), and is, among other things, largely what underwrites both the development of ‘table manners’ and our interest in the kinds of gory films, true-crime stories and hideous accidents which nonetheless disgust us to some degree. For the former, the ritualisation of our eating practices serves (in combination with core disgust) to separate our eating habits from those of other animals, and thus enables us to mark ourselves as distinct from and superior to such animals with regard to one of our most central activities (see also Elias 1978; Nichols 2000b; Thomas 1983). For the latter, what matters is the *sharing and comparing* of disgust reactions in the social situations in which interest in gore, etc. occurs, and such sharing and comparing serves to emphasise and perhaps even celebrate the supposed ‘barrier’ between humans and ‘animals’. In this way, Rozin et al. conclude, animal-nature disgust expands from and builds upon core disgust to enable us to distance ourselves as much as possible from our animal heritage.

Interpersonal disgust is disgust at indirect contact with strangers or other undesirables. Such contact is not often spontaneously offered by US subjects as an example of something disgusting. However, US adults do show an aversion to contact with objects of many kinds which have been used by healthy strangers, when compared to their reactions to contact with identical but unused objects, even when the used objects have been freshly cleaned (e.g., a sweater has been laundered). Moreover, this aversion substantially increases in strength when the stranger is said to have

- (1) had a misfortune (e.g., an amputated leg)
- (2) had a disease, or
- (3) moral taint (e.g., a murder conviction)

and aversion does not decrease when the stranger is said to have potentially positive attributes such as being a priest or being physically attractive.

Disgust of this kind might initially appear to be another instance of either animal-nature or core disgust. That is, what disgusts us in these cases might be thought to be contact with (traces of) the bodily products of other people. However,

Rozin et al. argue that as thorough cleaning (or even sterilisation) of the objects fails to reduce the extent to which subjects think that contamination would occur, and that aversion also increases in line with non-physical attributes, such properties make interpersonal disgust seem significantly different from these other kinds of disgust. Moreover, there is evidence that attitudes toward interpersonal disgust vary in accordance with cultural interpersonal attitudes more generally. Unlike US subjects, Japanese subjects do spontaneously offer examples of interpersonal contact as disgusting, and such examples are also considered to be more serious by Japanese subjects than by those from the US. This perhaps reflects the contrast between the *interdependent* and the *independent* conception of the self in Japan and the US respectively. Similarly, interpersonal disgust is highly developed in Hindu India. In fact, it is interpersonal disgust as much as core disgust that governs most of Hindu India's rules about acceptable and unacceptable foods. Thus interpersonal disgust in Hindu India appears both to reflect and enforce the implementation of the Hindu caste system in the context of the central human activity of food consumption.

It seems, therefore, that interpersonal disgust serves primarily to discourage contact with those who are not intimates, or, more broadly, with those who are not part of one's ethnic or 'in'- group. The function of interpersonal disgust is thus not only to protect the body and self, but also to preserve social distinctiveness and social order by working as an ethnic or 'out-group' marker. Thus interpersonal disgust is clearly distinct with respect to both elicitors and function from the other forms of disgust outlined thus far.

Finally, there is moral disgust. As one might expect, many of the examples of disgusting things provided by US and Japanese subjects do not fall into the categories of elicitors for either core, animal-nature or interpersonal disgust. Such things include, for example, hypocrites, child abusers, racists, and liberals. More specifically, the elicitors of moral disgust are the actions or attitudes of such people, and moral disgust seems to be focussed on the fact that such actions or attitudes (are thought to) "reveal a lack of normal human motivation" (2000, p. 643). Moreover, that such actions are considered disgusting rather than simply offensive is made clear by the fact that the property of contamination remains in force. That is, (in)direct contact with persons who have committed moral offences is highly aversive. Moral disgust, Rozin et al. conclude, may therefore "represent a more abstract set of concerns about the human-animal distinction, focussing not so much on the human body as on...the human as a member of a cooperating social entity" (2000, p. 644). The function of moral disgust is therefore first and foremost to protect the social order.

Given the potency of the disgust response in general, connecting certain actions with the disgust response clearly provides one powerful way in which to proscribe these actions, and any connection between what is disgusting with what is immoral will serve to increase aversion to moral violation within a given culture. And connections between disgust and immorality are both widespread and powerful in all cultures. However, just as one can find something immoral without finding it disgusting (e.g., bank robbery, or fraud), it is similarly possible to find something disgusting without considering it immoral. However, the extent to which this latter dissociation actually occurs shows considerable cultural and socio-economic variance. More specifically, upper-class subjects in all cultures are less likely to consider disgusting acts (in which no-one is harmed) as immoral, and subjects from cultures

(such as the US and other Western nations) which place a higher cultural value on individual autonomy than on notions of ‘community’ or ‘divinity’, are also less likely to consider disgust violations as also being moral violations (see, e.g., Haidt et al. 1993; Schweder et al. 1997; Rozin et al. 1999). Nonetheless, moral disgust remains a significant force in all known cultures, and the combining of disgust with an immoral act serves to greatly reinforce any individual’s negative attitudes toward that act.

Having provided this outline, it should now be clear that many instances of the disgust response will be overdetermined, and also that there will be many borderline cases for which it is not immediately obvious which kind(s) of disgust are operative. Nonetheless, consideration of central instances of animal-nature, interpersonal and moral disgust show that these responses can usefully be considered as distinct kinds of disgust with respect to both their elicitors and their function. Moreover, one reason for the difficulty in separating these different kinds is that the prototypical responses to disgust violations of each of these kinds are very similar, and remain closely tied to those for core disgust. Subjects typically experience ‘revulsion’, and usually try to distance themselves from the offending object. The only significantly different element is when experiencing animal-nature, interpersonal or moral disgust subjects also frequently raise their upper lip, either in place of or in addition to, producing the standard ‘gape’.⁴ Given this similarity, Rozin et al. conclude that whilst the elicitors and motivations for disgust in adult humans have expanded and altered during both cultural and individual development, the output of the disgust system has remained largely unchanged.

1.4 Disgust Sensitivity

In the preceding sections I have outlined the main components of and differences between various kinds of food rejection and disgust. Unfortunately, the complex and interrelated nature of these kinds entails that in many instances our disgust reaction and/or our motivation for the rejection of various foods will be multiply overdetermined. Determining which kind of rejection or disgust reaction is operating in any naturalistic (i.e., non-laboratory controlled) instance is thus extremely difficult, as is controlling for over-determination when the subjects involved are infants or young children. Nonetheless, such specific determination can sometimes be done. Moreover, it is also possible to measure (on a 32-point scale) the overall ‘disgust sensitivity’ of adult individuals, and to use this measure as an accurate predictor of how likely an individual will be to find some novel thing disgusting, or how willing that individual will be to touch, eat or otherwise interact with a ‘disgusting’ thing (Haidt et al. 1994; Haidt et al. 1999).⁵ Such data can then also be reliably correlated with other factors, and has been claimed to show, for example, that females are typically more disgust sensitive than males, that disgust sensitivity in adults declines with age for both females and males, that education is negatively correlated with disgust sensitivity (Doctoroff and McCauley 1996) and, perhaps most

⁴ As this ‘raising’ does not seem to have developed from an expression which has the function of expelling food, it is thought to have been co-opted from the teeth-baring expression typical of anger.

⁵ The Disgust Scale is composed of 16 True/False questions and 16 rating questions (not/slightly/very) concerning the disgustingness of particular behaviours or situations respectively. There are 4 questions from each of 8 domains. 7 domains tap core and animal-nature disgust, and concern food, animals, body products, sex, body envelope violations, death, and hygiene respectively; 1 domain taps magical thinking in relation to these other domains (see Haidt et al. 1994; Haidt et al. 1999 for more details).

surprisingly, that disgust sensitivity is positively correlated with meat consumption (Fessler et al. 2007).

This then is the understanding of disgust which provides the background to this paper, and for which developmental mechanisms are required. So let us now turn to the discussion of such mechanisms.

2. Development

Rozin et al. claim that core disgust emerges in all normal humans between the ages of 4 and 8 years old, and that this emergence requires a significant degree of enculturation. Prior to this age, or without enculturation, children exhibit food rejection only on the grounds of distaste and danger (and perhaps inappropriateness). Animal-nature disgust then emerges sometime after core disgust, and interpersonal and moral disgust sometime after that. However, Rozin et al. “have no suggestion as to an ordering of these [latter] two domains” (1997, p. 72), and also observe that “Interpersonal contamination and moral offences may become disgusting for reasons independent of the prior focus of disgust, but may access the already present rejection system of disgust” (2000, p. 645). The rest of this paper will attempt to fill in more details of this outline.⁶

Rozin et al. propose the following models and mechanisms for the development of human food preferences and disgust:

Our general thesis is that the distaste response, which includes much of the ‘programme’ (Ekman 1992) for the emotion of disgust, forms the prototype and basis for disgust. We hold that through a process like evolutionary preadaptation, this programme – an expressive, physiological (nausea), and behavioural rejection system – is attached successively to a variety of things that are offensive within a particular culture. Some of these things...are likely to be universal, but most are not. Disgust, in this view, becomes the means by which culture can internalise rejection of an offensive object, behaviour or thought...It is more efficient to have [cultural] values internalised than to have to ensure compliance by policing compliance with a rule or law. Disgust accomplishes much of this internalisation of negative values.

(1997, p. 77)

In other words, the adult disgust response develops by means of the developing child coming to attach culturally specified disgust elicitors to a disgust

⁶ The empirical evidence Rozin et al. use to support their developmental claims comes primarily from three sources: studies of feral children completed in the 1960s and 70s (e.g., Malson 1964/1972); work done with normal infants and young children by Rozin and others in the mid-1980s (Rozin, Hammer, et al. 1986; Rozin et al. 1986; and see Appendix 1); and cross-cultural studies from the past 50 years or so “almost the entire literature [of which] comes from the approximately 6% of the world in which English is the native language” (Rozin et al. 2000, p. 647). Such evidence is thus far from being either comprehensive in scope or unequivocal in interpretation. One major benefit to our understanding in this area will therefore be the (re-)engagement in cross-cultural empirical work on food preferences and disgust in infants and young children which has begun recently (see, e.g., Birch et al. 1999; Hejmadi under review).

programme which is itself preadapted⁷ from the distaste response. Rozin et al. further claim that the attachment to the disgust programme of culturally specified disgust elicitors can occur via either of two processes:

Primary, meaning that a new rejection is learned from the reactions of others or from some new information...[and is] probably frequently induced by the displays of disgust in others, by a process that is not well understood

and

Secondary, meaning that the acquisition is related to an existing disgust substance...[, and] may occur by two pathways. One is generalisation, based on similarity, from existing disgust substances such as faeces. Another pathway is evaluative conditioning, a form of Pavlovian conditioning in which a valenced entity (an unconditioned stimulus-e.g., an already disgusting entity) is paired with a previously neutral entity, with the result that the neutral entity (the conditioned stimulus) changes in valence in the direction of the unconditioned stimulus.

(2000, p. 646)

For either of these secondary processes to occur, there clearly must be some substance(s) which the child already finds disgusting, and which the child can then associate in the appropriate way with any novel substance to render this novel substance disgusting. These kinds of secondary processes are complex, but they are also relatively well established and understood in the psychological literature. However, the Primary processes by which Rozin et al. propose that some initial substances are rendered disgusting are neither well established nor well understood. It is these processes, and the mechanisms which underwrite them, which the remainder of this paper will explore.

Rozin et al. argue that the high degree of cross-cultural similarity with respect to the elicitors of both core disgust and animal-nature disgust suggests that even though these elicitors are acquired by developing children from their cultural environment, children nonetheless also have some kind of 'preparedness' or 'predisposition' to attach certain substances rather than others to their disgust programme. In particular, children are especially 'predisposed' to attach foodstuffs, animals and animal products to their core disgust programme, and are perhaps correspondingly 'undisposed' to attach certain other sorts of things to their programmes, e.g., flowers, machines or snow. However, if this kind of 'preparedness' or 'disposition' does exist, then several further questions arise. For example, How do children come to know which (local) substances satisfy this disposition? How do children then attach these substances to the disgust programme? Moreover, how should we model this disgust programme, and what is it that the corresponding 'disposition' consists in? And how, if at all, is disgust *ontogenetically* connected to

⁷ Rozin et al. take the notion of 'preadaptation' from evolutionary biology (e.g., Mayr 1960), and mean by it the evolutionary process by which "a system/property which evolved to perform one function is subsequently shared or co-opted for another function" (1997, p. 65). Rozin et al. thus mean by 'preadaptation' the same as is meant by 'exaptation' in other evolutionary literature (e.g., Gould and Vrba 1982).

food preferences and distaste, given the slow emergence and the qualitatively different nature of the disgust response in comparison to the distaste response in human children?

3. Language as one Possible Model

Frequently, language development provides a useful model for examining the development of other human psychological capacities. Not because such questions in the domain of language acquisition have been unequivocally resolved, but rather because proposed answers from within the language domain are usually the most comprehensive and the most detailed. Thus comparison with such proposals can offer suggestion as to which answers to propose in the case at hand, and can also highlight the differences between the answers required. And the disgust response is no exception in this regard. However, what I will show is that it is the differences between the development of language and the development of the disgust response which are of most interest to us here.

Christopher Knapp (2003) explicitly details what he claims to be the similarities between the human disgust response and our language ability. More specifically, Knapp claims that there are structural and developmental similarities between the mechanisms which underwrite the disgust response and the mechanisms which underwrite our language abilities, and thus also between the ‘extra-mental objects’ tied to these mechanisms – disgustingness and grammaticality respectively.

Knapp argues that even though grammaticality is “a property which certain sequences of symbols have and others don’t” (p. 267) and that grammaticality consists in a sequence of symbols being formed in accordance with the rules of grammar, it is also the case that for any given sequence of symbols differing judgements concerning grammaticality can be made, where each judgement corresponds to a different set of grammar rules. In one sense this is obvious. There is one set of rules for ‘standard French’, another for ‘standard English’, etc., and a sequence of French or English symbols is grammatical (or not) depending on whether it accords with the appropriate set of rules. However, Knapp also claims that there are further sets of rules. For example, the set consisting only of the rules shared by *all* of one particular actual community or group, what Knapp calls a ‘G-grammar’. Or the set of rules *any given individual* has encoded within the language mechanism in her head, and which comprise what linguists refer to as her ‘I-grammar’. And it is this last set of rules which Knapp finds most significant.

All individuals possess a distinct I-grammar, and thus each individual’s judgements of I-grammaticality will also be distinct. Knapp notes that on Rozin et al.’s analysis of disgust, the same is true of each individual’s disgust elicitors and of their judgements of disgustingness. Knapp argues that these similarities exist because the mechanisms which underwrite linguistic performance (on the one hand) and disgust responses (on the other) are structurally similar, and develop in similar ways. It is easy to see why one might think this to be the case. As Knapp observes, current proposals concerning language development (e.g., Pinker 1994; MORE REFS) share many of the properties present in Rozin et al.’s model of the development of disgust. In both cases the capacity emerges a few years into the child’s life, the culturally-

specific rules or representations the child acquires are (somehow) specified for the child by her cultural environment, and these rules and representations differ, to varying degrees, from child to child. However, in both cases the content of these rules and representations is by no means wholly environmentally determined. Rather, the child is also (somehow) significantly constrained by some kind of ‘predisposition’ – an innate Universal Grammar (UG) in the case of language, and a ‘preadapted preparedness’ to find certain things disgusting (or not) in the case of disgust. Thus, Knapp claims, applying the linguistic model to the development of disgust enables us to explain the degree of similarity *and* the extent of variation observed both inter- and intra-culturally with respect to the human disgust response.

However, my claim is that whilst Knapp is correct to conclude from Rozin et al.’s analysis that, as with grammaticality, disgustingness is a property which is always necessarily “relativized” (p. 269) to some particular individual, group, or agreed standard, Knapp is mistaken when he claims that the developmental process for disgust is anything more than superficially similar to that for language.⁸

First, consider the disgust mechanism’s analogue of the language mechanism’s Universal Grammar – its ‘preadapted preparedness’. It seems to me that these will actually be cognitive structures of two quite different kinds. This is because although UG does not fully define a child’s grammar, it does proscribe many pre-theoretically possible grammars that the child could in principle acquire. In other words, and as Knapp writes, “people can only learn a language with a syntax that conforms to the assumptions made by UG” (p. 266). Thus UG *rules out* the possibility of the child acquiring one of very many possible grammars by preventing such grammars from being learnable by the child, and thus the child is confined to acquiring one of a very small number of possible grammars. In contrast, even if disgust’s ‘preparedness’ does make certain things more likely than others to be the initial focus of disgust, it surely does not do so by *ruling out* certain classes of things so that the child is left with only a small number of classes of thing to choose from, from which the child then chooses based on local conditions. Rather, the preparedness seems to function by, for example, making certain classes of things, or others’ reactions to these things, *more salient to* the developing child than other classes or reactions. Thus the preparedness makes such things more likely than others to be attached to the disgust programme. Alternatively, the preparedness may *reduce the number of exposures to* such classes or reactions that the child requires before such things are attached to the programme, thus once again making such things more likely to be attached. In other words, it seems that despite children’s disgust preparedness, a child could, given a suitably

⁸ As it happens, the truth of my claim may not cause too much difficulty for Knapp with respect to the overall argument in his paper. Knapp (2003) is attacking those he terms ‘neo-sentimentalist’ moral theorists (e.g., David Wiggins, John McDowell, and Simon Blackburn) whom, he claims, “hold that for a thing to be disgusting is for it to be ‘appropriate’ to respond to it with disgust” (p. 253). Knapp argues that as Rozin et al.’s analysis shows that disgustingness is in fact “an entirely descriptive (rather than evaluative) property” (p. 255), then “the neo-sentimentalist’s theoretical reach exceeds their grasp” (p. 277). Knapp’s overall argument may well therefore require only that disgustingness be a relativized notion, whatever the actual details are concerning the mechanisms by which the disgust response develops. However, whether Knapp can continue to make his case successfully is not my concern here. Rather, my concern is with the likelihood of the disgust mechanisms developing in a language-like manner *per se*, whether or not Knapp’s ‘anti-neo-sentimentalism’ requires such development. Though, of course, I do think that in general Knapp would do better to replace his language-based developmental model with the more realistic model that I develop in this paper.

constructed developmental environment, become initially disgusted by *any things*, including such things as machines or snow. It is just the contingent prevalence of animal- and food-centred disgust behaviour in all actual developmental environments that entails that initial disgust elicitors are just the sorts of things that the disgust mechanism is 'preadaptively prepared' for. However, in the linguistic case the child cannot acquire certain grammars *no matter what her environmental circumstances*, because UG is structured such that it prevents such acquisition. UG and preparedness thus seem to operate in two quite different ways, and to implement development via two quite different methods.

Moreover, consideration of the possible contents of UG and preparedness further emphasises these differences. There is, of course, much debate about the contents of UG. However, all those engaged in this debate agree that these contents will concern deep aspects of human grammars and will be highly specific. Debate concerns which aspects these are, and precisely how specific the principles of UG must be. For example, Baker (2004) examines the debates of this kind which concern possible UG principles such as the *Head Directionality Principle*, which many linguists claim could be:

HDP: Combine a word with a phrase to make a larger phrase by putting the new word first *or* by putting the new word last.

and the *Dislocation Parameter*:

DP: (i) Dislocated noun phrases appear at the beginning of the clause *or*
(ii) they appear at either edge of the clause.

We can see then that the principles in which UG consists are extremely specialised, and specify very restrictively the kinds of grammar a child can acquire. In contrast, it is hard to see that any similar kinds of principles will provide the contents for disgust's preparedness. Rather, it seems that such preparedness will consist in much more general rules such as 'note substances that elicit <disgust face> in others', or 'attach <disgust face causing object> to the disgust programme when condition(s) <C> are satisfied'. Or, perhaps more conceptually, 'attend to <animal products>', or 'attend to <food>'. Such rules are clearly of a different kind to the principles which linguists argue may constitute UG – in addition to allowing the child much greater flexibility with regard to the set of disgust elicitors which the child can eventually acquire. Thus it seems that the dis-analogy between the developmental mechanisms involved in language acquisition and those involved in the acquisition of disgust responses becomes even more apparent the more closely we examine the details of these two systems.

Furthermore, not only does the development of the language mechanism seem more highly constrained than that of disgust, the resultant capacity also seems far less alterable as a direct result of this development. That is, it is possible for me *to cease to* find certain things disgusting, even if these things are substances by which I was initially disgusted. This might happen because, for example, I become theoretically aware of the contingent and relativized nature of the elicitors of the disgust programme and then (somehow) work toward not being disgusted by some substance. Or, perhaps, because I actually see that others do not find this substance disgusting,

and thus (somehow) engage in a similar revision of my disgust elicitors. However, in the case of language, even when one becomes aware of the contingent and relativized nature of one's I-grammar, and indeed even when one becomes able to fluently operate a second I-grammar (e.g., a grammar related to a second language), one does not and cannot *cease to* judge as grammatical (or not) central instances of one's first language. For example, my own extended experience of Asian cultures and cuisines has resulted in my no longer finding such things as raw squid, pickled sea slug or whole baby octopus disgusting, and I might perhaps one day not be disgusted by rancid milk or cooked brain either. But no matter how fluent I become in Japanese, I will not find the English sequence 'John gave the book to Mary' ungrammatical (nor, conversely, will I find the sequence 'John Mary to book gave' grammatical).⁹ It seems therefore that the results of the language acquisition process are much more rigid than those of disgust acquisition process, and that this is in part a result of the more specific and proscriptive nature of the principles which compose UG. Thus once again the development of the disgust response mechanism seems significantly unlike that of the mechanism which underwrites our linguistic abilities.

I would conclude, therefore, that despite the superficial similarity of the development of our language and disgust mechanisms, more detailed consideration shows these mechanisms to be quite significantly different in several ways. So let us now turn to a different possible model, and one which I think is much more likely to provide a template for the development of our disgust mechanisms.

4. A Possible Model of the Development of Disgust

A quick recap: Under Rozin et al.'s proposals, the elicitation of distaste requires oral incorporation, and the detection of an undesirable sensory property. The elicitation of core disgust requires a sense of oral incorporation, the conceptualisation of the substance as an offensive substance (i.e., as an animal or animal product), and an understanding of contamination potency. The elicitation of other kinds of disgust requires the conceptualisation of an object or event in a particular way, and an understanding of contamination potency. Any model of the development of disgust must therefore explain (at least) the development of the conceptual elicitors of each disgust response, the development of the understanding of contamination potency, and the development of the interactions between these elements.

For all kinds of disgust, new elicitors are acquired via the association (i.e., by generalisation or associative conditioning) of new substances, objects or events with existing disgust elicitors. For (at least) core disgust, initial disgust elicitors are also acquired via a process involving preadapted preparedness. This process is not, I claim, usefully thought of analogous to the process of language acquisition. In this section I will first offer a different model of this process. I will then turn to the development of our understanding of contamination potency, and to the interactions of the various elements of the disgust reaction.

⁹ There are, in fact, some circumstances in which I might cease to judge as I initially did the grammaticality of a central sequence from my first language. However, such cases involve some kind of aphasia or other cognitive (and/or neural) damage, and so are not the result of coming to understand the nature of I-grammars, or of acquiring a second I-grammar distinct from my first.

4.1 The Preadapted Preparedness.

One central task for all omnivorous animals is to work out what can be eaten without causing distaste, danger or death. In response to this problem, many omnivorous species have evolved the ability to avoid ingesting substances which they observe to cause distaste, danger or death *to conspecifics*, in addition to being able to avoid ingesting substances which have caused distaste or danger to themselves. Daniel Fessler and Carlos Navarrete (2003) refer to the acquisition of disgust and danger elicitors in this way as *Socially Mediated Ingestive Conditioning* (hereafter SMIC). SMIC occurs in a variety of ways in different species, and Fessler and Navarrete argue that one readily observable aspect of this system in humans is that when we observe other humans exhibit nausea or vomiting, we too experience nausea (and may even vomit). In this way, individual humans can learn to avoid distasteful or dangerous substances by associating *their own* nausea with those substances, even though they have not actually ingested those substances. Furthermore, the human SMIC system seems also to have evolved such that not only does our observation of others *actually exhibiting* nausea or vomiting result in our experiencing nausea and thus avoiding distasteful or dangerous substances, but also such that our observing others merely *gaping as though to vomit* induces a (nauseous) reaction sufficient for us to come to consider distasteful or dangerous the substance towards which the others' expression is directed. In other words, the human SMIC system now functions so as to enable us to become averse to substances towards which other humans make the 'disgust face', in addition to functioning so that we become averse to substances which make others actually vomit.

In the context of providing a model of the development the disgust response, the fact that the human SMIC system functions in this way is significant for the following reason: it entails that any given human can become averse to substances towards which other humans make the disgust face *even if she herself cannot experience disgust*. This is because observation of the disgust face is sufficient for her to consider, via SMIC, such substances aversive for reasons of *danger* or *distaste*. And this is important because it turns out that children as young as 14 months old show aversion to objects toward which the disgust face is made (Repacholi, 1998). It seems therefore that even very young children can and do use observation of adults' exhibitions of the disgust face as indicators of which substances are to be avoided, even though such children do not actually experience disgust. In such cases, the infant's SMIC system is using these observations to generate aversion to the 'disgusting' substances for – and only for – reasons of danger and/or distaste. My suggestion then is that it is infants' ability to consider as aversive those substances toward which the disgust face is made that provides one central element of the preadapted preparedness which the development of the disgust response involves.

However, many details of this ability remain unknown. For example, we do not know how many such SMIC observations are required for infants to 'file' a given substance as a danger or distaste *elicitor*, as opposed to the infant simply being averse to the substance only at (or close to) the time at which the disgust face is made. Nor is it clear by which sensory (or other) properties such 'filing' is done, or whether infants exhibit any preferences concerning who is making the disgust face. Nonetheless, there are proposals from work in other cognitive domains may be of considerable help in this regard. Boyd and Richerson (1985) have shown that in many cases of acquisition

via social referencing, the most adaptive strategy is to attend to, and then adopt, the *most common* practices in one's social set, and/or the practices of the *most prestigious members* of one's social set. Boyd and Richerson therefore propose that cognitive 'biases' to this effect are (probably innately) present in all humans. In the case of infant attention to the objects associated with the disgust face, then, my suggestion is that such biases operate to make the infant 'file' – as distasteful or dangerous – those things towards which the disgust face is 'always' made (e.g., made with more than a given frequency) and/or those things towards which mothers or other primary caregivers make the disgust face. Thus recognition of the disgust face in others works together with certain more general (innate) cognitive biases to enable infants to compile a database of the elicitors of danger and distaste from the object-orientated behaviour of those around them, as well as from their own interactions with various objects.

We thus now have some sense of the mechanisms in which the preadapted preparedness initially consists. But what of Rozin et al.'s claim that such preparedness is somehow predisposed to attach *animal products* to the disgust response? My thought here is that this is because, at least initially, animal products are the most common elicitors of the disgust face in those whom infants observe. Such objects are therefore most likely to be filed by infants as elicitors of distaste or danger. The ubiquity and power of animal products as objects of disgust in adults is well established (as we saw in s.1.2). Moreover, there are good evolutionary reasons for this cross-cultural ubiquity and power: in general, animal products are far more dangerous to human health than non-animal products (Fessler and Naverrette 2003). So the question here is whether displays of the disgust face to animal products in the presence of infants are indeed sufficiently common for infants always to file animal products – under some description – as elicitors for distaste or danger. Clearly, empirical investigation is required to determine the answer, but my expectation would be that they are.

Moreover, I would also expect the initial elicitors of children's *disgust* to be animal products. If young children already have a database of elicitors for distaste and danger that consists largely of 'animal products under some description', then conceptualising this data as 'animal products' as part of the overall process of conceptual development seems a likely occurrence. And this seems particularly so given that children's overall conceptual development will also result in them filing certain 'animal products' as elicitors through the more direct route of observation of the disgust reactions of those around them (as well as their own experiences).

I claim, then, that young children's preadapted preparedness to attach animal products to the disgust program in order to generate the initial elicitors of core disgust consists in:

1. the ability to note those objects toward which other humans display the disgust face,
2. the fact that the objects noted in 1 are overwhelmingly likely to be animal products,
3. the operation of (innate) general cognitive biases of conformity and/or prestige through which the child files as elicitors of distaste or danger certain recurrent or highly salient objects noted via 1, and

4. the operation of general conceptual development which leads the child to
 - a. conceptualise the elicitors in 3 as animal products, and
 - b. file animal products as elicitors of disgust directly via 1-3.

And, of course, this process occurs alongside the infant's compiling of elicitors based on her own experiences of ingestion and its consequences, elicitors which will no doubt also play a role in component 4.

One feature of my account is that it does not require the cognitive mechanisms involved in the infant's preadapted preparedness to be 'predisposed' *in and of themselves* to attach animal products to the disgust program. Rather, it is the combination of such mechanisms with apparently universal and highly salient properties of cultural environments which results in the appearance of such a predisposition overall. My proposal may therefore seem at odds with the proposals of Rozin et al. However, I would argue that my account seems entirely consistent with the data they and others provide. Moreover, as my account is intended to 'fill in' some of the details of Rozin et al.'s proposals, the two accounts may in fact be less inconsistent than it first appears once this relation is taken into account.

One further thought on this is that young children's understanding of the animate/inanimate distinction may also play a significant role in the conceptualising required for component 4, and it would be interesting to know the extent to which the development of this understanding correlates (or not) with the development of the disgust response. Finally, it may well also be the case that some initial *animal-nature* disgust elicitors are also acquired by the same process as elicitors for core disgust, should it be the case that humans display the disgust face to the required objects in the appropriate manner. These questions clearly require further empirical investigation, as indeed does my account as a whole. However, I hope that in developing this account I have been able to provide a plausible sketch of some of the crucial mechanisms involved in the development of the disgust response, and some indication of potentially profitable directions for future research. With this in mind, let us now turn to the notion of contamination potency.

4.2 Contamination

According to Rozin et al., the sense of contamination essentially involved in the disgust response approximates to two of the laws of sympathetic magic: 'once in contact, always in contact', and 'if things resemble each other superficially then they also resemble each other in a deeper way' (see s.1.2 above). Furthermore, these laws play a significant role even in the psychological processes of adults who are nonetheless aware that the actual transmission of dangerous properties (e.g., diseases) requires the transmission of certain kinds of biological organisms.¹⁰ Finally, Rozin et al. claim that it is the absence of these laws from the psychology of young children which accounts for young children lacking the disgust response.

Data on contamination sensitivity in infants and young children indicate that an understanding of contamination is indeed absent from children younger than 3

¹⁰ Recall that, for example, adults consider an entire foodstuff disgusting even if only part of it has been in contact with a disgusting substance, and also find disgusting an otherwise desirable foodstuff which has been in contact with a sterilised cockroach or a new plastic insect.

years old – and that children’s contamination sensitivity increases with age, reaching adult status some time before the age of 10 (see Kalish 1999 for a review).¹¹ Children at 3 years old exhibit rapid adherence to the laws of sympathetic magic, in addition to showing partial understanding that physical contact is required for contamination to occur (Springer and Belk 1994). Then, between the ages of 4 and 7 years old, children develop the belief that contamination involves the transfer of some kind of particle-like entities, e.g., ‘germs’. However, children at this age believe that these ‘germs’ behave and spread like toxins or irritants, rather than like biological organisms (Solomon and Cassimatis 1999). Children this age also believe that psychological and congenital diseases can be transferred from one person to the next via such transmission mechanisms (Kalish 1999). Finally, toward the end of their first decade, children acquire a more accurate ‘biological’ understanding of ‘germs’ and contamination, at least in cultures where such understanding plays a significant societal role. There is currently much debate about the psychological processes involved in children’s change to this biological understanding (Siegal 2002). However, what seems clear is that neither children nor adults *replace* their initial ‘magical’ understanding of contamination with this more accurate biological understanding. Rather, we seem to hold both models simultaneously, somehow suppressing the magical with the biological in many circumstances. However, when faced with situations concerning disgust or disease, it is our ‘magical’ understanding which is typically operant, and which provides the immediate or reflexive sense of contamination potency upon which disgust depends.

Current data therefore support Rozin et al.’s claim that young children’s development of an understanding of contamination correlates with their development of the disgust response. However, Rozin et al. do not offer much in the way of an explanation of how the ‘magical’ understanding of contamination initially develops. Rozin et al. claim only that the concept of “‘transmission of influence via contact’ can be regarded as an intuitive..., spontaneously occurring concept”. That is, as a concept which is “available for use without conscious effort or reflection and [is] acquired easily, even under highly degraded learning conditions” (Nemeroff and Rozin 1994; Hejmadi et al. under review). However, Hejmadi et al. also note that such acquisition is at least partially culturally dependent, as initial contamination sensitivity develops more rapidly in children in India than in American children, paralleling the greater significance of contamination in Hindu Indian culture more generally. Thus if contamination sensitivity does lie at the heart of the disgust response, one important question is how the development of our magical understanding of contamination should best be explained.

One answer would be that this understanding is somehow innate, and that acquisition is simply a matter of the ‘triggering’ of this understanding by aspects of the local environment. The differences in developmental timing between children in

¹¹ Much of the work on children’s understanding of contamination has been done in the context of investigating children’s understanding of *illness* (e.g., Kalish 1999; Siegal 2002). It is therefore theoretically possible that work specifically focussing on contamination and *disgust* will turn out to provide significantly different data concerning young children’s beliefs about contamination. However, results from what little work there is on disgust and contamination in young children are consistent with proposals made about contamination in the illness literature (REFS), and very recent work on cross-cultural understandings of contamination and disgust in young children has confirmed this congruence (Hejmadi et al. under review).

American and Hindu Indian (and other) cultures would thus be the result of differences in, for example, the presence or salience of triggers in these cultures. If this were the case, one would then require an explanation of how the laws of sympathetic magic became innately specified, and of what such specification actually consists in. Such explanations can be generated – disease avoidance and the pragmatic value of taking appearance as reality may be able to do much of the work required. However, there is as yet little evidence with which to flesh out such explanations.

An alternative answer may lie with recent explorations of the development of certain kinds of social norms (e.g., Cummins 1996; Nichols 2002a; Sripada and Stich forthcoming). These explorations focus primarily on moral norms, and the proposals made by these theorists are explicitly highly speculative, but one central element of such proposals is that humans possess psychological mechanisms dedicated to the acquisition of moral or social norms. What these authors suggest is that during ontogeny specialised mechanisms operate automatically to enable the child to (a) identify behavioural cues in the child's environment which indicate that a social or moral rule operates in the local community, (b) infer the content of such rules from these behavioural cues, and (c) store such rules for later use. Of course, if such mechanisms do exist, then we will require some explanation of the processes by which such identification, inference and storage are implemented. And, unfortunately, such explanations are still at the extremely speculative stage. Nonetheless, the mechanisms which these authors propose exhibit several more general features which are of particular interest with respect to the development of our 'magical' understanding of contagion.

One property of the proposed 'social norm acquisition mechanisms' is that whilst these mechanisms do play a central role in the development of our moral capabilities, such mechanisms are not intended to operate *solely* in the moral domain. Rather, these mechanisms are designed to operate on *whatever* social norms are present in the local community, provided that such norms are of an appropriate kind.¹² Moreover, some separation is proposed to exist between the mechanisms which identify behavioural cues and infer rules from these cues ((a) and (b)), and those which store the resultant rules ((c)). My suggestion, then, is that it is via the mechanisms which implement (a) and (b) that children acquire the laws of sympathetic magic, in addition to their acquiring other social and moral rules. However, rather than these laws being stored (only) as part of our moral capacity, they are (also) stored as rules to be employed as part of our naïve theories of illness or disgust transmission. Thus acquisition of our magical understanding of contamination is implemented by the same mechanisms through which we acquire other social or moral rules, though such rules are then (also) employed for different ends. Culturally specific differences in the developmental timing of initial contamination sensitivity will thus be a function of the salience of the laws of contamination in the behaviours of the members of different cultures.

Of course, this suggestion leaves much still to be established. More detail is needed regarding the mechanisms which identify norm-implementing behaviours and which infer the associated rules, and also regarding how the rules of sympathetic

¹² Sripada and Stich, for example, provide a 10 item list of certain features of social norms which make these norms appropriate for their proposed acquisition mechanism.

magic come to be stored or used differently to other moral or social rules. Moreover, behavioural clues implementing the laws of sympathetic magic will have to be culturally present in a manner appropriate for these mechanisms to operate as proposed. Meeting such requirements will involve considerable theoretical and empirical work, and such work is only just beginning. However, I hope that once again I have been able to sketch the kind of mechanisms which may be involved in the development of our initial understanding of contamination potency, and have also provided some indication of how exploration of these mechanisms might proceed. Let us therefore now turn to the question of the interaction of the elicitor and contamination mechanisms, and to the disgust response which these mechanisms generate.

4.3 Interaction

The developmental mechanisms sketched above present the following model of the development of the disgust response: Young children acquire a database of elicitors for core disgust (and possibly also animal-nature disgust) through repeated and overlapping instances of (i) their own ingestive experiences, (ii) observing others make the disgust face toward various substances, (iii) generalisation or associative conditioning based on existing elicitors, and (iv) conceptualising these elicitors as animal products (and reminders) either directly or through standard conceptual development. During the same period, children acquire the laws of sympathetic magic through interaction with or observation of the behaviour of others in their culture. The existence of these elements, together with an understanding that the substances which the elicitors represent could potentially be orally incorporated, then results in the emergence of the disgust response sometime after the age of 3 or 4 years old. If this is all correct, then we must now consider how it is that this result comes about.

My suggestion is this: Note that in my model of both the development of the disgust response and the resultant capacity, *there need be no elements which are specific to this response*. The elicitors of disgust – representations of animal products, etc. – may well also be employed by other cognitive systems for other purposes (and, indeed, are initially stored as the elicitors of distaste and danger rather than disgust); the laws of sympathetic magic operate as part of our response to illness independently of their operation a part of the disgust response; and the sense of oral incorporation can also clearly play a part in cognitive processes other than those involved in disgust. So it seems that what is defining of the disgust response is not that one or more disgust-specific cognitive systems are operating, but rather that some particular set of more general cognitive systems is operating in a specific way. For example, each more general system is producing output of some given kind simultaneously, or producing output in some specific sequence. Thus it is this combination of outputs that results in the disgust response, and it is only once these combinations can be achieved that a disgust response is possible. And such combinations may only become achievable once the systems required have developed to the degree that they are developed in 3 to 4 year old children.

4.4 'Revulsion'

Suppose then that my suggestion in 4.3 is correct: various non-disgust-specific systems operate and output in some particular way, and a specific combination of

operations and outputs results in the disgust response. One final suggestion then is that the term ‘results’ can and should be understood in either of two ways. The first is that a specific combination of operations and outputs causes the classic disgust behaviours of gape, withdrawal and nausea. This, perhaps, is not so controversial.

The second, however, is that the feeling of ‘revulsion’ typical of the disgust response *just is* the occurrence of this combination of operations and outputs. In other words, ‘revulsion’ is what *that* combination of operations and outputs ‘feels like’. This, perhaps, is more controversial, not least because it makes revulsion an epiphenomenon. However, considering revulsion in this way may offer great benefit. For example, the ‘intensity’ of the feeling of revulsion will perhaps be positively correlated with the ‘value’ of some property of the combination of operations and outputs which provide the disgust response (e.g., their ‘speed’, or the value of some particular output(s)). Considering revulsion as epiphenomenal would therefore enable clarification of Rozin et al.’s claims about the relation between revulsion and disgust elicitors outlined earlier (s. 1.2 above). That is, we would now be able to explain why revulsion is typically present when we are disgusted – the value is sufficiently high to make the feeling of revulsion intense enough to be noticeable; why revulsion cannot be present without the required components of disgust – the value-giving property exists only when the disgust eliciting conditions occur; *and also* why revulsion need not always seem to us to be present when we are nonetheless disgusted – the property is there, but the value is too low for the feeling of revulsion to be sufficiently intense for us to notice it. Revulsion as epiphenomenon therefore makes some sense of Rozin et al.’s otherwise rather unclear claims.

A second potential benefit is that considering revulsion to be epiphenomenal enables the feeling of revulsion to temporally ‘overlap’ both the cause *and* the execution of the classic behaviours involved in the disgust response, without revulsion itself playing a causal role. This therefore perhaps offers some explanations as to why it has proved so difficult to fix the ‘location’ and role of revulsion in the disgust response, given the other empirical and theoretical data which must also be accommodated.

Whether these additional benefits can actually be accrued remains to be seen. However, my thoughts on ‘revulsion’ notwithstanding, what I hope is that in this section as a whole I have succeeded in (a) sketching a model of the development and operation of the disgust response which respects existing data and theory, (b) providing an indication of the mechanisms by which this model is implemented, and (c) offering suggestions as to how one might go about filling in the details of these models and mechanisms. So let me now end by considering the wider issues of the development of food preferences and disgust in which this model plays a part.

5. Conclusions

The model I have proposed involves an infant initially storing as elicitors of distaste and/or danger both those substances which cause her distress and those substances toward which she observes others make the disgust face. These distaste and danger elicitors then play some role in the subsequent development of her core (and perhaps animal-nature) disgust elicitors, in addition to disgust elicitors also being

acquired more directly. This model, then, leaves open the question of whether there now exists any *necessary* connection between the development of distaste and disgust in ontogeny. In other words, whilst distaste elicitors are acquired prior to those for disgust, and seem to play some role in the acquisition of some of those for disgust, these connections may be no more than contingent aspects of children's development, rather than being necessary elements of the development of the disgust response. Children could, it seems, develop the disgust response without acquiring *any* elicitors for distaste or danger, should their developmental environment be suitably engineered. It seems then that the disgust response need not therefore be thought of as some kind of ontogenetic extension of distaste, even if it is the result the preadaptation of an original distaste response.

A second outstanding issue is that of how one can *cease to be* disgusted by a given substance (recall s. 3). My proposals do enable some explanation of this, though this explanation is far from complete. Note that my model involves the sometimes independent acquisition of elicitors for distaste, danger, and disgust respectively – elicitors which we are then predisposed to develop into further disgust elicitors. Given such independence, the gradual 'overturning' of our initial filing of a substance as an elicitor of distaste or danger could be possible via, for example, the maturation of our sensory systems, or a positive conditioning process which reverses the initial aversive reaction. In such cases, the substance concerned would eventually cease to be an elicitor of distaste or danger. This revision might then undermine our having filed the same substance as an elicitor of disgust, particularly in cases where the initial filing of that substance as a disgust elicitor was largely the result of the processes of conceptual development operating on the appropriate distaste or disgust elicitor. We would therefore cease to find a substance disgusting as a result of no longer finding it distasteful or dangerous. In addition, the *secondary* processes by which disgust elicitors are acquired (i.e., generalisation and associative conditioning) can in fact transfer both positive and negative properties from one entity to another, even though they more readily transfer negative properties under normal circumstances. Such processes could therefore also work directly to overturn the filing of a substance as an elicitor of disgust.

However, there may well remain some core disgust elicitors for which neither of these revisionary processes are available, particularly in cases where such elicitors are acquired directly as conceptualised elicitors of core disgust. In such cases ceasing to be disgusted might perhaps only be achievable via the kind of 'framing' strategies mentioned in s.1.2 above. Or, perhaps, it may turn out that we will always remain disgusted by the substance in question, but can learn to suppress this response rapidly when it occurs. Determining which, if any, of these processes actually underwrite our ceasing to be disgusted will require further empirical investigation. However, my model of the development of the disgust response seems to provide a useful framework within which to undertake such investigation.

There is one further interesting consequence of our independently acquiring elicitors for distaste, danger and disgust, which we then develop into further disgust elicitors. Namely, that not only will our motivations for food rejection often be overdetermined, but such rejection will also sometimes be done for reasons of disgust even though the initial reason for rejection was one of individual distaste or danger. In which case, individuals with, say, particular allergies or intolerances may come to

consider certain foods ‘disgusting’ because these foods are actually dangerous to them *as individuals*, rather than because these foods are culturally-specified disgust elicitors. So it may turn out that when particular individuals have disgust elicitors which have not been culturally specified, such elicitors are in fact an erroneous result of the normal development of the disgust response – albeit an erroneous result with the understandable function of over-ensuring the rejection of the dangerous substance. However, such elicitors should really only be elicitors of distaste or danger.¹³ In some sense then, what all individuals *truly* find disgusting is culturally determined, but there are also some things which given individuals may find disgusting which are erroneously so found. And if this is so, then trying to make these individuals *cease* to find such substances disgusting would be potentially problematic, as this would expose them to the danger which the disgust response was now over-protecting them against.

These then are some of the possible consequences for our understanding of food preferences and disgust which may be entailed by my model of the development of our core disgust response. However, I will conclude by briefly considering some of the wider issues in which my model of disgust may play a part. First, there are issues surrounding how the development of core disgust relates to the development of interpersonal and moral disgust, and of how the disgust response is related to moral reasoning more generally. As yet I have no clear solutions to either of these issues. However, my model is consistent with the idea that children initially acquire and develop moral rules and the elicitors for moral judgements *separately from* the rules and elicitors they develop for disgust. Children would then come to connect these moral elicitors to the disgust response, probably via secondary acquisition processes. This kind of independent development and subsequent secondary acquisition would then allow for the separation of the moral from the disgusting which is apparent in some cultures, whilst also providing some understanding of why these properties are nonetheless hard to separate, and remain largely un-separated cross-culturally (see. e.g., Haidt et al. 1993; Rozin et al. 1999; s.1.3 above).

More generally, it seems that whilst we are born ‘ready’ to be disgusted, our actually becoming disgusted is culturally dependent, and the things we come to be disgusted by are also culturally specified. Individual disgust responses and cross-culturally universal disgust responses are the result of the interaction of our species-wide, non-disgust-specific attributes with particular aspects of our local cultures. Ultimately, what one finds disgusting is what one’s culture tells one to find disgusting. Changing what one finds disgusting may therefore require a comparable degree of cultural change.

¹³ I do not know of any direct evidence in support of this suggestion. However, the general idea is that some adults who, for example, reject milk as ‘disgusting’ may in fact (unknowingly) be lactose intolerant. Thus whilst these adults are indeed disgusted by milk, such disgust is in some sense an error. In fact, milk is really *dangerous* to such people, and should rightly be rejected for this reason. Milk might well therefore have initially been filed as a danger elicitor, and only later developed into an elicitor for disgust. So for those who are lactose intolerant, finding milk *disgusting* is the erroneous result of the way our disgust response develops from initial elicitors – albeit perhaps a result with the understandable function of over-ensuring milk rejection in those who are lactose intolerant.

References

- Baker, M. (2004). The innate endowment for language: underspecified or overspecified? In P. Carruthers, S. Laurence and S. Stich (eds.), *The Innate Mind: Structure and Content*. Oxford University Press.
- Birch, L., Fisher, J. and Grimm-Thomas, K. (1999). Children and food. In M. Siegal and C. Peterson (eds.), *Children's Understanding of Biology and Health*. Cambridge University Press.
- Blackburn, S. (1998). *Ruling Passions: A Theory of Practical Reasoning*. Clarendon Press.
- Boyd, R. and Richerson, P. (1985). *Culture and the Evolutionary Process*. University of Chicago Press.
- Cummins, D. (1996). Evidence of deontic reasoning in 3- and 4- year old children. *Memory and Cognition*, 24, ????
- Damasio, A. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain*. Grosset/Putnam.
- Doctoroff, G. and McCauley, C. (1996). Demographic differences in sensitivity to disgust. *Poster presentation, Eastern Psychological Association*, Philadelphia.
- Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, 6, 169-200.
- Elias, N. (1978). *The History of Manners: Vol. 1. The Civilizing Process*. Pantheon Books.
- Fessler, D. and Navarrete, C. (2003). Meat is good to taboo. *Journal of Cognition and Culture*, 3, 1-40.
- Fessler, D., Arguello, A., Mekdara, J. and Macias, R. (200?). Disgust sensitivity and meat consumption. *Appetite*, ??, ????
- Gould, S and Vrba, E. (1982). Exaptation – a missing term in the science of form. *Paleobiology*, 8, 4-15.
- Griffiths, P. (1997). *What Emotions Really Are*. University of Chicago Press.
- Hare, R. (1981). *Moral Thinking: Its Levels, Method and Point*. Oxford University Press.
- Haidt, J. (2001). The emotional dog and its rational tail: a social intuitionist approach to moral judgement. *Psychological Review*, 108, 4, 814-34.
- Haidt, J., Koller, S. and Dias, M. (1993). Affect, culture, and morality, or is it wrong to eat your dog? *Journal of Personality and Social Psychology*, 65, 613-28.
- Haidt, J., McCauley, C. and Rozin, P. (1994). A scale to measure disgust sensitivity. *Personality and Individual Differences*, 16, 701-13.
- Helmadi, A., Rozin, P. and Siegal, M. (under review). Once in contact, always in contact: contagious essence and conceptions of purification in American and Hindu Indian children.
- Howell, N. (1986). Feedbacks and buffers in relation to scarcity and abundance: studies of hunter-gatherer populations. In R. Scofield (ed.), *Beyond Malthus*. Cambridge University Press.
- Hume, D. (????).
- Kalish, C. (1999). What young children's understanding of contamination and contagion tells us about their concept of illness. In M. Siegal and C. Peterson (eds.), *Children's Understanding of Biology and Health*. Cambridge University Press.
- Knapp, C. (2003). De-moralizing disgustingness. *Philosophy and Phenomenological Research*, LXVI, 2, 253-78.

- Korsmeyer, C. (2002). Delightful, delicious, disgusting. *The Journal of Aesthetics and Art Criticism*, 60, 3, 217-25.
- Malson, L. (1964/1972). *Wolf Children*. Monthly Review Press.
- Mayr, E. (1960). The emergence of evolutionary novelties. In S. Tax (ed.), *Evolution after Darwin: Vol. 1. The Evolution of Life*. University of Chicago Press.
- Nemeroff, C. and Rozin, P. (1989). 'You are what you eat': applying the demand-free 'impressions' technique to an unacknowledged belief. *Ethos: The Journal of Psychological Anthropology*, 20, 96-115.
- Nemeroff, C. and Rozin, P. (1994). The contagion concept in adult thinking in the United States: transmission of germs and interpersonal influence. *Ethos*, 22, 158-86.
- Nichols, S. (2000a). Norms with feeling: towards a psychological account of moral judgement. *Cognition*, 84, 221-36.
- Nichols, S. (2000b). On the genealogy of norms: a case for the role of emotion in cultural evolution. *Philosophy of Science*, 69, ????
- Pinker, S. (1994). *The Language Instinct*. William Morrow.
- Ortner, S. (1973). Sherpa Purity. *American Anthropologist*, 75, 49-63.
- Repacholi, B. (1998). Infant's use of attentional cues to identify the referent of another person's emotional expression. *Developmental Psychology*, 34, 5, 1017-25.
- Rozin, P. and Fallon, A. (1987). A perspective on disgust. *Psychological Review*, 94, 1, 23-41.
- Rozin, P., Fallon, A. and Augustoni-Ziskind, M. (1986). The child's conception of food: development of categories of accepted and rejected substances. *Journal of Nutrition Education*, 18, 75-81.
- Rozin, P., Haidt, J. and McCauley, C. (2000). Disgust. In M. Lewis and J. Haviland-Jones (eds.), *Handbook of Emotions. 2nd Edition*. Guildford Press.
- Rozin, P., Haidt, J., McCauley, C. and Imada, S. (1997). The cultural evolution of disgust. In H. Macbeth (ed.), *Food Preferences and Taste: Continuity and Change*. Berghahn Books.
- Rozin, P., Haidt, J., McCauley, C., Dunlop, L. and Ashmore, M. (1999). Individual differences in disgust sensitivity: comparisons and evaluations of paper-and-pencil versus behavioural measures. *Journal of Research in Personality*, 33, 330-51.
- Rozin, P., Hammer, L., Oster, H., Horowitz, T. and Marmara, V. (1986). The child's conception of food: differentiation of categories of rejected substances in the 1,4 to 5 year age range. *Appetite*, 7, 141-51.
- Rozin, P., Lowery, L., Imada, S. and Haidt, J. (1999). The CAD triad hypothesis: a mapping between three other-directed moral emotions (contempt, anger, disgust) and three moral ethics (community, autonomy, divinity). *Journal of Personality and Social Psychology*, 76, 574-86.
- Shweder, R., Much, N., Mahapatra, M and Park, L. (1997). The 'big three' of morality (autonomy, community, divinity), and the 'big three' explanations of suffering. In A. Brandt and P. Rozin, (eds.), *Morality and Health*. Routledge.
- Siegal, M. (2002). The science of childhood. In P. Carruthers, S. Stich, and M. Siegal (eds.), *The Cognitive Basis of Science*. Cambridge University Press.
- Simoons, F. (1994). *Eat Not This Flesh: Food Avoidances from Prehistory to the Present*. University of Wisconsin Press.

- Solomon, G. and Cassimatis, N. (1999). On facts and conceptual systems: young children's integration of their understandings of germs and contagion. *Developmental Psychology*, 35, 113-26.
- Springer, K. and Belk, A. (1994). The role of physical contact and association in early contamination sensitivity. *Developmental Psychology*, 30, 864-8.
- Sripada, C. and Stich, S. (forthcoming). Explaining social norms: Psychological and Evolutionary foundations.
- Thomas, ?? (1983). ?????
- Urmson, J. (1968). *The Emotive Theory of Ethics*. ???

Appendix A

Details of one major study

(Rozin, P., Hammer, L., Oster, H., Horowitz, T. and Marmara, V. 1986)

In Rozin et al. 1986, children aged 16-60 months were presented with various potential foodstuffs and their reactions monitored. The potential foodstuffs were all substances which adults typically consider either acceptable or unacceptable as food, and the unacceptable substances were categorised as either inappropriate, disgusting, dangerous or 'acceptable individually but unacceptable in combination'. Substances included potato chips, sugar, spinach, caviar, blue cheese, chocolate covered hot-dog, dog-biscuit, Play Doh, kitchen sponge, hair, a 6cm long, dead, green (sterilized) grasshopper, and "an extruded mixture of peanut butter, limburger cheese and blue cheese extract that was remarkably similar in appearance, texture and odour to" dog faeces (p. 144). Children's reactions were measured on a 6-point scale ranging from non-contact (1) to eat (6). The child was considered as having accepted the substance as food if they either ate it or put it in their mouth and then removed it, and as having rejected it in all other cases (brought to mouth, sniff, touch, no contact)

Rozin et al. found that across the 16-60 month age range there was little change in children's treatment of food found by adults to be acceptable, acceptable but unacceptable in combination (e.g., chocolate covered hot-dog), and inappropriate, with the first two being eaten by over 90% of children, and the third by more than 50%. Conversely, there was a considerably decrease in children's interaction with dangerous substances, and a significant decrease reactions to substances that were disgusting (e.g., 'dog faeces'). However, disgusting substances were eaten by more than 40% of children under 30 months old (2.5 years old). Individual substances showing significant decline in acceptability from 30 to 60 months were Play Doh, sponge (both inappropriate), 'dog faeces', dried oriental fish (both disgusting), caviar and baby food. All other substances remained approximately equally (un)acceptable across all age ranges, with the exception of paper which significantly increased in acceptability (from 25% to 61%).

	Type	Function	Elicitors	Motivation	(Facial) Output	Notes	Age/Dev
Non-Disgust “Forms the prototype and basis for disgust”	Distaste	Protect Body Reject food	Bad (Bitter) Tastes	Sensory properties	Lip pressing Gape Nausea	Only this is present at birth Shared by rats and other animals	Birth
	Danger	Protect Body Reject food	?All potential foods	Bad consequences – Experience of self or others		Shared by rats and other animals	0-4 yo but at high end
	Inappropriate substances	?Protect Body Reject food	?All potential foods	Conceptual - Certain things are not food		?Shared by rats and other animals	Starts 4-8 yo
Disgust “The means by which culture can internalise rejection of an offensive object, behaviour, or thought.” Requires enculturation Not present in 50 feral children	Core	Protect Body and ‘Soul’ “You are what you eat” Reject food	Food, body products, animals Almost all food related disgust elicitors are animal (products), and almost all animal (products) elicit disgust	Principally Conceptual - <i>nature or origin [or history] of object</i> , but often believed to have bad taste or be harmful in some way	Gape Distancing from O Revulsion (Nausea)	“revulsion at the prospect of (oral) incorporation of an offensive object”. OOs are <i>contaminants</i> – following the ‘SM laws of contagion and similarity’ less powerful in Hindu India	Starts 4-8 yo “the primary and onto-genetically earliest expression of disgust”
	Animal Nature	Protect Body and ‘Soul’ Suppress realisation of our own mortality	Sex, death, hygiene, ideal body envelope violations		Distancing from O Revulsion Gape Raising upper lip (anger)	“Reminders of our animal nature” less powerful in Hindu India	“The second evolution” drove the development of ‘manners’
	Interpersonal	Protect Body, ‘Soul’ and social order	(In)direct contact with strangers and undesirables ‘strangeness, disease, misfortune, moral taint’		Distancing from O Revulsion Raising upper lip (anger)	“an ethnic or outgroup marker” more powerful (<i>and governs food</i>) in Hindu India	“No suggestion as to the ordering of these two domains”
	Moral	Protect social order	Moral offences Autonomy (anger) Community (contempt) Divinity (disgust)		Raising upper lip (anger)	High SES less inclined to link disgust with morality (focusing on A or C instead) - US subjects also	