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Volume 1

Food and the Status Quest. An Interdisciplinary Perspective

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Volume 2

Food Preferences and Taste: Continuity and Change

Edited by *Helen Macbeth*

**FOOD PREFERENCES
AND TASTE**

Continuity and Change

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Conclusion

For the Trobrianders, eating versus not eating shark is important on a symbolic and human ethological level. Through such a mix of physiologically and socially triggered disgust, cultural markers are established. This principle of building ethnicity through the described biopsychological mechanism is widespread, probably universal in the cultures of our planet. In this way a neuromuscular pathway, which originally evolved for physiological benefit, becomes the social disgust face, signalling disgust to others as well as self. It is, furthermore, argued in this chapter that the disgust expressed about the eating preferences of other groups is frequently used as an ethnic marker and thereby fosters exploitation of different ecological niches.

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6. DISGUST

PREADAPTATION AND THE CULTURAL EVOLUTION OF A FOOD-BASED EMOTION

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There has been a tendency in recent years to try to account for human behaviour in any domain as either highly constrained by biology or entirely socially constructed. In this chapter, we will make an effort to establish what we think is a reasonable middle ground. We describe how a food-rejection system, strongly rooted in mammalian biology, has been elaborated and transformed to become a distinctively human emotion. The biological roots of the transformed emotion are still apparent in its facial expressions, its characteristic behaviour (withdrawal), and its physiological correlate (nausea), but the meaning and elicitors of the emotion are totally transformed by culture. In brief, a mammalian mechanism for rejecting distasteful and noxious foods, a system which protects the body from harm, is transformed into a uniquely human mechanism for internalising cultural rules and, ultimately, we suggest, the protection of the human soul.

We identify the process through which these changes occur as an instance of preadaptation (a system/property evolved to perform one function is subsequently shared or coopted for another function). Preadaptation was originally advanced as a mechanism of biological evolution (Bock, 1959; Mayr, 1961; Rozin, 1976), but we apply it here to the cultural evolution of disgust. The cultural-historical trajectory of the emotion of disgust illustrates how a food-specific system forms a base, a biological and cultural metaphor, for a much larger domain of preadaptation.

This kind of trajectory should be no surprise, because our complex sociocultural world must grow out of fundamental and largely innate biological processes, such as eating, sex, and sleeping. In the domain of eating, in particular, basic processes attain a high level of abstraction and a wide range of generality. The 'smile' to palatable tastes (Steiner, 1979; Chiva, 1985) becomes invoked as an interaction facilitator, the vocabulary of taste (sweet, bitter and sour) become metaphors to describe a wide range of experiences (Lakoff and Johnson, 1980), and the distaste gape (drop of lower jaw), becomes a general expression of rejection from the self.

Given the wide range of applications of the word 'disgust' or its rough synonyms in other languages, it may not be obvious that this emotion is, at its core, about food. However, the name itself, disgust (and similar names in some other languages) means bad taste, the facial expression is similar to the expression made by animals and human infants that serves to expel food from the mouth, and the physiological manifestation of disgust – nausea – is uniquely effective in discouraging ingestion.

Origins of Disgust in Distaste

We believe that disgust originates in the gape response, seen in a variety of animals (Grill and Norgren, 1977) and newborn human infants (Steiner, 1979; Rosenstein and Oster, 1988) in response to innately distasteful substances. The bitter taste is probably the prototype for eliciting this distaste response. This piece of mammalian biology may, itself, qualify as an emotion according to some definitions commonly used. It involves a specific set of functional behaviours: withdrawal or ridding the body of an undesirable substance. There are distinctive functional facial (and bodily) movements, with expressive qualities and a likely communicative functions. There is reason to believe that, as with adult humans, these expressions are associated with the experience of nausea (see Rozin and Fallon, 1987; Rozin et al., 1993, for more details). It also seems reasonable also to presume that the feeling of revulsion experienced by humans may have a counterpart in other mammals showing the distaste response. We will call the distaste response a proto-emotion.

Elaboration of Food Rejection Systems in Humans

Our analysis of the basis of food rejection in adults (Fallon & Rozin, 1983) suggests that there are three kinds of motive leading to rejection

of potential foods by humans. One is distaste, that is, undesirable sensory properties (taste, smell, visual) of a substance. A second is anticipated consequences, what we have learned are the negative effects of eating certain substances. A third is conceptual, what we know about the nature or origin of substances.

These three motivations develop gradually, with only the distaste system present at birth. We believe that as other motives come in, the basis for food rejection becomes elaborated in development (Fallon, Rozin & Pliner, 1984; Rozin, Fallon & Augustoni-Ziskind, 1986). In the first years of life, children learn that some substances are not good for them. They either directly experience discomfort upon eating these substances or they learn from others to expect such discomfort. We identify these substances, rejected on account of anticipated negative consequences, as dangers (as opposed to distastes).

With growing sophistication and awareness, children learn that certain things are not to be eaten because they are not food (a conceptual distinction), even though they may cause no harm. We call such items inappropriate substances; the category includes earth, paper and tree bark.

Finally, in the age range of perhaps four to eight years in American culture, the more sophisticated form of conceptual rejection emerges that we call disgust. Disgusting foods are rejected principally because of conceptual reasons – their nature or origin. However, they are also believed to taste bad, and they are often thought to be harmful. So disgust can invoke all three motivations, at least in many cases (see Rozin, Fallon & Augustoni-Ziskind, 1986 for details on the development of disgust in children). Disgust is arguably the strongest form of food rejection.

Disgust, as we define it, is distinctively different from the other categories of food rejection (Table 6.1). Disgust shares with distaste a facial expression and perhaps the nausea response, but the basis of disgust is not primarily sensory. Thus, although we see disgust as originating in distaste, we see disgust as already qualitatively different from distaste for children in the early school years. Lima beans may be distasteful (to some), but no one thinks they are offensive; if they tasted different, or were swallowed whole with a tasty coating, they would be acceptable. Not so for worms, because it is not their taste that ultimately offends us, but their 'wormness'. The conceptual rejection characteristic of disgust is a notable cognitive achievement; disgust depends on the conception of an essence (wormness) that exists independent of any sensory qualities.

Core Disgust

We call the disgust response, as we have described it in American adults, core disgust (Rozin and Fallon, 1987; Rozin et al., 1993). Our working definition of core disgust derives from the definition provided by Angyal (1941) in his seminal paper on disgust. It is: 'Revulsion at the prospect of (oral) incorporation of an offensive object. The offensive objects are contaminants; that is, if they even briefly contact an acceptable food, they tend to render that food unacceptable' (Rozin and Fallon, 1987: 23).

There are three critical parts of this definition. The first part, oral incorporation, refers directly to eating and reflects the fact that eating is the principal way in which we materially incorporate the outside world into the self. This is, not surprisingly, an act that is laden with affect. We trace the intimacy of this act to the material invasion of the self that is involved in eating, and in particular, to the widespread traditional belief that one takes on the properties of what one eats - 'you are what you eat' (Rozin and Fallon, 1987). We have shown that there is an implicit belief of this sort even in educated American adults (Nemeroff and Rozin, 1989).

A second critical part of the definition is the idea of an offensive substance. It should be clear from the 'you are what you eat' principle that if one eats something offensive, one becomes offensive. Hence the reluctance to consume offensive substances. But what makes something offensive? Angyal (1941) proposed that animal waste products are the central elicitors of disgust and suggested that faeces are the universal disgust substance. Unlike bitter aversion, the aversion to faeces seems to be acquired (Petó, 1936; Rozin, Hammer, Oster, Horowitz and Marmara, 1986).

We have expanded Angyal's proposal to suggest that the central domain of disgust elicitors includes all animals and their products when considered as food (Rozin and Fallon, 1987). Almost all food-related disgust elicitors for Americans are animals or animal products: insects, reptiles, cats, dogs, mice, rats, monkeys, any kind of rotten flesh, and most animal products except cow's milk and chicken eggs. Of course, in most cultures, some animals or animal products, almost always a very small minority of the total types available, become desirable foods. But these exceptions, which for Americans include only a few parts or products of a few animal species, only underline the rule against eating animals. In the light of the 'you are what you eat' principle, one might say that humans feel threatened that they might become too 'animal-like', as a result of consuming other animals or their products.

The third part of the definition is contamination. Our analysis suggests that contamination is a manifestation of the law of contagion originally described by the anthropologists Tylor (1871), Frazer (1890/1959) and Mauss (1902/1962; see Rozin and Neneraffin 1990, for a review). This law was described originally as a belief typical of traditional societies: once two entities make physical contact, essential properties of each pass permanently between them ('once in contact, always in contact'). We have shown that the law of contagion appears even in the behaviour of American adults (Rozin, Millman and Nemeroff, 1986). That is, Americans are inclined to reject foods that have contacted a disgusting entity, such as a worm, cockroach or body waste product. The deep motivation in these rejections seems not to be fear of microbial infection, because the rejection is not substantially weakened if the disgusting contaminating agent is sterilized. The intuition here, even for educated Westerners, is that when a cockroach touches their mashed potatoes, even briefly with no visible residue, the potatoes have been 'cockroached' and take on some cockroach properties.

The coupling of the 'you are what you eat' principle with the law of contagion greatly enlarges the domain of contamination (Rozin, 1990). Thus, when an undesirable person prepares a food, that food is contaminated; subsequent ingestion of that food passes the offensive properties on to the consumer by the 'you are what you eat' principle. Hence, a chain of indirect human influences may be brought to bear on the process of eating, as happens most saliently in Hindu Indian culture (Marriott, 1968; Appadurai, 1981) and among the Hua of Papua New Guinea (Meigs, 1984).

It is our belief, indicated in the designation 'core disgust', that revulsion to animals and body products in the context of food is the primary and ontogenetically earliest expression of disgust. The core disgust system is constructed from the preadapted distaste food rejection system. The modification of this system involves a change in meaning and elicitors. Core disgust shares some of the properties of distaste, including the facial expression, behavioural withdrawal and nausea, but disgust differs qualitatively from distaste in both the presence of contamination and the sense of conceptually based offensiveness. The principal elicitors of core disgust are animals and animal products in a food context (Table 6.1).

Animal Nature Disgust

We have asked American adult subjects to list some examples of things that they consider disgusting, and Japanese adults to do the

same with respect to the closest Japanese synonym to disgust that we can find (*ken'ō*). In both cultures, only about one-quarter of the responses can be classified as core disgust (Haidt, Rozin, McCauley and Imada, 1997). Many of the remaining instances can be classified into one of the following four domains:

1. poor hygiene;
2. inappropriate sexual activities (e.g., between people of very different ages, or between people and animals);
3. body envelope violations (gore);
4. contact with death.

We have constructed a scale to measure individual differences in disgust sensitivity (Haidt, McCauley and Rozin, 1994). This scale includes instances that represent each of the seven domains of disgust we have mentioned (animals, food, body products, poor hygiene, sex, gore and death) and some items tapping contagion sensitivity as well. We find wide variations in disgust sensitivity in both American and Japanese respondents, with a high degree of similarity in the range of scores and item responses in Japan and the United States (Imada, Haidt, McCauley and Rozin, n.d.).

Wronska (1990) has independently constructed a disgust scale in Poland, and her scale is remarkably similar to our own in terms of the domains of disgust elicitors represented. Although her particular items were often quite different from ours in ways that reflect the rural environment of Poland (e.g., smell of a manure pit), her items could easily be recognised as representing five of our domains of elicitors: food, animals, body products, sex, and hygiene.

In examining our seven domains of disgust elicitors, we note that a common feature is that each domain refers to something physical that humans share with animals: basic body functions such as eating and sex, body care (with lack of cleanliness associated with animals), body excretions such as faeces and mucous, a body envelope that can be cut or ripped to reveal mushy insides (gore), and a body destined for death and putrefaction. This common feature is consistent with a suggestion made by Rozin and Fallon (1987) that one aspect of disgusting substances is that they are reminders of our animal nature.

There is abundant evidence from ethnographies that humans see themselves as qualitatively different from, and superior to, 'animals' (e.g., Leach, 1964; Tambiah, 1969). Reminders of our animal nature are unpleasant, and are to be rejected from the mind just as offensive foods are rejected from the mouth. Hence, we propose that, in both individual development and in cultural evolution, the already devel-

oped (preadapted) core disgust rejection system is expanded to include animal nature reminders (Rozin, Haidt and McCauley, 1993). In our account, animal origin disgust represents a second evolution of the emotion of disgust (Table 6.1).

Table 6.1 Proposed Pathway of Expansion of Disgust and Disgust Elicitors

	Disgust stage				
	Distaste	Core	Animal nature	Interpersonal contamination	Moral
Function	Protect body	Protect body and soul	Protect body and soul	Protect body, soul, and social order	Protect social order
Elicitors	Bad tastes	Food/eating, body products, animals	Sex, death, hygiene, envelope violations	Direct and indirect contact with strangers or undesirables	Certain moral offences

Death and Disgust

Examination of the relationships between each of the thirty-two questions on the disgust scale and the total score on the test reveals that some of the best predictors of the total score are individual items that deal with death, such as being disgusted by touching a corpse or picking up a dead pet cat (Haidt, McCauley and Rozin, 1994). The salience of death sensitivity fits well with the fact that the quintessential stimulus feature prompting disgust is the smell of decay. Furthermore, *miasma*, the ancient Greek concept akin to our concept of pollution, was prototypically engaged by contact with death (Parker, 1983). A critical role for death in disgust is further supported by the centrality of mortality in human psychological functioning, as argued by Ernest Becker in *The Denial of Death* (1973). Becker, taking a psychodynamic approach, argues that the main function of our defence mechanisms is to suppress the thought or realisation of our own mortality. He holds that it is our mortality, rather than our sexual or aggressive impulses, that represents the fundamental human dilemma. In this perspective (see Rozin, Haidt and McCauley, 1993 for more details), death becomes *hweder* the animal property that is most threatening to humans. Thus, a second account of animal nature disgust gives a central place to denial of death, with disgust serving to keep such thoughts out of the mind.

Although we are suggesting that disgust is an emotion that functions to keep away intimations of our mortality, we do not want to

go so far as to suggest that all experiences involving disgust are likewise avoided. Toy stores sell disgusting toys – imitation mucus, creatures that vomit – to school-aged boys. Film makers sell horror films and slasher films that probably elicit a good deal of disgust from their mostly adolescent audiences. Funerals and other rituals such as circumcision probably elicit disgust in at least some adult participants. Public interest in and discussion of crimes of violence is often high, as in the case of Jeffrey Dahmer who killed, dismembered, and ate at least ten people. Evidently, disgusting experiences are not always avoided.

The examples just cited all involve experience of disgust in a social situation: the toys, the films, the rituals and the news are used in interactions with others. It seems possible that sharing and comparing disgust reactions can be the source of a social bond or attraction that distinguishes the ingroup from outgroups. In this way shared disgust can be a celebration of the barrier between animal and human even as this barrier keeps out thoughts of our animal origins. The chapter by Schiefenhövel in this volume points in a similar direction.

Interpersonal Disgust

Some disgust elicitors do not fit within the category of animal nature reminders. These include certain moral violations and a wide range of direct and indirect physical contacts with other people (Table 6.1). We consider these two final domains of elicitors in this and the next section. We have no suggestion as to an ordering of these two domains, either in individual development or in cultural evolution.

Although it is not commonly suggested by subjects spontaneously offering examples of disgust, contact with undesirable persons is reliably considered both disgusting and contaminating (Haidt, McCauley and Rozin, 1994). In a questionnaire study of American adults, for instance, Rozin, Markwith and McCauley (1994) asked how much respondents would like to use each of three objects previously used by a target person: a sweater (laundered), a hotel bed (with clean linen), and a used car. The target person (previous user) was described as, in different instances, a healthy stranger, a person with tuberculosis (illness), a person with an amputated leg (misfortune) and a person who was a healthy convicted murderer (moral taint). A substantial minority of subjects rated the item used by the healthy stranger as considerably less attractive than a new item. Much more negative ratings were found for used objects when the previous user had experienced misfortune or had a disease or moral

taint. These more negative responses were characteristic of almost all subjects (even though the sweater was laundered, and the bed linen changed). The results clearly indicate a strong negativity (we read this as disgust) to any physical contact, even indirect, with an undesirable person.

Of course, the healthy stranger does not have any obvious undesirable properties. Further analysis indicates that elimination of any presumed negative properties of a stranger (e.g., by specifying that the person is a priest or is physically attractive) has little effect on those people who find stranger contact aversive/disgusting (McCauley, Rozin, and Markwith, n.d.). It seems that even indirect contact with unknown others can elicit disgust for many Americans. This can be interpreted as a self-protecting impulse, an aversion/disgust aimed at distancing the self from others, particularly different or strange others. Again we note that Schiefenhövel's paper in this volume comes independently to the view that disgust in humans serves as an ethnic or outgroup marker.

If we consider disgust as an expression of revulsion and a distancing of the self from a disgust elicitor, then it becomes an emotion much involved in both individuation and, by its absence, an expression of solidarity. This leads us to predict major differences in the interpersonal aspects of disgust in cultures that vary in interpersonal attitudes. Markus and Kitayama (1991) have recently summarised evidence suggesting a major difference between Japanese and Americans on this dimension, with Japanese characterised as having an interdependent self, in contrast to an American independent self. We do not yet know enough about the boundaries that define interdependence (other members of the family, friends, members of the local community, or all Japanese), but we would expect that the domain of interpersonal disgust in Japan might be quite different from that in the United States.

Furthermore, interpersonal deference and harmonious relationships have particular value in Japan. Hence, any violation of social interaction rules might be considered more serious and even disgusting in Japan. There is some support for this possibility in the spontaneous examples of *ken'ō* offered by Japanese subjects (Haidt, Rozin, McCauley and Imada, 1994). These examples include instances of failure in the management of everyday social interactions, such as 'when I was betrayed by a person I trusted' or 'when others around me took no notice of me' (Imada, Yamada and Haidt, 1993).

In Hindu India, the domain of interpersonal disgust may take on a yet more important and distinctive form. In general, Hindu Indians seem more concerned about interpersonal than 'animal' pollu-

tion. That is, the focus of disgust in Hindu India may be more on interpersonal and moral elicitors than on the animal nature and core disgust categories. This probably results from the high respect in which many animals are held, and to beliefs about reincarnation. The latter may both reduce human distinctiveness in relation to animals and mute the concern about human mortality.

Although interpersonal pollution (and, we presume, disgust) is highly developed in Hindu India, the focus of interpersonal disgust in India is foods. In this sense Hindu disgust does rest on core disgust after all. Rules about acceptable and unacceptable foods, formulated in terms of who previously contacted, prepared, or partly consumed a food, are of central importance, and form the principal concrete enactments of the caste system (Marriott, 1968; Appadurai, 1981).

Moral Violation as a Disgust Elicitor and Disgust as One of the Three Other-directed Moral Emotions

Many of the examples for disgust (*ken'o*) listed by American and Japanese subjects involve socio-moral violations that have little obvious connection with either core, animal nature, or interpersonal disgust (Imada, Haidt, McCauley & Rozin, n.d.; Imada, Yamada and Haidt, 1993). We feel that these examples of what we shall call moral disgust can be understood best in the context of a formulation of the nature of moral systems.

Richard Shweder (1990) and Shweder, et al. (1997) have explored moral systems cross-culturally, and suggested that moral ideas and moral arguments around the world tend to fall into three clusters or codes. The first he calls the 'ethics of autonomy', because it takes the autonomy of the individual to be of paramount importance. In this moral code, individuals must always be given the freedom to act on their preferences, and moral dilemmas consist of balancing the rights and welfare of competing autonomous individuals. The second code is called the 'ethics of community', because it takes the community to be of paramount importance, with all of its rules, roles, and traditions. Moral dilemmas in this code typically consist of conflicts between duties or role-based obligations within a hierarchical social structure.

The third code is called the 'ethics of divinity', because it takes spiritual advancement to be of paramount importance. Conflicts within this code focus on the human obligation to strive for closeness to God, physical purity, and the realisation of God within each person, while struggling against the downward forces of material attach-

ment, physical pollution, and animal-like behaviour. Thus Hindu children think that purity violations, such as eating beef or getting a haircut the day after one's father dies, are far more serious moral violations than rights violations such as tearing up the work of another child (Shweder, Mahapatra and Miller, 1987).

We have proposed (Rozin, Haidt and McCauley, 1993; Rozin, Lowery, Imada and Haidt, n.d.) that Shweder's three moral codes map on to what we shall call the three other-directed moral emotions: anger, contempt and disgust. That is, anger is the emotion linked to rights violations, contempt is linked to hierarchy violations, and disgust is linked to purity violations. This prediction was supported in a study in which Japanese, American and Indian subjects read scenarios embodying violations of each of the three Shweder codes. Subjects were presented with an array of anger, contempt and disgust faces and asked to assign each scenario to an emotional reaction. Assignments of scenarios to faces showed the expected linkage of rights, hierarchy, and purity violations with, respectively, anger, contempt, and disgust faces (Rozin, et al., n.d.).

In a related study, Haidt, Koller and Dias (1993) presented violations of the ethics of divinity to lower and upper-class subjects in the United States and Brazil. Scenarios were designed to involve no harm or violation of autonomy, and yet to elicit a sense of disgust: e.g., a family that eats its dead dog, or a man who has sexual relations with a dead animal. The scenarios were considered equally offensive by all groups, but the critical issue was whether the scenarios were considered to be moral violations. In accordance with the dominance of the autonomy/rights code in Western countries, Americans were less inclined to consider disgust violations as immoral (since no one was harmed). Also, upper-class subjects in all settings were less inclined to link disgust and morality. These results, along with our prior discussion, suggest that cultures differ not only in what elicits disgust but in the extent to which disgust elicitors are seen as moral violations. In the event of a moral involvement, however, disgust serves to reinforce the negative attitude to the act.

Historical Perspectives

Our scenario for the cultural evolution of disgust has ontogenetic and historical implications. The ontogenetic implications are simply that one would see a gradual development of disgust elicitors in accordance with the sequence we have laid out - from distaste, to

core disgust, to animal-nature disgust, and finally to interpersonal or moral disgust. There are little relevant data at this time.

The historical implications are similar, given that we propose a sequence in cultural evolution. There is some supporting evidence for our scheme, in relation to the particular category of animal nature disgust. There is probably a long history of offense at contact with death, judging for example by Parker's (1983) analysis of miasma and the pollution of death in ancient Greece. We do not know, of course, whether anything like the emotion of disgust was linked to death-pollution at that time. However, it does seem that many aspects of animal nature disgust were not in place in mediæval times in Europe. Norbert Elias' (1978) analysis of the history of manners suggests that mediæval Europeans engaged in many behaviours that would be considered disgusting in modern Western societies. In public eating situations, for example, they ate food from a common pot and returned bitten food to that pot, ate with their hands, and spat at table. Elias accounts for the development of manners as motivated by a desire not to be animal-like: 'it will be shown how people, in the course of the civilizing process, seek to suppress in themselves every characteristic that they feel to be animal'. If we can assume that these behaviours became disgusting, then, following Elias, we can describe disgust as the emotion of civilisation.

Keith Thomas (1983) offers a related analysis of the relation of man to nature in sixteenth to late eighteenth century England. According to Thomas, during this period the uniqueness of humans and their distance from animals became an important part of English sensibilities. Again, we can only presume that these changes were associated with the emergence or enlargement of animal nature disgust. Darwin's major reorientation of views about the relations of animals and humans comes after the period analysed by Thomas. It would be of great interest to analyse the influence of Darwin's ideas about the continuity of humans and animals upon the expression of animal nature disgust. In addition, the decline of organised religion in the last hundred years may have led many people to think about death in a different way, which may in turn have had an effect on the nature or expression of animal nature disgust.

Preadaptation and the Trajectory of 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 any particular culture. Some of these things, like human faeces, and perhaps contact with death, 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. The phenomenon of contagion, probably originally linked to core disgust, becomes an important component of reactions to the wider range of disgust elicitors, again by a process such as preadaptation.

The process of socialisation in any culture involves acquisition of many values. It is more efficient to have these 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. A good way to prevent traffic with something is to make it an elicitor of disgust.

There are two recent examples of this process in American society. Smoking has, over the last decade, entered into the domain of the immoral, from its prior status as just an undesirable habit (or maybe a desirable one). As this has happened, the manifestations of smoking (e.g., visible cigarette smoke, cigarette stubs or ashes, tobacco stains on teeth) have become disgust elicitors (Rozin and Singh, n.d.).

The process of becoming a vegetarian in modern American culture also illustrates the recruitment of disgust. Some vegetarians adopt their diet almost exclusively for health reasons, others for almost exclusively moral reasons (e.g., animal rights, saving the environment), and many, of course, invoke both types of justification for their vegetarian diet. Comparison of relatively pure 'health' and 'moral' vegetarians indicates that moral vegetarians are much more likely to be disgusted by the prospect of eating meat (Rozin, Markwith and Stoess, 1997). Here we see an example of the 'invocation' of disgust in the service of a moral issue. The vegetarian who is disgusted by meat can be said to have meat avoidance more internalised, and hence to be less tempted to consume meat.

The process of preadaptation is central to our analysis. Preadaptation was originally invoked by Ernst Mayr (1960; see also Bock, 1959) as an account of how novel systems could evolve. It seemed unlikely that every small approximation to a novel system would itself be adaptive, and hence subject to selection. Mayr suggested that major evolutionary changes could occur rather rapidly if a system evolved for one purpose was 'borrowed' for another. (Gould and Vrba, 1982, point out that the borrowed structure need not have

evolved under natural selection, but could be a neutral trait, and suggest the more general term, exaptation.) A classic example is the evolution of the mammalian middle ear bones (ossicles) from bones in the gill arch. A more familiar example is the human mouth, which clearly evolved as an aperture for processing and handling food (with appropriate adaptations such as tongue and teeth) but which is now shared by the speech output system. The tongue and teeth are essential parts of the articulation of speech sounds, although they did not originally evolve for this purpose.

In order for biological evolutionary preadaptation to occur, the 'pirating system' must have some 'contact' with the original system (Bock, 1959). In the absence of some link, natural selection cannot operate to increase the link. Bock (1959) illustrates the necessity for contact as a prerequisite for preadaptation with the example of a lower jaw bone spur that served as a muscle insertion, which increases in size, makes contact with the upper jaw, and becomes a new jaw articulation. It has been suggested that something like preadaptation (called accessibility) also occurs in individual development, where brain systems involved for one specific purpose become applied in new contexts or domains (Rozin, 1976). For example, it is argued that the auditory speech system linkage in the brain, critically important in spoken language comprehension and production, is partly shared by visual inputs in the process of acquisition of alphabetic writing systems. The phonological segmentation machinery critical for speech perception and production is 'accessed' in the process of learning to read; that is 'how' we come to appreciate that 'bat' has three sounds.

In biological evolution, preadaptation is like mutational variation in that both must wait upon a fortunate set of circumstances. In cultural evolution, however, variation can be intentionally produced and so can preadaptation. An individual, group or culture can put ideas in contact in ways that will serve as a preadaptation for cultural selection. We can recognise, for example, that the calculator and typewriter, if combined, could make a computer, or that the same principle used in a motorcycle, if enlarged and modified, could transport large loads in things as do trucks and cars. The history of technology (Girifalco, 1991) is, in substantial part, a history of preadaptations. Similarly, it is our claim that the sequence of evolution via preadaptation that we have presented for disgust represents a common sequence in cultural evolution.

Our analysis suggests that the major event in the cultural evolution of disgust is the expansion or replacement of meanings and elicitors, with the output side of the emotion programme largely intact. This is

not to say that there have been no changes on the output side. Recent studies of the facial expressions related to recognition of disgust suggest that there is a difference in prototypical expressions associated with different types of disgust (Rozin, Lowery and Ebert, 1994; critical studies on the production of disgust faces to different elicitors have yet to be done). Thus, distaste associated with bitter or sour tastes seems to be primarily related to lip pressing and purses, neither hallmarks of disgust. The gaping response, characteristic (along with the lip press and purse; Rosenstein and Oster, 1988) of infant responses to bad tastes seems primarily associated with two types of elicitors: oral irritation from high temperature or irritants like chilli peppers, and core disgust food entities such as rotten foods. On the other hand, animal nature, interpersonal and moral disgust are most associated with a raising of the upper lip. It is perhaps not accidental that this dominant expression of elaborated disgust has no obvious function in expelling foods or odours, but is rather linked to the mammalian upper lip raise associated with baring of the teeth. Disgust shares, in this respect, a facial expression also commonly seen in the anger face. As disgust approaches the moral domain, it seems to become more involved with an expression associated with another moral emotion.

Our conception of disgust is incomplete and undeveloped. We feel it is appropriate to at least call attention to a different, but somewhat related idea. It comes from Mary Douglas' (1966) analysis of the concept of pollution. Douglas sees pollution as an expression of 'matter out of place', that is anomalousness or uncanniness. She holds that the human psyche is offended by things that do not fit into accepted schemes, and such entities are polluting (and perhaps, disgusting). It is clear that anomaly, often manifested as deformity (such as amputated limb stumps, absence or unusual conformation of facial features) is a substantial elicitor of disgust. This falls roughly under our more limited category of body envelope violations. However, it is also clear that anomaly is neither a necessary nor a sufficient condition for the elicitation of disgust.

We are just at the beginning of understanding the cultural differentiation of disgust. We have suggested that important cultural values will correspond to notable variations in what is found offensive, immoral and disgusting in particular cultures. Thus, we have proposed that issues of social management may enter the disgust domain in Japan, and issues of interpersonal contact and morality may become primary in the expression of disgust in Hindu India. Whatever the validity of these particular suggestions, we are confident that the study of disgust will be useful in understanding cultural development and cultural variation. Disgust is culture's most effective means to enforce a prohibition.

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7. WILD PLANTS AS FAMINE FOODS FOOD CHOICE UNDER CONDITIONS OF SCARCITY

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Throughout history, famine and food shortage have been salient features of subsistence and peasant societies. Types of food shortage reported for pre-industrial groups vary from mild seasonal shortfalls in staple foods to occasional widespread and severe hunger. While in recent decades we have seen famines restricted to Africa and parts of Asia, there is probably no geographic region that has not experienced severe food shortage at some time in the past (Robson, 1981). As food shortage is so widespread in subsistence-oriented societies, such groups have developed strategies for coping with scarcity. These strategies can be seen as part of the overall adaptive repertoire of pre-industrial populations, and range from food sharing and reliance on less preferred foods to permanent migration and the sale of land and livestock.

One of the most frequently reported strategies for dealing with scarcity, whether short or long term, is the collecting and consumption of wild plants. Even for societies such as those of foragers, where wild plants are part of the normal diet, there is an increase in the range of plants exploited when staple foods are scarce. For many cultivators, wild plants that are condiments and medicines in normal times make increasing nutritional contributions when food supplies fail.

Despite the importance of wild foods as famine strategies, there has been little systematic research on the topic, and little is known