THE PSYCHOLOGY OF FOOD CHOICE

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2 The Integration of Biological, Social, Cultural and Psychological Influences on Food Choice

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Introduction

Almost everything influences food choice, at one time and place or another. Food is so important, and permeates human life in so many ways, that it engages and interacts with almost all of our activities: leisure, the arts, sex, work . . . everything but sleep . . . and there is nothing like a long sleep after a good meal.

Because of the richness and complexity of human food choice, many disciplines have something to say about it: biology, psychology, sociology, anthropology, economics, history and medicine, among others.

The plain fact is that the biggest determinant of what an individual eats is availability. One eats what is there, and more critically, one does not eat what is not there. This mundane fact should not discourage intellectual inquiry, because the determinants of what is available to any individual have biological, psychological, social, cultural and historical aspects.

One situation frequently focused upon by investigators, especially marketers, sensory testers and psychologists, has an individual facing a set of food choices. Under these conditions, we can say that psychological factors are probably pre-eminent, and that expectations about taste, convenience and health will predominate. The rich and complex interaction of expectations, beliefs and values can be modelled in this situation, as for example in the work of Richard Shepherd and his colleagues (Shepherd and Raats, 1996). As we focus more on availability, as opposed to the moment of choice, we are forced into considerations that take us well beyond psychology.

The 'moment' of food choice, for humans and other animals, is but a step in a series of behaviours organized for the quest for food. Typically, there is arousal by biological and cultural motives for nutrition (often described as hunger, in the former case, and 'mealtime' in the latter case). What follows, in the precultural environment, is the search for food, the detection of food or foods, the choice (or decision to accept or not), followed in some cases by capture of the food, then

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perhaps some preparation of the food, and finally its ingestion. For some species, especially food generalists, the stage of choice is particularly important. Food generalists such as humans, cockroaches and rats eat a wide range of foods, and encounter many different potential foods. 'To eat or not to eat' is a weighty decision, often made. The stakes are high: good food means life, and bad food may mean death. The risks are not just of consuming toxins, but of consuming nutritionally inadequate, unbalanced diets. For animals that eat a single type of food, like many carnivores and some herbivores, the choice situation is simplified. If it is the right size and alive, and capturable, the carnivore will go for it. There is no need to worry about toxins or imbalances: a live animal almost guarantees both safety and nutritional adequacy. For humans, cultural forces enhance the ambivalence of generalist eating. It is widely believed that 'you are what you eat'; that is, that people take on the properties of the foods they eat (Nemeroff and Rozin, 1989). These properties can be positive, such as strength, but also negative, such as animality.

Food and in particular, choosing and obtaining food, are as central to biological evolution as any activity. Furthermore, for the food generalist, there is usually no problem more difficult than finding nutritionally adequate foods, and avoiding toxins and imbalances. It is no accident that many animal groups are described in terms of their food habits: among the mammals (themselves named for their early milk drinking) there are Carnivora and Insectivora for example, and primates are often described in terms of their food habits: principally fruit or leaf eaters, for example.

Food choice assumes a central role in human evolution, with, according to most views, a shift from a primarily vegetarian diet to a more omnivorous diet with the movement from the forest to the savannah. And there is nothing more important in human cultural evolution than the twin advances of agriculture and animal domestication. As Diamond (1997) correctly notes, it is this major advance that makes most of the rest of the flowering of culture possible. It frees humans from day-to-day dependence on the vagaries of nature, and allows for the specialization of labour that leads to impressive technologies.

The quest for food plays a major role in the life of virtually all humans. For the less developed world, food probably accounts for 50% of total expenditures, in comparison to less than 25% for developed countries (Anon, 1990). But, of course, most human beings are in the former category. Among our daily activities, food-related behaviours are probably the third most time-consuming, following on sleep and work (Szalai, 1972).

Preadaptation and the Food Domain

Food would be complex enough for the reasons already stated. But for humans it is yet more complicated, because food has become integrated into many functions and activities that have nothing to do with nutrition. The process through which this has occurred is referred to as preadaption in biological evolution. As explained by Ernst Mayr (1960), preadaptation is the major source of innovation in evolution, and consists of the use of features already evolved to serve a

particular function, to now serve a new function. In the process, the original function may be displaced, or there may be a sharing of function. Appropriately for a discussion of food, the human mouth is an excellent example. The mouth, its tongue and teeth, evolved for breathing and for processing of food. But when language arises in humans, it takes advantage of the preadapted food/breathing system, with oral cavity, teeth and tongue in the line of breathing. The teeth and tongue become an integral part of speech production, although they evolved for food functions.

In cultural evolution, preadaptation is even more important than it is in biological evolution. This is because, unlike in biological evolution, humans can conceive of a value for one system in another context, and make it happen. For example, fire is useful both to keep warm and to cook food. They can use a wheel in many ways. In the preadaptive history of food in human cultural evolution, food moves from its original function to assume many others (Fig. 2.1a).

Food becomes a social marker. It identifies one's group, as does a distinctive cuisine distinguish, say, Chinese from Indians. It also functions socially as the opportunity for family social interaction at meals, and for celebrations, such as marriages. In modern Western societies, it becomes a major arena for making

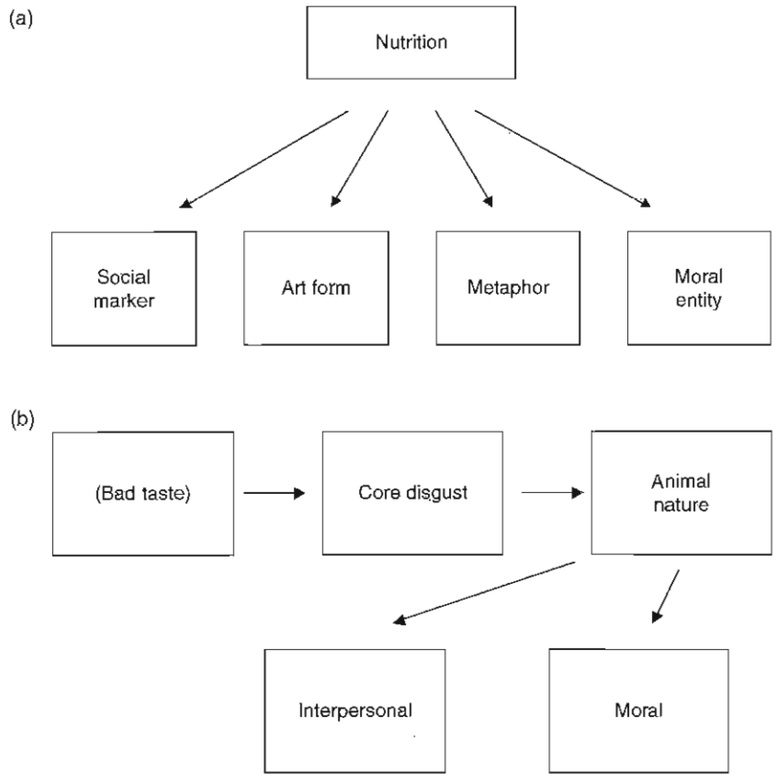

Fig. 2.1. (a) Preadaptation and food; (b) preadaptation and disgust.

social contacts, dating or business deals. And it becomes an expression of affection and attachment, as in chocolate on Valentine's day and turkey on Thanksgiving. Sharing of food is a major sign of intimacy, cross-culturally. A purely nutritional perspective would be totally inadequate to capture these important uses of food.

Food also becomes a form of aesthetic satisfaction. The development of cuisine, and high cuisines in some cultures, represents an attempt to enrich life and produce aesthetic pleasure. There is no way in which nutrition requires fancy desserts, or the elaborate mixtures of spices in Indian cuisine. The social and aesthetic functions of food are so prevalent that a visitor from another planet might take some time to discover that food was 'essentially' about staying alive, about nutrition.

Food enters into our language, as part of communication, in yet another preadapted form. Food words are central parts of metaphors. Metaphors themselves are examples of preadaptation, where a term from one domain (in this case, food and nutrition) is used to describe another. So, when we say that someone is a sweet person, that we can't stomach a particular ideology, that we wish Rozin would get down to the meat of this paper (meat will be discussed later), we are using food for non-nutritional functions.

Finally (Fig. 2.1a), food plays a role in the moral world. The laws of kashrut in the Jewish religion and the various food transfer prohibitions between castes in Hindu India have to do not with nutrition, but with moral standing. The taking of the host in the Catholic Mass is a symbolic, moral use of food. In Hindu India, more than in the USA, food is an explicitly moral entity, described by Appadurai (1981) as a 'biomoral' substance. One can recreate the Hindu caste structure, based essentially on moral purity, by simply studying food transfer rules. In the USA, the moral function of food is more muted, although it is hard to escape noticing how cigarettes have become morally undesirable ingestants, and further, suggestions that high-calorie, sweet and fat foods have taken on a negative moral tinge (Stein and Nemeroff, 1995).

The spectacular elaboration of food and eating, and entry of food into all of the domains of life, is captured beautifully, for European civilization, by Leon Kass (1994) in his splendid book, *The Hungry Soul*. He describes the transformation, at one point, as from 'fressen to essen'. Eating on the spot and wolfing down food, as opposed to sitting at a table, eating with silverware, not taking bites of the food on another's plate and using the meal as a focus for conversation.

There is something special about food in this regard. While, in general, the development of culture is often associated with a de-emphasis of humans' biological functions (e.g. the general modesty about carrying out sexual and excretory functions), the biological function of gaining nutrition is typically accomplished in public, and often celebrated. Eating is the one biological function that has been both celebrated and transformed by culture. Human sex and excretion are much more like dog sex and excretion than is human eating like dog eating. Kass's story of the transformation of eating requires an integration of biological (nutritional and evolutionary), psychological, social, cultural and historical perspectives.

The cultural evolution of disgust, as studied by myself and my colleagues, April Fallon, Jonathan Haidt and Clark McCauley, illustrates the co-opting of a

food function for a wide range of cultural purposes (Rozin and Fallon, 1987; Rozin *et al.*, 2000). The great majority of exemplars of disgust that we have elicited from Americans, Japanese and Asian Indians do not have to do with food. The varied involvements of the emotion of disgust in human life can be traced to a basic foundation emotion, which has to do with rejecting food (Fig. 2.1b). The prototype of disgust is the rejection of foods from the mouth based on a negative oral experience (taste, flavour, texture, temperature). In human cultural evolution, this response, which we can call the distaste response, transforms into a response that is basically about rejecting food because of its nature (ideational rejection), as opposed to its sensory properties. We call this 'core disgust', and it accounts for the principal food disgusts, such as responses in most cultures to specific spoiled foods, insects, animal wastes and other specific parts of animals. In our view, this type of disgust, which appears in children after the first few years of life, is what disgust is really about. Indeed, most adults do not label foods they do not like the taste of as disgusting. The original distaste system becomes disconnected from the disgust system.

The food-related core of disgust is evidenced in the following ways: (i) the word 'disgust', with similar derivations in some other languages, means bad taste; (ii) the facial expression of disgust, including a gape, is a gesture of oral rejection; and (iii) the physiological signature of disgust, nausea, is a symptom which specifically inhibits eating.

We hold that, in cultural evolution, this powerful rejection response has been co-opted by cultures to many things that are rejected by the culture. In the process of socialization, one can cause individuals to reject culturally undesirable entities by making them disgusting. According to our analysis, the major step in the cultural evolution has to do with disgust becoming attached to reminders of our animal nature, including aspects of sex, excretion, poor hygiene, indicators of our animal-like insides (blood, viscera) and, most interestingly, death, a property we share with animals. We note that the quintessential odour of disgust is the odour of decay or death.

We trace the cultural evolution of disgust (Fig. 2.1b) to two more domains of human life. Interpersonal disgust is about contact with other people, particularly people whom one does not like, or people from other groups. Finally, moral disgust has to do with attaching disgust to certain types of moral violations. These are usually what might be called violations of 'purity', best illustrated in Hindu India by disgust at contacts with less pure individuals or entities (associated with lower castes; see Miller, 1997, for an extended discussion of the invasion of the moral domain by disgust).

A central feature of core disgust is contagion: when a disgusting food touches otherwise acceptable foods, it renders them permanently inedible. This contagion property of disgust is carried along with disgust as it expands to a wider domain. Thus, individuals are disgusted by wearing clothing that had been worn by a person they consider immoral.

The trajectory described here for disgust, and that described for general food preadaptation by Kass (1994), illustrates the complex interactions of biological roots, individual psychology and culture in the shaping of the modern human mind and the physical and institutional world created by humans.

What is Food Choice?

The simplest manifestation of food choice is relative intake. Thus, we might note that the intake of rice is higher per capita in China than in the USA, but the intake of beef is higher in the USA. Food intake of particular foods is rather easy to obtain on a national basis, and is the focus of many economic analyses. It is motivated in part by preference and liking, but also, to a great degree, by availability, geographic and economic factors.

Preference has to do with a comparison of two of more foods, as part of a set from which a choice can be made. A prefers B to C means that when A is faced with a choice of B and C, under specified conditions, A prefers B. There are two important things to note about preference. First, although it influences intake, it is only one of many influences. Thus, Chinese might prefer beef to rice, but this would not be expressed in relative intake because of cultural, geographic and economic factors. Second, preference is related to liking, but does not stand for liking. One may prefer B to C, but like C better. For example, many Americans like ice cream more than salad, but will choose a salad because of concerns about weight and health.

Liking is the psychologically most interesting feature of food choice. It is most interesting because it motivates much food choice, and we do not really understand what gets people to like or dislike foods. It is easier to understand why health concerns or cost influence preference. So liking is a major determinant of preference, and preference is a major determinant of intake, but many other variables intervene.

The preference–liking distinction motivates a psychological taxonomy of foods, which in turn sets part of the agenda for understanding food choices. We can identify three basic motives for choosing or refusing potential foods: sensory properties (taste, flavour, smell, appearance), effects of ingestion (repletion, nausea, etc.) and ideational concerns (having to do with the nature or origin of a food; Rozin and Fallon, 1980). These three motives define four categories of food acceptance and rejection. With respect to rejections, distastes are motivated by sensory properties, and map rather clearly on to likings (examples might be hot pepper, black coffee or broccoli, depending on the individual). Dangers are motivated by concerns about the consequences of ingestion (examples for Americans include foods very high in fat or foods believed to contain toxins). Inappropriates are potential foods that just do not fit within the cultural definition of food (ideational rejection; examples include paper and sand). Finally, disgusts are multiply motivated rejections. They are primarily rejected because of their nature (ideational/inappropriate), but are also usually believed to be both harmful (dangers) and bad tasting (distastes). There is a corresponding division of accepted foods into those accepted because they are liked on sensory grounds (good tastes, e.g. candy), because they are thought to have positive consequences (beneficials, e.g. bread), because they are just classified as food (appropriates, e.g. turkey on Thanksgiving) and what we will call transvalued foods, the opposite of disgust, enhanced because of their nature or origin, and thought to be desirable on both sensory features and effects. Transvalued foods are much

less common than their opposite, disgusting foods. Examples might be food prepared by or partaken by admired or loved others.

Finally, any food liking or preference is heavily dependent on context. Breakfast foods are preferred and liked only for breakfast; steak and whipped cream are both highly desirable to most people, but not mixed together. The importance and function of context have been explored and reviewed by a number of investigators, including Meiselman (1996) and Rozin and Tuorila (1993). Howard Schutz (1989), in considering this important feature of food choice, coins the apt term 'appropriateness' to describe it.

Perspectives on Human Food Choice

In this section, the disciplinary foci on food choice will be summarized across the four disciplines that have the most to say about food: biology, psychology, sociology and anthropology. Food selection in a broad perspective is treated in a number of edited volumes (Barker, 1982; Meiselman and MacFie, 1996; Meiselman, 2000).

Biological (physiological and evolutionary/adaptive) influences

Biological approaches to food choice take two forms. One focuses on physiological mechanisms, and its focus is explaining, at the moment, what is going on in the body and the brain when a food choice occurs. Most of this research is carried out with animals, particularly the domestic rat. The focus has been on the regulation of energy intake, but there is important information on food choice as well. The pioneer in this area is Curt Richter (1943). The case of sodium appetite is perhaps best investigated (Richter, 1956; Denton, 1982; Schulkin, 1991). The physiological approach has two aspects, metabolic and neural. That is, one aspect has to do with the processing of nutrients, and the metabolic events that become the stimuli for action, via communication of nutritional states to the nervous system. The second aspect focuses on the brain, and how and where information about metabolic state is integrated with information about the environment, other motives, etc., to lead to choice. This very important area, growing in relevance to human food choice with the recent development of non-invasive brain scanning techniques, will receive no more attention in this chapter (see relevant chapters in this book for further discussion of this perspective).

More central to the present review is the adaptive/evolutionary approach, which places an animal in its ecological niche, and in the context of its evolutionary history attempts to understand food choice, feeding strategies and the like. The critical frame for humans, in this respect, is as a food generalist (Rozin, 1976). As such, it is impossible to make adaptive decisions about the safety and nutritional quality of a potential food on just sensory properties. Hence, for the generalist, most knowledge about the food world must be acquired.

There are some biological predispositions that help the generalist to negotiate the world of literally thousands of potential foods and poisons. Most clear are taste biases: innate biases to prefer sweet tastes (associated with fruit) and avoid bitter (correlated with toxins; Steiner, 1979). As well, there seem to be innate aversions to very strong tastes, including salt or sour. There are early-onset fat preferences and irritant avoidances, which are also probably innate. As Bartoshuk (1990) has noted, while the taste system has a number of innate links between tastes and hedonic responses, the smell system is much more open-ended and relies heavily on learning.

There is a complex of behaviours involving cautious sampling of new potential foods, a balance of neophobia and neophilia, most studied in rats.

There are specific learning mechanisms that facilitate the evaluation of potential foods in terms of toxicity (taste aversion learning; Rozin and Kalat, 1971; Garcia *et al.*, 1974) and beneficial effects (Sclafani, 1999), allowing learning to bridge the long delay between ingestion and the consequences of that ingestion (illness or repletion). And there is the general tendency to come to like entities that one experiences repeatedly (mere exposure; Zajonc, 1968). This can be enhanced by social learning; at a minimum, increased exposure can be produced by the food choices of local conspecifics (Galef, 1988).

Animals with specialized diets, such as koalas or anteaters, often have genetically prespecified means of detecting appropriate foods. With a very narrow range of potential foods, such animals simply need one internal detection system which indicates a need for energy (since all foods are essentially nutritionally complete) and a sensory system for identifying that food (Rozin, 1976). Dietary generalists have subsystems which operate like specialists. Thus, rats and humans have a water system, which indicates a specific need for water, and some means of detecting water or entities with high water content. A similar system exists, at least in rats and some other animals, for salt (Richter, 1956; Denton, 1982; Schulkin, 1991), and the hunger system provides guidance in the domain of energy: hunger indicates the need for energy, and sweet and fat preferences help to identify sources of calories.

None the less, the generalist, and in particular the human generalist, must for the most part learn about what is good to eat, and what is not; and yet more complicated, what combinations of foods are good, and what are not. The evolutionary/adaptive approach to human food choice that has been described looks at the behaviours that promote nutrition. Another approach, taken largely by anthropologists, is an adaptationist programme which attempts to show that traditional culinary practices are nutritionally adaptive. Marvin Harris (1985, 1987) and Solomon Katz (1982) are perhaps the strongest and most productive advocates of this point of view. Examples include explaining the Mexican combination of beans and maize as together providing a satisfactory balance of amino acids, the traditional leaching process that removes toxic cyanide from bitter manioc, and the use of some spices and combination of spices which limit the growth of bacteria (Billing and Sherman, 1998). These efforts are important and interesting. They leave two questions (Rozin, P., 1982): (i) How much of traditional culinary practice can be accounted for by nutritional adaptations? (ii) How were these processes discovered and institutionalized in cuisines?

Psychological influences

The experience with foods that any human has is largely determined by cultural traditions, since these determine what foods a person is exposed to. They constrain the operation of individual psychological factors, including genetic predispositions, parental influence and various other opportunities for learning. The mechanisms of acquisition of food preferences are reviewed in a few books, including Booth (1994) and Logue (2004), and edited books such as Meiselman and MacFie (1996) as well as in review articles (Rozin and Schulkin, 1990).

The developmental trajectory of humans in terms of food experience and preferences is striking. The initial 'food' of the fetus is blood, followed after birth by an exclusive milk diet and then the gradual introduction of adult foods. Weaning is, of course, a major event in this sequence.

Origin of preferences

Individuals *within a culture* vary widely in their food preferences. Many Americans like broccoli, lima beans and pork, and many do not. What is the source of this within-culture variation? The four most likely accounts are: genetics, early experience with parents, peer influences and other more general influences, such as the media. Of course, most of the latter are culture-wide influences, and hence cannot be easily invoked to explain within-culture differences. The most probable candidate is parental influences, because these encompass both genetic effects and early experience. Hence, it is quite surprising to discover that parent–child (with the children being young adults) correlations in food preferences are very low, in the range of 0 to 0.30, with a mean of about 0.15 (Rozin, 1991). Peers are another natural focus, although there is some evidence that peer influence may be smaller than expected (Rozin *et al.*, 2003). The origin of within-culture differences in preferences is, at this point in time, a mystery. There may be a substantial role for chance individual experiences. Also, results from marketing suggest that an important period for the development of preferences, specifically for genres of music, is between the ages of about 15 and 30 years (Holbrook and Schindler, 1989).

Acquisition of preferences

Psychologists have not paid much attention to the acquisition of preferences. We basically do not understand how food, music, pet or other preferences arise. There are three documented avenues to preference change.

1. *Mere exposure* (Zajonc, 1968). Generally, the more one is exposed to something, the more one likes it. Cultural traditions, family practices and peer preferences all influence the pattern of exposure an individual has. Mere exposure has been demonstrated as an influence on food preferences (Pliner, 1982).

2. *Evaluative conditioning.* Contingent pairing of tastes, appearances, etc. with biologically meaningful outcomes (e.g. sweet or bitter tastes) can cause acquired likes to occur by a Pavlovian mechanism (Rozin and Zellner, 1985), described,

for the case of hedonics, as evaluative conditioning. The research group headed by Frank Baeyens in Belgium has carried out a major share of the work on this issue (de Houwer *et al.*, 2001). Taste aversion learning, in which specifically nausea following a novel taste rather reliably reduces the liking for that taste, is a quintessential example of evaluative conditioning.

3. *Social influence.* This is a vague but very important category. There is some evidence indicating that approval of admired others, experiencing the enjoyment of others on eating a particular food, and things of that sort can produce enhanced (or for the opposite case, decreased) liking. In her work on the development of food preferences, Leann Birch (reviewed in Birch *et al.*, 1996) has demonstrated some of these effects under controlled conditions. Baeyens and his colleagues (Baeyens *et al.*, 1996) have demonstrated evaluative conditioning, where the unconditioned stimulus is observation of a person consuming a drink (simultaneously consumed by the subject) and showing clear positive or negative facial expressions. Animal studies on food preferences suggest limited domains of social influence, often accomplished by mere exposure that results from social influence (Galef, 1988).

It is commonly believed by laypersons that a range of rewards and punishments is effective in shaping food preferences. There is no doubt that rewards and punishments can influence food intake, but it is not clear that they actually change liking. Some work by Leann Birch (reviewed in Birch *et al.*, 1996) casts doubt on the efficacy of instrumental rewards for changing liking.

Food choice in the moment

Acquisition aside, at a given moment humans face food choices, and a host of factors influence the selection. Among them are the physical arrangements of the foods, beliefs about the foods including their taste and health values, value systems (as with vegetarianism), knowledge about and experience with the particular foods available, and simple cost and convenience. Richard Shepherd and his colleagues (Shepherd and Raats, 1996) have modelled this situation with particular care and given a sense of the integration of factors, including the relation of attitudes and beliefs to actual choice. David Booth (1994) has also approached this problem from a number of perspectives.

Work by Daniel Kahneman and his colleagues (Kahneman *et al.*, 1997) has provided an important perspective on the moment of choice. These authors distinguish between anticipated, experienced and remembered pleasure. Faced with a choice about whether, for example, to buy a food product, an individual refers to his or her memories of past encounters with the choices (remembered pleasure), and considers his or her likely future hedonic trajectory with the product (anticipated pleasure). For example, if he/she buys a large box of X, will he/she continue to like it, grow in liking or decline in liking, with multiple experiences? In most choice situations except those in a food testing laboratory, an individual is not actually experiencing (tasting) the relevant choices. Kahneman and colleagues have shown two very important things, with research mostly from the domain of pain. First, valenced episodes are remembered quite differently from the way they are experienced. Duration of

experience, a major determinant of the total pleasure received from an experience, is not recorded well in memory. Translating to the food domain, a few bites or a large number of bites of the same delicious food have very different effects on experienced pleasure, but are remembered as about equally pleasant (Rode *et al.*, unpublished). On the other hand, Kahneman has shown that people are poor at predicting their hedonic trajectories. Generally, they don't know whether repeated sampling of a given entity will increase or decrease their liking. Hence, in the purchase situation, individuals face distorted memories of past experiences with the foods in question, and poor abilities to predict their future reactions to the same foods.

CONTEXT. Understanding of any food choice must take into account both the surroundings (context) and the recent history of the person involved. Judgements are heavily influenced by the setting (décor, social situation; de Castro, 1990; Meiselman, 1996) and foods recently consumed (Rolls, 2000). (Contextual effects are reviewed in Rozin and Tuorila, 1993; Meiselman, 1996.)

Social influences (sociology)

The sociological approach to food choice is presented well in a few recent books (Murcott, 1983; Beardsworth and Keil, 1995; Maurer and Sobal, 1995). Sociologists have a particular interest in demographic variables as within-culture determinants of food choice. There are modest effects of age and gender on food preferences (for example, in the USA, meat avoidance is more common in women and, on account of greater weight concerns in women, preferences for low-calorie foods are higher in women). Gender, age and social status, while significant in accounting for food preference, do not account for very much variation (nor, as indicated above, do parents!).

Sociological concerns also deal with important influences on food choice and intake at the institutional level, such as in institutions and restaurants. The whole food system (Beardsworth and Keil, 1995; Maurer and Sobal, 1995), including the social organization of the growing of foods, delivery to markets and distribution of foods, has major influences on what is chosen.

And finally, one of the major influences on food choice is current fad movements, such as low-fat or 'lo-carb' or vegetarianism. These take their place, along with many other non-nutritional fads, in what appears to be a fundamental feature of human social organization.

Although this section is the shortest of the four on disciplinary influences on food, this reflects more on my own knowledge base than on its importance. The sociological perspective is vital in understanding food choice.

Cultural influences (anthropology)

In human food choice, culture is almost certainly the predominant influence. Consider the following. We have an unknown adult human being whose food

preferences we wish to predict. We have only one question to ask before making our guesses. What is the most informative question? There is no doubt: it is 'What is your culture?' Individuals grow up embedded in a world highly determined by culture, which monitors the available foods and, indirectly, their costs, as well as general attitudes to food, the meaning of food and the way children should be socialized to food. Furthermore, of the social science disciplines relevant to the understanding of food (and this includes economics and history, as well as psychology and sociology), anthropology is the discipline that pays most attention to the role of food in daily life and the meaning of food. Concentrating as it does, through ethnographies, on the daily lives of people, it follows that food will play a central role (see de Garine, 1972 and Messer, 1984 for general discussion of cultural influences).

We can describe the complex of cultural traditions that bear directly on food as cuisine. Some of these traditions are about the particular foods one eats, the kinds of things that appear on the table from day to day, and are described in ethnically faithful cookbooks. Elisabeth Rozin (1982) has provided a framework within which to describe cuisine in this narrower sense, dividing into staple foods, flavouring ingredients and methods of preparation. Thus, Chinese cuisine is characterized by a rice base, with pork and other foods as common ingredients, flavourings centred on the 'flavour principle' of soy sauce, ginger root and rice wine, and the stir-fry technique. Mexican food, on the other hand, is built around maize and beans, with chilli pepper, tomato and lime as the repeating flavours, and with stewing as a basic technique.

There is much more to cuisine than the individual dishes. There is the meal (see Meiselman, 2000 for an excellent treatment of the meaning of the meal): what constitutes an appropriate meal, order of serving, and the like. And then there are table manners, the social organization of the meal, food and ritual, and the meaning of food in life and social intercourse. Food, preadaptively, often assumes symbolic roles. Because it involves shared substance, it is closely tied to the social world, functioning frequently as a homogenizing agent through sharing of food with individuals with whom one is close, and as a heterogenizing agent, as a way of distinguishing oneself from most others by not sharing food with them (Appadurai, 1981).

Among the Hua of Papua New Guinea (Meigs, 1984), food is believed to carry important vital essences. Among these are gender-specific essences. In order to protect young males, as they enter puberty, from feminization, the boys are kept in a separate house, are not allowed to consume any food touched in any way by fertile women (allowing contact with only prepubertal or postmenopausal women) and avoid consumption of any foods considered to contain feminine essence, which includes among other things fruits with soft, reddish interiors.

Focusing on the developed world, there are substantial cultural differences that affect not only the foods eaten, but also the role of food in life. For example, in comparison to Americans, the French eat smaller portions, take longer meals, consider food a more important part of life, worry less about the health effects of foods, organize their social life and celebrations around it, and are less receptive to the foods of other cultures ('ethnic foods'; Stearns, 1997; Rozin *et al.*, 1999).

Five Examples of the Integration of Biological, Psychological and Cultural Factors

This particular book on food choice, and others that have preceded it, appropriately organizes food choice around issues such as origins, mechanisms and pathologies. Another orientation would be to use foods as a framework: vegetables, fruits, grains, dairy, meat and flavourings, for example. This is not how the field is organized, although food history is often so organized. One cannot organize a field simultaneously around foodstuffs and processes/influences. To help to redress this situation, and to illustrate the integration of forces in food choice, a brief discussion of five specific foods follows. The first three are components of the greatest food exchange in history: the mixture of foods and food traditions from the Western and Eastern hemispheres, consequent on the 'discovery' of the 'new' world by European explorers in the 15th–17th centuries. These and other examples are presented in somewhat more detail in Rozin, P. (1982) and by specific sources referred to in the discussion below.

Chocolate

Chocolate is one of the most popular foods in the Western world, and is the most craved food in the Western world. Its aroma and texture rank among the best of all foods. Chocolate comes from Mexico, and was introduced to Europe and the world by Cortez and the other early Spanish explorers (Coe and Coe, 1996). Raw chocolate was consumed by the ancient Aztecs in a bitter brew, seasoned with chilli pepper! It must have been very much an acquired taste. In the hands of the Europeans, a set of technologies were developed, involving drying and fermenting the beans, followed by grinding and extensive stirring under heat (conching), with the addition of sugar, vanilla (also a product of the Western hemisphere) and eventually milk. The result is the conversion of a bitter and gritty bean to a sweet and fat, luscious-tasting confection. The sweetness masks the bitterness. The aroma brought out by fermentation and other processes is irresistible. Of course, the critical addition of sugar depended on its availability, something that happened in the period prior to the European domestication of chocolate (Mintz, 1985). And most of the sugar came from plantations established by Europeans in the New World.

Chocolate is a perfect example of a culturally created super food. Its success is built on some human taste/texture predispositions: for sweet tastes and fatty textures (Drewnowski and Greenwood, 1983). Humans also seem to like foods that provide a dynamic sensory experience, changing in properties as they are consumed. The principal fat in chocolate is the only common fat that melts at body temperature. All of this is combined with the special, appealing aroma developed in processing. Chocolate also contains a number of pharmacologically active substances, including theobromine, caffeine and phenethylamine. These are all arousing substances. We still do not know their role in the popularity or craving for chocolate. What we do know is that chocolate is an example of culture capitalizing on some human food predispositions. It is expensive, and this may be part of the reason why it has not penetrated South America, Africa and

Asia to the degree that it has been accepted in Europe and North America. Economic and psychological factors, coupled by effective marketing, make it likely that chocolate will be a universal favourite in coming decades, particularly as the world moves towards Western tastes.

Chilli pepper

Chilli pepper is probably the world's most commonly consumed spice, other than garlic or salt (if one wishes to consider garlic and salt as spices; reviewed in Rozin, 1990). Chilli peppers come from the Americas, and were introduced to the Eastern hemisphere during the 15th–17th centuries. They now constitute basic flavourings in most of tropical Africa and Asia. It is hard to imagine Indian, Southwest Chinese, West African, Southeast Asian or Indonesian cuisines without chilli pepper. There is a flowering of varieties of chilli peppers, with different degrees of burn and different aromas, producing a range of mouth experiences that can be compared in some ways to the variety offered by cheese or wine.

The problem chilli pepper raises is that, on account of its oral irritant properties, it is innately aversive. It is, in an important sense, the opposite of sugar. In a still mysterious way, cultures have arranged to present chilli pepper as a flavouring in traditional foods, and choreographed gradual exposure to it in such a way that almost everyone in the relevant cultures is converted from a chilli hater to a chilli liker by the age of 6 years or so (Rozin, 1990). This is a case where culture has reversed an innate aversion; that is, opposed our biology. We do not yet know how this miracle occurs, but it is clear that the same burn that is negative initially becomes desirable through experience.

One of a number of accounts (all with insufficient evidence) for the production of chilli liking invokes the endorphin system. Endorphins are secreted in response to pain, and no doubt this happens on initial consumption of chilli pepper. The pain would normally stop further ingestion, but cultural pressures (such as, for children, eating what adults eat) keep it as an item of consumption for children. According to one model of addiction, opponent process theory, processes are set into operation on repeated exposure to pain which serve to neutralize the pain and perhaps, in some conditions, overcompensate for it. Thus, it is possible that excess endorphin secretion produces the pleasure that lovers of chilli pepper enjoy. This may or may not be a part of the acquisition mechanism; there are other possibilities (Rozin, 1990). But the important point about this example is that it illustrates a set of peculiar interactions among biology, psychology and culture. On the one hand, biological predispositions make chilli acceptance unlikely. On the other, in the face of repeated sampling, a biological (compensatory, homeostatic opponent) process is enlisted which, in this peculiar situation where an individual continues to administer pain to him- or herself, may reverse an aversion.

Maize

Maize comes from the Western hemisphere, specifically Mexico, along with chocolate and chilli pepper (and tomatoes, potatoes, squash, vanilla, manioc and groundnuts!). It entered Europe, and then spread around the world, in the same general manner as the other Western hemisphere products. Maize is a major source of energy, functioning as a staple food. It grows well in temperate climates, and is a highly efficient crop in terms of energy yield per hectare. Like all other vegetable foods, it does not contain sufficient amounts of all nutrients to be able to support mammals as their only food.

Maize functions as a staple food in Mexico and many other parts of the Americas. Katz (1982) has described in some detail how it has fitted into an adapted, nutritionally adequate cuisine. In Mexico, it is consumed along with beans, which have a complementary distribution of some critical amino acids; together they constitute a satisfactory array of essential amino acids. The tortilla is the major form in which maize is consumed in Mexico. Katz and his colleagues have shown how the traditional technique for making tortillas, which includes boiling the maize in an alkali solution, improves the nutritional quality of maize in a number of ways. These improvements are important, but none has rapid and dramatic effects, and it is not clear how they were discovered and maintained. Interestingly, when asked why they boil maize in alkali, Mexican women display no knowledge of the nutritional advantage, but point to a more palpable aspect of the tortilla technology (Rozin, P., 1982). The alkali softens the maize husks, and makes it easier to roll out a smooth tortilla. Katz's adaptive evolutionary account of tortilla technology raises interesting psychological problems as to how individuals discovered and retained the technique.

Maize had much less of an impact on the Eastern hemisphere than many other foods from the Americas: chilli peppers, chocolate, tomatoes, potatoes, manioc and groundnuts to name a few. In spite of its ability to grow well in Europe, it never became a human staple. But indirectly, it had a major effect on European eating because it became a principal source of animal feed.

It is not clear why maize was not readily accepted as a human food. One account is of particular interest, because it highlights the importance of unique and chance events in culinary history, and hence in food choice. Mexicans consume maize, a rather mealy and not particularly sweet staple, in the form of tortillas. Tortillas may well be tastier to most humans than maize itself, and are more nutritive as well. The tortilla-making technology is somewhat involved, and it is probable that none of the men in Cortez's expedition or other expeditions ever learned how to make them. Mexican men rarely do. So maize and maize seed were brought back to Europe but not the critical technology that made it more palatable and nutritious (Katz, 1982). Had there been a single Spanish woman on the expeditions to the New World, the tortilla technology might have been transferred back to Europe, with perhaps much more adoption of maize as a staple in Europe and beyond (the beyond being accomplished by later European colonization of Africa and Asia).

Milk

Milk is the special and unique food of baby mammals. As a food, it is as biological/predetermined as one could imagine. It is essentially a complete food.

The problem is that weaning from milk must occur, to allow a young mammal to find ways to obtain nutrition from the environment and free the mother for other activities, including having more offspring. Milk is a food only available to baby mammals.

Enter the domestication of animals, and the development of dairying traditions. Milk and milk products are now available to adult humans. But milk is specifically adapted as a food for the very young. Its substantial and energetically important carbohydrate component is in the form of lactose, a sugar that exists only in milk. Appropriately, the gut enzyme lactase, found only in mammals, breaks lactose down into two utilizable monosaccharides, glucose and galactose. But lactase is deprogrammed at about the time of weaning, so that, prior to dairying, no human adults could digest milk sugar. The result is what are called lactose-intolerant adults: the undigested lactose becomes a food for hindgut bacteria, with gas pains in the hindgut, diarrhoea and poor absorption of gut contents. Not fatal, but painful and inefficient.

So humans created a new adult food that they were biologically unprepared to deal with. As established largely by the work of Frederick Simoons (reviewed in Simoons, 1982), two solutions emerged that permitted the appropriation of milk, a very rich food, for adults.

1. *The cultural response.* Milk is an excellent food if one can digest lactose. The cultural solution is to digest lactose outside the body, and then drink the milk or milk product. Through a process of *culturing* (appropriately named), the milk is exposed to bacteria that break the lactose down to its two utilizable monosaccharides, glucose and galactose. In this form, with minimal levels of lactose, milk is a superb food for mammals. Cheese and yoghurt are two of the most ubiquitous outcomes of microbial digestion of lactose in milk.

2. *The biological response.* In one of relatively few clear demonstrations of how cultural forces have changed the human genome, the origin of dairying is connected with a genetic change that blocks the deprogramming of lactase at about the time of weaning. This single dominant gene mutation had obvious adaptive value, and through a process not yet documented became the dominant gene among the dairying cultures of northern Europe and among a few dairying groups in Africa. The rest of the world remained predominantly lactose-intolerant.

The problem of milk as an adult food was handled in two opposite ways. But there are still some important biocultural problems about milk as a human food. It is notable that milk and milk products are absent from China, home to one of the greatest and widely consumed cuisines in the world. The Chinese are known for their culinary ingenuity, having produced such complex products as soy sauce and tofu. Surely, they could have discovered that even leaving milk around for a few days would make it an acceptable food? This was discovered by many other cultures. The answer may well be that the rejection of dairy products by the Chinese had a sociocultural base. Milk and fermented milk products were basic foods for the Mongols, who conquered and ruled China. It may have been negative reactions to the Mongols that motivated the Chinese not to incorporate milk or milk products into their cuisine.

Yet another problem posed by milk, and a problem with a more biological account, has to do with weaning. It is an extraordinary and rare problem, in the animal world, to initially have a highly nutritive and exclusive food, and then be forced not only to wean from it, but for it to never be available again. What is to prevent young mammals from vainly seeking a beloved but unavailable food? There are apparently a number of biological adaptations to make this process easier (Rozin and Pelchat, 1988). Lactose intolerance develops at about the time of weaning. It is preprogrammed and not the result of declining milk intake. As a consequence, the late nursing mammal starts to experience the negative symptoms of lactose intolerance late in weaning, a contingency that would surely discourage milk ingestion. In addition, milk sugar, lactose, is much less sweet than most other sugars and its two monosaccharide components. Perhaps the low sweetness is there to detract from what is so positioned to be a super food. And, on the cultural side, weaning is often accomplished gradually, accompanied by introduction of other palatable foods, and, in many cases, by explicit discouragement of nursing by placement of bitter or irritant substances on the nipple.

The story of milk, biological, psychological and cultural, is particularly important, and particularly interactive. How could it not be? The universal first food remains at the centre of cuisine in some cultures, and disappears completely in others.

Meat

Like milk, meat plays a very important role in human evolutionary history and in human diets around the world. It is the quintessential complete food; since the nutrient requirements of most vertebrates are about the same, they essentially form packages of complete nutrients for other vertebrates. Meat can legitimately be claimed to be the most favoured and the most tabooed food across the culinary landscape (Simoons, 1961; Tambiah, 1969). It is the quintessentially ambivalent food for human beings, and this is the core of its great psychological interest. In many parts of the world, individuals or cultural groups are vegetarian. There is a dedication to a meat-free diet which is not paralleled by a dedication to a vegetable product-free diet; that is, there are few if any 'meatatarians'. While meat, particularly beef and chicken, is a favourite food among Americans, the most offensive foods for Americans are also of animal origin; indeed just move inches from a beef steak or chicken breast and we have kidneys, skin and guts, which are strongly repulsive to most Americans. Why?

Meat involves eating another living animal. By the 'you are what you eat' principle, this could involve taking on these animal's properties. And one of these properties is being *like* an animal, a core theme eliciting the emotion of disgust.

More than any other food, meat is associated with some things that are basically human. Hunting of larger animals, and adaptations to do it, provided one of the major motives for fundamental changes in humans as they evolved. Larger animal foods are a major factor promoting food sharing and social eating occasions. A hunter or particular family happens upon much more food than it

can consume before it goes bad. This is rarely true for vegetable foods. On the other hand, the killing that necessarily goes with eating meat is cause for both appeal (as in hunting) and concern. Among foods, meat is the focus of moral concerns. It plays a central role in moral concerns in some cultures, as Hindu India, and among dedicated groups of vegetarians within meat-eating cultures (see Twigg, 1983; see also Fiddes, 1991, for discussions of the meaning of meat).

Conclusion

The message of this chapter is that food and food choice can only be understood by a mixture of biological, psychological, social and cultural perspectives, all taken within a historical context. Culinary history is a major part of human history: directly, as it affects an important part of life, and indirectly, as it motivates other activities, such as the exploration and colonization of the Americas. Strong social movements, often describable as 'fads', characterize the history of foods, especially in more affluent countries. The story of food in America over the last 200 years, as told by historians such as Levenstein (1988, 1993) and Whorton (1982), is a complex mixture of religion, morality and other social forces, harnessed to a developing and powerful food industry, and more recently, major concerns about body image and health. The politics of food (Nestle, 2002), such as agreement on and dissemination of dietary standards and the food pyramid, and trust in institutions (Frewer and Salter, 2003), now has much to do with food choice. We are just beginning to understand all of this.

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