traditional factor analysis to structural-causal modeling in developmental research, in *Experimental Psychology in the Future*, V. Sarris and A. Parducci, Eds. (Erlbaum, Hillsdale, NJ, 1984); J.J. McArdle, Principals versus principles in factor analysis, *Multivariate Behavioral Research, 25*(1), 81–87 (1990).

2. For path analysis diagrams, see S. Wright, On "Path analysis in genetic epidemiology: A critique," *American Journal of Human Genetics, 35*, 757–762 (1982); J.J. McArdle and S.M. Boker, *RAMpath* (Erlbaum, Hillsdale, NJ, 1990).

3. For classical factor analysis, see J.R. Nesselroade and R.B. Cattell, *Handbook of Multivariate Experimental Psychology* (Rand McNally, New York, 1988); J.B. Carroll, *Human Cognitive Abilities: A Survey of Factor-Analytic Studies* (Cambridge University Press, New York, 1993).

4. For statistical testing in factor analysis, see D.N. Lawley and A.E. Maxwell, *Factor Analysis as a Statistical Method* (Butterworths, London, 1971); M. Browne and R. Cudeck, Alternative ways of assessing model fit, in *Testing Structural Equation Models*, K. Bollen and S. Long, Eds. (Sage, Newbury Park, CA, 1993).

5. For power analysis in SFA, see A. Sattora and W.E. Saris, Power of the likelihood ratio test in covariance structure analysis, *Psychometrika, 50*, 83–90 (1985); M. Sobel and G.W. Bohrnstedt, Use of null models in evaluating the fit of covariance structure models, in *Sociological Methodology 1985*, N.B. Tuma, Ed. (Jossey-Bass, San Francisco, 1985).

6. For factor analysis of item-level data, see R. Mislevy, Recent developments in the factor analysis of categorical variables, *Journal of Educational Statistics, 11*, 3–31 (1986); D.H. Parry and J.J. McArdle, An applied comparison of methods for least squares factor analysis of dichotomous variables, *Applied Psychological Measurement, 15*(1), 35–46 (1991).

7. For construct validity and SFA, see L.J. Cronbach and P. Meehl, Construct validity in psychological tests, *Psychological Bulletin, 52*, 281–302 (1955); J.J. McArdle and C.A. Prescott, Age-based construct validation using structural equation modeling, *Experimental Aging Research, 18*(3), 87–115 (1992).

8. Cronbach and Meehl, note 7, p. 291.

9. Canonical regression models can be written as a restricted structural equation model where we eliminate (a) the error variance $D^2 = 0$ on the latent variable C and (b) the internal validity assumptions of uncorrelated residuals among the Y variables; see McArdle and Prescott, note 7.

10. For the debate on job performance, see M.J. Ree and J.A. Earles, Intelligence is the best predictor of job performance, *Current Directions in Psychological Science, 1*, 86–89 (1992); R.J. Sternberg and R.K. Wagner, The *g*-ocentric view of intelligence and job performance is wrong, *Current Directions in Psychological Science, 2*, 1–4 (1993).

11. For the debate on personality factors, see B. Mershon and R. Gorsuch, Number of factors in the personality sphere: Does increase in factors increase predictability in real-life criteria? *Journal of Personality and Social Psychology, 55*, 675–680 (1988); L.R. Goldberg, An alternative "description of personality": The Big-Five factor structure, *Journal of Personality and Social Psychology, 59*, 1216–1229 (1990).

12. For the debate on behavioral genetic models, see J.J. McArdle and H.H. Goldsmith, Some alternative structural equation models for multivariate biometric analyses, *Behavior Genetics, 20*, 569–608 (1990); M.C. Neale and L.R. Cardon, *Methodology for Genetic Studies of Twins and Families* (Kluwer Academic, Boston, 1992).

13. For current issues in SFA group selection effects, see J.L. Horn and J.J. McArdle, A practical and theoretical guide to measurement invariance in aging research, *Experimental Aging Research, 18*, 117–144 (1992); J.J. McArdle and R.B. Cattell, Structural equation models of factorial invariance in parallel proportional profiles and oblique confactor problems, *Multivariate Behavioral Research, 29*(1), 63–113 (1994).

14. For classical issues of group selection effects, see W. Meredith, A method for studying differences between groups, *Psychometrika, 30*(1), 15–29 (1965); J.R. Nesselroade, Temporal selection and factor invariance in the study of development and change, in *Life-Span Development and Behavior*, Vol. 5, P.B. Baltes and O.G. Brim, Eds. (Academic Press, New York, 1983).

15. For SFA issues in longitudinal data analysis, see J.J. McArdle and E. Anderson, Latent variable growth models in research on aging, in *The Handbook of the Psychology of Aging*, J.E. Birren and K.W. Schaie, Eds. (Plenum Press, New York, 1990); J.J. McArdle and F. Hamagami, Modeling incomplete longitudinal and cross-sectional data using latent growth structural models, *Experimental Aging Research, 18*, 145–167 (1992).

16. For further issues about SFA missing-data models, see P.D. Allison, Estimation of linear models with incomplete data, in *Sociological Methodology, 1987*, C.C. Clogg, Ed. (Jossey-Bass, San Francisco, 1987); J.J. McArdle, Structural factor analysis with incomplete data, *Multivariate Behavioral Research, 3*, 409–454 (1994).

17. For critiques of TFA, see S.J. Gould, *The Mismeasure of Man* (W.W. Norton, New York, 1981); R.J. Sternberg, Human intelligence: The model is the message, *Science, 230*, 1111–1118 (1985).

18. For critiques of SFA, see N. Cliff, Some cautions concerning the application of causal modeling methods, *Multivariate Behavioral Research, 18*, 115–126 (1983); P. Cohen, J. Cohen, J. Teresi, M. Marchi, and C.N. Velez, Problems in the measurement of latent variables in structural equations causal models, *Applied Psychological Measurement, 14*, 183–196 (1990).

19. R.B. Cattell, *Factor Analysis: An Introduction and Manual for the Psychologist and Social Scientist* (Harper & Brothers, New York, 1952), p. 315.

Recommended Reading

Bollen, K.A., and Long, J.S. (Eds.). (1993). *Testing Structural Equation Models* (Sage, Newbury Park, CA).

Loehlin, J.C. (1992). *Latent Variable Models: An Introduction to Factor, Path, and Structural Analysis* (Erlbaum, Hillsdale, NJ).

McDonald, R.P. (1985). *Factor Analysis and Related Methods* (Erlbaum, Hillsdale, NJ).

Mulaik, S.A. (1988). Confirmatory factor analysis. In *The Handbook of Multivariate Experimental Psychology*, J.R. Nesselroade and R.B. Cattell, Eds. (Plenum Press, New York).

Towards a Psychology of Food and Eating: From Motivation to Module to Model to Marker, Morality, Meaning, and Metaphor

Paul Rozin

Each human being experiences a food trajectory that begins with one food, milk, and expands to an incredibly varied set of foods and preparations, attitudes, and food-related rituals. Food progresses from being a source of nutrition and sensory pleasure to being a social marker, an aesthetic experience, a source of meaning and metaphor, and, often, a moral entity. These transformations are directed mainly by culture-specific traditions. This article deals with three psychologically significant

Paul Rozin is a Professor of Psychology at the University of Pennsylvania. His research interests are the interaction of biological, psychological, and cultural influences in relation to food attitudes and food choice; cultural psychology; and cultural evolution. Address correspondence to Paul Rozin, Department of Psychology, University of Pennsylvania, 3815 Walnut St., Philadelphia, PA 19104-6196; e-mail: rozin@cattell.psych.upenn.edu.

aspects of human relations with food. First, although food relations constitute a major part of human life, they have been virtually ignored by psychologists. Second, biological, psychological, and cultural adaptations to food problems become the basis (model) for other biological and cultural aspects of humans, by the processes of preadaptation in evolution and accessibility in development, so that food adaptations become generalized to other systems. This progression constitutes one of the great transformations in human cultural and individual history, and represents the linkage of a basic biological motivational system to aesthetic, social, and moral aspects of life. Third, human and animal food relations offer special advantages for the study of general processes.

THE CENTRALITY OF FOOD AND EATING IN THE LIFE OF ORGANISMS

Food in Animal Life

The search for food, its capture, and its ingestion surely occupy more time than any other waking activity for most animal species. Other than taxonomic status, the most informative thing to know about an animal is the type and range of food it eats. This information predicts types of receptors, motor skills, plasticity (learning ability), and body form. Food habits figure prominently in taxonomic categories. The class Mammalia is named for its unique method of feeding young. Families of mammals, the carnivores and insectivores, are named explicitly for their food habits. Shapes of birds' bills, as adaptations for handling different types of food, are central in bird classification and bird identification.

Explicit demands made by food on animal abilities and plasticity depend very much on two things: the type of food and the range of food. Specialists, who concentrate on one kind of food (such as carnivores, insectivores, and some fruit and leaf eaters), face few problems in selecting or balancing their diet. Because their range of foods is narrow, their food must, of necessity, contain all essential elements (the only way for a lion to be vitamin B1 deficient is for it to eat vitamin-B1-deficient zebra). For such animals, the identification of food can be programmed genetically. For carnivores, most psychologically interesting adaptations occur in the search process (because they often eat prey that are widely scattered and hard to detect) or in the capture of moving prey. Substantial social cooperation, motor and tracking skills, and elaborate constructions (e.g., spiderwebs) may be involved.

For the generalist species, who eat a wide variety of foods, the problem of finding potential food is often less demanding because there are so many sources. However, the identification of food is much more difficult because there is no simple way that the genes can specify what should be eaten, and what should not. With a wide range of animals and plants as fair game, the possibility of ingesting toxins is high, as is the possibility (with high amounts of plant foods in the diet) of eating a nutritionally unbalanced diet. Hence, great plastic demands are made on such animals.

Food in Human Life

The attainment of a nutritionally complete and relatively nontoxic diet has been suggested to be the principal force in primate evolution.[1] A switch from forest foraging to a savannah life that included hunting has been invoked in many accounts of the evolution of the human brain, body form, and mind.

Throughout human history, obtaining adequate or pleasing food has been a major force in determining both daily events and events of great significance. The linkage between the Eastern and Western Hemispheres, initiated by Columbus, had a massive effect on world politics and daily life. The explorations that led to this great "Columbian exchange" were motivated in large part by a desire for spices.

Today, expenditures on food constitute the largest single category for the world at large.[2] Food and drink constitute approximately 21% of total expenditures in Western developed countries, but more than 50% in many of the much more populous Third World countries, notably, India and China. In both economic and social-moral terms, food is more central in the lives of Third World than First World people.

Food is a major source of pleasure for almost all humans. In the elaborated forms of cuisine, the enjoyment of food has emerged as an aesthetic pleasure, with food as an art form.

Food plays a central role in development: Nursing and weaning are major features of early life; there is nothing more important in early life than learning about what is edible and what is not. Food is also a center for parent–child interaction. Such interactions are not always positive; one of the most frequent complaints American parents of toddlers make to their pediatricians is that their toddlers accept only a very narrow range of foods.

Food plays a central role in human folk psychology, too. People in traditional cultures typically believe that "you are what you eat." They put forth the very reasonable suggestion, in accordance with most experiences in the world,

that when food and food consumer "mix," the consumer takes on properties of the ingested food.[3] Thus, eating owls improves night vision, eating lions fosters bravery, eating a fast-growing plant promotes growth, eating one's friends' food promotes one's well-being, and eating one's enemies' foods dims one's prospects. There is evidence suggesting the existence of an implicit belief in "you are what you eat" in educated Westerners.[3]

The social roles of food are particularly clear in immigrant groups, who seem to retain their ethnic identity through food long after they have become assimilated in most other ways. Similarly, food habits and taboos frequently serve as markers for particular culturally defined groups of people. The sharing of food is a major feature of the expression of solidarity, just as avoidance of food sharing is an expression of social distance, especially in Hindu India.[4] Even in American culture, sharing of food is an indicator of close relationships.

Food is often central in religious systems. The eating of an apple is the core of the Adam and Eve story. In the Hindu religion, ritual purity is maintained, in large part, by food offerings to the deities and the avoidance of foods that are polluted by virtue of their nature or their previous human contacts.

Eating is the principal mode of material transaction between the world and the person. Given the way that food has permeated human life, it is not surprising that among the Hua of Papua New Guinea, the word for everything is "that which can be eaten, and that which cannot."[5]

Food and Psychology

Despite these facts about the centrality of food in human life, the foods that humans eat—the selection of those foods and their role in daily life and thought—have almost completely escaped the interest of academic psychology. Current psychology journals and textbooks pay almost no attention to what humans or animals eat. The only food issue given serious attention is how much humans or animals eat.

Consider some major psychology journals that include a significant focus on human affairs and might be expected to pay some attention to human food choice: *Developmental Psychology*, the *Journal of Abnormal Psychology*, the *Journal of Personality and Social Psychology*, *Psychological Bulletin*, *Psychological Review*, and *Psychological Science*. In 1993, there were 497 articles published in these journals. Only 3 have any relevance to human food selection, and none focused on it.

In the most recent editions of eight leading introductory psychology textbooks, with a median length of 668 pages, the median number of pages devoted to what humans eat and why is 0.4 pages. In comparison, medians of 8 pages are devoted to hunger and 12.5 to sleep.

It is not the purpose of this article to explain why psychology has ignored food selection, nor is there a clear answer. However, one contributing factor may be the strong emphasis on process, and general processes in particular, in psychology. Food is not uniquely ignored; major domains of human activity, including religion, sports, and other leisure activities, receive minimal attention as well.

FOOD ADAPTATIONS AS A SOURCE OF GENERAL ADAPTATIONS

Preadaptation and Increased Accessibility

Adaptations that originate to solve problems in food selection may subsequently appear in other domains, by the processes of preadaptation in biological or cultural evolution and increased accessibility in development.

Ernst Mayr[6] has invoked the process of preadaptation as a principal account for major evolutionary changes, such as the evolution of complex structures. Preadaptation is the engagement of a system, process, or structure in a functional system other than the one it was originally evolved for. In this manner, an existing structure may be co-opted for a new purpose, avoiding the necessity of a new structure evolving by a gradual process in which each intermediate form is either neutral or adaptive in itself. The preadapted structure may or may not continue to function in its original context. In principle, the preadapted structure need not have been specifically selected for its original function, but may be a structure of neutral adaptive value.

The middle ear bones of mammals, which originated from parts of the reptile jaw, are an example of a preadaptation that ceased to function in its original context. The human mouth is an example of a preadaptation that has maintained its original function. The mouth evolved originally as a way to incorporate foods, and one can easily account for the presence of tongue and teeth in this manner. With the evolution of an elaborate linguistic communication system in humans, features of the mouth, such as tongue and teeth, served as preadaptations for articulatory devices. They have a critical function in pronunciation of consonants.

I[7] extended the idea of preadaptation into the developmental realm, using the term *access*. Systems evolved to handle specific problems in the world can be accessed in development to handle other types of problems. Thus,

some abilities move from being domain-specific to being more domain-general during development and as a result of education. For example, Siegal[8] proposed that reasoning ability appears first in the food system (with respect to avoiding contamination), and later in other areas. I[7] proposed that the "ear/mouth route," the machinery that evolved specifically for comprehending and producing speech by segmenting it into significant units of sound (phonological segmentation), becomes co-opted in reading systems that employ alphabets. Thus, children's realization that the word *bat* has three sounds, an essential accomplishment for comprehending alphabetic systems, involves some type of access to this phonological segmentation machinery.

Preadaptation is probably most common in cultural evolution because preadaptation can occur in biological evolution only at a point where the new functional system has some "contact" with the original structure.[9] Jaw bones can be selected for sound transmission only at a point where they already have some minimal value in this regard. However, in cultural evolution, human realization of the value of a part of one system in another system is sufficient to establish the link. One does not have to wait for cars to gradually get big enough to haul large loads (trucks); one can engineer this result once the possibility is realized. Similarly, a computer can arise from a combination of calculator and typewriter without any chance linkage of the two.

There are a number of interesting cultural preadaptations in the food domain. Food itself, primarily an instrument of nutrition and pleasure in animal life, becomes utilized by humans as part of an aesthetic system (cuisine), a social marker (e.g., in ethnic cuisines), and a moral instrument (as in Hindu culture). Food terms take on new meanings as symbols to represent gender and other important issues. Food concepts come to be used as metaphors (a form of preadaptation) for other matters, as in the generic uses of the words *bitter* and *sweet*, and in such formulations as "digesting the facts," being "unable to swallow" a particular conception, reading the "meaty part" of a paper, "biting off more than you can chew," or "spoon-feeding" students.[10]

Learning about what is edible and what is not is of absolutely fundamental importance for generalist animals. Unlike many other systems, such as mate identification, food selection is what Mayr[11] called an open system, that is, a system in which one cannot genetically prespecify critical categories. It is quite likely that some plastic abilities that originated in learning about foods were eventually accessed in other systems. In the framework of modularity, food adaptation modules may presage the development or evolution of more generally useful systems.

The cultural evolution of disgust illustrates cultural preadaptation.

The Cultural Evolution of Disgust

According to the analysis I have constructed with my colleagues April Fallon, Jonathan Haidt, Clark McCauley, and Sumio Imada[12,13] disgust originates as a rejection response to bad-tasting foods and expands, in humans, into a general system for putting out of one's mind anything that one's culture considers offensive. Disgust evolves culturally and develops from a system to protect the body from harm to a system to protect the soul from harm.

The proposed pathway is illustrated in Table 1. The origin of human disgust is in the rejection-withdrawal response to bad tastes, observed in many mammals and in the human infant. This response is characterized, facially, principally by the gape response, which has the function of causing what is in the mouth to dribble out, and is elicited by innately bad

Table 1. *Proposed pathway of expansion of disgust and disgust elicitors*[13]

	Disgust stage				
Characteristic	Distaste	Core	Animal origin	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 and eating, body products, animals	Sex, death, hygiene, envelope violations	Direct and indirect contact with strangers or undesirables	Certain moral offenses

tastes (e.g., bitter substances) and acquired bad tastes. My colleagues and I call this entire set of reactions to bad tastes the *distaste* system, to distinguish it from disgust.

Disgust is one of the basic emotions. It is characterized on the response side by a behavioral withdrawal; a facial expression including gape, wrinkling of the nose, and raising of the upper lip; a physiological manifestation of nausea; and a sense of revulsion. There has been very little study of this emotion (the two classical contributions are by Darwin[14] and Angyal[15]). We believe this emotion derives from the initial distaste response, and shares with it many facial features, nausea, withdrawal, and revulsion—in short, all of the output features. However, the category of elicitors and the meaning of the system are qualitatively changed.

In the first stage of this cultural evolution and development, the food focus remains, but the eliciting category becomes potential ingesta that are offensive. That is, rejection is based on the idea of what the food is and on its nature rather than on its sensory properties. In accord with Angyal, we define this type of disgust, which we call *core disgust*, as "revulsion at the prospect of (oral) incorporation of an offensive substance. This substance has contamination properties. It is so negative that if it touches an otherwise acceptable food, it renders that food unacceptable (contamination)."[16]

Core disgust, in our view, is based on the "you are what you eat" principle, which we believe is operative in modern Western cultures, as well as traditional cultures.[3] The idea is that if you eat something offensive, then you will become offensive. We believe the basic eliciting category for core disgust is foods of animal origin. Although humans want to distinguish themselves from animals, by eating animals, by the "you are what you eat" principle, they blur the distinction between humans and animals, and become animal-like. The contamination principle may appear first in disgust to foods, and is perhaps the original manifestation of the sympathetic magical law of contagion: once in contact, always in contact. When one's mashed potatoes are briefly contacted by an earthworm, "wormness" enters into them, they are permanently "wormed."[17]

Body wastes, particularly feces, may constitute the strongest elicitors of core disgust, and disgust at feces seems to be the universal disgust. Thus, the elicitors of core disgust are animals, food, and particularly body wastes.

Core disgust is qualitatively different, in terms of meaning, from distaste. Disgusting items need not have negative sensory properties. Distasteful substances typically do not have contamination properties, whereas disgusting substances do. In short, we claim that in terms of elicitors and meaning, disgust is not an extension of distaste, but an entirely new category of ideationally based, contamination-sensitive revulsion or withdrawal.

When we ask Americans or Japanese what they find most disgusting, only about 25% of the responses fall into the animal-food-body wastes domain. Many of the other responses invoke poor hygiene, body envelope violations (e.g., gore), inappropriate sex, or death. We believe that these eliciting categories, along with the core disgust elicitors, have in common that they refer to properties humans share with animals. We therefore conceive of this wider category of disgust as *animal-origin disgust*. It involves a withdrawal from reminders of humans' linkage with animals, an origin people would prefer to forget. Disgust functions like a defense mechanism, to keep human animalness out of awareness.

We have developed a disgust-sensitivity scale.[18] Analysis of results from this scale suggests that of the eliciting categories, contact with death may be the best predictor of total disgust sensitivity. (Two of the five items that best predict the total score on the disgust scale are "It would bother me tremendously to touch a dead body," which is answered "true" or "false," and "Your friend's pet cat dies, and you have to pick up the body with your bare hands," which calls for a response of "not disgusting at all," "slightly disgusting," or "very disgusting.") We interpret this finding to mean that the most threatening aspect of humans' animalness is their mortality,[19] and that disgust serves as a defense against pondering mortality. Animal-origin disgust shares the disgust output system (nausea, withdrawal, revulsion, facial expression).

There are two other common categories of elicitors of disgust. We have no idea of their order in development or cultural evolution, but they are clearly tied into the same system. One is *interpersonal disgust*, in which the elicitors are contact with strangers or undesirable others. This kind of disgust accounts for the aversion that most Americans have to wearing clothing previously worn by undesirable people (e.g., personal enemies, morally tainted or unsavory people) or to consuming food previously bitten by such people. Interpersonal disgust is more highly developed in other cultures. For example, in Hindu India, the accompanying sense of pollution is highly salient and forms a major part of the psychological basis for maintenance of the caste system.

A final category of disgust is *moral*. Certain types of moral offenses are often characterized as disgusting. Shweder and his col-

leagues[20] have suggested that there are three basic moral systems in the world. One has to do with rights violations, one with community and social hierarchy violations, and one with purity violations. We propose that disgust is the emotion linked to moral violations in the purity domain. Among the elite in modern Western cultures, disgust is not a moral emotion because purity violations (such as eating cockroaches) are not considered immoral. However, in many traditional cultures and among less well educated people in Western developed cultures,[21] purity violations (such as eating dog meat or using an old national flag as a cleaning rag) are considered immoral. Indeed, although rights violations may be the exclusive form of morality among educated people in Western cultures, community-hierarchy and purity violations constitute a major part of morality in Hindu India.[20]

We have mapped a hypothetical sequence of elaboration of disgust (Table 1), holding that this sequence occurs in both development (by increased accessibility) and cultural evolution (by preadaptation). Disgust becomes a major route to socialization; if you want people to refrain from some activity, make it disgusting. Note that the contamination property of disgust expands as the categories of elicitors expand, so that, in both India and the United States, wearing clothes previously worn by undesirable people or making physical contact (e.g., via clothing) with healthy but morally tainted people (e.g., murderers) is both disgusting and contaminating.

FOOD AS A CONVENIENT MODEL SYSTEM

The study of food-related behavior in animals and humans has appeal because of some specific properties of the food system. Food-related behavior is extremely frequent and renewable, and often involves complex systems and plasticity. For the case of humans, food-related behavior is generally easy to observe, and food is a subject that most people will discuss readily.

It is no accident that the classic work on learning, in the laboratories of Pavlov, Skinner, and Thorndike, used food reinforcement. More recent research on learning has extensively used conditioned taste aversions as a paradigm, and has also explored foraging for food.

Whether or not the food system is the origin of a particular feature or process, it is often convenient to study that feature or process in the food system. Some examples related to some basic issues in psychology are described briefly in this section.

Internalization

Surprisingly little is known about how humans come to like (or dislike) things such as work, sports teams, pets, foods, music, and stamp collecting. To some extent, research in this area involves understanding the process of internalization, that is, how people get to like things for their intrinsic value, rather than as means to an end.[22,23] Likes and dislikes for foods develop very frequently and can serve as a model system for study. Conditioned taste aversions in animals and humans are probably the best documented and understood example of a change in liking for any entity.

Transmission of Preferences and Values

The mechanisms of parental influence on preferences and values of children are central concerns of developmental psychology. It has been shown, using food and other domains, that within-culture variation in preferences of children is only very weakly related to parental preferences. I have labeled this the *family paradox*.[24] However, parent–child correlations for values (e.g., attitudes to abortion) that vary within culture show much stronger parent–child correlations.[24,25] Food is a particularly apt domain in which to explore critical issues here because attitudes to foods include both preferences and values. For example, liking for meat is generally a preference issue, but it becomes a moral issue for some vegetarians. The process of acquisition of moral values is well exemplified in the food domain, especially with respect to the moralization of tobacco smoking and meat eating in America in recent decades.[26]

The Study of Conflict: Rational-Irrational Oppositions and Ambivalence

The conflicts between different parts of the person have been central to psychology since Freud. The food domain is of special interest in this regard because human intelligence is highly developed in this domain,[8] but at the same time people have strong feelings related to the entrance of substances into the body via the mouth. The power of disgust and contagion as deep feelings and cognitions has already been discussed. Because it is easy to talk to people about food, the food domain is a good place to explore conflicts between feelings and cognitions. Thus, people will openly admit to their irrationality in not wanting to eat a sterilized cockroach, but still acknowledge these feelings. Finally, conflict as expressed in ambivalence is quintes-

sentially illustrated in attitudes to meat. High appeal to the human palate and excellent short-term nutritional value are pitted against concerns about long-term health risks and the immoral treatment of animals.

Playing With the Limits and Benign Masochism

Humans are unique among animals in enjoying activities that produce innately negative feelings or emotions (e.g., movies eliciting sadness), activities that induce fear (e.g., riding roller coasters), and activities that produce pain (e.g., smoking cigarettes, eating chili peppers, taking hot baths). I have suggested[27] that such preferences represent a benign masochism, a sort of pleasure at the mastery of mind over body. For the case of innately aversive foods (or the recreational elicitation of disgust), there may be pleasure resulting from the fact that the body is signaling rejection, but the person knows there is no real threat (obviously the case in roller-coaster riding). The existence of preferences for innately unpalatable foods in all cultures offers wide opportunities for research.

Disgust as an Ethical and Convenient Way to Study Affect

The laudable rise in concern for the mental health of experimental human subjects has placed limits on the use of aversive stimuli in experimental studies. Disgust holds promise as a strongly negative system that can be elicited with ease in the laboratory. For fascinating and not fully understood reasons, neither individuals nor (consequently) human subject protection committees seem concerned about elicitation of this emotion. There is something amusing, at the same time as it is negative, about disgust. It is probably the only way to reliably elicit strong negative affect ethically in the laboratory.

CONCLUSIONS

In this broad survey, I have attempted to engage the interest of psychologists, with the aim of both conveying something about the important domain of food selection in humans and encouraging more research in this area. If we are what we eat, then we should certainly want to know what we eat and why. There is no domain where there is a richer interaction of basic biological urges, cultural values, and individual abilities and experiences. There is no area where the progression from motivation to module to model to marker, morality, meaning, and metaphor is more apparent.

Acknowledgments—Much of the research described in this article, along with the writing of this article, was supported by grants to Paul Rozin from the Whitehall Foundation and the John D. and Catherine T. MacArthur Foundation network on health-related behaviors. Thanks to Monica Schindlinger Rozin for comments on the manuscript.

Notes

1. K. Milton, Diet and primate evolution, *Scientific American*, pp. 86–93 (August 1993).

2. R.J. Samuelson, Ed., *The Economist Book of Vital World Statistics* (Random House, New York, 1990).

3. C. Nemeroff and P. Rozin, "You are what you eat:" Applying the demand free "impressions" technique to an unacknowledged belief, *Ethos: The Journal of Psychological Anthropology, 17*, 50–69 (1989).

4. A. Appadurai, Gastro-politics in Hindu South Asia, *American Ethnologist, 8*, 494–511 (1981).

5. A.S. Meigs, *Food, Sex, and Pollution: A New Guinea Religion* (Rutgers University Press, New Brunswick, NJ, 1984).

6. E. Mayr, The emergence of evolutionary novelties, in *Evolution After Darwin: Vol. 1. The Evolution of Life*, S. Tax, Ed. (University of Chicago Press, Chicago, 1960).

7. P. Rozin, The evolution of intelligence and access to the cognitive unconscious, in *Progress in Psychobiology and Physiological Psychology*, Vol. 6, J.N. Sprague and A.N. Epstein, Eds. (Academic Press, New York, 1976).

8. M.S. Siegal, Becoming mindful of food, *Current Directions in Psychological Science, 4*, 177–181 (1995).

9. W.J. Bock, Preadaptation and multiple evolutionary pathways, *Evolution, 13*, 194–211 (1959).

10. G. Lakoff and M. Johnson, *Metaphors We Live By* (University of Chicago Press, Chicago, 1980).

11. E. Mayr, Behavior programs and evolutionary strategies, *American Scientist, 62*, 650–659 (1974).

12. P. Rozin and A.E. Fallon, A perspective on disgust, *Psychological Review, 94*, 23–41 (1987).

13. P. Rozin, J. Haidt, and C.R. McCauley, Disgust, in *Handbook of Emotions*, M. Lewis and J.M. Haviland, Eds. (Guilford Press, New York, 1993).

14. C.R. Darwin, *The Expression of Emotions in Man and Animals* (University of Chicago Press, Chicago, 1965) (Original work published 1872).

15. A Angyal, Disgust and related aversions, *Journal of Abnormal and Social Psychology, 36*, 393–412 (1941).

16. Rozin and Fallon, note 12, p. 23.

17. For a review of the literature on contagion, see P. Rozin and C. Nemeroff, The laws of sympathetic magic: Psychological analysis of similarity and contagion, in *Cultural Psychology: Essays on Comparative Human Development*, J. Stigler, R.A. Shweder, and G. Herdt, Eds. (Cambridge University Press, Cambridge, England, 1990).

18. J. Haidt, C.R. McCauley, and P. Rozin, A scale to measure disgust sensitivity, *Personality and Individual Differences, 16*, 701–713 (1994).

19. E. Becker, *The Denial of Death* (Free Press, New York, 1973).

20. R.A. Shweder, N.C. Much, M. Mahapatra, and L. Park, The "big three" of morality (autonomy, community and divinity), and the "big three" explanations of suffering, in *Morality and Health*, A. Brandt and P. Rozin, Eds. (Routledge, New York, in press).

21. J. Haidt, S.H. Koller, and M.G. Dias, Affect, culture and morality, or Is it wrong to eat your dog? *Journal of Personality and Social Psychology, 65*, 613–628 (1993).

22. L.L. Birch, Children's food preferences: Developmental patterns and environmental influences, in *Annals of Child Development*, Vol. 4, G. Whitehurst and R. Vasta, Eds. (JAI, Greenwich, CT, 1987).

23. P. Rozin, Acquisition of stable food preferences, *Nutrition Reviews, 48*, 106–113 (1990).

24. P. Rozin, Family resemblance in food and other domains: The family paradox and the role of parental congruence, *Appetite, 16*, 93–102 (1991).

25. L.L. Cavalli-Sforza, M.W. Feldman, K.H. Chen, and S.M. Dornbusch, Theory and observation in cultural transmission, *Science, 218*, 19–27 (1982).

26. P. Rozin, Moralization, in *Morality and Health*, A. Brandt and P. Rozin, Eds. (Routledge, New York, in press).

27. P. Rozin, Psychological, biological and cultural perspectives on the use of chili pepper by humans, in *Chemical Irritation*, B. Green, R. Mason, and M.R. Kare, Eds. (Marcel Dekker, New York, 1990).