The Psychological Categorization of Foods and Non-foods: A Preliminary Taxonomy of Food Rejections

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The problem of how humans come to define food is investigated by examining the full range of substances rejected as food in one subculture. College students answered questions about their attitudes and reactions to rejected substances. Patterns of attitudes emerged which suggested the existence of at least three different psychological types of rejections: (1) distaste: rejection primarily because of taste, smell, or texture; (2) danger: rejection primarily because of fear of bodily harm; and (3) disgust: a strong affect-laden rejection based primarily on the idea of what something is or knowledge of its origin. Disgusting substances in trace amounts usually can render an acceptable food unacceptable and are almost always animal products. We propose the existence of a fourth category of affectively neutral rejections also based primarily on ideational grounds.

Every food generalist or omnivore, including man, must learn to distinguish edible from inedible substances (Rozin, 1976). We know surprisingly little about how this critical information is acquired by any animal, especially man.

There is some evidence that human infants, along with many other animals, have some built-in circuitry to guide food selection. For example there is some evidence that newborn infants avoid bitter tastes, as revealed primarily by negative facial expressions (Peiper, 1963; Steiner, 1974). This is an adaptive response, since many toxic substances in plants give rise to bitter sensations (Shallenberger & Acree, 1971). Infants show both positive facial expressions and enhanced intake and sucking in response to sweet tastes (Crook, 1978; Desor, Maller & Turner, 1973; Peiper, 1963; Steiner, 1974). In the natural environment, sweet tasting substances are often sources of nutrients. While preprogrammed taste preferences do provide some basic information for a food versus non-food categorization, such innate mechanisms can account for only a small part of human food selection. In all omnivores or generalists, individual experience plays a major role in food choice. For example, food rejections or aversions develop as a consequence of the negative visceral effects experienced after the ingestion of a particular substance (Garcia, Hankins & Rusiniak, 1974; Rozin & Kalat, 1971). The existence of such acquired taste aversions has been reported in human subjects (Garb & Stunkard, 1974).

While animals and human infants rely on innate guidelines and personal experience, innate and acquired taste preferences and aversions account for only a

small proportion of the food selection of human adults. The avoidance of many substances is based on culturally transmitted information or attitudes concerning their nature or origin. Powerful cultural factors cause people to classify many items that they have never experienced as edible or inedible.

The transition from exclusive reliance on personal and innate mechanisms to culture-based categorization of the world into edible and inedible seems to take place in early childhood; surely, by 10 years of age a child has internalized much of the cultural definition of food. The understanding of this categorization and its development is fundamental to the understanding of human interactions with food. It relates to maladaptive rejections of nutritious foods by young children and to the difficulties encountered in introducing new foods in various parts of the world.

The study of how humans come to define food could legitimately begin with the examination of food preferences or rejections. Our inquiry into the nature of food selection involves the examination of the full range of rejections within a narrowly defined "culture group" of American university students. We propose an analysis that would subdivide the totality of food rejections into psychologically meaningful categories.

Based on our own intuitions and informal interviews, we hypothesized that human food rejections could be classified into at least three "psychological categories". We provisionally described these categories as:

(1) distaste: rejection primarily because of taste, smell or texture;
(2) danger: rejection primarily because of anticipated negative post-ingestional consequences;
(3) disgust: rejection primarily because of knowledge of the origin or nature of a substance.

METHOD

Preliminary interviews led to the development of a questionnaire for use with an American university student population. It was designed to capture the essential characteristics of the hypothesized distaste, danger and disgust categories, as well as to explore other possible kinds of food rejections. The questionnaire consisted of 13 sections, each devoted to one substance or type of substance. A list of the substance descriptions presented to the subjects is given below. The first three categories were designed to elicit instances of the three proposed categories. The remaining ten were selected as "tests" for the adequacy of the three category system. (Each description is followed by the label used for it later in the paper, and in Figure 1.)

(1) A food that you consider disgusting (e.g. a cockroach or a specific excretory product). (Disgust.)
(2) A food that you strongly dislike because of its taste, but that does not disgust you (e.g. quinine water, strong black coffee, hot chili peppers). (Distaste.)
(3) A canned food that you like which may contain small amounts of a dangerous micro-organism. (Danger.)
(4) Cold human mother's milk. (Human milk.)
(5) Cold milk. (Cold milk.)
(6) A food to which you are allergic. (Allergy.)
(7) Roast pork (for kosher subjects). (Pork.)
(8) Body temperature milk. (Warm milk.)

(9) A food that you strongly like but that you would dislike as your first food of the day. (Breakfast.)

(10) Meat and dairy combinations (for kosher subjects). (Meat-dairy.)

(11) A combination of two foods that you like individually but strongly dislike in combination (e.g. catsup and ice cream, hamburger and whipped cream, chocolate and string beans). (Combination.)

(12) A dislike that you can trace to a particular experience in your past. (Aversion.)

(13) Meat (for vegetarian subjects). (Meat.)

In all cases where the question did not specify a particular substance (disgust, distaste, allergy, breakfast, combination, and aversion), the subject was asked to write down the particular item chosen. For any question that specified a particular item, we only analyzed the data for subjects who indicated that they rejected or disliked the item in question. For the cases of allergy and aversion, subjects were asked to give details of the symptoms involved and their past experience with the substances in question.

For each substance, the subject was asked to respond with "true" (rejected for this reason), "false" or "uncertain" to the eight statements listed below. The statements are listed in the same order as they are displayed along the abscissa of Figure 1, and include the code letter used in Figure 1:

(T) I dislike the taste, smell or texture of this food. (Taste.)

(N) The thought of eating this food makes me nauseous. (Nausea.)

(S) I dislike the idea of having this food in my stomach. (Stomach.)

(A) I dislike the appearance of this food. (Appearance.)

(H) I would dislike it if some of this food got on my hands. (Hands.)

(C) I would dislike any dish that contained even the tiniest amount of this food, even if I could not taste, smell, feel or see it. (Contamination.)

(O) I dislike this food because of the idea of what it is or where it comes from. (Origin.)

(D) I feel that this food might contain something that even in modest amounts might physically endanger my body. (Danger.)

The questionnaire was administered to 263 students (135 male) at the University of Pennsylvania[1].

RESULTS

A profile of each category was generated by tabulating the percentage of "true" responses for each statement. ("Uncertain" responses were included with "false" responses in this analysis. An analysis which treated them as intermediate between true and false led to very similar results.) The response patterns are presented in Figure 1. For convenience, the eight statements are ordered in such a way that the percent "true" for the distaste category decreases from left to right. The same order of statements was then used for plotting all other substances. The response patterns for the three hypothesized basic categories (distaste, danger, and disgust) are distinctively different. Of course, our descriptions of these categories intentionally biased subjects toward a particular type of rejection. Nonetheless, this would not remotely approach a unique specification of responses to the eight statements.

[1] The subjects are a representative sample of University of Pennsylvania undergraduate students, with the following exception. Our original sample had insufficient numbers of vegetarians, kosher Jews, and people with allergies. We supplemented the original sample by soliciting, from the same population, subjects with any of these characteristics. Such subjects were run on all substance-categories.

Results indicate that distaste can be rather narrowly defined as rejection based on taste, smell and/or texture. No other feature is prominent in this category (Figure 1). The danger category is characterized by rejection based on anticipated harmful consequences and presence in the stomach. Rejection is also often based on objection to
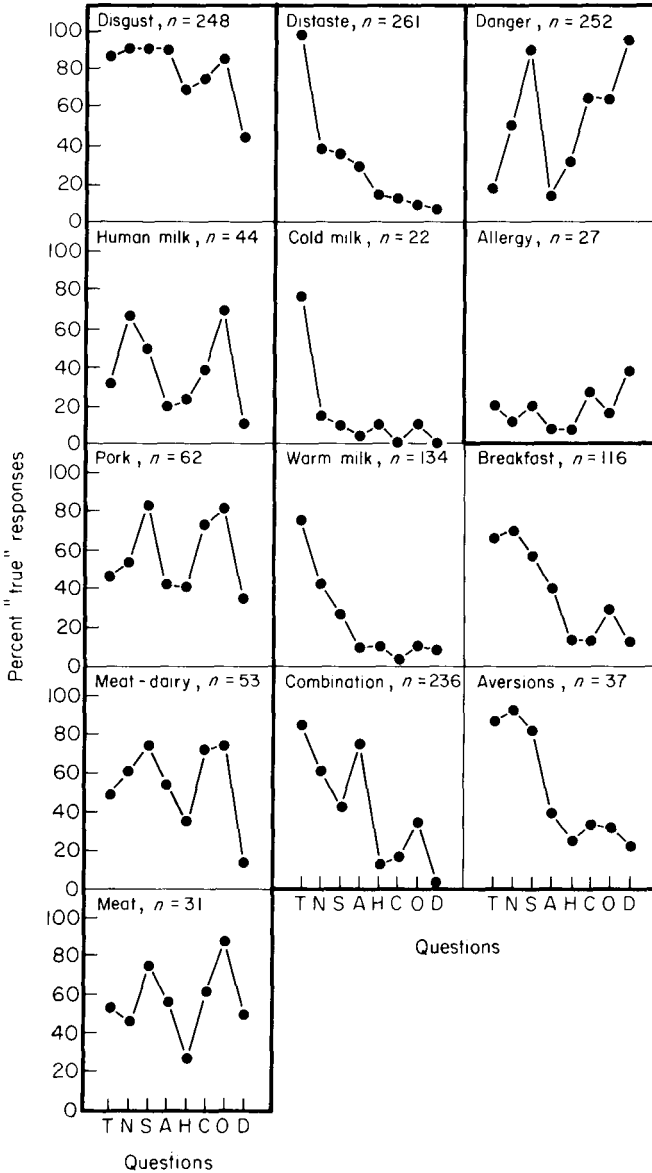

FIGURE 1.   Response patterns for three prototypical categories and 10 types of foods. The heavier border lines in the figure enclose substances which fall within the same general prototypic category. Percent "true" responses to each of the eight statements is plotted on the ordinate. The order of questions as plotted, is the same for all substances, and corresponds to the decreasing order of "true" responses for the distaste category. The statements are listed in the text, along with the abbreviations used here. Briefly, T = disliked taste, N = thought induces nausea, S = disliked in stomach, A = disliked appearance, H = disliked on hands, C = contamination, O = disliked because of nature or origin, and D = dangerous.

tiny amounts of these substances in liked foods (contamination) and to ideational (origin) factors. In contrast to disgust and distaste, there is not generally a negative response to the taste of substances classified as dangerous (in this case, we described the dangerous item as otherwise liked, but we have come across many other instances of liked foods that show the danger pattern).

Disgust shows a strong rejection response to all but the danger statement. It contrasts markedly with the danger category, since the danger statement is most characteristic of danger, and least characteristic of disgust. Almost all substances classified as disgusting produce nausea and are disliked because of their nature or origin. There were strong objections to any contact with such substances; the appearance, taste, presence on the hands or in the stomach were all aversive. Foods were rejected if they were known to contain even a tiny untastable amount of such substances (contamination).

On the disgust item, subjects were asked to select (and write down) "a food that you consider disgusting (e.g. a cockroach or a specific excretory product)". We have analyzed the disgust results as a function of the type of item selected. Roach or excretory products were selected by 30·2% of the 241 subjects who wrote in their choice. These were the strongest rejections, as judged by the percentage of "true" responses across all questions (Table 1). Almost all responses were "true" except for a substantial number of "false" responses to the danger statement (Table 1, Figure 2). The total rejection across questions (total percent "true") decreases as one moves through the animal categories of arthropods (other than cockroaches), mammals, other invertebrates, parts of edible animals (e.g. liver, kidney, tongue), and non-mammal vertebrates (Table 1). In this sequence, the danger statement consistently shows the lowest percent "true" (Table 1). Dislike on the hands is the next lowest, followed by contamination (Table 1, Figure 2).
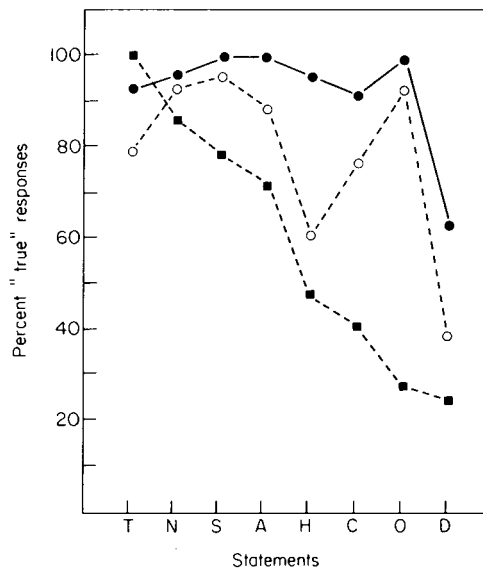

FIGURE 2. Response patterns for three subgroups of substances considered disgusting by subjects. The interpretation of the axes and patterns is the same as for Figure 1. ●, Cockroach or excretory products ($n = 73$); ○, all other non-mammalian animals ($n = 71$); ■, substances of vegetable or mineral origin ($n = 29$).

TABLE 1

Characteristics of different types of substances described as disgusting

Category	n	Percent of total	Percent "true" responses	Items scoring below 75% "true"[a]
Excretory products	41	17·0	93·3	danger
Cockroach	32	13·2	91·4	danger
Other arthropods	32	13·2	83·8	danger, hand
Mammals	12	5·0	83·3	danger = hand
Other invertebrates	26	10·8	76·9	danger, hand, contamination
Non-muscle parts of edible animals	36	14·9	69·7	danger, hand, contamination
Non-mammal vertebrates	13	5·4	68·9	danger, taste = contamination = hand
Decayed matter	9	3·7	83·3	contamination, hand = origin
Vegetable and mineral items	29	12·0	60·2	danger, origin, contamination, hand, appearance
Miscellaneous	11	4·6		

[a] Listed are questions for which there was less than 75% "true" response. The questions are listed in the order of increasing "true" response.

Angyal has suggested that almost all objects of disgust are animals or animal products (Angyal, 1941; Rozin & Fallon, in press). In support of this view, 86·7% of the disgusts in our sample were animals or animal products. The animal-disgust linkage is further supported by analysis of the non-animal choices of our subjects: there were 27 disgust items of vegetable origin, and two of mineral origin (Table 1). A majority of these items were common vegetables; only tomato and lima beans appeared twice. Although subjects did select these items as "disgusting", analysis of the response patterns to them clearly indicates that they show the distaste rather than the disgust pattern (Figure 2). By our analysis of disgust, they are *not* disgusting. Hence, almost all items that qualify as disgusting in our sense are animals or animal products. [The group of items we classify as decay products (n = 9, Table 1) is too small to be usefully analyzed. However, most of these items are animal in nature. Their pattern is similar to other disgusting substances, with the exception that decay products show a much higher score (89%) on danger.]

Response profiles for 10 additional rejected items can be compared visually to the profiles of the three proposed prototypical categories (Figure 1). We have made the comparison more formally, by using an adaptation of the χ^2 statistic for goodness of fit[2].

[2] The pattern of the percentage of "true" responses for every category or substance (as displayed in Figure 1) was compared to the pattern for every other category or substance. The χ^2 for any pair of substances was computed based on the two (substances) by eight (statements) array. The percentage true for each cell was treated as if it represented the number of observations in that cell. For example, if 60% of subjects responded "true" to the hands question for substance one, and 40% for substance two, the entries in the appropriate cells would be 60 and 40, respectively. We then treated these numbers as if they were independent of the entries for the other questions. Since a single subject could contribute from 0 to 8 responses (trues) to the distribution, this procedure does not meet the requirements for assignment of confidence intervals to the χ^2 statistic. However, the χ^2 is a legitimate measure of goodness of fit. This procedure discounted the total level of rejection (the total number of true responses) and was only sensitive to the pattern of true responses.

The χ^2 statistic for any two categories or substances can be interpreted as a measure of similarity between them. These "distances" have been subjected to multidimensional scaling, using a non-metric procedure (MINISSA: Lingoes, 1973). A two-dimensional procedure, accounting for 87% of the variance is displayed in Figure 3. Categories or substances with more similar profiles are located closer to one another.

Meat for vegetarians, pork and meat-dairy combinations for kosher subjects, and human milk (left column of Figure 1) show the disgust pattern. In the two-dimensional analysis (Figure 3), these items cluster together in the lower left-hand quadrant. Allergies are most similar to the danger category. We included only allergies with respiratory system or skin symptoms, in an attempt to clearly differentiate these from gastrointestinally based aversions. It is curious that although allergies provoke negative physical symptoms, less than half of the subjects consider allergy-producing foods to be harmful. Symptoms can range from a rash to severe breathing difficulties. Indeed, when we analyzed the symptoms of the subjects who felt that their symptoms were dangerous, 50% were, in our judgment, life-threatening; of the subjects who felt that their symptoms were not harmful, we felt that 16% were life-threatening. We isolated 10 subjects with cutaneous or respiratory symptoms that we considered to be life-threatening. Their results yield a pattern that is more similar than the total allergy pattern to the danger profile.

Cold and body temperature milk fall clearly within the distaste category (Figures 1 and 3). Disliked combinations are most similar to distastes, but differ primarily in being more negative in appearance than other instances of this category. We included only aversions that involved gastrointestinal symptoms in their origin, and in which an
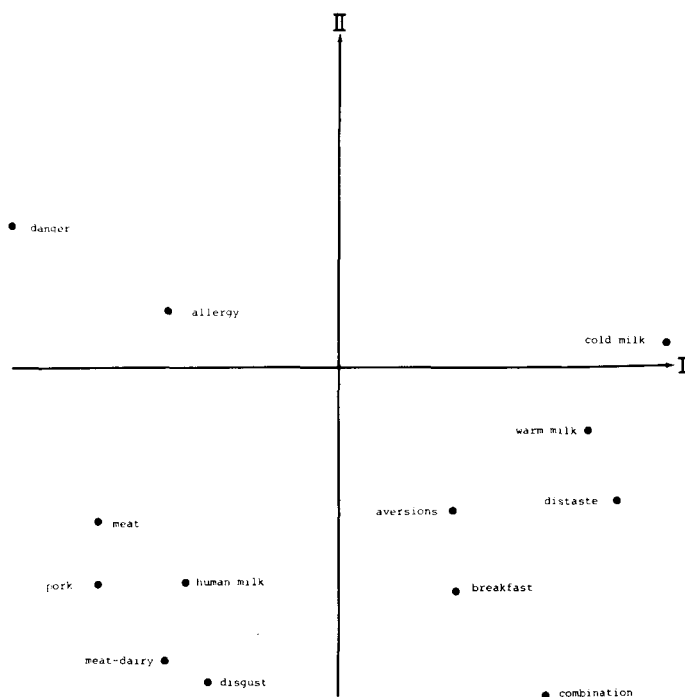

FIGURE 3. Two-dimensional solution achieved by a non-metric multidimensional scaling technique. The axes are selected for statistical rather than psychological reasons.

increased dislike resulted from these symptoms. These aversions, and inappropriate breakfast foods fall between distaste and disgust, but closer to distaste (Figure 3). These two items are quite similar to each other, and resemble distastes except that there is a high level of nausea associated with them.

We performed a separate analysis comparing vegetarian and allergy subjects with the rest of the sample, with respect to the patterns of responses to the eight substance-categories to which all subjects responded. Neither group differed significantly from the rest of the sample.

DISCUSSION

This analysis makes some clear psychological distinctions among foods that share similar sensory properties. Thus, notwithstanding the flavor and nutritional similarities between human and cow milk, the former is a clear instance of disgust, and the latter of distaste. Similarly, the meat-dairy combination for kosher subjects falls clearly within the disgust category, while this same combination (when selected in the disliked combination category) for non-kosher subjects looks more like distaste.

In general, we believe that the clusterings and categorizations suggested for these substances by our analysis are in accord with our intuitions. Eight of the 10 specific substances show a much closer fit with one of the prototypical categories than with either of the others. However, it is likely that some substances, for some subjects, will share the characteristics of two categories (e.g. a dangerous and disgusting substance).

We recognize two problems in the interpretation of these results. First, the disgust pattern may be attenuated because of a partial ceiling effect (number of true responses being high across all statements). A more distinctive set of disgust patterns emerges when we exclude the strongest disgusts (see curve for "other non-mammals" in Figure 2). We will explore milder disgusts in future studies (Fallon & Rozin, Note 1). Second, in this study we use a true-false-uncertain response choice. This has the advantage that it makes very simple demands on the subject, and can be responded to very quickly. However, it requires us to make inferences about the relative importance of any psychological variable for a particular substance and individual from data generated across individuals. For example. we infer that if, for a particular substance, 60% of subjects respond "true" to dislike taste, and 30% respond "true" to dislike appearance, then dislike taste is a stronger component *within* individuals than dislike appearance. This inference can be defended, but it should be supplemented and validated by scaled ratings of intensity of dislike (or "truth") by individuals, so that true individual profiles could be generated. We are in the process of performing such an analysis on a different data base, and the results indicate high agreement between the within and between subject profiles (Fallon & Rozin, Note 1).

The emotional negativity that the disgusting substances provoked, along with the observation that almost all are animal in nature, leads us to inquire about the large class of other substances that we never think about consuming. These include a wide variety of plant and inorganic items. The thought of ingesting them does not seem to evoke great resistance or emotional negativity. They are rejected primarily on ideational grounds. That is, they are rejected simply because they are not considered food. Grass and sand might be examples, in American culture. We suggest a fourth category of inappropriate rejected foods. These would be characterized primarily by a high score on the nature or origin statement. Within the framework of four rejection categories, we suggest three fundamental dimensions: (1) flavor: the extent to which a disliked flavor is inherently involved in rejection (true only for distaste); (2) affect: the

extent to which rejection is associated with a negative affective response (true for distaste and disgust, and possibly for some instances of danger); and (3) cultural or ideational mediation: the extent to which socially transmitted knowledge or inform-ation are critical (true for inappropriate and disgust, and in some cases of danger) [see Rozin & Fallon (in press) for an extension of this analysis, and its application to food acceptance].

The suggested four-part taxonomy is based on results from a subgroup within American culture. A cross-cultural examination of food rejections would have to be carried out to determine the general validity and usefulness of these categories. Furthermore, our psychological analysis must eventually be related to concepts such as "purity" or "matter out of place", and to the literature on folk classification systems and food taboos (Bulmer, 1967; Douglas, 1966; Simoons, 1961). However, we believe that this preliminary taxonomy is a first systematic step in the psychological description of the total group of substances that are rejected as foods.

REFERENCES

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

Bulmer, R. Why is the Cassowary not a bird? A problem of zoological taxonomy among the Karam of the New Guinea highlands. *Man*, 1957, *2*, 5–25.

Crook, C. K., Taste perception in the newborn infant. *Infant Behavior and Development*, 1978, *1*, 52–69.

Desor, J. A., Maller, O., & Turner, R. E. Taste in acceptance of sugars by human infants. *Journal of Comparative and Physiological Psychology*, 1973, *84*, 496–501.

Douglas, M. *Purity and Danger*. New York: Praeger, 1966.

Garb, J., & Stunkard, A. Taste aversions in man. *American Journal of Psychiatry*, 1974, *131*, 1204–1207.

Garcia, J., Hankins, W. G., & Rusiniak, K. W. Behavioral regulation of the milieu interne in man and rat. *Science*, 1974, *185*, 824–831.

Lingoes, J. C. *The Guttman-Lingoes Non-metric Program Series*. Ann Arbor, Michigan: Mathesis, 1973.

Peiper, A. *Cerebral Function in Infancy and Childhood*. New York: Consultant's Bureau, 1963.

Rozin, P. The selection of foods by rats, humans, and other animals. In J. Rosenblatt, R. A. Hinde, C. Beer & E. Shaw (Eds.), *Advances in the Study of Behavior* (Vol. 6). New York: Academic Press, 1976.

Rozin, P., & Fallon, A. E. The acquisition of likes and dislikes for foods. In J. Solms (Ed.), *The Role of Food Components in Food Acceptance*. Zurich: Forster, in press.

Rozin, P., & Kalat, J. W. Specific hungers and poison avoidance as adaptive specializations of learning. *Psychological Review*, 1971, *78*, 459–486.

Shallenberger, R., & Acree, T. E. Chemical structures of compounds and their sweet and bitter tastes. In L. Beidler (Ed.), *Handbook of Sensory Physiology, IV: Chemical Senses, 2: Taste*. Berlin and New York: Springer-Verlag, 1971.

Simoons, F. J. *Eat not this Flesh*. Madison: University of Wisconsin, 1961.

Steiner, J. The human gustofacial response. In J. F. Bosma (Ed.), *Fourth Symposium on Oral Sensation and Perception: Development in the Fetus and Infant*. Washington, D.C.: United States Government Printing Office, 1974.