Binary categorizations of foods by American, French and Indian adults: Predominance of healthy-unhealthy and minimal emphasis on animal-plant

Paul Rozin *, Callie Holtermann

University of Pennsylvania, USA

ARTICLE INFO

Keywords:
Cultural influences
Food choice
Food categorizations

ABSTRACT

Objective: Food and drink form a substantial part of health advice, and a significant part of pleasant or unpleasant memories, expectations and experiences. They can be divided into two categories in many ways, and the preferred way in which any person makes this division may be an indicator of how that person thinks about the food-drink domain, with potential health implications. Binary categorization is an uncommon technique but it offers a window into “default” categorization of the world. We employ two different methods to assess binary categorization, spontaneous categorizations, and ranking of a set of defined categorizations. Insofar as these two methods give convergent results, this would serve to strengthen the evidence provided by our findings. Methods: Samples of each of approximately 300 on-line American, French, and Indian adults spontaneously offered a preferred way of dichotomizing the food/drink domain. At a later point in the same questionnaire, they ranked ordered the importance to them of each of five categorizations including natural versus processed, animal origin versus plant origin, and healthy versus unhealthy.

Results: The predominant categorization by both methods was healthy-unhealthy. The animal-plant origin categorization was rare. The correspondence between results for spontaneous nomination of dichotomies versus ranking a fixed list of dichotomies on importance is substantial, and is a form of validation of the spontaneous method.

Discussion: “Healthy-Unhealthy” is a continuum rather than a dichotomy, is subject to changing classifications by the nutrition-medical community, and is limited in value because small amounts of “unhealthy” foods are not unhealthy. In an important sense, “healthy-unhealthy” is an incorrect principle for dividing foods. Surprisingly, only a very small percent of individuals suggested (or ranked highly) animal origin versus plant origin, although this is a true dichotomy, and on biological and nutritional and sustainability grounds, this might be the most fundamental dichotomy.

Food is at the center of life, is fundamental for health/survival and a major source of pleasure and displeasure. On a “higher” level, food has multiple meanings. In our recent work, we identify and offer measures of five such meanings: spiritual, moral, social, health and aesthetic (Arbit et al., 2017; see also; Grunert, 2020). There are many ways to parse the food domain. In presentation in supermarkets, focal dichotomies include fresh and canned, animal and plant, vegetables and fruits, savory and sweet, organic and other, and even gluten-free and containing gluten. Other dichotomies, usually not explicitly presented in food stores, are healthy-unhealthy, natural-processed, high-fat – low fat, or high carbohydrate low carbohydrate. In terms of personal worlds, food can be divided into liked and disliked, or foods of my culture versus foods of other cultures. The salience or prioritization of some of these categories may reflect a person’s or culture’s general orientation to foods. Is it seen primarily as a fuel, a health vehicle, a moral entity, an indicator of social or religious identity, or an entity with distinguishing sensory or hedonic properties?

The most salient categorization both reflects priorities, and is likely to lead to subsequent thoughts prompted by this categorization. In short, a personally prominent binary categorization is an indication of how a person thinks about the food domain, and in particular, the relation between diet and health. The primary categorization (division) of foods can be considered the default way of conceptualizing them; generally, default differences may represent a fundamental distinction between cultures (Rozin, 2003). It seems that in the developed world, more and more attention has been paid to food as a health vehicle, associated with

* Corresponding author. Department of Psychology, 3720 Walnut St., Philadelphia, PA, 19104-6241, USA.
E-mail address: rozin@psych.upenn.edu (P. Rozin).

https://doi.org/10.1016/j.appet.2021.105150
Received 18 March 2020; Received in revised form 26 January 2021; Accepted 31 January 2021
Available online 4 February 2021
0195-6663/© 2021 Elsevier Ltd. All rights reserved.
the promotion or retardation of degenerative diseases (e.g., Rozin et al., 1999).

The closest prior study to the present study is an analysis of free associations to the word “food” by Americans, French, and Indians (Rozin et al., 2002). Methodologically, free associations have some similarity to our elicitation of spontaneous first binary categorizations of the food world. The major findings of the free association study were that Americans expressed the most worry about what they consumed (including mention of “fat” words), and the highest mention of what are often considered to be unhealthy foods (e.g., pizza). The French were most likely to mention specific foods (a food “content” focus), while Indians were most likely to mention “healthy foods”, and show the highest incidence of evaluatively positive words. These findings generally fit with prior work on French-American differences (e.g. Rozin et al., 1999; summarized in; Rozin et al., 2019), and form one of the bases for the predictions we make about food categorizations in the present study.

To get a sense of how modern adults think about food (including beverages), we examine how people in three different countries spontaneously describe what they take to be the most basic binary division of all foods/drinks, and later, in the same questionnaire, participants ranked the importance of five possible divisions (healthy, unhealthy; natural, processed; animal origin, plant origin; solid, liquid; and my country, other country). We thus use two methodologies as a way to get hopefully converging evidence about an important aspect of how people think about food.

It is our opinion that the most justifiable and useful way to dichotomize foods is plant versus animal origin. This issue will be treated in the discussion.

We make the following predictions, based on our familiarity with the three countries, a pilot questionnaire, the research we have done and some converging evidence about an important aspect of how people think about food.

1. The animal versus plant origin distinction will be the most prominent, overall.
2. Given the great attention to food and health in the United States, the division of foods into healthy and unhealthy will be more frequent for Americans as opposed to French or Indians.
3. Conflict between health and pleasure should be highest in Americans because of the greater food-health concerns in Americans, and perhaps the Protestant tendency to negatively associate pleasure and virtuous activities. There is some data supporting a stronger health-pleasure opposition in the food domain for Americans as opposed to French (Raghu Nathan et al., 2006; Werle et al., 2013).
4. French and Indians will be more inclined to classify foods in terms of their own versus other cuisine, since they have old and distinct cuisines (albeit with many subvarieties) in comparison to Americans.
5. Given recent emphases on the virtues of naturalness in the health literature and marketing, both French and Americans will be more inclined to classify food in terms of natural and processed than Indians.
6. There will be a substantial but far from perfect relation between spontaneous dichotomizations and ranked importance. Importance rankings require some explicit consideration and are not spontaneous. As well, the first thing that comes to mind may not be the most important thing.

1. Method

With respect to ethical issues, the questionnaire was approved by the University of Pennsylvania Institutional Review Board.

We assembled a three country on-line sample of a target of 300 participants in each country. The sample, chosen by Qualtrics, was selected to represent a wide range of geographic areas within each country, and to be 60% female and 40% male. Age was specified to be a representative distribution but this specification was not properly implemented in the actual sampling. The Indian sample had too many young people and the American sample had too many old people. For this reason, we restricted the subject age range to 25–75 years. This reduced the country age difference to modest mean differences of less than 10 years, but did not eliminate age differences (see Table 1). The surviving sample was 305 French, 314 Indians and 328 Americans. The Indian sample was not “representative” because less than half of Indians are on the internet, and these are, of course, more affluent Indians. In addition, the Indian survey was in English. Depending on degree of fluency between 10 and 25% of Indians speak English, but this percentage is much higher for those on the internet.

The French items were translated from English by a French-English bilingual, and back translated by a different French-English bilingual who had not previously seen the English version. The minimal disparities between the original and back translated English were discussed, and a few French items were adjusted. The questionnaire was about 30 min in duration, and was hosted on Qualtrics. Answers were required for each question. The questionnaire consisted of a number of studies. It began with a standard set of demographics (some in Table 1). The religion question was: “Which of the following best represents your religious affiliation (if any)? agnostic, atheist, Buddhist, Christian-Catholic, Christian-Protestant (e.g. Baptist, Methodist), Hindu, Jewish, Muslim, no religious affiliation, other.” This was followed with some measures of satisfaction with food life. The relevant section for this study followed, and is described below. Subsequent items are irrelevant, since they came after the food categorization items.

The first food categorization question was an open-ended spontaneous categorization of foods. It was presented first because we felt that a multiple choice item, that specified possible dichotomies, would influence spontaneous choices. The open-ended item read as follows:

“If you had to divide all the things we eat and drink into two categories, what would they be? - Category 1, Category 2’f.

After a set of six questions on food attitudes, unrelated to the categorization items (to separate them a little from the second set of categorization items), participants were asked to rank order the importance of five binary divisions of the food world. The five divisions were always presented in the same order, but were all visible on the screen when being rated. Participants were required to assign a ranking, from 1 to 5, for each of the divisions, such that each ranking was entered only once. The instructions follow:

“Please rank each of these divisions in terms of what you think is the most important division for what people might eat and drink (1 = most important, 5 = least important).

Table 1 Animal Origin vs. Plant Origin

<table>
<thead>
<tr>
<th>Feature</th>
<th>France</th>
<th>India</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>305</td>
<td>314</td>
<td>328</td>
</tr>
<tr>
<td>Gender</td>
<td>58.4%</td>
<td>57.0%</td>
<td>62.2%</td>
</tr>
<tr>
<td>Age (years)</td>
<td>48.1 (13.6)</td>
<td>42.4 (13.0)</td>
<td>50.5 (15.4)</td>
</tr>
<tr>
<td>Social class*</td>
<td>4.77 (2.01)</td>
<td>3.82 (1.50)</td>
<td>5.10 (1.59)</td>
</tr>
</tbody>
</table>

Note: means(standard deviation)) for age and social class.

* “Please think of the ladder below as representing where people stand in the society of your country today. At the top of the ladder are the people who are best off—those who have the most money, most education and the best jobs. At the bottom are the people who are worst off—who have the least money, least education and the worst jobs or no job. The higher up you are on this ladder, the closer you are to people at the very top and the lower you are, the closer you are to the bottom. Where would you put yourself on the ladder? Please check one step. The ladder had seven steps.
On examination of the data, we composed a simple coding scheme of ten categories, each code described in a few sentences. The ten codes are identified in the results section. An item was classified as “uncodable” if the division it proposed left out most foods and beverages, or made no sense. Some cases that suggested a categorization were included in that categorization. Coding of all of the open-ended dichotomies was done by one of us, and the 328 USA dichotomies were separately coded by the other author. Of the 328 dual coded items, 36 (89%) received different codes. The main source of disagreement (26 cases) had to do with whether a pair was classified as uncodable or assigned to one of the nine other categories. For example “meat-fruit” could be classified as “animal-plant” or uncodable, and “protein-sugar” could be classified as nutritious or uncodable. Another source of disagreement was whether the term “sweet” was classified as a valenced or sensory term.

2. Results

The demographic results, other than religion, are presented in Table 1. For religion, the predominant results for each group are as follows: France: atheist/agnostic/no religious affiliation 46.2%; Catholic 27.4%; atheist/agnostic/no religious affiliation 25.9%. India: Hindu 77.4%; Muslim 8.9%. USA: Protestant 34.1%; Catholic 43.6%. Not surprisingly, the predominant results for each group are as follows: France: atheist/agnostic/no religious affiliation 46.2%; Catholic 27.4%; atheist/agnostic/no religious affiliation 25.9%. USA: Protestant 34.1%; Catholic 43.6%. India: Hindu 77.4%; Muslim 8.9%.

In accordance with the order in the questionnaire, we present the open-ended categorizations first. For all results, we adopt a significance level of p < .01 or better for any of the dichotomy categories, for either part 1 (spontaneous nomination of categories) or part 2 (ranking of five presented dichotomies). For the ranked five dichotomy categories across the full 947 participants, no independent t-test was significant at even the p < .05 level. For healthy-unhealthy, the lowest ranked category, which we might expect to be more important (lower ranked) for females, the mean ranks were identical at 2.38, Especially given the large n of over 900 participants, we reject a significant effect of gender. We therefore combine the genders for both sets of results (Tables 2–4).

Spontaneous (open-ended) Classifications.

The list of the five most common of ten dichotomy categories that we derived from examination of the spontaneous reports is presented in the first column of Table 2. The categories are listed in declining order of their frequency in the total sample, which is indicated in the second column. The remaining four categories are briefly described in the text below, along with non-uncodable dichotomies. The third to fifth columns present the frequencies in France, India, and the USA respectively. The sixth column represents a χ², 3 countries by 2 frequencies (number in the relevant category and number in all other categories), and when that χ² reached a level of p < .01 (two tailed) or better, we examined the 2 × 2 χ² for the 3 pairings of the 3 countries. We describe the coding of the ten categories below, along with the

<table>
<thead>
<tr>
<th>Rank</th>
<th>France</th>
<th>India</th>
<th>USA</th>
<th>χ² (2, 944)</th>
<th>post hoc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>solide-liquide (34)</td>
<td>veg/étarian – non veg/étarian* (47)</td>
<td>healthy – unhealthy/ not healthy (81)</td>
<td>35.26***</td>
<td>FU ***</td>
</tr>
<tr>
<td>2</td>
<td>aliment/nourriture – boisson (food-drink) (30)</td>
<td>healthy – unhealthy/ not healthy (34)</td>
<td>Food-drink (25)</td>
<td>6.415</td>
<td>p &lt; .01, ***p &lt; .001</td>
</tr>
<tr>
<td>3</td>
<td>sain – malsain/pas sain (healthy - unhealthy) (20)</td>
<td>eat – drink (16)</td>
<td>Solid-liquid (13)</td>
<td>4.255</td>
<td>**p &lt; .01</td>
</tr>
<tr>
<td>4</td>
<td>sacré-salé (sweet-salty)</td>
<td>junk-healthy 12</td>
<td>Food – beverage (12)</td>
<td>10.942</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>5</td>
<td>legumes-viande (vegetables-meat) (9)</td>
<td>food- drink (8)</td>
<td>junk-healthy (11)</td>
<td>.909</td>
<td>***p &lt; .001</td>
</tr>
</tbody>
</table>

Note: Dichotomy (number of instances).

* Written as either “vegetarian non-vegetarian” or “veg non-veg”.

Table 2

Percent of open-ended pairs in each of 5 most common categories for each country and the total sample (combined across gender).

<table>
<thead>
<tr>
<th>Category</th>
<th>total</th>
<th>France</th>
<th>India</th>
<th>USA</th>
<th>χ² (2, 944)</th>
<th>post hoc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy vs Unhealthy</td>
<td>22.6</td>
<td>13.9</td>
<td>19.7</td>
<td>33.0</td>
<td>35.26***</td>
<td>FU ***</td>
</tr>
<tr>
<td>Solid vs Liquid</td>
<td>22.5</td>
<td>24.0</td>
<td>21.4</td>
<td>22.0</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Animal vs Plant</td>
<td>10.6</td>
<td>9.9</td>
<td>17.8</td>
<td>5.2</td>
<td>26.52***</td>
<td>FI **</td>
</tr>
<tr>
<td>Health vs Pleasure</td>
<td>6.4</td>
<td>8.4</td>
<td>3.9</td>
<td>6.7</td>
<td>2.12</td>
<td></td>
</tr>
<tr>
<td>Natural vs Processed</td>
<td>3.9</td>
<td>8.2</td>
<td>1.6</td>
<td>3.1</td>
<td>22.24***</td>
<td>FI***</td>
</tr>
</tbody>
</table>

Note: (range 1–5). Mean (s.d.). For each country, the lowest ranked dichotomy (most important) is in bold face. For each dimension, the lowest ranked country is underlined.

Low scores correspond to high ranking of importance.

**p < .01, ***p < .001.

* Post hoc Tukey. Report tests of individual pairs of values if 3 × 2 one-way ANOVA is significant at p < .01 or better. Nat Proc: France-India ***, France USA **; Country: USA-India **.

Table 3

Five most common pairings for each country (not including uncodable items).

<table>
<thead>
<tr>
<th>Rank</th>
<th>France</th>
<th>India</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>solide-liquide</td>
<td>veg/étarian – non veg/étarian*</td>
<td>healthy – unhealthy/ not healthy</td>
</tr>
<tr>
<td>2</td>
<td>aliment/nourriture – boisson</td>
<td>healthy – unhealthy/ not healthy</td>
<td>Food-drink</td>
</tr>
<tr>
<td>3</td>
<td>sain – malsain/pas sain</td>
<td>eat – drink</td>
<td>Solid-liquid</td>
</tr>
<tr>
<td>4</td>
<td>sacré-salé</td>
<td>junk-healthy</td>
<td>Food – beverage</td>
</tr>
<tr>
<td>5</td>
<td>legumes-viande</td>
<td>food- drink</td>
<td>junk-healthy</td>
</tr>
</tbody>
</table>

Fig. 1. Percent first rankings by country and type of dichotomy.

Natural: France vs India vs USA
Healthy: France vs India vs USA
Processed: France vs India vs USA
Food-Bev: France vs India vs USA
Country: France vs India vs USA
Anim-Plant: France vs India vs USA

FI refers to the France-India difference, FU to the France-USA difference, and IU to the India-USA difference. Only differences of p < .01 or better are indicated.

**p < .01, ***p < .001 two tailed, by 3 × 2 χ² squares, with post-hoc 2 × 2 χ² squares when overall χ² is significant at p < .01 or better.
most frequent examples, including the five most frequent examples for each country in Table 3. These examples account for somewhat more than one-third of all responses.

1. The Healthy vs Unhealthy category was 22.6% of all responses. It was the dominant category in the USA, with “healthy-unhealthy” (or “healthy - not healthy”) the most frequent dichotomy in the entire sample (81 cases out of 328 in the USA). It was the second most frequent dichotomy in India and the third most frequent in France. “Junk-healthy,” a very similar dichotomy which falls in the same healthy-unhealthy general category, is the fourth most frequent specific dichotomy in India and fifth most frequent in the USA (Table 3). A variety of dichotomies were included in this general category if one of the words was healthy or nutritious, and the other word was related to unhealthy, such as “junk”, “fast”, “toxic”, or a specific substance such as “sugar” or “fat” (e.g., “healthy-fat”). The healthy-unhealthy category was most common by far in the USA (33% of all responses, with the next most common category at 22%; Table 2). The incidence of the healthy-unhealthy category differed significantly by country ($\chi^2(2, 944) = 35.26, p < .001$), more common in the USA than either France ($p < .001$ by $\chi^2$) or India ($p > .001$), though the incidences in France (13.9%) and India (19.7%) were not significantly different (Table 2).

2. The Solid vs Liquid category constituted 22.5% of the total (essentially identical to healthy-unhealthy). This basic division is suggested by our instructions (“If you had to divide all the things we eat and drink”,) since there is no common word to describe food and drink in English or French (“consumables” extends beyond food and drink, and “ingestibles” is an uncommon word). By far the most common exemplars, in each country, are “solid-liquid, food-drink, eat-drink, food-beverage” or their French equivalents. (French has two common words for food, “nourriture” and “aliment”. We considered them equivalent in coding for food and drink). The four specific dichotomies listed above constitute 64% of all the dichotomies classified as solid-liquid. Overall, the two most common specific dichotomies for France (“solide-liquide” and “aliment/ nourritoue – boisson”) fall in this category, as does the third and fifth most common in India and the second, third and fourth most common for the United States (Table 3). Other dichotomies were included in this category if they consisted of an enumeration of solid foods versus an enumeration of liquid foods (e.g. for India: “Chapati rice pulses salad green vegetables” versus “Tea Coffey hurbel drink”). There are no significant differences in incidence of this distinction between France, 24.0%; India, 21.4%, and USA, 22.0% (Table 2; $\chi^2(2, 944) = 0.67, n. s.$). This is a very reasonable and understandable dichotomy, though it is threatened by foods like soups or ice cream. Unlike healthy-unhealthy and some later categories, solid-liquid is psychologically rather uninteresting.

3. Animal vs plant (10.6% of the total) The categorization was rarely suggested in its most accurate form (only seven cases in the full sample, such as “animal origin – plant origin”). However, it was approximated in many cases in India. The two most common forms of this dichotomy “vegetarian-non-vegetarian” (or the equivalent, “veg-non veg”), almost entirely in India, or “meat-vegetable” in France or the USA. Of course, in both of these cases, dairy and eggs, major sources of animal food, are not included in the “animal” category, but we still coded these items as animal-plant. For “meat-vegetable” we literally took the word “vegetables” to mean plant food and meat to mean all animal foods. Of the five most common particular dichotomies (Table 3), only two represented animal-plant; one was the 47 cases, the most frequent for Indians, which combines vegetarian-non-vegetarian and veg-non-veg (meat-vegetables). Because of the high incidence of “vegetarian – non-vegetarians” or “veg-non-veg” in India, there was a significant effect for country ($\chi^2(2, 944)-26.52, p < .001$). This category occurred at a significantly higher level in India (17.8%) than in either France (9.9%) or USA (5.2%) (Table 2).

4. Health vs pleasure dichotomies constituted 6.4% of the total, They were expressed most frequently in French as “sain-gourmand” (healthy-gourmet) and “plaisir-besoin” (pleasure-need). The most common form in India was “healthy-tasty” and in the USA, the two most common forms were “need-want” and “healthy-indulgent”. None of the five most frequent pairings for each country included anything from this category. There was not a significant country difference for this category ($\chi^2(2, 944) = 2.12, n. s.$). Health pleasure items were reported in 8.9% of French cases, 3.9% of Indian cases, and 6.7% of American cases.

5. Natural vs processed (3.9% of total). This is a self-explanatory basic contrast. The most common exemplars are “naturel-industriel” [natural-industrial] and “processed–unprocessed”. None of the five most frequent pairings for each country included anything from this category. There was a significant country difference on this category ($\chi^2(2, 944) = 22.24, p < .001$). This type of dichotomy was reported by 8.2% of the French, 1.6% of the Indians, and 3.1% of the Americans. The French percentage was significantly ($p < .001$) higher than the Indian or American.

We have accounted above for the most common five of our ten categories. Except for the non-codable category, the remaining four, all occurred as less than five percent of the total. One was sensory dichotomies, with the most common pairing being “sucré-sale” (sweet-salty), in France. This was the fourth most common specific pair for France (Table 3), and the only pairing from the residual four categories that appeared in the five most common dichotomies. A second category was nutrients, with both terms nutrients, such as protein, fat, or carbs. A third category was valence, with dichotomies like “good-bad.” The fourth category was rather vague: we call it “occasions” and it is represented by dichotomies such as “weekday-weekend” or “home-cooked – outside.” The tenth category was uncodable dichotomies (21.2% of the total). These were either nonsense items (e.g. “0–40”) or categorizations that failed to even approach a complete division of food plus drinks, such as “soda-viande” (meat) for France or “meat-potatoes.” Our two most amusing pairs were uncodable: they were “watermelon-chicken” and “diet soda – meatloaf.” There was no significant difference in percent of noncodable responses across countries (France: 20.1%, India: 24.9%, and USA: 18.6%).

Strikingly, not a single person out of 947 divided foods into foods of their own country versus other foods, nor did a single person divide foods into personally liked or disliked.

2.1. Rank-ordered classifications

Of 947 participants, 28 did not give 5 complete ranks and were eliminated from the analysis, leaving 919 participants. There was no effect of gender for the combined sample (at $p < .05$ or better) on any of the five dichotomy rankings.

Table 4 presents the mean rankings of importance, by country, for each of the five alternative dichotomies that we presented. Fig. 1 displays, by country, the percent of participants who ranked each classification alternative first.

We selected the five dichotomies to be ranked before we obtained the open-ended results, although we had some pilot open-ended dichotomies from some American participants. We knew that health and solid-liquid would be major categories. We selected natural-processed and animal-plant origin because they were mentioned in the pilot American results, and because they are both fundamental and receive attention in American discourse about food, with respect to health and sustainability. We added the fifth contrast, food of one’s country versus other food. This seemed important to us, and though it did not appear at all in the American pilot data, we believed that in the much more defined French and Indian cuisines, country would be more prominent.
For the combined 919 participants with complete rankings, the lowest mean ranking (range 1–5) was 2.39 for healthy-unhealthy, followed by 2.62 for natural-processed, 3.26 for food-beverage, 3.33 for country vs other, and 3.39 for animal-plant. For first rankings, from highest to lowest percentage, 35.9% (330) were for healthy-unhealthy, 24.9% (229) for natural-processed, 14.8% (136) for country-other, 12.7% (117) for food-beverage and 11.5% (106) for animal-plant. First rankings and mean rankings correspond almost perfectly, except food beverage (3rd in mean, 4th in percent first) and country-other (4th in mean, 3rd in percent first). Most striking in the overall results is the lowest mean and highest first-rank percent ranking for healthy-unhealthy, and the lowest ranking on both scores for animal-plant, albeit by only a small amount. Also notable is the second position for natural-processed, and the fourth or third position for country-other, even though it was never mentioned in the open-ended responses. Generally (Table 4), healthy-unhealthy and natural-processed received the lowest (most important) rankings, with the other three dichotomies closely aligned in a second tier.

The overall significance of country differences for mean scores was only significant (one way ANOVA, Table 4) for two dichotomies. One was Natural processed (F(2,915) = 10.706 (p < .001), with post hoc (Tukey) tests revealing that France ranked this classification significantly lower than India (p < .001) and the USA (p < .01). Own Country-other was the only other classification which showed a significant country difference (F(2,915) = 6.405, (p < .01), with the ranking significantly lower for Indians than Americans (p < .01). Animal-plant was last for both French and Indians.

There was no effect of age on any of the five dichotomy rankings. The five correlations between age and rankings (considering the sample as a whole) varied between −0.04 and 0.04.

2.2. Results with respect to initial hypotheses

1. “The animal versus plant origin distinction will be the most prominent, overall.” This prediction was clearly disconfirmed by both data sets. The predominant distinction was healthy-unhealthy, and animal plant was either the lowest or one of the lowest.

2. “... the division of foods into healthy and unhealthy to be most salient/important for Americans.” This hypothesis is strongly supported by the open-ended results, but for the rankings, there are no significant country differences.

3. “Conflict between health and pleasure should be highest in Americans ...” Our results do not support this prediction. Only the open-ended results bear on this, because a healthy-tasty type of alternative was not included in the ranking part. This dichotomy was the fourth most common (6.4%), but there were no significant differences in incidence (Table 2), and, in fact, the highest incidence was in the French (8.9%) compared to 6.7% in Americans and 3.9% in Indians. We are puzzled by this finding.

4. “French and Indians will be more inclined to classify foods in terms of their own or other cuisine ...” Since, surprisingly, no one suggested this dichotomy in the open-ended results, this prediction can only be evaluated from the ranking data. In support of this hypothesis, India, with the most well defined and most insulated cuisine, scored a significantly higher ranking than the USA, with France in the middle. This is the order we expected, but this division is less important than we had expected.

5. “… both French and Americans will be more inclined to classify food in terms of natural and processed than Indians.” We would have predicted an order of importance of USA, France and India, but what we observed, in partial support of our prediction, was the order France, USA, India.

6. “There will be a substantial but far from perfect relation between spontaneous dichotomizations and ranked importance.” The two sets of data are congruent in many respects. In both sets of data, health dichotomies were predominant or very common, and animal-plant were uncommon. Natural-processed is more salient in the rankings, and country-other, which does not appear at all in the open-ended responses, is in the middle range in the rankings. This increase in salience is largely at the expense of food-beverage, which is markedly lower in the rankings than in the open-ended results. The one way ANOVA for the mean health rankings was not significant (Table 4), while there was a substantial country effect for this dichotomy on the open-ended results.

3. Discussion

We collected data on spontaneous nominations of the preferred dichotomy to divide the food world, and later in the same survey, had the same subjects rank five explicit dichotomies in terms of importance. The subjects were approximately 300 adults each, from France, India and the USA. The major results from the spontaneous dichotomies, representing “default” ways of conceiving the food/drink domain, showed a predominance of the healthy-unhealthy dimension, with surprisingly few participants (7/947) explicitly identifying the animal-plant domain. Americans showed the strongest inclination to suggest the healthy-unhealthy domain. The ranking of importance was based on five dichotomies (Animal Origin vs. Plant Origin, Foods vs. Beverages, Healthy vs. Unhealthy, Natural vs. Processed, French/Indian/American (depending on the country of the participant) vs. Other). Here as well, healthy-unhealthy had the lowest ranking overall, and was lowest for India and the USA, but natural-processed was lowest for France. Animal-Plant performed near the bottom of the rankings, but was much more common (11.5% number one rankings in importance) than it was in the spontaneous nominations. The similarity in results for the two different methods provides some degree of validation for the spontaneous dichotomy suggestion method. The dominance of the healthy-unhealthy dimensions is surprising, and is based on questionable assumptions by the participants.

The contrast between the popular healthy-unhealthy dimension and the much less popular animal-plant dimension deserves comment. Healthy-unhealthy is not a dichotomy, but rather a continuum. It receives much attention in the popular literature, and in some professional literature as well. In our view, it is a mistake to assign foods to the healthy or unhealthy “categories”, because this really depends on amount consumed. Small amounts of “unhealthy” foods like pizza or ice cream may be healthier than large, obesogenic amounts of whole wheat cereals. Dark chocolate, an “unhealthy” food, is a vegetable product. It would be more appropriate to describe foods as recommended in smaller versus larger amounts. Furthermore, what is healthy or not depends on demographic features such as age, and the general adequacy of nutrition in a country. And, of course, what is healthy or not depends on the historical times; for example, avoidance of foods high in cholesterol now seems less important in the USA than it was a few decades ago.

On the other hand, there is much to be said for animal-plant as the most important dichotomy. First of all, it represents a real dichotomy. Second, it has phylogenetic reality. Third it has economic reality, with animal foods generally more expensive. Fourth, it has nutritional reality, with high fat (especially saturated fat) and more complete proteins in animal foods, as well as a more complete range of micronutrients. Fifth, with modern concerns about sustainability, animal foods are problematic because they are generally less efficient and kind to the planet than plant foods (Fresán & Sabaté, 2019).

We were also surprised by the absence, in the open-ended data, of any personal-hedonic division of foods, e.g. “those I like and those I do not like.” Participants seem to have taken the task to be “above” the level of personal preference. It is also notable that not one of 947 participants suggested “food of my country” versus “other food”, which we take to be an important determinant of intake in countries with traditional cuisines. Our ranking results support this. The “health-pleasure” conflict was also much less common than we expected, and was not more common in the USA than in other countries.
The major country difference we report are a general tendency for Americans to nominate healthy-unhealthy more frequently (in the spontaneous procedure), and a greater salience of the “natural-processed” dimension by the French, present in both methodologies. Although not ranked very low, the category of one’s own country’s food versus other country’s food was more prominent in the two countries with more distinct cuisines, India and France.

Our prior study on free associations to food in France, India and the USA (Rozin et al., 2002), reviewed in the introduction, is the only study that is parallel to the present study in sampling. However, it was carried out 20 years ago, and the India-US comparison of that study was limited to college students. Nonetheless, the greater concern with health by Americans emerges in both studies, including nomination of more “fat” word, fewer healthy foods and more unhealthy foods by Americans as opposed to Indians or French. In free associations, there was no indication of a general dominance of health concerns: of the four most common words for 3 countries by two genders (a total of 24 words), there was only one case of “fat/fattening” of a health-related word, and that was in American females. It may be that asking for a dichotomy primes health thoughts more than straight free associations to “food.” In our other studies with French and Americans (e.g Rozin et al., 1999; see Rozin et al., 2019 for a review) the greater American health concern also appears. There was no opportunity to examine inattention to the animal plant dimension in any of our prior studies.

We employed two methods (open-ended and ranking of explicit options for food importance), with reasonably congruent results. Overall, across two different methodologies, health dominates, but more clearly in the spontaneous suggestions. Health dominates in thinking about food, especially for Americans (Rozin et al., 1999, 2003). The solid-liquid (Food-beverage) dichotomy is tied with healthy-unhealthy for frequency in the spontaneous results, but is ranked a distant third, and very close in ranking to the two less favored categories, own country and animal-plant. This major difference may be partly due to the possible priming of this distinction by mention in the instructions for the spontaneous dichotomies, especially in the absence of other alternatives, which were available in the ranking. Another major distinction between the methods is the much higher salience of the animal-plant distinction in the rankings. In a way it may have been masked, and not even thought of, given the dominance of both health and solid-liquid in the minds of the respondents. Although only 7/947 spontaneous reports literally identified the animal-plant distinction (as opposed to approximations such as “vegetarian – non-vegetarian” or “meat-vegetable”), 11.5% of the same respondents ranked it first of the five choices. However, animal-plant did receive the highest (least important) ranking of the five choices. Finally, own country’s food vs other food gets some level of attention in the importance rankings (14.8% of respondents ranked it first), but was never mentioned in the spontaneous dichotomies. And, remarkably, in the spontaneous dichotomies, no one mentioned personally liked versus disliked foods. No doubt this important dichotomy could be prompted with different instructions. The major differences between the results from the two methods probably arose because the open-ended distinctions, which were arrived at very quickly, did not seem to consider some possibilities which, in the ranking, scored as important. Animal-plant and country-other show more prominently in the rankings, and solid-liquid in the spontaneous nominations.

This is a first study of the relative salience or importance of different dimensions to describe the food domain, and as such, has some notable limitations. The present study, while it employed two measures of salience/importance, did not involve a much wider range of procedures that might be usefully employed, including open-ended discussion of the food world not explicitly focused on divisions. The sample, was geographically “representative” and covered a wide range of ages. For India, the sample is not representative, since it is limited to English speakers on the internet. Furthermore, the level of English fluency was lower in the Indian sample than in the American sample. We did not screen for this, but misspellings and occasional grammatical errors were more common in the Indian sample. Finally, the prompt for the open-ended question, in order to define the domain whose categorization was sought, mentioned “all the things we eat and drink”, which may have primed the food-beverage distinction; this was the second most common category of spontaneous dichotomies. That this may have been a factor is suggested by the lower importance that this category received in the rankings.

Understanding how people think about one of the most important activities and choices in their lives is important in understanding human life. Specifically, diet has an important role in health, and food choice and intake are among the most potent determinants of health over which an individual has some control. Our findings suggest that the food-health link is very salient for many individuals, especially Americans. Insofar as this strong mental link does not translate into lower food intake and more healthy choices, it may be counter-productive. The importance of major social and pleasure functions of eating were not manifested much by our questions and methods of elicitation. We were surprised that the health-pleasure dichotomy, which represents a conflict, especially for Americans, was not a common nominal dichotomy. Unfortunately, we did not include it among the ranked choices. It may be subsumed in the healthy-unhealthy division, with the implication that unhealthy foods provide more pleasure, even if the pleasure is seasoned with guilt. Of course, the salience of health may be motivated by guilt for unhealthy eating, as well as desire for healthy eating. It may be that changing availability of “healthier” and “unhealthier” foods, for example by making the former more convenient, may be a more effective way of changing food habits than printed or video persuasive messages.

Further research is necessary to elaborate the differences between ranked importance and spontaneous suggestion of dichotomies, and of course, to see if either predicts actual food choice. The country with the greatest salience of health categorizations of the food domain is the United States, which is also probably the country with the least “healthy” food choices of the three countries (Rozin et al., 2002). Does encouraging the classification of foods in terms of health actually serve the end of increasing healthy eating? It may increase guilt with respect to food choice, and tend to exclude foods healthy in modest amounts from the diet, which could decrease the pleasure of eating. We hope our results add some new perspectives on the understanding and encouragement of healthy and pleasurable eating.

Category ethics

The study protocol was approved by the University of Pennsylvania Institutional Review Board (approval #829987), and conformed to the Declaration of Helsinki.

References


