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Research report

European and American perspectives on the meaning of natural ☆

Paul Rozin [a,*], Claude Fischler [b,c], Christy Shields-Argelès [c,d]

[a] Department of Psychology, University of Pennsylvania, 3720 Walnut St., Philadelphia, PA 19104-6241, United States
[b] CNRS, Paris, France
[c] EHESS, Paris, France
[d] American University of Paris, Paris, France

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ABSTRACT

Attitudes to natural foods and genetically modified organisms, assessed by multiple choice items, definitions of natural, and free associations to the word "natural" were determined for a representative sample of adults from France, Germany, Italy, Switzerland, the U.K., and the U.S.A. Individuals in all countries had a very positive attitude to natural. There is a surprising degree of similarity in conceptions of natural across the six countries, with a focus of food (and beverages) as central to the idea of natural, and links to the ideas of biological, healthy, plants, and the environment. Demographic differences (e.g., sex, education) were also small. Analysis of definitions and free associations suggests, and other data confirm, that across all countries, natural is defined principally by the absence of certain "negative" features (e.g., additives, pollution, human intervention), rather than the presence of certain positive features. Across all countries, plants, and in particular, plant foods, are more frequent exemplars of "natural" than are animals, with green the dominant color associated with natural. There is opposition to genetic engineering, which can be thought to be the opposite of natural, in all countries, but it is highest in continental Europe and lowest in the U.S.A.

Across time and cultures, what we refer to as "nature" was successively or simultaneously seen as the source of life and the locus of most perils, whether from disasters, living creatures or supernatural entities. In the ancestral environment, the natural world constituted the selection pressures under which humans evolved. In modern times, cultural institutions, artifacts, and values have become substantial influences on the success of both individual humans and the species. While, in the words of Max Weber (1958 [1905]), the world has become largely "disenchanted" (i.e. belief in magic and supernatural creatures has all but disappeared) nature still looms large in importance. As civilization and its products threaten much of the natural world, movements have arisen, over recent centuries, that revere and aim to preserve nature (Thomas, 1983). The excitement and accomplishments associated with the conquest of nature have been tempered by two types of concerns. First, an instrumental view, that the preservation of the natural world is ultimately better for the survival and success of *Homo sapiens*. Second, on ideational grounds, independent of human welfare, it is morally correct to defend and preserve the natural world. This type of view can be based on the idea that the original form is, by its nature, the best form. Kellert (1993) has reviewed a range of attitudes to nature among Americans, and listed a total of nine.

Attitudes to natural in the developed world are dynamic, and continuously changing. For example, until the 19th century, "natural product" meant primarily perishable product, and then the term changed to have more of a relation to toxicity, and finally to the current benevolent view (Stanziani, 2008). Risk and safety, nutritional value, sacredness, and stewardship are among the issues that have influenced conceptions of nature, all affected by social standing and education, as well as time period (Stanziani, 2008).

Concern with natural has been a matter of some scholarly interest in a number of disciplines, including biology, psychology, anthropology, history and philosophy (e.g., Descola, 2005; Freidberg, 2009 Kellert, 1993; Thomas, 1983). Across history, natural has had a complex relationship with related terms such as freshness; major changes starting in the late nineteenth century, such as refrigeration, that launched a global food economy also had important effects on conceptions of natural (Freidberg, 2009). A range of pro-environmental concepts such as the preservation of biodiversity have also become related to natural (Descola, 2005). The views of natural are not only time dependent, but very much dependent on culture, with various non-Western cultures basically ignored in most of the literature (but see Descola, 2005).

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* Corresponding author.
E-mail address: rozin@psych.upenn.edu (P. Rozin).

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In recent years, in the Western-developed world, the adjective "natural" has been attached to food products whenever possible. In both the U.S.A. and Western Europe, there is currently a great deal of media attention given to the values of natural in the domains of food and health, and there seems to be particular attention given to the anti-natural aspects of genetically modified organisms in Western Europe (Frewer, Hedderly, Howard, & Shepherd, 1997; Gaskell, Bauer, Durant, & Allum, 1999; Hohl & Gaskell, 2008; Weiner & Rogers, 2002).

In past research in the U.S.A., we have documented the preference of Americans for food products that are labeled as natural (Rozin et al., 2004). This natural preference, manifested as a preference for a natural food versus the same category of food that was processed (additives, pesticides, extractions, synthetic components, or some other form of human intervention), describes the attitude of the great majority of American respondents. This preference could be based on instrumental reasons, e.g., that the natural choice is healthier, more pleasing in flavor and appearance, or kinder to the environment. On the other hand, it could be based on the ideational position that natural is inherently better. Our results indicate that ideational reasons play a major role in natural preference. When it is explicitly stipulated that the natural and commercially processed choices are chemically identical, the majority of those who showed a natural preference maintain it (Rozin et al., 2004). The importance of ideational factors is supported by participants' accounts for why they prefer "natural." A modest preference has also been demonstrated for natural over processed medicines, but this preference is substantially smaller than the natural food preference (Rozin et al., 2004). Much more research has to be done on the extent of and reasons for natural preference, especially in non-Americans, in both the developed and less developed world.

The existence of natural preference, in some sense, begs the question of what "natural" means in different cultural contexts. Whatever it is, people seem to like it, but it is important to have some idea of what it is that they like.

Our first study on the nature of natural dealt with a sample of Americans (Rozin, 2005). The questionnaire used in that study asked people to judge the naturalness of a variety of entities, such as spring water, spring water with natural or synthetic minerals added, fresh peanuts, peanut butter, low-fat peanut butter, whole milk, skim milk, wolves, German shepherd dogs, wild, organic, or commercially grown strawberries, and pigs or corn which had a gene from another species inserted into them (GMOs). The results of this study provided evidence for the following claims:

Mixing of like natural entities (e.g., water from two different springs) has only a small effect in reducing naturalness.

Chemical transformations (e.g., additives) are much more destructive of naturalness than physical changes (e.g., freezing, grinding). Non-natural additives often act like contagious negative entities; very small amounts produce a marked and permanent drop in perceived naturalness.

The process that an entity has been subjected to seems more potent in reducing naturalness than any change in content.

With respect to the process finding, while domestication of plants or animals, associated with major human interventions and producing major changes in the genotype and phenotype, produce only small changes in naturalness, GE (genetic engineering) manipulations, which usually change just a single gene, produce a large reduction in naturalness. Our subsequent work emphasizes the importance of process as opposed to content in determining naturalness. Understandably, Americans rate spring water or natural tomato paste as much more natural than those same entities after a small amount of a natural substance (e.g., natural minerals or sugar) has been added to them. This action involves both a process (adding) and a change in content. What is striking is that if it is stipulated that all of the additives are subsequently removed, the resultant substance is rated *less* natural than the substance with the additive (Rozin, 2006). The substance that had an additive that was then removed has been subjected to two "processes," but is now identical in content to the original "natural" substance. This set of results (confirmed with the opposite sequence of removing a component of a natural substance, and then replacing the removed component (Rozin, 2006)) argues strongly for the importance of process as opposed to content in natural judgments.

The present study was conceived and carried out in parallel to most of the studies we just described. It is part of a large-sample general study on cultural differences in attitudes to food and health. It has the virtue, compared to our prior work, of a much more representative sample, and the inclusion of five European countries along with the U.S.A. One particular finding from this data base has already been published. Additives play a special role in reactions to foods. In what we call "additivity dominance", we report, based on survey results from these six countries, that additives have a much more potent role in reducing naturalness than do "subtractives" (Rozin, Fischler, & Shields-Argelès, 2009). It is as if adding engages the idea of processing more than subtracting.

As indicated by the review above, the meaning of natural has received little attention in the social and decision science literature. However it borders on a set of problems which has received a great deal of attention: perception of food risks, and in particular, opposition to genetically modified foods. Earlier research on the "psychometric" approach has emphasized the importance of lay beliefs and attitudes for the formulation and implementation of public policy. Recent studies about perception of food risks have been soundly based on judgment-decision research, initially summarized well by Slovic (1987). The two-dimensional dread and unfamiliarity model which emerged from early research has proved to be very useful in understanding public reactions to new foods. However, research has also exposed other important psychological and cultural variables that influence food risk perception, including trust in institutions, general cultural and individual attitudes to technology, availability of information, and media attention (e.g., Finucane, 2002; Gaskell et al., 2004; Ronteltap, van Trijp, Renes, & Frewer, 2007). Although many excellent studies have explored reactions to genetically modified foods and other new technologies, they may have underestimated the importance of the meaning of natural as a cause of reactions to food technologies. Reactions to natural can be both an individual and a cultural variable. Sjoberg (2000) identifies resistance to tampering with nature as a major predictor of opposition to GE foods in Europeans, and also indicates, as with our work on natural, that this opposition is deeply based in fundamental beliefs, often with moral overtones.

The economic and social importance and potential of genetically modified foods (especially in the less developed world) is coupled with a substantial difference in government and public reactions to it, across Europe and North America. Gaskell et al. (1999), in a questionnaire distributed to 1000 residents of each E.U. country, the U.S.A., and some others, report more support for GM (genetically modified) crops and food in Americans, but more support for genetic testing in Europe. They can account for most respondents as supporters, opponents, or risk tolerant supporters. Surprisingly, analysis of media reports in the various countries does not indicate more negativity to GMOs or GE in Europe than in the U.S.A. Although similarities outweigh differences in different European countries, there are a number of distinct differences in attitudes, belief, and trust in institutions (Hohl & Gaskell, 2008). Overall, it is highly unlikely that Europeans are more concerned about diet and health than Americans (e.g. Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999), but at least for GE foods and mad cow disease, there is greater European public concern. And

there are also differences by country and continent in public policy on food risks, and perhaps in the relationship between public perceptions and public policy. The available data suggest that most of the variation in attitudes to food risks, and in particular GE foods, is within country, and that there are few if any general statements that can be made that differentiate Europeans and Americans (Weiner & Rogers, 2002). At the level of public policy, Americans are more conservative (precautionary) about food risks in some domains, and less so in others.

The present study allows us to address cultural differences and similarities in natural preference and the meaning of natural, based on free associations, definitions of natural, and answers to some specific multiple choice questions. It allows for further testing of some of the tentative conclusions listed above (from Rozin, 2005), promotes a few other hypotheses about the nature of natural, and allows for demographic analyses. The motivation for this study was primarily to better understand the meaning of natural in a number of different cultures, rather than to test specific hypotheses. Since the present study includes samples from five European countries and the U.S.A., it promises to provide information on similarities and differences in the meaning of natural that might map on to economically and socially important issues.

Method

A large scale study comparing food attitudes in six countries was funded by OCHA (Observatoire CNIEL des Habitudes Alimentaires) a part of the French Dairy Industry's Centre National Interprofessionnel de l'Economie Laitière (CNIEL) in Paris. The six countries were France, Germany, Italy, Switzerland, the U.K. and the U.S.A. The study consisted of a three stage program, led by Claude Fischler in collaboration with a researcher from each country (Rozin was the American collaborator, and Shields-Argelès was one of the principal individuals who initially designed and organized the surveys and focus groups). In the first stage, exploratory focus groups were conducted in each of the six countries (in four languages) by the same team of facilitators. In this paper, we do not report results from this first phase. Information gathered in the focus groups was used to construct a largely open-ended questionnaire which was administered by telephone to a stratified sample consisting of approximately 180 people per country (approximately one-third physicians, one third school-teachers, and one-third a randomly selected national sample excluding physicians and teachers). The interview lasted about 45 min of phone time, and was administered by a professional polling organization, in the native language of both the interviewer and informant. In phase 2, all of the Swiss respondents were from French-speaking Switzerland. In light of analysis of this data set, in phase 3, a 15 min multiple choice questionnaire was constructed and administered again by telephone to representative samples in the six countries (n = about 900 for each European country and n = 1500 for the U.S.A.). (In phase 3, the Swiss respondents were a representative sample of the entire country.) Both the second and third phases included collection of a full range of socio-demographic variables, including gender, income, education, religion, occupation, household size, number of children in the household, and size of town of residence. The focus group phase was conducted between June and December, 2000, the second phase between May and July of 2001, and the third phase in the spring of 2002. The sampling for the second phase was based primarily on lists of telephone numbers from public directories or professional directories, and was carried out by a professional organization (Le Terrain, Paris, France). Care was taken to represent all major regions of the countries. The phase 3 sample was carried out by the same organization, and was stratified by gender, age, socioeconomic level (education and income), size of municipality and region of country. The acceptance rate of qualified contacted respondents was about 50%.

The information collected in phase 2 and 3 included specific items related to attitudes to or beliefs about "natural," or food attitude items that might be related to attitudes to natural. These specific items are the subject of this paper, and are described when treated in the results.

Results

Given the large n, we adopt a significance criterion of $p < .01$, two tailed.

Free association valences to "natural"

In phase 2, each participant produced three words as free associations to the word "natural." This question occurred near the beginning of the questionnaire, right after demographics, so there was minimal influence on these associations from later questions. However, it was preceded by three free associations to the word "Food" which may have biased respondents to think of "natural" in the context of food. After completing a series of free associations, with natural followed by "organic" ("biologique"), then "fresh" and then "chemicals", participants were guided back to their set of free associations and asked to evaluate each free associate for this set of words as positive (+1), neutral (0), or negative (−1). The natural valence score we employ is simply the sum of these three numbers, and hence varies from −3 to +3. It serves as one of a number of possible measures of positivity toward "natural." We provide a substantive analysis of the free associations later; here our concern is only with the valence of the term "natural." As we expected, the sample as a whole is very positive to "natural," with a mean natural valence score of 2.40, and a median +3 (the highest possible score, Table 1). Unlike the responses to GE foods, there is very little variation across country in the natural valence scores. A one-way ANOVA by country is significant ($F[5,969] = 5.065$, $p < .001$) but the absolute difference between the most positive country (Germany at 2.62) and the least positive (U.K. at 2.21) is only .41 scale units, and Scheffé tests did not reveal a single significant ($p < .01$) pair difference (Table 1). (German is significantly higher than France or U.K. at $p < .05$). It is interesting that the net positivity score for organic/biologique was positive but significantly lower than the score for natural, and correlated $r = .22$ ($p < .001$) with the naturalness score.

Effects of gender on natural positivity were not significant [female ($n = 557$, $x = 2.43$, s.d. = 0.942), male ($n = 418$, $x = 2.35$, s.d. = 1.08), t (973) = 1.252 n.s.], while profession revealed a modest tendency for doctors to rate naturalness less positive than either teachers or randomly selected individuals [random ($n = 332$, $x = 2.46$, s.d. = .88), teachers ($n = 355$, $x = 2.47$, s.d. = .94), doctors ($n = 288$, $x = 2.25$, s.d. = 1.18), $F(972,2) = 4.712$, $p < .01$.

Finally, there is surprisingly absolutely no effect of age on positivity to naturalness; the pearson r for age and natural valence is r (967) = .00 (age range, 21–91, mean age = 48.3).

The meaning of natural: definitions

In phase 2, all participants provided an open-ended definition of natural, which was transcribed verbatim by the interviewer, in real time. We developed a coding scheme for the definitions of "natural." As illustrated in Table 2, the most common specific features in the definitions are no chemicals (247 mentions), no alterations (228), no additives (172) and no contact with/ intervention by humans (151). Note that these most common attributes, common in

Table 1
Net valence of the three free associations to "natural".

	All	France	Germany	Italy	Switzerland	U.K.	U.S.A.
Mean	2.40	2.22	2.62	2.56	2.45	2.21	2.34
Standard deviation	1.00	1.08	.85	.88	.85	1.13	1.11
N	975	166	162	155	171	161	160

Table 2
Categories and most frequent specific responses in defining natural.[a]

Category[a]	France	Germany	Italy	Switzerland	U.K.	U.S.A.	Total
1. No processing	**128**	**82**	**114**	**120**	**121**	**122**	**687**
Not altered	32	39	51	36	32	38	228
Not affected by industry	44	4	9	26	6	6	95
Not touched by humans	22	19	27	21	29	33	151
Not processed	11	11	18	13	30	34	117
2. No additives	**105**	**63**	**74**	**113**	**113**	**136**	**604**
Nothing added	32	13	18	27	41	41	172
No chemicals	40	33	35	49	39	51	247
No preservatives	9	5	6	12	7	24	63
3. Origin in nature	**15**	**57**	**65**	**62**	**32**	**62**	**293**
From nature	0	30	24	29	7	17	107
Found in nature	12	11	33	11	13	18	98
4. Specific objects	**17**	**25**	**28**	**40**	**44**	**48**	**202**
Foods	9	12	19	27	35	39	141
5. Miscellaneous	**8**	**12**	**12**	**14**	**33**	**32**	**111**
6. Pure	**6**	**21**	**20**	**14**	**19**	**25**	**105**
7. Human/not commercial[b]	**19**	**10**	**9**	**25**	**12**	**18**	**93**
8. Healthy	**35**	**13**	**14**	**17**	**3**	**10**	**92**
Healthy foods	35	11	11	15	3	10	85
9. Grown	**6**	**11**	**7**	**10**	**26**	**31**	**91**
10. Fresh	**20**	**9**	**6**	**23**	**22**	**7**	**87**
11. Biological/organic	**7**	**9**	**13**	**29**	**5**	**4**	**67**
12. Positive words	**10**	**8**	**11**	**7**	**9**	**3**	**48**
13. Simple/basic	**1**	**1**	**12**	**6**	**17**	**3**	**40**
14. Authentic	**6**	**3**	**4**	**1**	**0**	**1**	**15**
15. Spiritual	**1**	**1**	**2**	**2**	**6**	**0**	**12**
16. No removals	**3**	**1**	**0**	**0**	**3**	**4**	**11**
17. Tasty	**3**	**0**	**2**	**4**	**0**	**0**	**9**
18. Whole/complete	**0**	**0**	**0**	**1**	**5**	**0**	**6**
% Nos: (1 + 2)/total	233/390	145/326	188/393	233/488	234/470	258/506	1291/2573
	57.9%	44.4%	47.8%	47.8%	49.8%	51.0%	50.2%

[a] The number in each column is the number of individuals who included the feature in the left column in their definition of natural. Scores are provided for any specific item with at least 60 mentions, and some others. *N* = 155–170 for each country. Category (numbered and bold faced in left column) is the sum of more common entries listed below it, and others not listed that were lower in frequency. For example, no pesticides is included in No additives, but not listed separately.).
[b] This category refers to specific human contact, such as home grown, as distinguished from commercial contact.

all six cultures, are all negatives, indicating the *absence* of certain types of processes or products. We grouped the features conceptually, forming larger categories such as a general no additive category (no additives, no pesticides, no preservatives, no chemicals) or no processing (including no alterations, no contact with humans, no industrial intervention, etc.). The frequency of each of these categories is displayed in Table 2, along with the most common specific features, listed under their general category. The largest category is no processing (687 instances) followed by no additives (604 mentions). These two categories dominate the features of natural, with the next most frequent categories being original/from nature (293) and the mention of specific categories of entities (202, with food the most predominant item within this category). Other common themes include grown in a human context (homemade, from a garden), simply "grown", healthy, and pure. The definitions do not differ markedly across countries: the no-additives and no-processing categories are the most frequently cited in all countries.

There are a few notable features of the definitions. The first is, as mentioned, the dominance of negative terms, no- or un-, in English. Second, it is striking how many terms refer to adding things to an otherwise natural entity (604) and how few refer to removing things, or "subtractives" (only 11 cases). We discuss this observation ("additivity dominance"), which arose from this study, in a separate paper (Rozin, Fischler, & Argelès, 2009). Overall (see bottom line of Table 2), slightly over 50% of coded definition terms stipulated the absence of something, with this percentage highest in Germany (57.9%). The definitions are very similar across countries. However, there are some notable differences. In particular, the French are most likely to include in their definitions not affected by industry (44 cases, next most common, 26 cases for Switzerland), and the French are less likely to define natural in terms of "origin in nature" (15 mentions, next least common, the U.K. at 32). We cannot account for these differences.

The meaning of natural: free associations

In phase 2, all participants offered their first three free associations to the word "natural." Free associations, though very influenced by context, seem to be a reasonable aggregate measure of group attitudes (Rozin, Kurzer, & Cohen, 2002). Our past work has indicated that results are very similar when one examines the most frequent associations, as opposed to combined categories of association, so we opt for the former in our analysis by country, although we do a categorical analysis for the whole sample and some demographic groups. For individual item analysis, we group together any words that are different forms of the same word (e.g.,

fish, fishes), or words that are essentially synonyms (e.g., in French, the two words for food: aliment and nourriture).

The 10 most frequent associations to "natural", for each country, are listed in order of frequency in Table 3. At least three of the top 10 for each country are food/beverages: food, water, vegetables, fruits, and yogurt. (Note that an item like "vegetables" only refers to mention of this word; tomato or cucumber do not count in the vegetable tabulation, although they are included in the "plant food" category in the later analysis.) Other than foods/beverages and the listing of near synonyms to natural ("nature, biological, organic"), the most common items include aspects of the environment ('air, country'), and positive affect (e.g., "good" and "health/y"). These five most common categories seem to constitute an intuitive sense of natural: biological, positive affect, environment, food (particularly plant products), and health.

There are some similarities across countries, with biological/organic, fruits, vegetables, and water, present in the top 10 in every country. The biggest differences (Table 3) between countries include the prominence of health/y for Americans, water (acqua) for Italians, and yogurt for the U.K. The yogurt response from the U.K. was most distinctive; it was the highest free associate among the U.K. participants, and did not appear in the top 10 for any other country. It is notable that the most common free association for any country is "biologique" (72 cases) for the French, and the second most common (46) is this same word for the French Swiss. This word (including its rough synonym "organic" in English) appears in the top ten associates for all countries (Table 3). We cannot account for its higher frequency in French speakers.

For group comparisons other than country, we organized the free associates into categories (listed in Table 4). We counted the three free associations of each respondent as independent entities, so that each respondent contributes three items to the tabulations in Table 4. Under "foods" we arranged four subcategories: plant products (vegetables [including the generic term and any specific exemplars], fruits and grains), animal products (meat [including fish], dairy, eggs), water, and Other (condiments, desserts, beverages other than milk, food related activities such as fishing or cooking, or nutrition terms). The domestic/home/agriculture category included words referring to these terms, with garden and homegrown among the most common terms. The health-biological category included references to health or healthiness, biological processes or organic, and stems that included the "nature" root. The category of non-food entities included the subcategories plants, animals, physical/general features of environment (e.g., wind, meadow, country, mountain), and specific non-food objects (e.g., leather, shampoo). The categories fresh, pure, authentic, simple, as listed in Table 4 are self-explanatory. The final substantive category is valenced entities, which we divide into positive words (e.g., good, tasty) and negative words (e.g., over-valued, boring), negated negative words (e.g., unspoiled, uncontaminated) and negated positive words (e.g., not good). We recorded the latter category, even though it was very small, because it is the opposite of the large negated-negative-word category. Finally, under miscellaneous, we included words that were unintelligible, or defied categorization, or words in categories (e. g., persons, which included "mother", or "Sophia Loren"!!) that were very uncommon.

A number of items fell into two categories. In such cases, we assigned a half point to each of the categories, such that the entry only counted, in total for one unit. Thus, fruit juice was scored as .5 beverage and .5 fruit. Exceptions to this rule were water and milk, which were not counted as beverages, but under their own categories (water and dairy, respectively). Also, we counted the negated negative words in their own category, even if they corresponded to another attribute as well. Thus, uncontaminated is counted under negated-negative, not pure, and unspoiled under negated-negative, not fresh.

The distribution of categories of free association responses across all respondents (second column of Table 4) reveals a number of themes that correspond to the individual free associations and to the open-ended definitions. The most common category of response (making up 14.5% of all responses) was plant foods. The other most common categories, in order of decreasing incidence (other than miscellaneous, at 10.7%) were positive words (9.6%), biological/organic (8.8%), physical and general environment (7.8%) and health (6.0%). All of these common categories are well represented by specific most frequent exemplars in Table 3.

Group differences were analyzed for males and females and for doctors versus non-doctor (other and teacher combined) occupations. There is surprising uniformity across these demographic variables in the distribution of free associations to "natural." Using a criterion of $p < .01$, 2 tailed, there were only two categories in which doctors differed from non doctors (by chi-square): doctors were less likely to offer physical/environmental words and more likely to offer negative words. Females were more likely than males to offer physical/general environment words and "fresh." The similarity across demographic categories is illustrated by Pearson correlations. We compared the pattern of frequency of mentions of each category across males and females (21 pairs, we

Table 3
Most common free associations to "natural" by country (word followed by number of instances).

Freq rank	France	Germany	Italy	Switzerland*	U.K.	U.S.A.
1	Bio/logique 72	Natur 22	Acqua (water) 46	Bio/logique 40	Yogurt 36	Healthy 24
2	Legume (vegetables) 25	Obst (fruit) 19	Frutta 24	Legumes (vegetables) 36	Organic 31	Fruit 21
3	Eau (water) 22	Wasser (water)18	Verdura (vegetables) 22	Fruits 30	Vegetables 22	Vegetables 20
4	Fruits 20	Gemüse (vegetable)17 Wiese (meadow) 17	Bio/logi 19	Eau (water) 24	Fruit 20	Water 18
5	Sain (healthy) 19		Genuino 17	Sain 15	Water 19	Organic 17
6	nature 16	Baum (tree) 11	Cibo (food) 14	Aliment 12	Healthy 16	Food 12
7	Ecologie15	Biologisch (organic)10 Wald (forest) 10 Luft (air) 10	Sano (healthy) 12	Animaux10 Campagne 10 Jardin 10	Pure 11	Good 11
8	Campagne (country)13		Aria (air)10 Latte (milk) 10		Air 10	Grain 9 Vitamins 9
9	Sante (health) 12				Color 8 Environ 8 Trees 8	
10	Jardin (garden) 11	Milch (milk) 8	Campagna (country) 9	Cereale 9		Trees 8

* Note that in this phase 2 data, only French speaking Switzerland is surveyed.

Table 4
Categories of free association response for all participants, and by gender and occupation (group differences indicated only when significant at $p < .01$).

Category	% of total associations	Doctor vs. non doctor[b]	Female vs. male[c]
Foods			
Plant foods (veg, fruit, grain)	14.51		
Animal foods (meat, dairy, egg)	4.84		
Other food (food, beverages, nutrition, cooking)	5.79		
Water	4.77		
Domestic/home/agriculture	2.25		
Health-Biological			
Health	6.03		
Bio-organic	8.77		
Nature-related	3.17		
Non-food entities			
Plants	4.23		
Animals	1.27		
Physical/general environment	7.84	ND > D***	F > M***
Non-food objects	3.74		
Attributes [a]			
Fresh	1.41		F > M**
Pure	1.08		
Genuine/authentic/original	1.32		
Simple/basic/common	1.73		
Color	1.86		
Valenced/affect words			
Positive words	9.55		
Negative words	1.21	D > ND **	
Negated negative words [a]	3.83		
Negated positive words	0.06		
Miscellaneous	10.73		

** Chi square: $p < .01$.
*** Chi square: $p < .001$.
[a] Some of the attribute values are artificially low, since negated words, like uncontaminated or unspoiled were counted under negated negative words, rather than, in this case, under pure and fresh, respectively.
[b] D > ND means that doctors mention this category at a significantly higher incidence than non-doctors.
[c] F > M means that females mention this category at a significantly higher incidence than males.

dropped negated positive words because frequency was extremely low for this category); the correlation was $r = .95$. The correlation between the doctors and non-doctors across the 21 categories was $r = .91$.

Finally, as with the definitions of natural, there are many negated negative expressions (e.g., uncontaminated, no pesticides), accounting for 3.83% of the total.

Animals vs. plants

It is notable that of the 60 most common free association words (10 from each country) (Table 4), 12 are fruits or vegetables, two grains/cereals, none are meat, and only three are dairy. Including plants (e.g., tree, forest) and animals in general, there are 20 plant mentions, and only four of animals or animal based foods among these top 60 free associates. The free association analysis by category of word confirms this relationship: there are 428.5 references to plant foods and only 143 to animal foods (plant/animal ratio of 3.00), and for non foods, there are 125 references to plants and 37.5 to animals (a plant/animal ratio of 3.33). Another indication of this link is the incidence of color words. Green, the color associated with plants, accounts for 79.7% (31.5/39.5) of all specific color words mentioned in the free associations.

Attitudes to genetically modified organisms (GMOs) and genetic engineering (GE)

Given that a major feature of natural is no-processing and no additives, genetically modified organisms stand as strongly opposed to natural As mentioned in the introduction, as opposed to natural, attitudes to GE foods has received a lot of scholarly attention. We included in phase 3 two items that directly asked about attitudes to GE foods: "I am in favor of the use of Genetically Modified Organisms in foods" and "I am in favor of research aimed at the development of Genetically Modified Organisms in general." Both were answered on a four point agreement scale, with no neutral value. Scores on the two items correlated at $r = .53$. As indicated in Table 5, a majority of individuals in all countries disagree with both statements, with agreement (strongly agree or agree) 16.4% for GMO foods, and 36.8% for GMO research. There are substantial country differences, with the same pattern for both questions. A one way ANOVA with country as the factor yielded $F(5,5898) = 128.697$ for GMO foods, and $F(5,5917) = 58.367$ for GMO research. In both cases, post hoc Scheffé tests revealed country pair differences at the $p < .001$ level between any of the four continental countries (France, Germany, Italy, Switzerland) and the U.K. or U.S.A. These were the only differences significant at $p < .001$, suggesting a clear pattern of higher opposition to genetic engineering on the European continent. These results are generally consistent with the prior literature as described in the introduction. However, it is important to note that the net opinion on GE is negative in all countries, just more negative in continental Europe.

We combined the two scores on attitudes to GE. This averaged GE score was not substantially related to most demographic variables (age; $r = .01$; religiosity = $-.03$; gender = .09), but there was a somewhat larger $r(5772) = -.14$ ($p < .001$) correlation with education level. People with more education tended to be less opposed to GE.

Discussion

In this study of attitudes to natural in six countries, we have confirmed and extended many findings that have appeared in the

Table 5
Attitudes to genetic engineering of foods and genetic engineering research (mean [0–3 disagree–agree scale], % agree)[1].

Item	All	France	Germany	Italy	Switzerland	U.K.	U.S.A.
I am in favor of the use of Genetically Modified Organisms in foods	0.69	0.52	0.46	0.51	0.45	0.91	1.05
	16.4%	12.1%	11.5%	13.5%	10.9%	20.8%	24.5%
I am in favor of research aimed at the development of Genetically Modified Organisms in general	1.13	0.93	0.98	1.05	0.91	1.32	1.41
	36.8%	28.9%	28.7%	35.6%	27.4%	44.7%	47.9%

[1]The actual scale used was 1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree. Scores were inverted and converted to a 0–3 scale, with 3 = strongly agree.

prior literature, added a more elaborate country and demographic analysis than has been available in most studies, and uncovered a previously unreported feature of natural judgments. This feature is that plants come to mind much more than animals when people think about "natural." The dominance of plants is also illustrated by the predominance of green as the color associated with natural in our free association study. The predominance of plants may be some sort of generalization of the joint beliefs that natural entities are healthier than non-natural entities and that plant foods are healthier than animal foods. It is also true that "natural" is an unambiguously positive quality for most people, while animals and their products have been singled out as particular foci of strong and often ambivalent feelings in people (Angyal, 1941; Pliner & Pelchat, 1991; Rozin, 2004; Rozin, Haidt, & McCauley, 2000; Tambiah, 1969).

There are many more similarities than differences in the conception of natural across the six countries studied. Across all countries there is a focus on the domains of food and water, an extremely positive framing, a tendency to define natural in terms of the absence of human intervention or artificial substances, a focus on plants as opposed to animals, and the conception of natural as the absence of additives as opposed to the elimination of subtractives (Rozin et al., 2009). Differences in free associations across countries have more to do with particular exemplars (water for Italians, yogurt for the English) than with general categories (foods, health, positivity), except for the very common use of "biologique" in French speakers. There is also surprisingly little variation to be accounted for by demographic variables such as gender, occupation, education and religiosity.

The predominant similarities in the lay meaning of natural across the Western-developed countries we have surveyed require some explanation. The success of the industrial revolution in these countries, with its apparent virtues and shortcomings, may be a factor in uniting their views about nature. Nature refers to the "original" status of things, and may have particular appeal for people who come to resent the intrusion of technology into basic traditions. For example there is an idealization of an agricultural past as well as present day spaces that recall this past, such as the garden or the farm in results from the focus groups of phase 1 across the six countries (Shields-Argelès, 2004). Such findings seem to reflect what has been found elsewhere: that the agricultural past symbolizes the "primordial" self of the highly urbanized and industrialized (Ohnuki-Tierney, 1993). There is an important component of "authenticity" in modern western views of natural.

We emerge with a better sense of the meaning of naturalness, and a rather coherent set of features, across the Western-developed countries under study. The biggest country differences have to do with attitudes to genetic engineering – although it should be emphasized that *in all the countries* in the survey a majority of the population expresses opposition to GM foods. While the disparities are strong, they make for a difference in degree, rather than a qualitative difference. The aversion to genetic engineering may be related to additivity dominance (Rozin et al., 2009), in the sense that genetic engineering can be framed as adding genes. No processing is also a feature of definitions of natural, and GE certainly counts as processing. Another potentially important feature of genetic engineering is that it may be the most psychologically salient representation of the idea of tampering with nature, a belief that is strongly opposed to natural (Rozin, 2005; Sjoberg, 2000).

Our study has a number of limitations. It represents a single temporal snapshot, from the first years of the twentieth-first century. By the present time (2012), some of the features we have described may have changed substantially, just as they changed in the decades leading up to our study. The rapid advances in genetics over recent decades (including the development of genetic engineering) have surely influenced thinking about natural. Also, our measures do not include reports about consumption as opposed to attitudes and beliefs. There are possible disconnects between beliefs and attitudes and consumption, particularly because it is often true that natural or organic foods are more expensive than commercially prepared foods.

Given the similarity in attitudes to natural in this Euro-American sample, it would be of particular interest to examine attitudes to natural in non-industrial cultures, and in Japan, the most prominent developed country outside of the Euro-American tradition.

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