Natural Food

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Introduction

In April 2012, a picture of a note posted in a natural food store in Rhode Island went viral. It stated that Kashi cereals were taken off the shelves because they were made with genetically modified ingredients. For many customers, the use of genetically modified soy was incompatible with the company's "natural" labeling, but Kashi argued they hadn't done anything wrong. As a spokesperson explained, "the company defines natural as 'food that's minimally processed, made with no artificial colors, flavors, preservatives or sweeteners.'"

This case highlights the confusion around the concept of natural food. The *Codex Alimentarius,* established by the International Food and Agriculture Organization and the World Health Organization, includes no principles or guidelines for the production and labeling of natural food (World Health Organization and Food and Agriculture Organization of the United Nations 2013). Many countries have nonetheless developed their own definitions of the term "natural" as it applies to food. In the United Kingdom for instance, the Food Standards Agency restricts the use of the label "natural" to foods that have "ingredients produced by nature, not the work of man or interfered with by man." (Food Standards Agency 2008). In Canada, the *processes* involved are what matter; the Canadian Food Inspection Agency (CFIA) states that food products should not be described as natural if they were "submitted to processes that have significantly altered their original physical, chemical or biological state." CFIA goes on to give a list of processes affecting the natural character of food (Canadian Food Inspection Agency 2012, section 4.7). In the United States, the Food and Drug Administration (FDA) does not restrict the use of the term "natural," but discourages the food industry from using it. It is interesting to note that after beginning a process of trying to define the term in 1991, the FDA finally gave up in 1993 (Houchins 2008).

Kashi's case is not unique. Using the claim that some food is "natural," or "all natural" as a selling point is widespread in food marketing today. The success of the "natural" label as a marketing tool suggests that many customers are looking to eat food that is – at least in some sense – natural, and that they consider that food labelled as such is somehow better than the food they deem "unnatural". A survey conducted among 1006 US customers even shows that American customers do believe that a "natural" label is greener than "organic" (Scott-Thomas 2009). However, as the confusion around it shows, the term "natural" is a polysemous one. In his book *Keywords*, Raymond Williams (1985, 219) notes that "[n]ature is perhaps the most complex word in the language," and long before him Hume (1978, 474) famously said of the word "nature" that "there is none more ambiguous and equivocal." This equivocity of "nature" makes it uneasy to clearly understand statements about the value-adding character of naturalness. This entry examines the various meanings of "natural" and their possible relevance for food ethics.

Natural, supernatural, artificial

A classical examination of the meaning of "natural" and its ethical relevance can be found in J. S. Mill's essay "On Nature" (Mill 1874). In this essay, Mill isolates two meanings of "natural." A first meaning, which will be referred to as **natural**$_1$, denotes "the sum of all phenomena, together with the causes which produce them; including not only all that happens, but all that is capable of happening; the unused capabilities of causes being as much a part of the idea of Nature as those which take effect." (Mill 1874, 5). This concept includes as natural all that happens in the physical world, and thus defines "nature" as opposed to the *supernatural* or the *miraculous*. In a second sense, which will be called **natural$_2$**, "natural" means "what takes place without the agency, or without the voluntary and intentional agency, of man." (Mill 1874, 8). In this second sense, *natural* is opposed to *artificial*, understood as *human-made*.

In the context of natural food, **natural$_1$** is an obviously trivial concept, as food production cannot escape the laws of physics and make use of *supernatural* powers. **Natural$_1$** is presumably the concept involved in most empty and deceitful claims of naturalness, such as those assigning an "all natural" label to highly processed food, like Frito-Lay's line of "natural" potato chips, or "natural" white cheddar *Cheetos*.

Natural$_2$, by defining naturalness in opposition to human intervention, seems, at first sight, to be a more plausible value-adding concept of naturalness. It can be seen for instance on the packaging of juices containing "only fruits." "Natural food" is colloquially opposed to "processed food," and here the epithet "processed" points intuitively to some technological transformation operated by humans. However, given the fact that almost all food consumed today is somehow human-transformed, and that many ingredients would not be comestible prior to undergoing at least some basic processing (e. g. chopping, mixing, centrifugation, deboning or cooking), the concept of **natural$_2$**, if it is understood as an *all-or-nothing* affair, risks casting the net of natural food on a too-restrictive class of products. Even raw fruits like oranges, which often remain green when they are ripe, are exposed to ethylene gas to make them orange and saleable. Under an *all-or-nothing* interpretation, perhaps only berries self-picked in the wild would count as natural food. But as Siipi (2008, 77–8) remarks, **natural$_2$** need not be so restrictively construed, and can also be interpreted as a *continuous gradient*. In such an interpretation, food can be more or less natural according to the *amount* of human transformation involved in its preparation. Therefore, it seems that **natural$_2$** must be understood in this later way if it is to be applied to food in a practical way. There is a significantly different degree of transformation involved in, on the one hand, transformations that are usually not taken to destroy the naturalness of a product (e.g. grinding wheat and cutting up and cooking meat); and, on the other hand, those involved in the production of industrially processed food (e.g. hydrogenation, interesterification). Thus **naturalness$_2$** interpreted as a *continuous gradient* seems better able than **natural$_1$** and the *all-or-nothing* **natural$_2$** to account for the distinction between natural and processed food by those who assign value to food in virtue of its naturalness.

A problem that remains with the continuous gradient **natural$_2$** concept, however, is that it appears to involve some level of arbitrariness. A first kind of arbitrariness comes from the fact that, as all other gradient notions when used for classificatory purposes, it faces a *threshold problem*. Provided that one could develop an uncontroversial way to quantify the degree of naturalness of a product (and this is far from being achieved), one would still have to establish a threshold above which some food is too human-transformed to be legitimately labeled "natural." As the continuous gradient of **naturalness$_2$** logically cannot, by itself, provide grounds to establish it, such a threshold would have to be set in reference to a property other than naturalness (say, the property of being the result of *industrial* transformations). Yet it follows then this other property would have to be defined with some precision, and, to avoid circularity, this definition would have to avoid any reference to naturalness. In this case, however, naturalness itself would no longer be what makes the products under the established threshold of naturalness more desirable than those above it, but this other property (being industrially transformed) appealed to in order to set the threshold.

Another, and perhaps more profound, way in which the **natural$_2$** involves some arbitrariness is that, by defining naturalness in opposition to human agency, it implicitly sets humans outside of nature. This is arbitrary because it is widely-accepted, and has been since Darwin first voiced his theory, that humans are the product of the same evolutionary processes as all other living beings, and that there can only be differences of *degree* between what human and nonhuman living beings do (Callicott 1991, 349–50; Vogel 2003, 152). In this context, it is arbitrary to draw a special class with the outcomes of human activities. One could withstand this upshot by putting forward that human activity is significantly different from what other living beings do, because we humans are cultural beings, and this allows us to have incomparably more dramatic impacts on our environment than those of other animals. This response seems plausible, as although, like humans, other species significantly modify significantly their environments (Ereshefsky 2007, 60; Jones, Lawton, and Shachak 1994) and transmit knowledge culturally (Ereshefsky 2007, 65–6; Callicott 1991, 351), it seems correct to assert that homo-sapiens are unrivaled in the *degree* of these modifications. As Callicott (1991, 351) notes, it seems reasonable to concede that "the cultural component in human behavior is so greatly developed as to have become more a difference of kind than of degree." As many ecologists have remarked (e.g. Angermeier 2000), this degree of cultural sophistication is what allows humans to have extraordinarily destructive impacts on the earth's ecosystems; the changes brought in the ecological world are so wide in scale that other species cannot evolve quickly enough to adapt to them. Similarly in the context of food and human health, one could argue that, given humans' ability to synthesize artificial molecules, our species is a lot more likely to produce molecules that cause health and ecological problems (like many of the chemical pesticides widely used in agriculture).

But should these observations be right, they would not support the claim that the potentially harmful effects of human's cultural abilities are such in virtue of their being the effect of human culture *per se*. The fact that our cultural abilities *can* generate harmful effects does not imply that they *must*. On the contrary, the very fact that humans are cultural beings is what makes it (in theory) possible for us to learn from our mistakes and create more innocuous alternatives to our unsafe products. Thus, it seems that harmful unnatural$_2$ products are not to be disvalued because of their **unnaturalness$_2$** itself, but rather because of their harmfulness. Hence, given the fact that there is no *necessary* connection between ecological or health harmfulness and the concept of **naturalness$_2$**, the human/nature dualism presupposed by this concept seems to remain arbitrary.

Naturalness, biological normality and processed foods

If customers were shocked by Kashi's products, it is not because there is human agency involved in the production of those cereals. It is because they contained genetically modified soy. What is so special about genetic modification?

For ancient philosophers, "nature" was conceptually tied to *life*, as indicated by the etymology of the word, "natura," which means "birth," and its Greek equivalent, "physis," which means "growth". In accordance with this etymology, Aristotle used "nature" principally to denote the inherent principle of growth and development of living beings. He viewed living beings as having their own teleological or goal-directed tendencies, and these tendencies explained their usual forms and directions of growth in terms of what is *natural* for them to do. As historians have observed, these teleological tendencies engendered *rules* regulating the typical behavior of natural entities. These rules admitted exceptions but stood *for the most part* or *the most often* (Daston and Park 1998, 120).

The possibility of exceptions to the rules of nature allowed Aristotelians to define a concept of naturalness which is different from Mill's **nature$_1$** and **nature$_2$**. For them, "natural" meant what happens according to the *normal* rules determining the functioning of complexly organized entities (resulting from their *telos*), and "unnatural" referred to breaches of these rules. The paradigm case of unnaturalness in this Aristotelian sense was that of *monsters*. For Aristotle, monsters were unnatural neither in the sense of *supernatural* (**unnatural$_1$**) nor in that of *human-made* (**unnatural$_2$**), but in the sense that they were deviations from the normal course of biological nature. This characterization indicates a third concept of naturalness: the **natural$_3$**, which can be defined as what happens according to the normal or ordinary course of the organic world. It is distinct from **natural$_1$** in that this latter concept is tied to matter and its necessary laws (the basic laws of physics), whereas **natural$_3$** relates to nature as organized into forms and its rules of normal functioning. It also differs from **nature$_2$** in that it is not opposed in principle to human agency, for deviations from the normal course of organic nature can occur with or without human intervention.

Nowadays, a similar idea of breach of the ordinary course of biological nature seems involved in people's repugnance for highly processed food, sometimes referred to as the "yuk factor" (Midgley 2000; Siipi 2008, 91–2). Yuk factor events are not reactions to the mere fact that some products are man-made (i.e. that they are **unnatural$_2$**). Processed foods are perceived as artificial in the much deeper sense that they involve types of transformations or modifications which lie outside the normal course of biological nature. For instance, if chemicals are added in food products to make them grow faster, be less prone to damage caused by insects or fungi, or simply to look better and last longer, when the chemicals used are not part of the normal biological processes characterizing the life-cycle of these products, they will be viewed as less **natural$_3$**. A study by Rozin (2005) illustrates people's intuitive use of a concept of **naturalness$_3$** in the evaluation of the naturalness of a product. The study shows that the perceived decrease of naturalness is stronger in the case of *chemical* transformations than in the case of *physical* transformations. "Physical transformation" in Rozin's study denotes changes that do not alter the inner properties of the products involved, e.g. freezing water, grinding peanuts or squeezing oranges; whereas "chemical change" denotes the opposite, e. g. boiling water, adding fat to peanut butter, pasteurizing or irradiating milk. Such perception points to a distinction between, on the one hand, **natural$_3$** changes, that is, changes that do not alter the inner natures of the substances and entities involved, and which could happen through the normal course of the organic world; and on the other hand, **unnatural$_3$** transformations, that is, alterations that denature the substances and entities involved by exposing them to processes of change that do not normally occur in the organic world. The legal definitions of "natural food," in terms of processes mentioned at the beginning of this entry, also seem to be grounded in this opposition between chemical and physical processes of transformation.

Attfield (2006) defends the relevance of the **natural$_3$** for health-related issues. He argues that:

> [T]he *good* and equally the *harm* of a living organism depend on its nature. If we did not know the nature of an organism, we could not tell what constituted its good or its harm. This is not just to say that the concepts of good and harm are species-specific; it is to say (unsurprisingly enough) that grasping the good or harm of a creature involves some grasp of its inherited constitution or make-up. (Attfield 2006, 111)

Attfield's contentions seem plausible. It appears reasonable to say that it is good, at least *prima facie*, for a being to grow and develop according to its nature. The standards of health for a living being depend on the kind of being it is; and, as pain has plausibly evolved as a means to motivate animals to move away from things that threaten their life and health, it seems reasonable to think that, even for animals, there is a strong correlation between their well-being and what concurs with their natures. One possibly problematic case, however, is that of organisms of highly modified species (modified either through selective breeding or genetic engineering). If, in order to maximize profit, the genetic form of a species is selected in a way that it makes it painful for its members to grow according to their (human-modified) **nature$_3$**, then the correlation between **naturalness$_3$** and well-being disappears. For instance, in the previous 40 years, milk yield per dairy cow has more than doubled due to genetic selection. As a result, declining fertility, increasing leg and metabolic problems and declining longevity have been observed. These are for the most part attributable to selection for increased milk yield and indicate a substantial deterioration in cow welfare (Oltenacu and Broom 2010). Today's dairy cows, then, are victims of their own seemingly natural growth processes, with individual cows prone to suffering without any outside human interference.

From the perspective of the human food-consumer, it may be healthier to eat **natural$_3$** food. Food whose production and conservation has involved significant chemical interference to normal biological processes is likely to be more harmful to health, if, as it often revealed to be the case, the chemicals involved have significant levels of toxicity for humans. However, if the chemicals involved kill some germs that are pathogens for humans, then their consumption will presumably be healthier than that of **natural$_3$** food products. Hence, there might be trade-offs involved when assessing the relation between **naturalness$_3$** and human health. One could nevertheless argue that, in general, given that the dangers related to **natural$_3$** food are easier to assess and predict than those of foods with chemical additives, in the absence of contrary information, **natural$_3$** food should be preferred. The harmful effects of biological pathogens are usually observable quickly enough after consumption so that a correlation can be drawn between them and their harmful effects. This is not the case with the harms related to chemical additives, which are less easily tractable, and sometimes become visible only long after someone has been exposed to them. For instance, exposure to pesticides is an important environmental risk factor associated with cancer development, but its effects can appear years after exposure.

What about the case of GMOs? Genetically modified organisms, sometimes denigrated as "frankenfoods" by their detractors, are often said to be unnatural because they "cross the species barrier." This idea of a "species barrier" seems to resonate well with the **nature$_3$** concept, as this concept is tied to the Aristotelian idea that species have essences which define their identity. Evolutionary biology, however, imposes qualifications to such idea. As it has been emphasized by biologists and philosophers of biology (Sober 1980; Mayr 1959), this sort of essentialist thinking about species is disqualified by evolutionary biology. According to Darwinian biology, species are not eternal essences, but concrete lineages in a perpetually ongoing process of change. Hence, in a Darwinian biological world, there are no sharp species barriers, and in this context, the argument that GMOs are unnatural because they cross such barrier is a nonstarter. Thus, if one wants to make the argument that GMOs are **unnatural$_3$**, one should point to other sorts of deviations from the normal course of the biological world involved in genetic engineering.

A counter argument to the idea that GMOs are unnatural, is the picture of genetic engineering as simply an alternative way to achieve what evolution does all the time: creating and selecting biological variation. According to this line of reasoning, genetic engineering involves nothing significantly different from artificial selection through repeated crossbreeding, a practice presumably as old as farming itself; and crossbreeding is itself equivalent to natural selection, as both use essentially the same processes (the selective pressures being the preferences of the breeder in the case of crossbreeding). But some would disagree with the view that there is no significant difference between genetic engineering and selective crossbreeding. In a biologically well-informed discussion of genetic engineering, Vandana Shiva (2000, 13) emphasizes important differences between the two practices: "[u]nlike conventional breeding, genetic engineering recombines genetic material from different unrelated species which do not interbreed in nature and for which there is no, or very little, probability of natural progeny." As she illustrates, "conventional breeding does not transfer genes from bacteria and animals to plants. It does not put fish genes into potatoes or scorpion genes into cabbage. It crosses rice with rice, and wheat with wheat." Hence, Shiva identifies ways in which genetic engineering achieves changes that could not occur normally in the biological world. Traditional crossbreeding faces the exact same constraints as natural reproduction, while the technique of recombinant DNA allows GMO producers to get around these constraints and achieve genetic combinations which could not occur through normal evolutionary processes. GMO plants like the soy contained in Kashi cereals are now commonplace illustrations of such combinations, but research is currently being done on genetically-modified animal products (though none are on the market yet). One is the AquAdvantage salmon, an Atlantic salmon in which genes from a Pacific Chinook salmon and an ocean pout have been added to the salmon's DNA in order to make it grow year-round and for the fish to reach market size in half of the time required for its non-modified counterpart (16 to 18 months rather than three years). Some modifications also involve human genetic material. In order to produce an alternative to infant formula, which is often criticized as being an inferior substitute to human breast milk, Chinese scientists have recently introduced human genes into 300 dairy cows to give their milk the same properties as human mother's milk.

Thus, although the "species barrier" argument is problematic in the light of Darwinian biology, there may still be good reasons to categorise GMOs as **unnatural$_3$**.

Ecological naturalness

Daston (2010) distinguishes two versions of naturalness as biologically normal: *specific* natures and *local* natures. *Specific* natures refer to the essences or the kinds of entities, that is, "to what makes an object be itself, in a recognizable and distinct way, to its ontological identity card: what makes gold is gold (and not copper for instance), what makes a bear is a bear (and not a trout)." This version of the natural as the biologically normal is the Aristotelian one, which was the focus of the previous section, and sets the standard of normality at the level of the living organism. The other version of naturalness as the biologically normal depicted by Daston is that of *local* natures. As she defines them, the local natures are the "characteristic combination of the flora and fauna, of the climate and geology which confer a landscape its physiognomy: the desert oasis, the tropical forest, the Mediterranean cost or the heights of the rocky mountains." (Daston 2010, 248–9) Daston adds that "[t]he modern science of ecology studies the way in which organisms and topography interact to create the specific local natures; but the order of local natures was noticed long before the birth of this science" (Daston 2010, 249). According to this concept, "nature" refers to "the ecological world," and "natural" denotes what is in harmony with the ecological world, or in more technical terms, what promotes, or at least is not detrimental, to ecosystem health (C. Dussault In prep.). This ecological concept forms a fourth concept of naturalness which will be referred to as **natural$_4$**.

The intuitive idea that the ecological world has an inherent balance which human industrial activities often upset is central to ecocentric views in environmental ethics (Leopold 1949; Callicott 1999; 1989), although it has been observed that the idea of a *balance of nature* may require qualifications (Callicott 2003; 1999; Botkin 1990). According to such views, some food production practices may be deemed unnatural in the sense of unecological (**unnatural$_4$**). A study by Verhoog et al. (2003) illustrates the intuitive appeal to a concept of **natural$_4$** made by organic farmers and organic food customers in their characterization of organic farming as more natural than industrial farming. The respondents in Verhoog et al.'s study said that it was necessary to view nature not "as a mechanistic material system but as a complex organic living whole" which has "a self-organizing capacity." Moreover, although the respondents "[a]ll realized that farming as such is a cultural activity in which human beings interfere in nature," they nevertheless thought that somehow organic farming is "harmoniously integrated into nature" while conventional farming is not (Verhoog et al. 2003, 35–8). The respondents' acknowledgement that farming is a cultural activity shows that the concept of naturalness they have in mind is not the **natural$_2$**, which excludes in principle humans' cultural activities; and their depiction of human interventions in nature as more or less in harmony with it clearly suggests a concept of ecological naturalness.

Just like the concept of **naturalness$_3$** had immediate connections with the issue of human and animal health, the concept of ecological naturalness is directly tied to ecological issues. As this concept is defined as what is harmonious with the healthy functioning of ecological systems, what is natural in this sense should be expected to be good from an ecological standpoint. However, substantive questions remain about whether particular food production techniques, such as irrigation or the use of GMOs are (un)natural in this sense. Is irrigation ecologically equivalent to rain (presumably a **natural$_4$** phenomenon)? Are GMOs always a threat to ecosystems? The complexity of ecological dynamics makes giving definite answers to such questions an uneasy task. Nevertheless, some clearer answers can be found when one considers how these food production practices are currently implemented. Irrigation plays a crucial role in increasing crop yields and stabilizing production but also causes major environmental problems (Dougherty and Hall 1995). Meanwhile, GMOs initially supposed to free agriculture from chemicals are in fact used to bolster the chemical industry (Food & Water Watch 2013; Shiva 2000).

The connection between ecological naturalness and human and animal well-being issues is less straightforward. As humans and non-human animals can only thrive in healthy ecosystems, the goals of human and non-human well-being, and that of ecosystem health seem to meet in the long-term, but whether there are trade-offs between them in the short-term remains an open question. Organic farming has been criticized as requiring more land to produce less food than conventional methods. The green revolution has contributed to a reduction in hunger in Asia; between 1970 and 1975, cereal production doubled, while land under cultivation only grew by 4 percent. Can organic farming feed the world? There is no clear consensus on this question (McWilliams 2009, 55–61). According to a recent meta-analysis of 66 studies presenting comparisons of organic vs. conventional agriculture yields (Seufert, Ramankutty, and Foley 2012), organic agriculture yields are typically lower than those of conventional agriculture, but these differences vary depending on the system and site characteristics, and on the types of plants grown. The study reveals large organic vs. conventional yield differences for cereals and vegetables (-26% and -33% respectively), and small ones for fruits and oil seeds (-23% and -11% respectively). The study also observes that organic and conventional yields are more equal when best organic management practices are used (-13%), and when organic legumes or perennials are grown on weak-acidic to weak-alkaline soils, in rain-fed conditions (-6%).

One final observation about the concept of ecological naturalness concerns its relationship to **naturalness$_3$**. It may seem intuitive to suppose that if some food production involves a great deal of chemical transformation – thereby making it **unnatural$_3$** – this will also make it unnatural in the ecological sense. Some remarks by Odum (1971) on how ecological science should inform our food production practices, however, suggest that processed foods may sometimes be natural in the ecological sense:

> Present agricultural strategy is based on selection for rapid growth and edibility in food plants, which, of course, make them vulnerable to attack by insects and disease. Consequently, the more we select for succulence and growth, the more effort we must invest in the chemical control of pests; this effort, in turn, increases the likelihood of our poisoning useful organisms, not to mention ourselves. Why not also practice the reverse strategy—that is, select plants that are essentially unpalatable, or that produce their own systemic insecticides while they are growing, and then convert the net production into edible products by microbial and chemical enrichment in food factories? We could then devote our biochemical genius to the enrichment process instead of fouling up our living space with chemical poisons! (Odum 1971, 269)

The first "frankenburger," made from lab-grown meat and consisting of stem cells that were placed in a medium to grow and reproduce and then bound together by Prof. Mark Post's team in Maastrich, was recently served at a press conference in London. Compared with conventionally raised livestock, large-scale production of cultured meat would reduce water, land and energy use, as well as emissions of greenhouse gases. In vitro meat production may also decrease contamination with bacteria like *Salmonella* and *E. coli*, by eliminating contact with animal feces.

Another possible point of divergence between the **natural$_3$** and the **natural$_4$** concerns the debate over the (un)naturalness of vegetarianism. Usually, this debate centers around the question of whether our species has evolved to be herbivorous or omnivorous. This is a question about the **naturalness$_3$** of vegetarianism, that is: about the evolved normal capabilities of our species' digestive organs. From an ecological standpoint, however, what past evolution has made us physiologically capable of should not dictate what should or must be done. What matters in this case is what our species must *now* do to live in harmony its supporting ecosystems. It has been clearly shown that the earth's ecosystems will not be able to support the growing human population if we all eat meat (McMichael et al. 2007). Thus, insofar as we are able to live healthy lives on vegetarian diets, doing so may well be what is ecologically natural (**natural$_4$**) for us to do. This is indeed why ecocentrists like Callicott (2002) have emphasize the ecological reasons for vegetarianism:

> Much of the plow land in midwestern United States is devoted to feed crops, such as corn and soybeans, most of which are eaten not by human beings, but fed to factory farmed cows, pigs and chickens. Animals burn about 90 percent of the food they eat and convert the rest (only 10 percent at best) to meat, so Americans would need only about 10 percent of the land now under cultivation to grow food if we consumed grains and legumes directly and altogether eliminated mass-produced meat from our diets. The elimination of industrial animal agriculture would, therefore, make millions of acres available for prairie restoration on a truly grand scale. (Callicott 2002, 319)

Summary

Four concepts of naturalness have been defined and discussed:

Natural$_1$: What happens according to the basic laws of physics. Natural as opposed to *supernatural* or *miraculous*.

Natural$_2$: What happens independently of human voluntary agency. Natural as opposed to *artificial* or *human-made*.

Natural$_3$: What happens according to the normal or ordinary course of the organic world. Natural as opposed to the *monstrous* or *biologically abnormal*.

Natural$_4$: What stands in harmony with the ecological world. Natural as opposed to *unecological* or *ecologically-harmful*.

Natural$_1$ includes anything physically possible as natural and so fails to draw a useful distinction between natural and unnatural foods. **Natural$_2$** seems at first sight to capture the intuitive natural/unnatural food distinction, but reveals problematic upon closer analysis for three main reasons: 1) It sets humans outside of nature when doing so is incompatible with Darwinian biology; 2) It is too restrictive when understood as an *all-or-nothing* affair, as almost all sorts of food involve human transformations; and 3) It faces a problem of threshold arbitrariness when understood as a *continuous gradient*. **Natural$_3$**, by drawing a distinction between biologically normal and abnormal processes, seems better-suited to account for the intuition that highly processed and genetically-engineered food is unnatural, and to justify, to some extent, the intuition that natural food is usually safer and healthier. **Natural$_4$** resonates with the common observation that some food production practices like organic farming are more natural in the sense that they are in better harmony with and less harmful to the ecological world.

This classification confirms the polysemous character of the term "natural," but at the same time reveals that this polysemy does not preclude the notion from being helpful in discussions of food ethics. Two concepts of naturalness, **natural$_3$** and **natural$_4$**, have been shown to have some relevance for issues central to this field, like animal welfare, human health and environmental ethics. Indeed, many particular questions about the value of natural food remain when looking at specific issues discussed in those fields.

References

Angermeier, Paul L. 2000. "The Natural Imperative for Biological Conservation." *Conservation Biology* 14 (2): 373–381.

Attfield, Robin. 2006. "Is the Concept of 'Nature' Dispensable?" *Ludus Vitalis: Revista De Filosofía De Las Ciencias De La Vida* 14 (25): 105–116.

Botkin, Daniel B. 1990. *Discordant Harmonies: A New Ecology for the Twenty-First Century*. New York: Oxford University Press.

C. Dussault, Antoine. In prep. "Ecological Nature: A Non-Dualistic Concept of Naturalness"

Callicott, J. Baird. 1989. *In Defense of the Land Ethic: Essays in Environmental Philosophy*. Albany, N.Y.: State University of New York Press.

———. 1991. "The Wilderness Idea Revisited: The Sustainable Development Alternative." *The Environmental Professional* 13: 236–242. Cited as reprinted in *The Great New Wilderness Debate,* edited by J. Baird Callicott and Michael P. Nelson, 337–366. Athens, London: University of Georgia Press.

———. 1999. *Beyond the Land Ethic: More Essays in Environmental Philosophy*. Albany, N.Y.: State University of New York Press.

———. 2002. "My Reply." In *Land, Value, Community*, edited by Wayne Ouderkirk and Jim Hill, 291–329. Albany, N.Y.: State University of New York Press.

———. 2003. "The Implications of the Shifting Paradigm in Ecology for Paradigm Shifts in the Philosophy of Conservation." In *Reconstructing Conservation: Finding Common Ground*, edited by Ben A. Minteer and Robert E. Manning, 239–261. Washington, D.C.: Island Press. Cited as reprinted in *The Wilderness Debate Rages on: Continuing the Great New Wilderness Debate*, edited by Michael P. Nelson and J. Baird Callicott, 571–600. Athens, Georgia: University of Georgia Press.

Canadian Food Inspection Agency. 2012. "Guide to Food Labelling and Advertising." URL = http://www.inspection.gc.ca/english/fssa/labeti/guide/ch4ae.shtml.

Daston, Lorraine. 2010. "Pourquoi La Nature A-t-elle Une Autorité Morale, Et Doit-elle En Avoir Une?" In *Darwin: 200 Ans*, edited by Alain Prochiantz. Paris: Odile Jacob.

Daston, Lorraine, and Katharine Park. 1998. *Wonders and the Order of Nature, 1150--1750*. New York: Zone.

Dougherty, T.C., and A.W. Hall. 1995. “Environmental Impact Assessment of Irrigation and Drainage Projects - 53 FAO Irrigation and Drainage Paper.” URL = http://www.fao.org/docrep/v8350e/v8350e00.htm#Contents.

Ereshefsky, Marc. 2007. “Where the Wild Things Are: Environmental Preservation and Human Nature.” *Biology & Philosophy* 22: 57–72.

Food & Water Watch. 2013. “Superweeds.” URL = http://documents.foodandwaterwatch.org/doc/Superweeds.pdf.

Food Standards Agency. 2008. “Criteria for the Use of the Terms Fresh, Pure, Natural Etc. in Food Labelling.” *Food Standards Agency - Homepage*. URL = http://www.food.gov.uk/multimedia/pdfs/markcritguidance.pdf.

Houchins, Jeannie. 2008. “Is There a Definition for Natural Food?” *IFT13 | IFT Annual Meeting & Food Expo*. URL = http://www.am-fe.ift.org/cms/?pid=1000744.

Hume, David. 1978. *A Treatise of Human Nature*. Edited by L.A. Selby-Bigge and P. H. Nidditch. 2nd ed. Oxford, New York: Oxford University Press.

Jones, Clive G., John H. Lawton, and Moshe Shachak. 1994. “Organisms as Ecosystem Engineers.” *Oikos* 69 (3): 373–386. doi:10.2307/3545850.

Leopold, Aldo. 1949. *A Sand County Almanac, and Sketches Here and There*. New York: Oxford University Press.

Mayr, Ernst. 1959. “Typological Versus Population Thinking.” In *Evolution and Anthropology: A Centennial Appraisal*, 409–12. Washington, D.C.: The Anthropological Society of Washington.

McMichael, Anthony J, John W Powles, Colin D Butler, and Ricardo Uauy. 2007. “Food, Livestock Production, Energy, Climate Change, and Health.” *The Lancet* 370 (9594): 1253–1263. doi:10.1016/S0140-6736(07)61256-2.

McWilliams, James E. 2009. *Just Food: Where Locavores Get It Wrong and How We Can Truly Eat Responsibly*. New York: Little, Brown and Company - Hachette Book Group.

Midgley, Mary. 2000. “Biotechnology and Monstrosity: Why We Should Pay Attention to the ‘Yuk Factor’.” *The Hastings Center Report* 30 (5): 7–15. doi:10.2307/3527881.

Mill, John Stuart. 1874. “Nature.” In *Nature, the Utility of Religion, and Theism*. London: Longmans, Green, Reader, and Dyer.

Odum, Eugene. 1971. *Fundamentals of Ecology*. 3rd ed. Philadelphia, London, Toronto: W.B. Saunders Company.

Oltenacu, P. A., and D. M. Broom. 2010. “The impact of genetic selection for increased milk yield on the welfare of dairy cows.” *Animal Welfare* 19 (S): 39–49.

Rozin, Paul. 2005. “The Meaning of ‘Natural’: Process More Important Than Content.” *Psychological Science: A Journal of the American Psychological Society* 16 (8): 652–658.

Scott-Thomas, Caroline. 2009. “US Consumers Think Natural Is Greener Than Organic, Says Survey.” *FoodNavigator-USA.com*. http://www.foodnavigator-usa.com/Suppliers2/US-consumers-think-natural-is-greener-than-organic-says-survey.

Seufert, Verena, Navin Ramankutty, and Jonathan A. Foley. 2012. “Comparing the Yields of Organic and Conventional Agriculture.” *Nature* 485 (7397) (April 25): 229–232. doi:10.1038/nature11069.

Shiva, Vandana. 2000. *Genetic Modification and Frankenstein Foods*. Lok Swaraj Series on Natural Resources and Peoples Rights. India: Navdanya New Delhi. URL = http://navdanya.org/attachments/Genetic_Engineering2.pdf.

Siipi, Helena. 2008. "Dimensions of Naturalness." *Ethics and the Environment* 13 (1): 71–103.

Sober, Elliott. 1980. "Evolution, Population Thinking, and Essentialism." *Philosophy of Science* 47 (3): 350–383.

Verhoog, H., E.T. Lammerts Van Buerren, M. Matze, and T. Baars. 2003. "The Role of the Concept of the Natural (naturalness) in Organic Farming." *Journal of Agricultural Ethics* 16 (1): 29–49.

Vogel, Steven. 2003. "The Nature of Artifacts." *Environmental Ethics* 25 (2): 149–168.

Williams, Raymond. 1985. *Keywords: A Vocabulary of Culture and Society*. Revised ed. New York: Oxford University Press.

World Health Organization, and Food and Agriculture Organization of the United Nations. 2013. "CODEX Alimentarius: List of Standards." URL = http://www.codexalimentarius.org/standards/list-of-standards/.