

# How to Label ‘Natural’ Foods: a Matter of Complexity

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**Abstract** Food is sometimes labeled as ‘100% natural’ or as containing ‘all natural ingredients’. There is however controversy on how to justify, design and implement such labelling. This paper argues that since (1) naturalness is not one single concept, but several ones (polysemy), and (2) those concepts typically allow degrees, so that things can be more or less natural, thus, (3) this complexity should be reflected in labelling of foods. There is no obvious way of presenting an aggregate measure of a particular food item’s naturalness, and therefore a graphical representation that contains several axes, with the degree of naturalness represented on each axis, is considered. Such a mode of representation might however be too complex to be practical, and a possible compromise would be to settle for a small number of labels that represent some common combinations of degrees of naturalness along the axes.

**Keywords** Naturalness · Labeling · Food · Ethics

## Introduction

At least since the days of John Stuart Mill, philosophers have been eager to dissect and even do away with the category of the natural. There are indeed some good reasons for doing so, for instance that ‘the natural’ all too often has been used for dubious ideological purposes (Soper 1995).

However, despite those efforts, appeals to nature and the natural continue to be prevalent in academic discourse and in public and political discussions concerning for instance medicine, reproductive technology and other topics related to biomedical ethics, as well as in marketing of commercial products, among them cosmetics, food and drinks (Nuffield Council on Bioethics 2015). And John Stuart Mill’s observation that ‘the word unnatural has not ceased to be one of the most vituperative epithets in the language’ (Mill 1988 [1874], p. 11) still holds true.

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This appears particularly relevant in discussions about food, not least genetically modified food (Chapman 2005; Mielby et al. 2013; Siipi 2015; Tenbült et al. 2005; van Haperen et al. 2012). Enter any supermarket, and you are likely to stumble upon breakfast cereals, pasta sauces, and a whole range of food products that boast ‘natural ingredients’, ‘100% natural’, and so on. It seems that food producers are not unwise to use such marketing measures – studies indicate that people do have a preference for ‘natural’ food (Rozin et al. 2004; Ronteltap et al. 2016), and similar considerations are relevant also for, e.g., textiles (Overvliet et al. 2016).

In this paper I discuss the idea of labelling food as natural. It is a contribution to the project suggested by Ronteltap et al., that ‘it would be worthwhile to formulate a code of conduct considering the use of the term naturalness’ (Ronteltap et al. 2016, p. 664). That there are several and unclear meanings of ‘natural’ poses problems for producers, retailers and consumers of food. For instance, the confusion might lead to unfair competition, and it might also mean that consumers’ ability to choose freely – and in extension, their autonomy – is compromised. The proposal here by no means amounts to producing a ‘code of conduct’ as referred to by Ronteltap et al. (2016), but it could, arguably, be part of such a code. I utilize the toolbox of analytic philosophy and draw upon existing work presenting various senses of the term natural. I note that the concept of naturalness displays both polysemy and vagueness. Naturalness is not one concept, but several ones, and it is often unclear whether some particular item falls under the concept. Furthermore, those concepts typically allow degrees – things can be *more* or *less* natural. I argue that this should be reflected in labelling of foods and tentatively propose some ways in which this could be carried out.

## Food Labelling: Types and Rationales

Food labelling comes in many different guises. Noting that ‘[l]abeling schemes work by altering the information environment for buyers’, Caswell and Anders (2011, p. 476) offer a categorization of labelling schemes into six types, based on (a) owner of labelling standard, (b) primary means of label certification and (c) labelling approach, i.e. whether voluntary or mandatory. The types of labelling are listed according to increasing degrees of third-party and government involvement. For instance, Type I labelling includes ‘product or process claims on labels by individual companies based on self-declared standards, with self-certification by buyer or seller’ (Caswell and Anders 2011, p. 477). Type IV represents voluntary labelling according to standards set by an independent third party, such as an NGO. Type VI is mandatory labelling to standards owned and certified by government. Caswell and Anders note that ‘[i]n practice there are no clear demarcations between private, third party, and government labelling. There are many hybrid schemes, and innovation in labeling program design is ongoing’ (Caswell and Anders 2011, p. 472).

There may be different rationales for labelling (Caswell and Anders 2011). *Government-owned* labelling schemes often aim at protecting consumers from harm or assuring that foods are not adulterated or sold under false pretenses. Such schemes may be dictated by local, national, or supranational regulatory bodies. One supranational example is the extensive EU legislation that for instance requires stating the presence of some allergens in foods, including that served in restaurants (European Union 2011). *Private parties* may of course also have reasons for labelling, for instance to signal quality. In recent years, there has been a tendency to move to labelling systems involving collective efforts and third-party certification (Caswell

and Anders 2011, p. 479). In addition, *non-governmental organizations* may use labelling schemes to promote particular political or other goals, for instance reduction of environmental impact, promotion of animal welfare, compliance with some particular religious or cultural prescription, or improvement of workers' conditions. Labelling might of course relate both to product characteristics and process ones. For instance, there might be no qualitative difference whatsoever between, say, two bananas (product), but if one has been produced according to some 'fair trade' certification scheme and one not, their production histories (process) might be very different.

There are several moral issues involved in labelling. Arguments in favor of labelling (of various kinds) are often framed in terms of consumer autonomy and 'the right to know', or in some cases, the right to stay ignorant in case one wishes to (Bonotti 2014; Loi 2014).<sup>1</sup>

It is clear that there is some demand from customers for food that is perceived as natural. At the same time, mandatory labelling of foods as natural or not does not seem to be forthcoming. Therefore we might expect that such labels will primarily be a matter of companies voluntarily labelling foods based on self-declared (individually or collectively) standards, possibly certified by a third party, that is, Types I-IV in the categorization of Caswell and Anders (2011).

This is not to say that governments will not be involved in, or have opinions about, such labelling. For instance, as Bonotti notes, there are potential cases in which 'government intervention would be justified in order to protect and attempt to reconcile the diverging interests of consumers' (Bonotti 2014, p. 303). Such intervention might be in the form of strict regulations, or it might be of the 'softer' kind, e.g. guidelines such as those presented by (UK) Food Standards Agency (2008). It is my belief that the proposals in the present paper could be useful when governments consider such intervention, or for third-parties in designing a voluntary labelling scheme for 'natural foods'.

## 'Natural' – Polysemous and Vague

In a recent commentary on labelling food, Allyson Weaver (2014) makes the seemingly simple point that 'natural' should mean 'natural'. Weaver writes in an American (US) context, where this has been a hot topic for a long time. Recently, the US Food and Drug Administration (FDA) solicited comments on the use of the term 'natural' in food labelling. The comment period was originally planned to end on February 10th, 2016, but it was extended to May 10th (Food and Drug Administration 2016). This is not the first time the FDA has asked for such comments from the public: it was done in the early 1990s as well; however, no definition was established at that time, according to the FDA because of 'resource limitations and other agency priorities' (cit. in Weaver 2014, p. 663). Weaver argues that the FDA and the US Department of Agriculture (USDA) should together adopt a definition of 'natural' in the context of food labelling, and that the definition should be 'narrow' and 'in accordance with the regular, everyday meaning of the word' (Weaver 2014, p. 672). In support she cites the Merriam-Webster Dictionary definition of 'natural' with the core meaning of not containing anything artificial (ibid.). She also cites a poll according to which 61% of the respondents

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<sup>1</sup> For a concise overview of pro and contra arguments regarding labelling, see Hemphill and Bannerjee (2015, pp. 438–439). They discuss mandatory labelling of GM foods in the US context, but the arguments they list have more general applicability.

believe that ‘natural’ implies absence of genetically modified foods. This she takes as reinforcing the dictionary definition.

It is indeed highly commendable to search for a definition for regulatory purposes that is in accordance with a term’s common usage, which is what Weaver tries to do in referring to descriptive dictionary definitions – in her words, that ‘natural’ should mean ‘natural’. However, there are also other factors to be taken into account, and when it comes to labelling or not labelling food as natural, there are considerations that complicate Weaver’s suggestion and make it less than convincing. Those considerations have to do with the fact that ‘natural’, and related terms, are both *vague* and *polysemous*.

Let us begin with vagueness. Everyday terms and concepts are typically not precise, but vague. Take the concept of ‘hot’. For example if I wash up cutlery when camping in the mountains, I use hot water from my camping stove. I do not specify exactly what is required for the water to be ‘hot’, and I might not be able to tell whether the water is still hot after it has cooled by, say, 8.5 degrees Celsius. For most everyday purposes there is no need for such precision. But philosophy, science, law, policy and many other contexts often require more precision. Suppose that I operate a commercial butchery within the European union: Then I cannot have the same casual attitude to hot water as I have when mountain hiking – I must make sure that I provide for cleaning my utensils in water that is at least 82 degrees Celsius, as required by regulations.<sup>2</sup> And a physicist will require an even more specific conceptual apparatus for ‘heat’ and temperature.

For such purposes, everyday concepts are made more precise by the provision of a stipulative definition. The usual term for this is ‘explication’. The term is Carnap’s, and it stands for ‘the transformation of an inexact, prescientific concept, the *explicandum*, into a new exact concept, the *explicatum*’ (Carnap 1950, p. 3). The explicatum is thus supposed to be an improvement, in the intended context, compared to the explicandum, while still being similar to the explicandum.

Making a concept more precise is to deal with imprecision, or vagueness, and nature and the natural are indeed vague concepts. For the sake of illustrating this, let us make the intuitively reasonable assumption that a wild plant foraged by a hunter-gatherer is natural and that something produced entirely or almost entirely by humans – say, in vitro meat – is artificial and not natural. Given this, for an arbitrary food item, it is very often unclear whether it falls under the concept of the natural. What about corn (maize) and other agricultural crops? And teosinte (the origin of maize)? Is rock salt a natural flavouring while monosodium glutamate is not? If honey is a natural sweetener, what are we to make of refined beet sugar, not to mention aspartame? This discussion has of course been particularly intense in association with genetically modified food (Moula 2015; Siipi 2015), but also concerning food additives (Weaver 2014 and references therein).

However, vagueness is only one aspect of the problem. We also have to consider that a term might have several distinct but typically related meanings (polysemy). All those meanings might be more or less vague. Such polysemy very much holds for ‘nature’ and ‘natural’. This has been discussed at length in the philosophical literature, and the food-related part of that literature bears witness to this. Several authors on food and naturalness who have provided analyses of the concept of naturalness identify this polysemy and come up with a number of different meanings (explications) of the term (Siipi 2013; van Haperen et al. 2012). We will return to this.

<sup>2</sup> REGULATION (EC) No 853/2004, 29 April 2004.

Traditionally, when discussing distinct meanings of ‘nature’ and ‘natural’, philosophers refer to John Stuart Mill’s essay *On Nature*, even though there is evidence that he owes the distinction to Hume.<sup>3</sup> Mill mentions two senses of the term:

In one sense, [nature] means all the powers existing in either the outer or the inner world and everything which takes place by means of those powers. In another sense, it means, not everything which happens, but only what takes place without the agency, or without the voluntary and intentional agency, of man. (Mill 1988 [1874], p. 8)

Keekok Lee, in her book *The Natural and the Artefactual*, lists seven senses of ‘nature’, including the two discussed by Mill (Lee 1999, Ch. 3).<sup>4</sup> She is mainly concerned with nature as ‘the foil to the artefactual, which itself is defined in terms of what is brought into material existence *deliberately* because of human intentions’ (Lee 1999, p. 83, emphasis added).

To cut a long story short, we can, following tradition, characterize the existing senses of ‘natural’ by referring to the different antonyms of the term. First there is Mill’s sense of the natural as the opposite of the *supernatural*. Anything happening in accordance with the laws of nature is natural, while divine intervention and miracles are not. Secondly, the natural might be the opposite of the *unfamiliar* – things that are natural are the ones that we are well acquainted with. Third, the natural might be the opposite of the *inappropriate*. This sense is of course explicitly normative, and corresponds well to the way in which ‘unnatural’ is used, that is, as an expression of distinct disapproval. (Let us remember that even purportedly civilized and democratic states have sent people to prison for being involved in sexual intercourse that is ‘contrary to nature’.)

This brings us back to Mill, and to the fourth sense of natural, namely the natural as that which is *somehow independent of humans*. This distinction is intuitive for many of us. Eric Katz even goes as far as claiming that it is ‘so clear that I am often perplexed by people who claim that there is no distinction’ (Katz 2003, p. 140). There are of course some familiar problems with this sense of ‘natural’ (Soper 1995; Takala 2004; Sheehan 2009). Human action has affected the environment to an extent that some scholars are arguing that we have entered the ‘anthropocene’ (Waters et al. 2016). Thus, it is questionable whether there is anything at all that is ‘natural’ in this sense, at least on our planet. Furthermore, the distinctions between man-made and natural things are becoming more blurred than ever before, in the age of synthetic biology and other technological novelties. This is the subject of a discussion about nature and its value that has been going on in environmental philosophy for quite some time, from Robert Elliot’s (1982) essay ‘Faking Nature’ to Eric Katz (1993, 2003) and Steven Vogel (2002, 2003, 2015).

I will put these concerns aside here, and accept the idea of nature as something unaffected by human actions as meaningful and important. However, complexity remains. Let us analyze it a bit further.

To begin with we have things which are *actually* independent of humans. Very few things, at least on Earth, are today independent of humans in an absolute sense. One example might perhaps be a subglacial lake in Antarctica (such as the Vostok Lake which until recently had not been interfered with by humans). However, things might be more or less dependent of, or interfered with, by humans. They are thus natural in a relative sense. Fish caught in the wild is more natural in this sense than farmed fish; cloudberries picked in the wild are more natural

<sup>3</sup> Wiggins (2000, p. 23n).

<sup>4</sup> For further useful references see Siipi (2013), p. 801–802.

than cultivated strawberries. And a trout that was conceived in a tank and then planted into a river to live its life ‘wild’ might be considered relatively more natural than the farmed salmon – perhaps.

We might also distinguish between things that are *macroscopically* natural and those that are *microscopically* natural. The latter are typically things whose chemical structure is independent of humans. For instance a toxin from a microbe found in a subglacial lake is an example of something that is actually natural in the microscopic and the absolute sense. If the toxin in question were to be purified and used in, say, a medicine, it would be natural in an actual, relative and microscopic sense.

But in the context of food and food labelling, we are not likely to deal primarily with things that are actually natural. Nobody thinks that the ‘100% natural’ breakfast cereals were made from seeds picked in pristine nature. However, and this seems to be important to some people especially when discussing genetically modified plants, they were made from seeds that *could* somehow come into existence without human agency. The idea of respecting species boundaries is related to this (Myskja 2006). There might be some serious doubts whether it is empirically true that plants similar to cultivated varieties could have come about without human intervention, but let us put that to the side for the moment. The point is that we have a sense of naturalness that is *counterfactual* rather than actual. Here too we can speak of macroscopic and microscopic naturalness, respectively. Table 1 below provides an overview of naturalness in the sense of ‘independence from humans’, and provides some examples. The table is not exhaustive – there are some senses of naturalness that are not covered, but I believe that it covers the most important ones that are relevant for natural foods. Furthermore, the categories are not independent of each other, and it is perfectly possible that some food items might fit in more than one category.

What we have explored here is of course only one of the many senses of naturalness. In her paper ‘Is natural food healthy?’ Helena Siipi (2013) introduces three more senses of natural that are relevant in food contexts. Those are naturalness as *nutritive suitability*, naturalness as *authenticity* and naturalness as *moderate needs satisfaction*. Nutritive suitability is what is referred to in expressions like ‘it is natural for ruminants to eat grass’, or ‘humans are natural omnivores’, albeit the latter claim is perhaps less uncontroversial. Authenticity is itself a complex notion, as is moderate needs satisfaction. However, I will not dwell on this here, but proceed to another point: As Siipi observes, some of the senses of natural she discusses are ‘relational’ – naturalness comes in degrees (Siipi 2013, p. 809). I agree with this but will take issue with another of her claims, namely that naturalness as independence from humans and as the opposite of artefactuality (ibid.) are ‘absolute’. As I argued above, those senses *might*, but need not, admit of degrees as well (see also Sandin 2013). We might perhaps add another one: naturalness as wildness; that which is unintended or unpredictable (Vogel 2015). Such wildness, however, does not imply that wild things are unaffected by human actions. Consider wild mushrooms. Humans certainly did not create those mushrooms, and we do not plant

**Table 1** Naturalness as independence from humans, with examples for illustration

	Actual independence		Counterfactual independence
	Absolute	Relative	
Macroscopic	Wild deepwater fish	Released trout	Strawberry
Microscopic	Toxin from Antarctic microbe	Purified Antarctic toxin	Vanillin

them. However, some mushrooms, such as *Agaricus campestris*, thrive in environments that have been very much affected by humans – in fact, *A. campestris* are known in English as field mushrooms or meadow mushrooms. If you are looking for them, a grazed meadow is your best bet. Likewise, if you are foraging for false morels (*Gyromitra esculenta*) in Scandinavia, you would be well advised to head for a clear-cut area.

Can this idea of wildness play a role in the highly goal-directed activity of producing food for humans? Possibly. Let me illustrate with an example: People walking on an unpaved surface rather quickly create a visible trail on the surface. When such trails appear in parks and other recreational areas they are often termed *desire paths*, in contrast to *planned paths*. Of course planned paths and desire paths might coincide, and sometimes desire paths are formalized, i.e. paved and possibly signposted. In fact it is becoming more common to utilize emerging desire paths in the planning process. Planners do not plan so many paths, but wait for some time to see where people tend to walk. Paths are then formalized retroactively. Something similar might perhaps be relevant for food as well. Consider a baker using wild yeast, which results in different batches of bread having different qualities, in a way that is not fully predictable. This variation might play a part in marketing the baker’s products (variation as opposed to standardization is appealing to some customers). Perhaps she also uses wood-fired ovens, again giving a less predictable result than electric ones, possibly resulting in some other benefits as well, say, better taste and a rustic appearance of the bread. Similar considerations apply to many other ‘artisanal’ products, for instance beer, cheese, or wine.

Summing up this discussion, we can conclude that naturalness, when we speak of natural foods, can be interpreted in several ways, and that those interpretations allow of different degrees of naturalness. We have a bundle of characteristics which all have claims to be ‘naturalness’, and those claims are not easily debunked.

### Labelling the Complex

My point is thus the following: Labelling of ‘natural’ food should reflect that there are several relevant senses of naturalness and they can come in degrees. Can this be achieved, and, if so, how?

If some foods are more natural than others, they can in principle be placed on a scale with, for instance, foods that are more natural to the left of foods that are less natural. That the scales allow ‘more or less’ rankings means that the scales should be conceived of as at least ordinal. Whether they are also interval scales allowing representation of degrees of difference between the points on the scale is an open question. For an illustration, see Fig. 1 below.

The diagram in Fig. 1 could be used as a starting point for developing naturalness labels. This labelling would not necessarily be judgmental (cf. Bonotti 2014) – that depends on the

<b>Dependence on Humans</b>	Low	←————→	High
<b>Familiarity</b>	High	←————→	Low
<b>Nutritive suitability</b>	High	←————→	Low
<b>‘Wildness’</b>	High	←————→	Low

**Fig. 1** Some naturalness characteristics. (The further left on the scale, the more natural)

specific characteristics of the chosen axes. Naturalness as nutritive suitability would be judgmental, naturalness as wildness would not.

Of course it would be possible to produce some sort of aggregate measure of naturalness, based on the degrees of naturalness along the respective axes. Perhaps some axes are more important than others and should be given greater weight. There are of course problems with defining and measuring naturalness along the axes, but those problems need not be unsurmountable. Whatever the purpose of a food label – low fat, high fibre, organic, etc. – the criteria have to be somehow operationalized, and naturalness is no exception. Perhaps the aggregate measure could be represented as a percentage (e.g. ‘60% natural’), or in the form of a small number of different labels for different degrees of naturalness (e.g. three stars for the most natural foods, two for moderately natural). What most strongly speaks in favour of an aggregate measure is its simplicity. Nevertheless, this option is unsatisfactory. The main reason is that there is no obvious way of aggregating the different degrees of naturalness. What about something that scores high on naturalness in one sense, but low in another? For example a novel, unfamiliar food that has eminent nutritive suitability? Or something very familiar that turns out to be less than ideally suitable from a nutrition perspective, perhaps even toxic?

Therefore, I would suggest designing a naturalness label on the basis of Fig. 1, with a number of naturalness axes allowing of degrees. The labelling is pluralist, in the sense that it allows different interpretations of naturalness. It is consistent with everyday usage of the term ‘natural’, thus as far as possible fulfilling Weaver’s (2014) request that ‘natural’ should mean natural, while at the same time providing more precision, i.e. explicating naturalness. An example is the label sketched in Fig. 2. The two axes represent ‘dependence on humans’ and ‘wildness’. Just as in Fig. 1, the further left on the scale, the more natural. ‘Not affected by humans’ is represented by the tree and its opposite (artificiality) by the lab bottle. ‘Wildness’ is represented by the mountains and its opposite (e.g. cultivation, predictability) by the cultivated cereal.

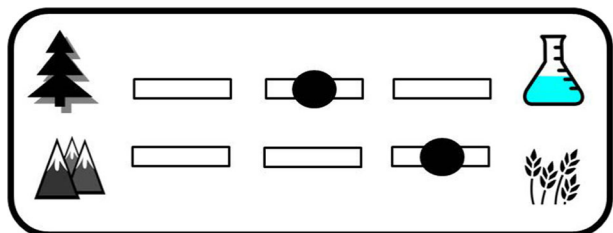
It must be emphasized that the sketch here is merely intended to illustrate the conceptual approach proposed. It is by no means a final suggestion for an actual label design.

## Conclusion and Suggestions for Further Research

There is not one everyday meaning of ‘natural’, but several. Those are not mutually exclusive. Something can be natural in one or more senses of the term. Furthermore those senses admit of degrees, so that things can be more or less natural.

Thus, stipulatively defining ‘natural’ in a sense that concurs with ‘The’ everyday notion of naturalness is futile. Instead we should aim for a system that takes different senses of naturalness as well as different degrees of naturalness into account. Of course this conflicts

**Fig. 2** Example of a label displaying naturalness along two axes





with a core idea of labelling food in the first place, namely that the labelling system should be easy to grasp. There is no easy solution to this conflict. On the one hand, intellectual honesty requires nuances. On the other hand, providing a label that looks like a complex diagram rather than as a visually strong, immediately recognizable badge of honor is pointless. So a possible compromise would be to settle for a small number of labels, perhaps three or four, that represent some common combinations of degrees of naturalness along the axes. My tentative suggestion is that such a small number of different labels might do the job.

I believe that in order to develop a labelling scheme according to the ideas presented here, some research would need to be undertaken. (I am assuming a voluntary labelling scheme here, with or without third-party certification.) Given the large volume of philosophical writings on naturalness, I think we can assume that most of the conceptual work is done. At least since Mill, we have a reasonably fair grasp of the different senses of naturalness, and in the food area, work like Siipi's (2013) provides a platform.<sup>5</sup>

From there, the first step would therefore be to conduct empirical investigations of people's conception of relevant foods as more or less natural. There is a considerable body of literature on this topic already that would be the obvious starting point (Abrams et al. 2010; Rozin et al. 2004; Ronteltap et al. 2016, among others). One approach would be through exposing subjects to exercises in pairwise comparison and sorting of food items along the naturalness axes. It is of course possible that this will yield some inconsistent results. For instance it is not necessary that empirical rankings of foods in this way will be transitive: Food A might be perceived as more natural than food B, food B as more natural than food C, while A nevertheless is not perceived as more natural than C. This might appear paradoxical and problematic. However, the pluralism of the present proposal can handle some such apparent inconsistencies by recognizing that the different axes of naturalness may be independent of each other (cf. Siipi 2013).

The second step would be to operationalize the 'axes' of naturalness. For instance, one could develop some sort of scoring sheet for naturalness. It is important to note that this scoring system would to a large extent be conventional. It would reflect what those endorsing the labelling scheme have agreed upon constitutes the naturalness axes, which in turn (as discussed above) should reflect the common views of naturalness, being consistent with everyday usages of the term 'natural'. Such a system could be analogous to some existing schemes. Take a label like KRAV, a Swedish third-party organic label with stricter requirements than for instance the EU Organic label. KRAV produces elaborate standards that users of the label need to comply with (KRAV Association 2015). Such standards are operationalizations of 'organic', and are of course subject to revision as ideas about organic changes, for instance in the light of new knowledge. If we look to existing work on perceptions of naturalness in food, it is reasonable to infer that at least factors such as degree of processing, authenticity – closely related to for instance 'heritage' labelling categories such as Traditional Specialties Guaranteed (TSG) and Protected Designation of Origin (PDO)<sup>6</sup> – and presence of additives would be considered relevant. Such a labelling scheme could resemble the ones of KRAV and similar organizations, but presumably be significantly simpler and less comprehensive.

A lot of work remains to be done before a structured approach to 'naturalness' labelling can be implemented, and there are considerable challenges involved. In this paper, I have tried to

<sup>5</sup> See also, e.g. Chapman (2005); Mielby et al. (2013); Sandin (2013); and Siipi (2015).

<sup>6</sup> The cited terms and abbreviations refer to schemes in the European Union. More information is available from European Commission (2016).

show that such labelling would need to reflect the facts that naturalness is not one concept, but several ones, and that those concepts allow degrees. I believe that some of the considerations in the present paper provide ways of approaching some of these challenges in constructive ways.

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## References

- Abrams, K.M., C.A. Mayers, and T.A. Irani. 2010. Naturally confused: consumers' perceptions of all-natural and organic pork products. *Agriculture and Human Values* 27: 365–374.
- Bonotti, M. 2014. Food labels, autonomy, and the right (not) to know. *Kennedy Institute of Ethics Journal* 24: 301–321.
- Carnap, R. 1950. *Logical foundations of probability*. London: Routledge and Kegan Paul.
- Caswell, J.H., and S.M. Anders. 2011. Private versus third party versus government labeling. In *The Oxford handbook of the economics of food consumption and policy*, ed. J.L. Lusk, J. Roosen, and J.F. Shogren, 472–498. Oxford: Oxford University Press.
- Chapman, A. 2005. Genetic engineering: the unnatural argument. *Techné: Research in Philosophy and Technology* 9(2). <https://scholar.lib.vt.edu/ejournals/SPT/v9n2/chapman.html> Accessed 22 Sept 2016.
- Elliot, Robert. 1982. Faking nature. *Inquiry* 25(1):81–93.
- European Commission. 2016. Geographical indications and traditional specialities. [http://ec.europa.eu/agriculture/quality/schemes/index\\_en.htm](http://ec.europa.eu/agriculture/quality/schemes/index_en.htm). Accessed 22 Sept 2016.
- European Union. 2011. Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers. <http://eur-lex.europa.eu/eli/reg/2011/1169/oj>. Accessed 22 Sept 2016.
- Food and Drug Administration. 2016. “Natural” on food labeling. <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm456090.htm>. Accessed 22 Sept 2016.
- Food Standards Agency. 2008. Criteria for the use of the terms fresh, pure, natural etc. in food labelling. Revised July 2008. <http://www.food.gov.uk/sites/default/files/multimedia/pdfs/markcritguidance.pdf>. Accessed 23 Aug 2016.
- Hemphill, T.A., and S. Bannerjee. 2015. Genetically modified organisms and the U.S. retail food labeling controversy: consumer perceptions, regulation, and public policy. *Business and Society Review* 120: 435–464.
- Katz, E. 1993. Artefacts and functions: a note on the value of nature. *Environmental Values* 2: 223–232.
- Katz, E. 2003. Understanding moral limits in the duality of artifacts and nature: a reply to my critics. *Ethics and the Environment* 7(1): 138–146.
- KRAV Association. 2015. Standards for KRAV-certified Production 2015 Version. <http://www.krav.se/sites/default/files/krav-standards2015webb.pdf>. Accessed 15 Sept 2016.
- Lee, K. 1999. *The natural and the artefactual: The implications of deep science and deep technology for environmental philosophy*. Lanham, MD: Lexington Books.
- Loi, M. 2014. Food labels, genetic information, and the right not to know. *Kennedy Institute of Ethics Journal* 24: 323–344.
- Mielby, H., P. Sandøe, and J. Lassen. 2013. Multiple aspects of unnaturalness: are cisgenic crops perceived as being more natural and more acceptable than transgenic crops? *Agriculture and Human Values* 30: 471–480.
- Mill, J. S. 1988 (1874). *Three essays on religion: Nature, the utility of religion, theism*. Amherst, NY: Prometheus Books.
- Moula, P. 2015. GM crops, the hubris argument and the nature of agriculture. *Journal of Agricultural and Environmental Ethics* 28: 161–177.
- Myskja, B.K. 2006. The moral difference between intragenic and transgenic modification of plants. *Journal of Agricultural and Environmental Ethics* 19: 225–238.

- Nuffield Council on Bioethics. 2015. Ideas about naturalness in public and political debates about science, technology and medicine. Analysis Paper, November 2015. <http://nuffieldbioethics.org/wp-content/uploads/Naturalness-analysis-paper.pdf>. Accessed 5 Aug 2016.
- Overvliet, K.E., E. Karana, and S. Soto-Faraco. 2016. Perception of naturalness in textiles. *Materials and Design* 90: 1192–1199.
- Ronteltap, A., M.J. Reinders, S.M. van Dijk, S. Heijting, I.A. van der Lans, and L.A.P. Lotz. 2016. How technology features influence public response to new agrifood technologies. *Journal of Agricultural and Environmental Ethics* 29: 643–672.
- Rozin, P., M. Spranca, Z. Krieger, R. Neuhaus, D. Surillo, A. Swerdlin, and K. Wood. 2004. Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite* 43: 147–154.
- Sandin, P. 2013. Naturalness, artifacts, and value. In *Norms in technology*, ed. M.J. de Vries, S.O. Hansson, and A.W.M. Meijers, 207–221. Dordrecht: Springer.
- Sheehan, M. 2009. Making sense of the immorality of unnaturalness. *Cambridge Quarterly of Healthcare Ethics* 18: 177–188.
- Siipi, H. 2013. Is natural food healthy? *Journal of Agricultural and Environmental Ethics* 26: 797–812.
- Siipi, H. 2015. Is genetically modified food unnatural? *Journal of Agricultural and Environmental Ethics* 28: 807–816.
- Soper, K. 1995. *What is nature?* Oxford: Blackwell.
- Takala, T. 2004. The (im)morality of (un)naturalness. *Cambridge Quarterly of Healthcare Ethics* 13: 15–19.
- Tenbült, P., N.K. de Vries, E. Dreezens, and C. Martijn. 2005. Perceived naturalness and acceptance of genetically modified food. *Appetite* 45: 47–50.
- van Haperen, P.F., B. Gremmen, and J. Jacobs. 2012. Reconstruction of the ethical debate on naturalness in discussions about plant-biotechnology. *Journal of Agricultural and Environmental Ethics* 25: 797–812.
- Vogel, S. 2002. Environmental philosophy after the end of nature. *Environmental Ethics* 24: 23–29.
- Vogel, S. 2003. The nature of artifacts. *Environmental Ethics* 25: 149–168.
- Vogel, S. 2015. *Thinking like a mall: Environmental philosophy after the end of nature*. Cambridge: MIT Press.
- Waters, C.N., J. Zalasiewicz, C. Summerhayes, A.D. Barnosky, C. Poirier, A. Galuszka, A. Cearreta, M. Edgeworth, E.C. Ellis, M. Ellis, C. Jeandel, R. Leinfelder, J.R. McNeill, D. deB. Richter, W. Steffen, J. Syvitski, D. Vidas, M. Waprich, M. Williams, A. Zhisheng, J. Grinevald, E. Odada, N. Oreskes, and A.P. Wolfe. 2016. The Anthropocene is functionally and stratigraphically distinct from the Holocene. *Science* 351(6269). doi:10.1126/science.aad2622.
- Weaver, A. 2014. ‘Natural’ foods: inherently confusing. *Journal of Corporation Law* 39: 657–764.
- Wiggins, D. 2000. Nature, respect for nature, and the human scale of values. *Proceedings of the Aristotelian Society* 100: 1–32.