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DIMENSIONS OF NATURALNESS

HELENA SIIPI

This paper presents a way of classifying different forms of naturalness and unnaturalness. Three main forms of (un)naturalness are found as the following: history-based (un)naturalness, property-based (un)naturalness and relation-based (un)naturalness. Numerous subforms (and some subforms of the subforms) of each are presented. The subforms differ with respect to the entities that are found (un)natural, with respect to their all-inclusiveness, and whether (un)naturalness is seen as all-or-nothing affair, or a continuous gradient. This kind of conceptual analysis is needed, first, because discussion concerning (un)naturalness is common in current bioethics and environmental ethics, and second, because the terms natural and unnatural are highly ambiguous. Thus, the lack of an exact definition of the type of (un)naturalness may lead into equivocation, other forms of bad argumentation, or at least vagueness.

Discussion concerning naturalness and unnaturalness has been ongoing in both public and academic spheres of bioethics and environmental ethics. Within the context of new biotechnologies, it has at least concerned genetic modification and genetic engineering in general (Reiss & Straughan 1996, 59–64; Midgley 2000, 9–10), genetically modified crops (Nuffield Council on Bioethics 1999, 13–15; Karafyllis 2003, 8–10), genetically modified food (Sagoff 2001; Madsen et al. 2002, 269), transgenic organisms (Cooley & Goreham 2004), and human cloning

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(Warnock 2003). In the context of biological conservation naturalness and unnaturalness discussions are often raised about conservation goals (Angermeier 1994; Hunter 1997; Kendle & Rose 2000; Angermeier 2000) and values dependent on naturalness of biotic entities (Elliot 1982; Katz 1997a; 1997b; 1997c). Claims about naturalness and unnaturalness have also been presented in numerous other fields of bioethics including organic farming (Verhoog et al. 2003), health care (Wachbroit 2003), human sexual activities (Levy 1980; Priest 1997, 362–63; Baltzly 2003), and animal welfare (Callicott 1995, 245; Fraser et al. 1997, 187, 190–92).

Generally, the (un)naturalness discussion has concerned two questions. First, it has been argued whether naturalness is morally relevant or in some other sense provides an important criterion for decision making. For example, does naturalness provide the ultimate goal for biological conservation (Angermeier 2000, 377; Haila 1997)? Do unnatural methods of gene transformation violate the dignity of human beings produced by them (The President's Council on Bioethics 2002; Häyry 1994, 211)? Are natural species extinctions more acceptable than unnatural (i.e. human caused) ones (Lee 2004, 167)? Are natural ecological disasters and disturbances more tolerable than unnatural ones (Abramovitz 2001; Callicott 1996, 371)?

There has also been discussion over whether something is natural or, when naturalness is understood as a continuous gradient, whether something is more natural than something else. For example, are restored ecosystems artifacts (Elliot 1982; Katz 1997a, 1997b, 1997c)? Are genetically modified organisms (GMOs) more unnatural than products of traditional breeding and cultivation methods (Reiss & Straughan 1996, 61; Streiffer 2003, 37–38)? Are domestic plants and animals artifacts (Simon 1984, 5; Callicott 1995, 245)?

The two issues are often intimately linked. The question about an entity's status as natural or unnatural is often motivated by the implications of such status. For example, a discussion concerning artifactuality of DNA-sequences is closely connected to the view that only artifacts may be patented (Pietarinen & Launis 1999, 146; Sagoff 2002, 12; Lee 2003a, 160–61). Similarly questions about naturalness of restored ecosystems are relevant to value discussions concerning them (see for example Elliot 1982; Katz 1997a, 1997b, 1997c).

The number of the presented bioethical contexts indicates that the terms 'natural' and 'unnatural' are used in bioethics in widely varying ways.¹ Naturalness as a goal of biological conservation may have little to do with naturalness of food, naturalness in animal welfare, or naturalness of genetic modification. Moreover, there is no reason to suppose that the moral relevance of one form of (un)naturalness would imply the moral relevance of some other form of (un)naturalness. The same is true about other ways in which naturalness may be relevant to decision making. For example, even though artifactuality may be required for patenting, there is no reason to suppose that in order for an entity to be patentable, it has to be unnatural in all senses of the term. Thus, in order to avoid conceptual confusions and their undesirable consequences, analysis of the different meanings and forms of the terms natural and unnatural is needed. One such analysis is presented here. This analysis is mostly based on classifying between different types of entities that are found to be natural or unnatural and different types of reasons for finding those entities natural or unnatural.

ENTITIES OF NATURALNESS

Forms of (un)naturalness differ with respect to the entities that are considered (un)natural. It is common that arguments from naturalness concern *objects* or *beings* (Higgs 1991, 102; Karafyllis 2003, 9). Domestic animals (Lee 2003a, 1), transgenic organisms (Donnelley et al. 1994, 8), GM-food (Sagoff 2001; Madsen et al. 2002, and restored ecosystems (Elliot 1982; Katz 1997a, 1 1997b, 1997c) are examples of objects and beings that have been claimed not to be natural in some sense of the term.

Sometimes, not a whole object or being but only some of its *traits* are regarded as (un)natural. For example, Mill (1969, 393–95) discusses naturalness of such traits of human character as courageousness, selfishness, sympathy, self-control, and will for cleanliness. The discussion can be applied to animals and animal species too. It is sometimes claimed, for example, that a tendency to guard is a natural trait for dogs, and that a fear of human beings is a natural trait for members of many species of wild animals. However, the discussion does not need to be restricted to psychological traits. Having a transplanted heart, for example, might be considered an unnatural trait for human beings. Yet, having this trait does

not imply that the person having it is unnatural. An unnatural trait does not necessarily imply unnaturalness of the whole entity having it.

The discussions and debates about naturalness also concern *events* (Higgs 1991, 102; Karafyllis 2003, 9). Janet Radcliffe Richards (1984, 76–77), for example, analyzes the discussion about naturalness of menopause,² and Bill McKibben (1989, 58–60) argues for unnaturalness of current climate change. Even “natural disasters” have been divided into natural and unnatural ones (Abramovitz 2001, 6–8). Following Lawrence B. Lombard (1999, 292–93), I understand the word ‘event’ to mean anything that happens. Some events are composed of other events (for example, a thunderstorm may consist of several heavy showers of rain and flashes of lightning), but not all groups of events comprise another event (for example, a certain explosion in Venus and my birth do not compose an event).

Actions are a subclass of events. All actions are events, but there are events (such as a flash of lightning) that are not actions. (Davidson 1980, 43; McCann 1998, 110.) Often an author’s several actions are intimately linked together to serve a common intention. These collections of actions are called activities. For example, writing a book is an activity that consists of several actions of the author (typing, reading, and deleting, etc.). (White 1970, 1). I understand activities to be a subclass of events. To put it more strictly, they are a subclass of those events that are composed of several other events. Not all events in our body (or mind) are actions or activities. Behaviors differ from actions in their lack of intentionality³ (Davidson 1980, 44–45; 4; McCann 1998, 7, 110). For example, intentional voting by raising a hand is an action, whereas a kick reflex caused by tapping a knee with a rubber hammer is merely a behavior.

Actions, activities and behaviors are often analyzed with respect to their (un)naturalness. Donald Levy (1980) and Eric Matthews (1988) discuss unnaturalness of certain sexual activities. Other actions or activities that have been evaluated with respect to their naturalness are, for example, breastfeeding of babies (Radcliffe Richards 1984, 75–76), organic/biotic farming (Varner 1998, 137–38; Verhoog et al. 2003), bio-engineering (Midgley 2000, 7), human cloning (Warnock 2003, 454–57), xenotransplantation (Midgley 2000, 7), and certain infertility treatments (Häyry & Häyry 1989, 183–188).

Besides objects, beings, traits, and events, *states of affairs* can also be

regarded as (un)natural. For example, it is sometimes held that certain states of ecosystems are (un)natural (Anderson 1991; Hunter 1996, 695).⁴ Mill (1969, 393) discusses the natural state of mankind and Janet Radcliffe Richards (1984, 67–68) analyzes the discussion about/on (un)naturalness of certain social arrangements.⁵

In the context of bioethics and environmental ethics the most interesting entities of unnaturalness are objects and beings, actions and activities, and events that are not actions. Traits and states of affairs are left on lesser notice. In this paper I will also concentrate on these more frequently discussed and more central entities and analyze them from the viewpoint of reasons for finding them natural or unnatural.

REASONS OF NATURALNESS

There are three different *reasons* for finding entities natural or unnatural. *History based* forms of (un)naturalness and meanings of (un)naturalness terms refer to the history and origin of an entity (Varner 1998, 125; Vogel 2003, 160). Especially how an entity came into being and what kind of modifications it has gone through are relevant to this form of (un)naturalness. Perfectly restored ecosystems are an example of a purely history based form of unnaturalness. Restored ecosystems have been strongly modified and influenced by human beings and they are, thus, by their history highly unnatural. Yet restored ecosystems ideally have the very same (non-historical) properties as original ecosystems evolved by evolution (Angermeier & Karr 1994, 695; Elliot 1994, 136; Higgs 1997, 340). Another example of purely history based unnaturalness is animal clones.⁶ Their origin involves strong human involvement and interference. Yet, ideally their properties and features do not differ from those animals that have come into being without those modifications.

Property-based forms of (un)naturalness and meanings of (un)naturalness terms concentrate on current (non-historical) properties and features of entities (Varner 1998, 125; Vogel 2003, 160). Entities are found natural or unnatural because of their current properties or features, not because of happenings in their history. Certain sexual activities, for example, have been thought to be unnatural in this sense (Levy 1980; Matthews 1988). The question of naturalness is then associated only with properties of the sexual activity, not on its history or origin. Similarly, it

has been argued that organic farming is, with respect to its properties, more natural than other forms of agriculture, for in organic farming "man interferes less radically in natural processes and living entities" (Verhoog et al. 2003, 36). Property-based (un)naturalness is not limited to human actions. For example, when naturalness is interpreted as normality, events, objects, and beings can also be natural with respect to their properties. This is the case for example when a normally functioning heart is seen as a natural one, or when it is stated that, despite their very similar histories, restored ecosystems are much more natural than gardens or commercial fields—restored ecosystems after all share the same properties as the naturally evolved ones.

(Un)naturalness can also be interpreted as a relation between entities. This is the case, when naturalness is interpreted as familiarity (Radcliffe Richards 1984, 65–66; Rääkkä & Rossi 2002, 33; Madsen et al. 2002.). People tend to consider those entities to which they are accustomed and which occur relatively frequently to be natural. On the other hand 'unnatural' often means 'uncustomary' or 'odd.' (Mill 1969, 400; Rääkkä & Rossi 2002, 33.) However, familiarity of some entity x is not a property of x , but rather a relation between x and the person who is more or less familiar with x . A further example of *relation-based (un)naturalness* is naturalness as a moderate satisfaction of needs (Matthews 1988, 121; Häyry & Häyry 1989, 186; Karjalainen & Häyry 1992, 11). According to this line of thought, it is natural to act in a way that tends to satisfy our needs moderately. Intentional superabundant or inadequate need satisfaction is, on the other hand, unnatural. (Brennan 1988, 89–90; Matthews 1988, 121.) Need satisfaction is a relation between an entity (typically an action) and an agent's need. For example, eating hay may meet the nutritional needs of a horse, however hay does not sufficiently satisfy human (nutritional) needs, and thus it can be seen as unnatural for human beings.⁷

It is common that entities are unnatural in more than one of the described senses. For example, a genetically modified cow that produces medicine in its milk may be unnatural in all three senses. The cow has an exceptional history and origin—it has been produced and greatly modified by modern biotechnologies. Moreover, it has a property that is rather unnatural (at least in the sense of being exceptional) for cows—it produces medicine in its milk. Moreover, it seems that many people find these

kinds of cows unnatural due to their unfamiliarity. Thus, the cow is unnatural also in a relation-based sense. Similarly, an exotic species may contribute to unnaturalness in all three senses. They are historically unnatural in being transported to their new locations by human transport (Rolston 2001, 271). Moreover, they make the ecosystem in which they grow less natural in the property-based sense. Thirdly, they are unnatural in the relation-based sense in that they are out of place in their new locations (Rolston 2001, 270). As a matter of fact, being exotic seems to consist of (un)naturalness of the three different senses. An organism being unnatural in one of the described senses is not sufficient for it to be considered an exotic.

The entities and reasons of (un)naturalness form the basis of analyzing and classifying the different forms of unnaturalness and different meanings of the (un)naturalness terms. However, two further factors that need to at least sometimes be taken into consideration can be found.

TWO FURTHER CATEGORIES OF (UN)NATURALNESS

The forms and meanings of (un)naturalness differ with respect to whether (un)naturalness is considered a continuous gradient or an all-or-nothing affair (Varner 1998, 125–26; Attfield 1999, 15–16).⁸ The concepts of natural as the opposite of being an artifact (see for example Katz 1997a, 1997b, 1997c), and natural as that which is according to God's will (Häyry & Häyry 1989, 186) are examples of the latter interpretation. Entities are either artifacts or not, and similarly they are either against God's will or not. McKibben (1989) also views the "naturalness of nature" as an all-or-nothing affair—he argues that since human influence is present in all ecosystems on Earth, nature has ended.

Contrary to McKibben's view, (un)naturalness in the sphere of biological conservation is often interpreted as a continuous gradient referring to *degree* of human interference. According to this line of thought, even if no area is (any longer) natural in the sense of being totally independent of human beings, some places are more natural than others. Total naturalness is an abstract state at the end of a continuum and some ecosystems are closer to that ideal than others. (Anderson 1991, 348; Peterken 1996, 15; Varner 1998, 126; Attfield 1999, 15–16; Angermeier 2000, 375; Hunter 2000, 573; Rolston 2001, 272.) Similarly, even if no human involvement with nature can produce totally natural ecosystems,

products of some involvements (for example of different forms of agriculture) can be more natural, closer to the ideal naturalness than the products of others. (Lund & Röcklinsberg 2001, 393; Verhoog et al. 2003.) Further examples of naturalness as a continuous gradient include naturalness as a moderate need satisfaction (Matthews 1988, 121; Häyry & Häyry 1989, 186; Karjalainen & Häyry 1992, 11) and naturalness as normality (Wachbroit 1994, 580–81; Räikkä 1996, 354–55).

Forms of (un)naturalness may also differ in their *all-inclusiveness*. Some meanings of (un)naturalness can be applied to all entities. For example, all entities can be evaluated with respect to being natural in the sense of being familiar. Moreover, all entities are more or less natural in the sense of being normal. However, some meanings of (un)naturalness are not applicable to all entities. For example, when naturalness is contrasted with being an artifact, some entities do not fit to either of the two categories. For example, pollution and side products (such as sawdust) are neither natural nor artifacts.⁹ Similarly, evaluations of naturalness as moderate need satisfaction are limited in their sphere. Activities without need-satisfying (or denying) purposes—such as painting a house and paying bills—seem to fall outside the sphere of this kind of (un)naturalness.¹⁰

For the rest of the paper, I will further analyze the forms of (un)naturalness and meanings of (un)naturalness terms. The analysis mostly rests on the dimension of reasons of (un)naturalness. All three reason-based categories—history-based, property-based, and relation-based—of (un)naturalness are discussed. It is found out that all three forms of (un)naturalness have further subforms that are partly based on distinctions of entities of (un)naturalness, all-inclusiveness of forms of (un)naturalness and on whether (un)naturalness is seen as a continuous gradient or an all-or-nothing affair. Moreover, some subforms have further subforms.

HISTORY BASED (UN)NATURALNESS

History Based (Un)naturalness as All-or-nothing Affair

In the context of history based (un)naturalness, naturalness is understood as independence from human activities or at least some types of human activities. Unnaturalness, on the other hand, is associated with human involvement. However, human involvement and independence from human beings can mean several different things and, thus, history

based (un)naturalness has at least five subforms. Three of them can be applied to objects, beings, and events that are not actions. Two are applicable to human actions and activities. Some of the subforms have further subforms.

First, history based (un)naturalness can be interpreted as total independence from human beings.

HA1: Naturalness as total independence from human beings: An entity X is natural = df. Entity X exists and has its properties independently of human beings.

According to this line of thought, naturalness of an entity indicates that it is, by its origin and history, totally independent of human beings. Natural entities are then considered in opposition to everything that is human-produced or in any way modified by human beings. (For this type of interpretation see for example McKibben 1989, 55, 58–59; Soper 1995, 15; Kendle & Rose 2000, 20; Delaney 2003, 34.) According to this view, every entity that exists and has its properties without the agency of human beings is natural. On the other hand, every entity that is produced or modified by human beings is unnatural. (Mill 1969, 375, 380; Elliot 1982, 84; Hunter 1996, 695; Lee 1999, 82.)

Not many beings and objects are natural in the sense of HA1. All human products—for example products of traditional farming, products of organic farming, GMOs, chimeras and clones—are similarly unnatural in this sense. The only entities that can, even in principle, be natural in the sense of HA1 are entities in human-independent nature. However, it has been argued that, because of invasiveness of human actions, biotic objects, beings, and events that are natural in the sense of HA1 do not exist on Earth anymore. Because of the human-caused pollution and changes in planetary atmosphere, every place on Earth is in practice human modified. (McKibben 1989; Christensen et al. 1996, 679; Katz 1997a, 103–4; Vitousek et al. 1997, 494; Vogel 2003, 150.) Thus, in practice, it is not useful to adopt naturalness in the sense of HA1 as an ideal in biological conservation or in any other practical context concerning objects, beings, and events on Earth. On Earth naturalness in the sense of HA1 is and will be unattainable.

History based (un)naturalness as all-or-nothing affair can also be interpreted in another sense. (Un)naturalness is then understood to indi-

cate certain types of human activities in the history of an entity. According to this line of thought, only certain types of human activities but not all human activities in the history of an entity cause it to be unnatural. (See for example Brennan 1988, 88–89; Hilpinen 1992, 60; Hilpinen 1993, 156; Katz 1997c, 122; Lee 1999, 83.) In short, certain types of human activities turn an entity unnatural; entities with other types of histories are natural.

HA2: Naturalness as independence from certain types of human activities: An entity X is natural = df. Entity X exists and has its properties independently of certain types of human activities.

Interpretation HA2 does not offer a tool for separating natural entities from unnatural ones. It needs to be further supplemented by indicating which types of human activities in the history of an entity contribute to its unnaturalness. Different interpretations can be given, one of the most important concerns the conditions of being an artifact.¹¹ Not all human activities in the history of a being turn it into an artifact. That an area is unintentionally polluted by human activities is not usually understood to imply artifactuality of that area. Nevertheless, artifactuality clearly depends on some type of human activities. No human-independent entity would count as a (human) artifact. In bioethics, conditions of artifactuality have been discussed at least with respect to domestic plants and animals (Simon 1984, 5; Callicott 1995, 245), DNA-sequences (Pietarinen & Launis 1999, 146; Sagoff 2002, 12; Lee 2003a, 160–161), restored ecosystems (Elliot 1982; Katz 1997a, 1997b, 1997c; Lo 1999), and GMOs (Siipi 2005, 100–105).

History Based (Un)naturalness as Continuous Gradient

History based (un)naturalness can also be interpreted as a continuous gradient (see for example Anderson 1991, 348; Christensen et al 1996, 679; Elliot 1997, 82, 131; Varner 1998, 126; Lo 1999, 253–54). (Un)naturalness then varies in degree between extremes of entirely natural and entirely unnatural. The more human dependent in terms of its origin and/or history an entity is, the more unnatural it is.¹² The more independent of human beings an entity is, the more natural it is. (Anderson 1991, 348; Elliot 1997, 82; Lee 1999, 52–53; Angermeier 2000, 375.)

HC1: (Un)naturalness as a continuous gradient: An entity X is more natural than an entity Y = df. Entity X exists and has its properties more independently of human beings than entity Y.

This view is useful in biological conservation and other context where distinctions between different types of ecosystems need to be made. It is compatible with the view that human involvements can differ with respect to their invasiveness (Peterken 1996, 15; Hunter 2000, 573; Lee 2003a, 153–155; Lee 2003b, 2). In other words, not all human interference in an entity's history causes the entity to be unnatural to the same extent. It has been argued, for example, that because of differences in human involvements in entities' histories, GMOs and products of traditional breeding methods differ with respect to the degree of their (un)naturalness (Reiss & Straughan 1996, 61; Nuffield Council on Bioethics 1999, 14; Lee 2003a, 148, 153–55).

However, this interpretation needs further clarification. The expressions 'more dependent on human beings' and 'more independent of human beings' are ambiguous and it is not clear how GMOs, ecosystems, species extinctions, or other entities could be compared in this respect. One method could be to measure the entity's independence from human beings by determining the amount of time and effort and the types of actions human beings have used for influencing it. The more time and effort and the more interfering types of actions are used for modification, the less natural the entity will be.

HC2: (Un)naturalness as a degree of human activities: An entity X is more unnatural than an entity Y = df. Human beings have spent more time, effort, and/or more interfering types of actions for modifying entity X than for modifying entity Y.

It has been suggested in the context of ecosystem preservation, for example, that the use of technology is a highly interfering type of human action and its use is a threat to naturalness of an ecosystem (see for example Katz 1997b, 111–12; Katz 1997c, 122; Lee 1999, 10, 107, 112; Angermeier 2000, 374–75). Similarly it has been stated that since GMO production involves crossing species barrier, GMO production is more interfering than traditional types of breeding and cultivation, and GMOs

are thus more unnatural than traditional domestic plants and animals (Donnelley et al.1994, 4; Reiss & Straughan 1996, 61; Lee 2003a, 148).

However, HC2 needs to be further clarified by analyses on which human actions are more interfering and which are less interfering and which imply the use of more or less effort. Moreover, HC2 is sometimes insufficient in distinguishing between different degrees of historical (un)naturalness. This is due to the fact that same type of human activity, for example species introduction, may—depending on factors such as time, the species to be introduced, and the type of ecosystem—cause very different changes.¹³ Moreover, very different kinds of human activities can bring about similar change processes. For example, extinction of a species can be brought about in many different ways, some of which acquire much effort and some of which are almost effortless. Thus, other interpretations of HC1 are also needed.

The second possibility is to interpret the expression 'more independent of human beings' as referring to the degree of change processes caused to the entities by human activities. According to this line of thought, the more change processes human beings have brought about in the entity and the greater the changes caused by those processes are, the less natural it is.

HC3: (Un)naturalness as a degree of human-caused change processes:
An entity X is more unnatural than entity Y = df. There has been more and/or greater human-caused change processes in the history of entity X than in the history of entity Y.

Interpretation HC3 differs considerably from interpretation HC2. In HC3 the focus of interest is purely on human-caused change processes that have happened in the history of the entity. The interest is not in the amount or type of human action itself, but rather in its consequences—i.e. in the change processes brought about by that action. For example, two plant species that have gone through similar change processes are according to HC3 similarly unnatural, even when it is the case that bringing about the change processes has in one's case required more human effort and interference than in the other's case. It should further be noted that when (un)naturalness of entity is understood in the way presented in HC3, the interest is not in how much the properties of an entity resemble the properties of a totally human-independent entity of the same type.¹⁴ For example, a species driven into extinction and then recreated by

advanced DNA technologies is highly unnatural in this sense, even though its properties are similar to the ones before extinction.¹⁵

The third possible interpretation of the expressions 'more dependent on human beings' and 'more independent of human beings' refers to the amount and type of human-caused properties of an entity. The more an entity has properties and features that are brought about by human beings, the more unnatural the entity is.

HC4: (Un)naturalness as a degree of human-caused properties: An entity X is more unnatural than an entity Y = df. Entity X has more human-caused properties than entity Y.

Whether the properties of an entity are similar or dissimilar to the properties of a totally human-independent entity of the same type is not important to this kind of (un)naturalness.¹⁶ What matters is how the entity acquired its properties. Every property that an entity has as a result of human activities alters the entity to render it more unnatural. Every property that an entity possesses which is caused by factors other than human activities in its history is conducive to the naturalness of that entity. Robert Elliot seems to have something like this in mind when he states that

'natural' means something like 'unmodified by human activity'. Obviously some areas will be more natural than others, according to the degree they have been shaped by human activity. Indeed most rural landscapes will, on this view, count as non-natural to a very high degree. And instances of even modest environmental restoration will be to some extent non-natural. (Elliot 1997, 82.)

Interpretations HC3 and HC4 are intimately connected. When several human-caused change processes have happened in the history of an entity, many properties of that entity are necessarily brought about by human beings. Actually the degree of change process means the amount of changes that process has brought about in the entity. Yet, the two interpretations still offer a different point of view to the history based (un)naturalness of beings, objects, and events.

History-based (un)naturalness of human actions

Human actions and activities can also differ with respect to their history-based (un)naturalness. As all human actions and activities are

human-caused, the distinction between historically natural and unnatural actions cannot simply be based on their dependence on human beings. Rather, the history-based (un)naturalness of human actions and activities is intimately related to the action's sources in human beings. Some human actions and activities are based on our genes and biology, whereas other forms of our action are culturally originating. According to this line of thought, culturally based human activities are unnatural, whereas biologically and genetically based actions are natural. (Rolston 1979, 10; Matthews 1988, 122; Elliot 1994, 143; Oelschlaeger 1999, 223; Angermeier 2000, 374; Fukuyama 2002, 130; Verhoog et al. 2003, 41.) In other words, human activities that exceed our genetically evolved capacities (and are thus dependent on culture) are unnatural (Brennan 1988, 88–91; Katz 1997a, 104; Angermeier 2000, 374).

However, this distinction between historically unnatural and unnatural human actions is problematic, since it conflicts with the basic principle of genetics. The phenotype and actions of any organism—including human organisms—are the result of interaction between genes and environment. By definition, no action or activity is the product only of genes. Nor is there a form of action that is totally culturally based. Our actions and activities, even when shaped and modified by culture, always have biological roots and limits (Rolston 1979, 10; Wachbroit 2003, 57.) As Mary Midgley (1978, 286) puts it, “culture is not an alternative or replacement for instinct, but its outgrowth and supplement.” This is not to say that no differences between human beings and animals exist. Nevertheless, if the history-based (un)naturalness of human actions is interpreted as a distinction between biology and culture, this type of (un)naturalness must be understood as a continuous gradient, not as an all-or-nothing affair. The two extremes of the continuum—purely culturally based and purely biologically based actions—are mere abstractions.¹⁷ The more an action arises from instincts, or genetic or biological factors, the more natural it is. The more an action is motivated by cultural factors, the more unnatural it is.

HC5: Unnaturalness as the cultural dependency of actions: An action X is more unnatural than an action Y = df. Action X is more culturally based and more culturally motivated than action Y.

Natural actions are then, following Fukuyama (2002, 130), interpreted as something that people are, because of their genetic inheritance,

inclined to do or tend to do in all cultures. In this sense, forming cultures is natural for human beings. We are by our genes and situation in organic world bound to form cultures. (Evernden 1993, 123.) Thus, if naturalness is understood as being genetically based, it is natural for us to act unnaturally (i.e. to form cultures that are foreign to human independent nature).

History-based (un)naturalness of human actions can also be interpreted in a way related to intentionality. Our actions are always intentional. Yet, human beings may *behave* in unintentional ways. It has been presented that a distinction between historically natural and historically unnatural human behavior is to be drawn on this basis. According to this line of thought, all actions are at least partly guided by rational thought and thus foreign to nonhuman nature and in this sense unnatural. Unintentional behavior, on the other hand, depends quite purely on our animate side and can thus be seen as historically natural. (Mill 1969, 375; Radcliffe Richards 1984, 69–70.)

Moreover, even though all actions are in some sense intentional, they differ with respect to the attention and consideration given to them. Thus, distinguishing actions on the basis of their intentionality and rationality needs not to imply that all actions are similarly (un)natural. Rather, the distinction may be based on how spontaneous or considered an action is. The more spontaneous the action, the more natural it is. The deeper and longer the consideration preceding the action, the more unnatural it is. (Mill 1969, 381; Rolston 1979, 11; Oelschlaeger 1999, 223.)

HC6: Naturalness as spontaneity: An action X is more natural than an action Y = df. Action X is performed more spontaneously and with less consideration than action Y.

However, the naturalness of actions can be understood also in a totally opposite way. According to this line of thought, rationality defines human nature and it is natural for a being to act in accordance with its nature. Thus, considered actions are more natural to human beings, and spontaneous ways of action are seen as less natural for us.

PROPERTY-BASED (UN)NATURALNESS

Necessity of Ideal Comparative Models

The property-based forms of (un)naturalness and meanings of (un)naturalness terms concentrate on the current (non-historical) proper-

ties and features of entities (Varner 1998, 125; Vogel 2003, 160). For example, a genetically modified sheep that produces human proteins in its milk is unnatural with respect to its (non-historical) properties because it has a property (the production of human protein) that is usually foreign to sheep. Similarly, freaks of nature like green dogs are unnatural with respect to their (non-historical) properties regardless of the way in which they have acquired them. Not just beings and objects but also events and actions can be (un)natural with respect to their (non-historical) properties. Many people think, for example, that organic farming is more natural than traditional farming (Lund & Röcklinsberg 2001, 393; Verhoog et al. 2003) or that ways of landscaping can differ in the (un)naturalness of their properties (Rolston 1979, 12–13).

Property-based (un)naturalness is always a question of comparison. In order to find out whether some entity is more or less natural with respect to its properties, its current properties and features need to be compared with properties and features of some ideally natural entity. The more the current physical and mental (if the entity has any) properties and features of the entity resemble the ones of the ideal entity, the more natural the evaluated being is considered to be. (Hobbs & Norton 1996, 101; Dupre 1998, 2; Cooley & Goreham 2004, 50.) Property-based unnaturalness is always relative to some set of entities. An entity cannot be unnatural with respect to its properties without being unnatural as a certain type of entity—for example an unnatural sheep, dog, or farming procedure. (Dupre 1998, 2; Cooley & Goreham 2004, 50.) The crucial question then is: which beings or objects should be used as *ideal comparative models*? I will analyze three suggested answers to this question.

Historically Natural Entities as Comparative Models

According to the first answer, those entities which are (to the greatest possible extent) independent of human activities should be used as ideal comparative models. In other words, historically (highly) natural (either in sense of HA1 or HC1) entities function as ideal comparative models.¹⁸ According to this line of thought, those entities that have properties and features similar to the ones belonging to historically natural entities are natural with respect to their properties.

P1: Naturalness as similarity to historically natural entities: An entity X is more natural than an entity Y = df. The properties of entity X are

more similar to the properties of historically natural entities than the properties of entity Y are.

Thus, in order to find out the degree of the property-based (un)naturalness of an entity, its properties are compared with the properties of historically natural entities. Some defenders of the naturalness (and moral acceptability) of homosexuality, for example, have used this tactic. They note that it is not uncommon that wild animals perform homosexual activities, and conclude from this that there is nothing unnatural in human beings performing homosexual activities. On the same basis, the use of advanced technology has been labeled unnatural (Katz 1997b, 110–12). Since actions involving advanced technology are not similar to the historically natural ones, they are unnatural with respect to their properties. Similarly, the more similar a human-built ecosystem is to a natural ecosystem, the more natural it is. In this sense, restored ecosystems differ dramatically from other human-built ecosystems like gardens and commercial fields.

The property based (un)naturalness of human actions (and other events) can be understood analogously with the property based (un)naturalness of beings and objects. Then, the more the properties of an action resemble the properties of a historically natural action in sense of HC5, the more natural it is with respect to its properties.

P2: Naturalness of actions as similarity to genetically and biologically based actions: An action X is more natural than an action Y = df. The properties of X are more similar to biologically and/or genetically based actions than the properties of Y.

According to P2, an action or activity, regardless of its origin, is highly natural with respect to its properties as long as overtly similar ways of action are caused biologically or genetically. (For similar views see Elliot 1994, 143; Hunter 1997, 303.) According to this line of thought, that human beings drive other species into extinction, for example, may be a natural way of action, since in nature (non-human) species do drive other species into extinction (Callicott 1988, 138; Sober 1988, 181; Callicott 1996, 371). Moreover, whether human predation of a fish population is natural or unnatural with respect to its properties depends on how similar or dissimilar human predation is to historically natural predation (Hunter 1997, 303).

Many philosophers have connected the property based unnaturalness of human actions and activities to technology use (Rolston 1979, 12; Katz 1997a, 110–11; Katz 1997c, 122; Kendle & Rose 2000, 21; Lee 2003a, 56). According to Paul Angermeier (2000, 374), for example, “[h]uman activity becomes unnatural when it involves technology.” According to this line of thought, an action is natural with respect to its properties as long as it does not involve the use of technology (Katz 1997c, 122–23; Angermeier 2000, 374).

P3: Naturalness as the absence of technology: An action X is natural =
df. Action X does not involve the use of technology.

When understood this way, the property-based naturalness of an action implies abandoning new technologies and using old methods, which human beings have used for centuries. (Karjalainen & Häyry 1992, 7–8; Katz 1997c, 122–23.) Natural farming then means farming without chemical fertilizers, pesticides, or machines based on new technology (Verhoog et al. 2003, 36). Similarly, natural childbirth means giving birth without technical surveillance, medical painkillers, or surgical operations (Rolston 1979, 12).

Normality as a Comparative Model

Besides historically natural entities, also other types of entities can be used as comparative models. One possibility is that ideally natural objects or beings are the ones that are normal.

P4: Naturalness as normality: An entity X is natural = df. Entity X is normal.

It is common that property-based (un)naturalness is seen related to (ab)normality.¹⁹ According to this line of thought, normal entities form an ideal comparative model on the basis of which the property-based (un)naturalness of entities can be evaluated. A being or object that is seen as normal by its properties is also considered natural with respect to its properties. (Radcliffe Richards 1984, 70; Sagoff 1985, 113; Sober 1988, 180; Fraser et al. 1997, 192; Priest 1997, 363; Dupre 1998, 3; Baltzly 2003, 5; Cooley & Goreham 2004, 48, 50.)

However, the concept of (ab)normality is ambiguous (Gräsbeck 1995, 66; Rääkkä 1996, 354) and it can be understood in several differ-

ent ways. Yet, at least two forms of (ab)normality are related to (un)naturalness. First, (ab)normality can be understood as a statistical concept. Normality is then related to being usual or common. Normal entities are average with respect to their properties. If the property in question can be mathematically measured, normal entities fall close to a mean or median. (Levy 1980, 195; Sober 1988, 180; Wachbroit 1994, 580; Gräsbeck 1995, 67; Priest 1997, 363; Levinson 2003, 31; Wachbroit 2003, 52; Cooley & Goreham 2004, 51.) Statistical (ab)normality is intimately related to property-based (un)naturalness, since people have a tendency to regard beings and objects with rare and unusual properties as unnatural (Midgley 2000, 8; Räikkä & Rossi 2002, 33).

Second, (un)naturalness sometimes refers to functional normality (Levy 1980, 196; Wachbroit 1994, 580; Priest 1997, 363; Dupre 1998, 4; Levinson 2003, 31; Wachbroit 2003, 53), which may be described as follows. "If we know the biological function of an entity, then we are already able to characterize its biologically normal state since any description of its 'function' refers to its actions in its biologically normal state" (Wachbroit 1994, 581). Function is here understood as a biological role of a part of a living being. In other words, the function of *x* refers to the way in which *x* contributes to a complex activity or capacity of an organism. (Wouters 2003, 635.) Functional normality of a being or its part means that it does not have malfunctions; in other words, it works properly as it should. A functionally abnormal being, on the other hand, fails to fulfill its purpose. For example, a functionally normal heart circulates blood in the body, whereas a functionally abnormal heart fails to do this or does it too efficiently. (Wachbroit 1994, 580–82; Dupre 1998, 4.) Functional abnormality is not limited to parts of individuals. Analogously to them, species (and even individuals) have been seen to have functions in evolutionarily evolved self-supporting ecosystems. According to this line of thought, a species (or even an individual) that fails to fulfill its purpose in an ecosystem is functionally abnormal and in that sense unnatural.

Human Nature as Comparative Model

Third, evaluations of the property-based (un)naturalness of human actions and activities may be based on comparisons using the ideal norm that rests on (an account of) human nature or purpose of human activities.

P5: Naturalness as accordance with human nature: An entity X is natural = df. Entity X is in accord with human nature and/or purpose.

At least three different interpretations of P5 can be provided. They all share a common idea that human nature and purpose are seen as an ideal comparative model that determines the naturalness of our actions. Nevertheless the three interpretations differ in what is seen as central to human nature and purpose. In other words the three interpretations differ in their views about human nature and purpose.

First, human nature and purpose can be understood in terms of a harmony with nature. Our actions and activities can be disruptive to nature in various ways, and it is often thought that the (un)naturalness of our actions depends on the degree of the disturbance they cause (Rolston 1979, 12). Natural human actions and activities cause merely minor changes or such changes that nature can absorb. Natural alterations do not deteriorate the ecosystem and they are the most congenial to the natural environment. (Rolston 1979, 20; Elliot 1997, 120–21). So, naturalness of human actions and activities depends on how radically they interfere with or destroy nature. Life styles and activities “compatible with planetary ecosystem health” are more natural than lifestyles and activities that are incompatible with it. (Rolston 1979, 15). Natural human actions are those that fit better with nature. For example, some farming practices fit in with the characteristics of a particular soil and climate while others do not. “Bluegrass does well in Kentucky and in the Midwest, but the Southern farmer is foolish to plant it; and who would plant cotton in New England?” (Rolston 1979, 12).

In the second interpretation of P5, property-based naturalness (and being in accordance with human nature) is understood to mean that an action contributes to the biological adaptiveness or evolutionary survival of its performer (Baltzly 2003, 3; Levinson 2003, 31; Williams 2003, 117). According to this line of thought, biologically motivated activities often have some well-defined goals or functions. A biologically motivated action is natural if it contributes to that function; and it is unnatural if it is used for something else. (Priest 1997, 363.) In the context of sexual activities, the function or goal is often associated with the type of behavior that can lead to reproduction, conception, or procreation (Levy 1980, 198; Priest 1997, 364; Soble 2003, 57; Williams 2003, 117). An example can be found in the orthodox Catholic Church consideration of mastur-

bation and sex with contraception as perverted and thus unnatural (Priest 1997, 364). According to Peter Morris (1997, 270), bestiality is seen as highly unnatural on similar grounds.

Third, P5 can be interpreted as a command to act according to God's will. According to this line of thought, God created human beings for some purpose and it is natural for us to act according to that purpose. Overstepping the natural God-set boundaries should not be done. (Radcliffe Richards 1984, 72.) In other words, even though human beings may interfere with events in nature, there are natural limits beyond which human beings cannot proceed without unacceptably playing God (Matthews 1988, 123; Häyry 1994, 206; Nuffield Council on Bioethics 1999, 14–15; Madsen et al. 2002, 270).

RELATION-BASED (UN)NATURALNESS

(Un)naturalness and the 'yuck' factor

Relation-based (un)naturalness has at least four different forms. First, it is not uncommon that people are disgusted and feel repugnance towards some products or procedures of new biotechnologies. For example, pictures of a mouse with a human ear growing on its back have raised strong feelings of disgust and aversion. These feelings are often spelled out by stating that the entity in question is unnatural. Thus, claims about unnaturalness can often be interpreted as emotional reactions against the violation of some moral limit or as arguments of repugnance (Räikkä & Rossi 2002, 34; Baillie 2003, 46; Thompson 2003, 27). Claims about unnaturalness are then considered instances of the so-called 'yuck' factor (Streiffer 2003, 38), which means an experience of disgust and outrage raised by some entity (Midgley 2000, 9). Thus, the first form of relation-based (un)naturalness in its simplest form can be spelled out as the following.

R1: Unnaturalness as a 'yuck' factor: An entity X is unnatural = df.
I/we find entity X disgusting and/or repugnant.

Unnaturalness as a 'yuck' factor is a relation-based form of (un)naturalness. Whether an entity raises feelings of disgust and repugnance is not a property of the entity, but a relation between the entity and the agent being disgusted. This form of (un)naturalness is a continuous gradient—people can find entities more or less disturbing. Moreover,

unnaturalness as a 'yuck' factor can be related to all kinds of entities—to objects and beings, their traits, events (including actions, activities and ways of behavior), and states of affairs. Interestingly, it can also concern entities that are natural by their histories. Spontaneous nature sometimes produces monstrosities like two-headed calves. Even though they are natural with respect to their history, they may be considered unnatural in the sense of 'yuck' factor. Whether naturalness as 'yuck' factor can also concern entities that are natural with respect to their properties is less clear.

(Un)naturalness as (Un)familiarity

Sometimes the term 'natural' can be interpreted as 'familiar' or 'customary'. People tend to consider those entities to which they are accustomed to be natural, with which they are familiar, and which occur relatively frequently. On the other hand, 'unnatural' often means 'uncustomary,' 'odd,' and that the entity is not what we are accustomed to. (Mill 1969, 400; Rääkkä & Rossi 2002, 33.) (Un)naturalness as (un)familiarity is applicable to all types of entities, and it can be seen as a continuous gradient. People can be more or less familiar with objects and beings, traits, all kinds of events, and states of affairs.²⁰ In all cases (un)naturalness as (un)familiarity is a relation between a human being, or a group of human beings, and an entity that is seen as more or less (un)natural in the sense of being more or less (un)familiar. To put it more strictly, the second form of relation-based (un)naturalness can be conceptualized as follows.

R2: (Un)naturalness as (un)familiarity: An entity X is (un)natural = df.
Entity X is (un)familiar and/or (un)customary for me/us/people relevant to the case.

The argument that women should stay at home—or at least attend to the housework—because women are by nature domesticated, is often based on this form of (un)naturalness. People were (and some still are) accustomed to women staying at home and taking care of the housework, and thus women working outside home and men doing housework seemed rather unnatural to many people.²¹ (Radcliffe Richards 1984, 65-66; Häyry & Häyry 1989, 184.) (Un)naturalness as (un)familiarity has currently been associated with bioethical issues such as gene technology in general (Rääkkä & Rossi 2002, 33), genetic engineering (Häyry 1994, 209), and genetically modified plants (Madsen et al. 2002, 268, 271).

(Un)naturalness, Telos, and Needs

According to Dirk Baltzly, in Aristotelian thought it is believed that “human beings have a *telos* which is both natural and morally significant” (Baltzly 2003, 5). *Telos* means that toward which every being strives. It is the primary goal and the proper end of a being’s development. The striving toward *telos* does not need to be conscious; according to Aristotle, even mindless plants have a *telos* towards which their development is directed. (Aristotle, *Physics* II.9, 199a 9–12, 15–19; Priest 1997, 365; Aquinas 1999, 119). The *telos* of human beings is *eudaimonia*, which is usually interpreted as happiness. The closer to its *telos* a being has developed, the more perfect and flourishing it is. (Aristotle, *Nicomachean Ethics* I.7, 1097b 1–7; Baltzly 2003, 5).

Janet Radcliffe Richards suggests that the Aristotelian way of thought can form a basis of evaluating (un)naturalness of entities. According to her, (un)naturalness is related to *telos* because entities that move a being closer to its *telos* are natural to it. In other words, what is natural to something is that which is conducive to its well being and encourages it to flourish (Radcliffe Richards 1984, 73).²² Thus, clean water is natural to oaks as well as human beings. Pollutants are unnatural to both, since they harm development and prevent flourishing. Similarly, actions and activities that take human beings closer to their *telos* and *eudaimonia* are natural to them.

R3: Naturalness as accordance with Aristotelian *telos*: An entity X is natural for being A = df. X moves A closer to A’s *telos*.

However, it is often extremely difficult, if not impossible, to use R3 as basis for evaluating naturalness of different actions and activities. We cannot usually say whether different applications of human genetics—for example a particular gene transfer—serve development toward the human *telos*. Neither can we say whether they are working against the striving for *telos*. The reason for this is, first, our lack of knowledge concerning the exact nature of *telos* (Lund & Röcklinsberg 2001, 412) and *eudaimonia*, and second, that we are unaware of the effects that different applications of human genetics may have for reaching the *telos*. The same seems to be true about genetic manipulation of animals and plants as well as most other forms of new biotechnologies.

Naturalness of actions and activities in modern thought is often, fol-

lowing these Aristotelian lines, connected to the satisfaction of needs. According to this line of thought, it is natural to act in a way that tends to satisfy our needs moderately. Intentional superabundant or inadequate need satisfaction is, on the other hand, unnatural.²³ (Brennan 1988, 89–90; Matthews 1988, 121; Häyry & Häyry 1989, 186; Karjalainen & Häyry 1992, 11.) Eating and drinking, for example, are natural forms of behavior as long as they stay within reasonable and moderate limits. A person who deliberately starves himself however, is acting unnaturally. Analogously, continuous excessive eating and drinking is, according to this line of thought, unnatural.

However, not all human actions and activities are directly associated with satisfaction of human needs. Watching a movie, painting a house, and driving a car may indirectly contribute to satisfying some human needs, but in themselves they do not satisfy our needs either moderately or immoderately.²⁴ Should these actions thus be considered unnatural? There are two possible solutions. First, naturalness as moderate need satisfaction may be understood as a form of naturalness that is not all-inclusive. According to this line of thought, moderate need satisfaction is natural, intentional superabundant or inadequate need satisfaction is unnatural, and many human actions and activities are excluded from the sphere of (un)naturalness. For example, activities like watching a movie, painting a house, and driving a car are neither natural nor unnatural. Naturalness and unnaturalness are then interpreted in the following way.

R4: Naturalness as moderate need satisfaction:

An action X of agent A is natural for A = df. Action X moderately satisfies some need(s) of A.

An action X of agent A is unnatural for A = df. Action X works against moderate satisfaction of A's need(s)

The second possibility is the following. Ways of acting that hamper human flourishing and which work powerfully against self-development, or importantly limit life possibilities, are unnatural. All other actions and activities are understood as natural (Baltzly 2003, 14, 18; Levinson 2003, 31, 32). Thus both actions that contribute to moderate need satisfaction and actions that are indifferent to it are considered natural. The first interpretation of R4 is then modified accordingly.

R4: Naturalness as moderate satisfaction of needs:

An action X of agent A is natural for A = df. Action X does not work against moderate satisfaction of A's need(s).

An action X of agent A is unnatural for A = df. Action X works against moderate satisfaction of A's need(s)

CONCLUSION

I have in this paper distinguished several different meanings of the terms 'natural' and 'unnatural.' The general conclusions to be drawn from my considerations and arguments are that there are several forms of (un)naturalness and the terms 'natural' and 'unnatural' are used in numerous different senses in bioethical argumentation. The central bioethical entities—such as GMOs and different types of ecosystems—may be natural in one sense and unnatural in another. Thus, in order to present good (un)naturalness arguments in the bioethical field, the intended meaning of (un)naturalness always needs to be elucidated. Otherwise there is a risk of equivocation, other forms of bad argumentation, or at least vagueness.

I hope that the distinctions, arguments, and conclusions of this paper contribute to clarifying the notion of (un)naturalness in bioethical discussion. These may be helpful in answering naturalness and unnaturalness claims presented by opponents of different applications of biosciences. Yet, the analysis may also serve to highlight the importance of some (un)naturalness claims by forcing them to the front of the debate. Moreover, it is clear that discussion concerning naturalness and unnaturalness in general is quite meaningless; we should rather discuss different forms of (un)naturalness. This is the case also in discussions concerning moral relevance of (un)naturalness.

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NOTES

1. Thus, the presented questions cannot be diminished simply by stating that since supernatural is not possible, everything is equally natural. Even though 'natural' can be contrasted with 'supernatural,' the term 'natural' has also numerous other contrasts.

2. Radcliffe Richards criticizes the Essex Road Health Group, which argues from the naturalness of menopause to the view that it should not be treated.
3. Intentionality implies purposefulness and deliberateness. However, the exact meaning of the term 'intentional' is an issue of philosophical debate (McCann 1998, 7).
4. When is an ecosystem (un)natural and when is it in an (un)natural state? I understand the distinction between these two to be the following. When disturbed, an ecosystem may turn into an unnatural state without losing its identity as the kind of ecosystem it was before the disturbances. An unnatural ecosystem, on the other hand, is unnatural because of its identity as a certain kind of an ecosystem, not because of its state.
5. According to Radcliffe Richards (1984, 67–68), "the two sides in feminist disputes about the natural seem to agree that there is indeed a natural state for women to be in, and that the natural state, whatever it is, is good. Both sides think that the real thing is better than the travesty that (from the feminist point of view) men have made for women, or (from the traditional point of view) feminists are now trying to produce. Since then, the area of disagreement is about what *is* natural—perhaps we should begin to trying to decide what it means to say that something is in its natural state."
6. Perfect restoration and perfect clones cannot usually be carried out by current technologies. However, for the sake of clarity of argument I suppose they could be accomplished.
7. As indicated by the two presented forms of relation-based (un)naturalness—relation-based (un)naturalness is often dependent on an agent, time, and even place. What is natural to one may be unnatural to another. Furthermore, something may be natural to somebody at one moment, but unnatural to him or her at another moment of time.
8. Gary Varner (1998, 125–26) and Robin Attfield (1999, 15–16) make this distinction, but claim that, at least in the context of ecosystems (un)naturalness is always a continuous gradient.
9. For the distinction between artifacts and side-effects of artifact production (such as sawdust) see Siipi, H. (2003, 2005).
10. It might be argued that all intentional human activity is motivated to some kind of need satisfaction and that activity without this motivation does not exist. However, even when this view is accepted, some of our actions are only very remotely and indirectly need-satisfying, and it is not clear whether these activities can be evaluated with respect to naturalness as moderate need satisfaction.
11. I will not discuss the definition of artifacts here. For further discussion on the issue see Siipi, H. (2003, 2005).
12. The term 'origin of an entity' refers to the way the entity has become into existence. The term 'history' refers to everything that has happened to the

- entity during its existence. Thus, it is possible for an entity to be natural by its origin, but yet highly unnatural with respect to its history.
13. Sometimes, albeit rarely, the only effect of species introduction is the existence of an extra plant or animal in the ecosystem (Perlman & Adelson 1997, 23). Yet, sometimes an introduced species drives some local population into extinction by competition, predation, and transmission of diseases, and thereby causes dramatic changes in the composition, structure, and functions of the ecosystem (Samson & Knopf 1993, 510–11; Angermeier 1994, 601; Koricheva & Siipi 2004, 33). The rabbits in Australia, and grey squirrels and giant hogweed in UK are examples of introduced species that have caused major changes in ecosystems (Nuffield Council on Bioethics 1999, 98). An opposite case is the (unintentional) introduction of La China (*Impatiens wallerana*) in Costa Rican rain forests. La China grows among widespread, weedy, second growth plants and it seems that the only change its introduction has brought about is the existence of the extra plant in the rainforest. (Perlman & Adelson 1997, 23).
 14. It is conceivable that an entity that is highly unnatural in the sense of HC3 has the very same physical properties than the most maximally human-independent entity. Such would be the case, for example, when human beings have first greatly changed the original qualities of the ecosystem and then restored it back to its earlier condition.
 15. This type of procedure has been carried out in practice. In a cloning method called nuclear transfer, the nucleus of an egg of some common animal is sucked out and replaced with a cell from a genetically closely related extinct or endangered species. Scientists have already cloned a gaur by this method and they are planning to clone a Sumatran tiger and a giant panda. (Lanza et al. 2000).
 16. (Un)naturalness in the sense of HC4 should be clearly distinguished from property-based (un)naturalness. Property-based (un)naturalness is a question about what properties the entity has, whereas (un)naturalness in the sense of HC4 is a question about the extent to which the properties of an entity have been caused by human beings.
 17. Totally biologically or genetically based unintentional *behavior* (for example, a reflex) is possible, but since actions and activities require intentionality, they always have a cultural element in them.
 18. The idea of comparison has offered a strong reason for preserving historically natural ecosystems. Ecosystem management requires natural or wild areas as controls. Even though ecosystem management cannot produce historically natural ecosystems, it certainly aims and should aim to produce ecosystems that are natural with respect to their properties. (For this view see Christensen et al. 1996, 679).

19. However, there are also writers that clearly and explicitly separate (un)naturalness from (ab)normality (for this view see Callicott 1988, 138–39; Callicott 1996, 371).
20. However, interestingly, this type of (un)naturalness is restricted to entities in the sphere of human culture (as a contrast of human-independent nature). No matter how foreign entities of human-independent nature are to us, they are usually not considered unnatural in this sense of the term. Planets Neptune and Pluto, and new species found in wild nature, for example, are highly foreign and unfamiliar to us. Yet, they are rarely considered unnatural in the presented sense of the term.
21. The assessment may seem tempting because of an equivocation. Even though the statement of (un)naturalness is based on mere familiarity, it may be understood as a claim about genetically and biologically based tendencies and inclinations of women.
22. Cooley & Goreham (2004, 52) present a somehow similar view when they suggest that unnaturalness can be interpreted to mean that an entity is used against its function.
23. Needs must be separated from wants. Needs are more biologically based and more inherent to us than mere wants. Inadequate needs satisfaction necessarily has undesirable physical or psychological consequences for the human being in question, whereas leaving wants unsatisfied may sometimes even be beneficial. Yet, needs and wants are often intimately related and many wants are based on needs.
24. This is not to say that they do not satisfy our wants.

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