'Nature and I are Two': A Critical Examination of the Biophilia Hypothesis

*YANNICK JOYE

Research Centre of Marketing and Consumer Science
University of Leuven
Naamsestraat 69 - box 3545, 3000 Leuven, Belgium
Email: Yannick.Joye@econ.kuleuven.be
** Corresponding author*

ANDREAS DE BLOCK

Institute of Philosophy
University of Leuven
Email: Andreas.Deblock@hiw.kuleuven.be

ABSTRACT

In 1984, Edward O. Wilson proposed the idea that natural selection has resulted in an adaptive love of life-forms and life–like processes ('biophilia') in humans. To date, the idea of biophilia has been viewed as an ultimate explanation of many conservation attitudes in humans. In this paper, we contend that environmental ethics has little to gain from the biophilia hypothesis. First, the notion is open to various and even conflicting interpretations. Second, the empirical findings that do seem to corroborate a more well–defined version of the biophilia hypothesis can often be accounted for by alternative hypotheses. Third, the evolutionary reasoning behind the biophilia hypothesis tends to be unclear, and sometimes even inaccurate.

KEYWORDS

Biophilia, environmental aesthetics, environmental ethics, evolutionary psychology

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YANNICK JOYE AND ANDREAS DE BLOCK

INTRODUCTION

While originally introduced by the German philosopher and psychologist Erich Fromm, it was biologist Edward O. Wilson who popularised the notion of *biophilia* with his aptly titled 1984 booklet, *Biophilia*. In the book Wilson defines biophilia as the innate human tendency to focus on and affiliate with life forms and life-like processes. Moreover, Wilson argued that these affiliations are the result of millennia of human evolution in a natural environment, where repeated contact with, and dependence on life and life-like processes was crucial for hominin survival and reproduction. In such environments, biophilic tendencies were adaptive because an organism had clear evolutionary benefits when it was hardwired to focus on and to respond emotionally to certain survival-relevant living elements.

In 1993, interest in biophilia received a notable boost from the publication of the book *The Biophilia Hypothesis* (Kellert and Wilson, 1993). The book consisted of contributions from researchers in a wide range of different disciplines, and was aimed both at popularising the concept of biophilia and at broadening the evidence-base in support of it. The strategy was largely successful as, since 1993, biophilia has become influential in, among others, developmental psychology (Kahn, 1997), preventive medicine (Frumkin, 2001), and even architectural theory (Kellert, Heerwagen and Mador, 2008; Joye, 2007). Of specific relevance is that biophilia is intimately related to the field of environmental ethics. In particular, conservation biologists often interpret the biophilia hypothesis as an important stepping-stone to an anthropocentric environmental ethics that focuses not only on the material benefits living nature can provide, but also on its positive *psychological* influence on human beings (Kellert, 1993). The core idea is quite straightforward. Because we are presumed to be genetically predisposed to emotionally affiliate with living kinds and processes, it is in our own interest to preserve them. If not, we could become deprived of an important source of positive human emotions, fulfilment and happiness.

Although we largely share the ethical concerns and values of biophilia theorists, we do not believe that the theory itself can genuinely contribute to either an understanding of these values and concerns, or to the construction of a viable ethical theory of human interaction with other organisms or biological entities. Thus, the first goal of this paper is to critique the scientific value of the biophilia hypothesis. Such critical inquiry is needed, given the often uncritical acceptance of the biophilia hypothesis, both in the popular and academic literature. Obviously, we are not claiming that there cannot be evolution-based tendencies in the feelings people have about nature. But we do claim that much of the conceptual and empirical work in the literature on biophilia is sloppy. Second, we will argue that even if biophilia theorists were on the right track, its importance for any environmental ethics is very limited.

The structure of this paper is as follows. In the first part we will take a close look at the concept of biophilia, and assess whether it is a coherent scientific construct. Essential to the biophilia hypothesis is that it posits an intimate emotional link between humans and the living world. In the second section, therefore, we will examine what (empirical) evidence exists for supporting this emotional component. The final part is a critical assessment of biophilia's alleged implications for environmental ethics.

1. THE CONCEPT OF BIOPHILIA

Biophilia is often claimed to be still a *hypothesis* (e.g., Kahn, 1997), and we agree that one should have a certain tolerance for the fair degree of speculation that is part and parcel of any theory in its development. The minimal prerequisite for any hypothesis, however, is that it is open to falsification, perhaps in conjunction with the larger theory in which it is embedded. An inquiry into its different claims reveals that biophilia does not fare well in this respect. For the sake of clarity, let us take Wilson's (1984: 1) original definition of biophilia – 'the innate tendency to focus on life and life-like processes' [1] – and break it down into three discrete components or phrases that we will discuss separately: biophilia is the (a) *innate* tendency to (b) *focus* on (c) *life or life-like* processes.

Let us first consider the object of biophilic responses, namely 'life or life-like processes'. A first concern relates to the terminological sloppiness characteristic of the phrase. Not only is it inherently vague what 'life-like' might mean, it is also obvious that there is a wide gap between a life-like process and life itself, and that something that is life-like is not necessarily natural either. Despite this, biophilia theorists frequently use these terms interchangeably or do not provide a detailed conceptual analysis of how the terms 'life', 'life-like' and 'natural' mutually differ and overlap. A second and related issue is that 'life or life-like' seems to presuppose both a focus on or affiliation with things that *are* biological ('life') or that are *similar* to biological entities ('life-*like*'). This description sits awkwardly with the empirical support for biophilia, which regularly refers to non-biological natural elements, like for example water-features (Ulrich, 1993). One way to resolve this tension is by claiming that these non-living elements are somehow enough 'life-like' to warrant their inclusion in the biophilia research enterprise. But why would these elements be life-like? To the best of our knowledge, 'life-like process' is only a technical term in research on artificial life, and Wilson doesn't seem to think of life-like processes in that particular technical sense. Like Milton (2002), we think that the only sensible interpretation of Wilson's phrase 'life and life-like processes' is that it 'goes beyond the biological definition of life and implies the inclusion of anything that might be perceived as living or lifelike' (61). But as probably most would agree, this

definition does not say very much. Moreover, researchers who claim that, say, water-features are life-like should at least check whether their research subjects really do perceive these water features as living or life-like.

Next, consider the 'focus' part of the definition. Although Wilson originally defined biophilia as a tendency to *focus* on life and life-like processes, the majority of biophilia researchers nowadays talks about biophilia in terms of an affective *affiliation* with life. This shift from the cognitive ('focus') to the conative ('affective affiliation') is unproblematic in itself, as long as both are not mixed up[2]. A more troubling issue is that different proponents of biophilia hold different interpretations about which conative states are relevant to biophilia, even though most of them agree that states of heightened affect are of primary interest. Ulrich (1993), for instance, considers biophilia as a *positive* emotional affiliation, and strictly separates it from negative or 'biophobic' responses to natural entities. In contrast, Wilson (1993) employs 'biophilia' to refer to states ranging '[...] from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety' (31). Like Wilson, Stephen Kellert stretches the notion very far and lists nine possible 'dimensions' of biophilia (Kellert, 1993).[3] In contrast to their own definition, it thus seems that both Wilson and Kellert interpret biophilia as including not only affiliative states, but also aversive ones.

The last part of our reading of Wilson's definition of biophilia is the concept 'innate'. Although innate nonadaptive responses and mechanisms exist, most, if not all, biophilia theorists assume that innate biophilic tendencies had an adaptive value, which is why they were genetically retained. Despite this, the interpretation of the specific form these adaptive mechanisms might have taken has undergone quite some evolution and change. Initially, Wilson (1984) conceived biophilia as one broad instinct. Quite similarly, Verbeek and De Waal (2002: 1) have interpreted biophilia as 'a functional subunit of our 'adapted mind''. Although biophilia is embedded in evolutionary psychology thinking, such domain-general conceptions of the construct sit awkwardly with a basic tenet of contemporary evolutionary psychology, namely the idea that adaptations tend to be domain-specific (Tooby and Cosmides, 1992; Herzog, 2002). Some biophilia theorists address this problem of domain generality by claiming that biophilia consists of a complex *set* of adaptations (Wilson, 1993). Furthermore, the 'hard' innate character of biophilia, argued for by E.O. Wilson (1984), and Verbeek and De Waal (2002), is nowadays often softened up by considering biophilia as a form of 'biologically prepared learning, implying a relatively weak genetic component' (e.g., Kellert, 2005). Although we endorse abandoning narrow evolutionary psychology thinking, the few systematic descriptions of such alleged biophilic learning rules often only explain their possible adaptive function in the coarsest sense[4].

This brief analysis shows that behind the initial and seemingly simple definition of biophilia there is a wide range of explicit and implicit assumptions

and different interpretations. If one considers biophilia as the sum of all these assumptions then biophilia can probably better be defined as '*a set of genetic predispositions of different strength, involving different sorts of affective states toward different kinds of life-like things*'. The obvious problem with the breadth of such a description is that almost any possible affective attitude towards life-like entities could then be accommodated within a biophilic framework. Biophilia thereby seems to become almost entirely immune to possible counterexamples (see also: Kahn, 1997).

But perhaps such a broad definition is too harsh and hasty, and does not do justice to biophilia. It could well be the case that the impression of immunity is an artefact of our lumping quite different biophilia-hypotheses together. It appears, however, that choosing for one *particular* version of the hypothesis does not necessarily resolve this issue. As mentioned earlier, Wilson and Kellert contend that almost *any* kind of conative state toward life-like elements can count as biophilic. Opting for either one interpretation again implies that almost any affective attitude toward nature can be mapped onto a conative dimension of biophilia, turning it into an almost vacuous concept[5]. Nowadays most biophilia researchers furthermore seem to agree that biophilia is triggered by prepared learning. Even when biophilic responding is absent, but theoretically expected, a biophilia theorist could always invoke prepared learning theory and claim that just not enough learning has taken place to explain the absence of biophilic states. These two examples show that even for particular interpretations of biophilia and for generally accepted claims the problem of immunity resurfaces. A possible way out could be to narrow the scope of biophilia even further. In the ensuing sections, we will entertain this strategy by focusing on specific conative states related to well-defined classes of living entities (e.g., animals).

2. BIOPHILIA AND AFFECT

The human capacity for biophilia is supposedly the result of evolution in a biotic world. Hence, proponents of the hypothesis claim that this must also have left some 'traces' on our cognitive and neural functioning. (Ulrich, 1993; Salingaros and Masden, 2008). Although different empirical studies have examined how living kinds and artefactual stimuli are neurally (Gerlach, 2007) and cognitively processed (Fei-Fei et al., 2002; New, Cosmides and Tooby, 2007), the empirical evidence remains inconclusive. It does not unambiguously show a processing advantage of living kinds over artefacts, as the biophilia hypothesis would seem to suggest. While research undeniably indicates that human beings are equipped with cognitive mechanisms to think and reason about biological entities ('folkbiology'), the degree to which it is domain-specific and innate is still a matter of discussion. Scott Atran, one of the most renowned researchers

in the field, contends that there is an inborn learning mechanism present for biological things, and the details of this framework are gradually filled in and refined through experience (e.g., Atran, 1995). It should, however, be noted that a contrasting alternative to this view has also been proposed. Specifically, Carey (e.g., Carey, 1988) argues that a major conceptual shift occurs around the age of ten, when an autonomous folkbiology develops. Before that age, a child's understanding of biological kinds is based on a folk-psychological framework. This clearly indicates that the discussion of whether folkbiology is something innate or ontogenetically dependent is not yet settled .

Yet, even if the discussion were settled in favour of Atran's view, research into folkbiology says very little about conative states, which are much more crucial to biophilia than cognitive processes and mechanisms, as we have explained in the previous section.[6] It therefore seems more relevant to turn to the empirical evidence from research into human *affective* attitudes toward life or life-like processes and entities. In the literature on biophilia, research lines that examine human affective attitudes toward (1) savanna-type landscapes, (2) (companion) animals, and (3) vegetated settings are often discussed. As mentioned in the foregoing section, focusing on these particular research fields could help to overcome biophilia's disconfirmation/falsification problem. If there were solid proof that affective attitudes to one of these elements or categories were innate, then this would at least partially support the viability of biophilia.

2.1. The savanna hypothesis

A central concept in evolutionary psychology is the 'Environment of Evolutionary Adaptedness' (EEA). It refers to the environment in which a particular species' adaptations took form. The EEA should be understood as 'a statistical composite of the adaptation-relevant properties of the ancestral environments encountered by members of ancestral populations' (Tooby and Cosmides, 1990: 386). Many adherents of the biophilia hypothesis claim that savanna-type landscapes were characteristic of the human EEA – a view sometimes coined as the 'savanna hypothesis'. Kahn (1997) notes, in this regard, that '[b]y most evolutionary accounts, human beings lived for most of 2 million years on the savannas of East Africa' (3). Orians and Heerwagen suggest that as a result, 'people have a generalized bias toward savanna-like environments' (1992: 560). These environments are typically characterised by moderate to large open spaces, the presence of scattered trees or tree-groups, a smooth ground surface, and/or grassy vegetation of uniform length (Ulrich, 1993). Savannas are also high in biomass, and the prevalence of relatively low-lying types of vegetation allow(ed) for resources to be accessed quite easily (Orians and Heerwagen, 1992; Orians, 1980).

Biophilia does not only claim that humans evolved on savannas, but also that they are innately predisposed to display positive affective reactions toward such biomes. The following lines of evidence are often invoked to support this claim:

- First, aesthetic enhancements to artwork and landscape architecture are sometimes accompanied by an increase of visual characteristics typical of savannas (Heerwagen and Orians, 1993). Similarly, Heerwagen and Orians (1993) also point out that artificial changes to, and selections of, certain plant species – with the goal of aesthetically enhancing them – frequently result in an increase of morphological features that are characteristic of savanna vegetation, like low trunks and broad canopies.
- Second, indicative of the savanna hypothesis, is that empirical research shows that people find the shape of trees that flourish in the savanna biome more appealing than tree-shapes characteristic of other biomes (Heerwagen and Orians, 1993; Orians and Heerwagen, 1992; Sommer and Summit, 1995; Sommer, 1997; Summit and Sommer, 1999; Lohr and Pearson-Mims, 2006).
- Third, the most cited empirical evidence for the savanna hypothesis is the Balling and Falk (1982) study. It shows that eight-year-old children prefer high quality savannas over other types of biomes, while older subjects (age 15 and older) prefer coniferous forest, deciduous forest and savanna equally. Balling and Falk hypothesise that the choice of the eight-year-old children points to an innate preference for savannas. The decreasing preference for savannas with increasing age can be explained by the familiarity of older subjects with other types of environments (see also: Falk and Balling (2009) for a replication of these findings with non-western individuals that are most familiar with rainforests).

At first sight, this evidence seems quite compelling. Yet, we believe that there are a number of theoretical, methodological, and empirical reasons why it is less convincing than it seems to be and why it is only partially relevant for biophilia.

2.1.1. What does the savanna-hypothesis really say?

Although biophilia theorists regularly refer to the savanna hypothesis, they mostly remain silent about what this preferential bias for savannas exactly amounts to. In the ensuing paragraphs we will consider a number of possible interpretations of the savanna hypothesis and discuss some difficulties associated with each of them.

Let us first consider the interpretation according to which the preference for savanna environments is an adaptive trait. This interpretation is problematic in two respects. On the one hand, when a biophilia theorist would contend that human evolution took place almost exclusively in savanna-type landscapes then

it is difficult to see how a savanna preference might eventually have maximised fitness. If, on the other hand, habitats varied throughout human evolution (see section 2.1.2. below), it becomes even more difficult to understand why natural selection would have made the genes encoding this relatively inflexible preferential mechanism more common in our species' gene pool. Or as Ruso and colleagues put it: '[w]hen it comes to environmental preferences, it must be likely that choice mechanisms were put under selective pressure long before (and after) the Pleistocene era' (Ruso, Renninger and Atzwanger, 2003: 281).

Another interpretation of the savanna hypothesis is that it is an (adaptive or maladaptive) byproduct of particular psychological adaptations, but not an adaptation in itself[7]. This claim seems to be consistent with environmental psychology research into preferences for structural landscape features. A seminal account in this respect is Jay Appleton's 'prospect-refuge' theory. It claims that high-quality, and hence, preferred habitats contain (structural) opportunities for both 'prospect' and 'refuge', i.e., landscape elements that enable one to 'see without being seen' (Appleton, 1975, 1990), or what David Buss describes as 'a womb with a view' (Buss, 2000). Other factors that are (empirically) found to positively influence landscape appreciation are: complexity, coherence, mystery, legibility, depth, spatiality and ground surface (Kaplan and Kaplan, 1989; Ulrich, 1983).

What is crucial is that it is sometimes claimed that savannas or park-like settings contain a balanced mix of all these preferred features (Han, 2007). Note that quite a few adherents of biophilia are sympathetic to this interpretation of the savanna hypothesis (e.g., Heerwagen and Orians, 1993; Kahn, 1997). According to this view, the preference for savannas essentially is a by-product of preferences for more low-level structural landscape features that are cues for safety and resource opportunities. Although this explanation for savanna preferences is conceptually sound and most strongly backed up by empirical evidence, it is not directly clear what its added value for biophilia might be. While preferences for these structural landscape features have most likely evolved/developed in natural settings, they do not seem to be intrinsically related to life and life-like entities and processes[8]. As a matter of fact, these features may have very little in common with living organisms: caves (a 'refuge') and mountain peaks (a 'prospect') do not move or grow. Hence, although some people may sometimes think of caves as wombs, it is highly unlikely that we always consider them as wombs.

2.1.2. Is the savanna the EEA?

For the sake of the argument, we hitherto accepted the claim that the EEA can be equated with the savanna. However, a number of arguments undermine this claim.

First, it must be noted that, even in human sociobiology and evolutionary psychology, the EEA-concept includes more than the physical environment or the other species with which our ancestors interacted. The social environment is also part of the EEA, and probably the most important part of it. Richard Alexander, one of the founding fathers of (human) sociobiology, has elaborated the view that most unique human psychological adaptations function primarily to contend with social relationships. Human interactions with the physical and biological world were only a secondary source of recent evolutionary change (Alexander, 1971). Recent research seems to support Alexander's view (Flinn, Geary and Ward, 2005), and many evolutionary psychologists now acknowledge that social selection was a much more important factor in the evolution of our species than in the evolution of most other species (Hagen, 2005). This means that humans are not the most likely candidates to display highly specialised adaptations to a particular biological environment, such as the savanna (Smith, 2007). Of course, Alexander and other evolutionary social scientists still acknowledge that the non-human biological environment had some impact on the evolution of our species. This impact, however, was (a) thoroughly mitigated by social selection, and (b) much less significant than the impact of social interactions.

Second, it is still far from sure whether, during the Pleistocene, all early humans lived on the savanna. Indeed, while our species originated in Africa, there is also research that indicates that, during the evolution of early hominins, there was a good deal of variation in the environments which they inhabited, ranging from forests to savannas and open-canopy woodlands (Potts, 1998; Boaz and Almquist, 2002). It thus seems that biophilia researchers have been far from evenhanded in claiming that the savanna was the EEA; it is rather something about which we have no very detailed or conclusive evidence. Admittedly, biophilia-theorists may still contend that all these different environments were somehow savanna-like. But the concept 'savanna-like' can only be scientifically useful in the presence of a set of criteria that allows one to distinguish between environments that are savanna-like and those that are not. To the best of our knowledge, such a set of criteria has not been proposed yet by biophilia theorists.

Third, even if all hominins did live on the African savanna during much of the Pleistocene, it is highly unlikely that humans are not adapted to any of the environments which they inhabited since the end of the Pleistocene (Irons, 1998). As human behavioural ecologists have repeatedly pointed out, 10000 years (300 to 400 human generations) is sufficient time for evolutionary change to occur. Hence, one can safely assume that the relatively new and culturally shaped environments – culturally shaped by architecture, agriculture, and other technologies – in which we have lived for thousands of years, have had some impact on our genetic dispositions (Lumsden and Wilson, 1981, Richerson and Boyd, 2005).

Despite all these criticisms, however, it appears that biophilia only loses one of its specific claims, and that the hypothesised innate affiliation with what is alive or life-like remains a viable idea. In this regard, Peter Kahn Jr. (1997) notes, 'the savanna hypothesis [possibly] needs to give way to a broader account of genetic predispositions to inhabited [natural] landscapes' (24). In other words, while it may be somewhat farfetched to claim that we innately prefer savannas, we may be nonetheless innately attracted to particular living or life-like elements and processes. In the following two sections we will investigate whether such an account is either empirically or theoretically warranted.

2.2. Biophilia and animals

The research field of Animal Assisted Therapy (AAT) shows that contact with (companion) animals can have a range of positive effects on human psychological and physiological health, among others: reduced stress, less general health problems, lower systolic blood pressure and cholesterol (Frumkin, 2001). To give but one example, a well-known experiment by Friedmann and Thomas (1995) shows that survival chances of persons who had survived a myocardial infarction were higher after one year for patients who owned pets, and specifically dogs, in contrast to non-dog owners (see also: Katcher and Wilkins, 1993).

It is not our intention to present an exhaustive review of the empirical literature on AAT here. What interests us is that these effects are frequently considered to be an expression of biophilia (e.g., Frumkin, 2001; Fawcett and Gullone, 2001; Kahn, 1997; Melson and Fine, 2006). Indeed, this research does clearly show that humans affectively relate to certain natural entities, and it thereby supports the affective component of biophilia.[9] However, it is far from certain that the previous findings are truly indicative of a special and inborn relationship with such living organisms (i.e., biophilia). For example, in the context of dolphin-assisted therapy, Marino and Lilienfeld (2007: 243) conjecture that the therapeutic effects are perhaps not attributable to the presence of dolphins, but to components 'such as the size and touch of the animal and the opportunity for interaction with the animal'. Another alternative explanation is proposed by Archer (1997) who argues that (part of) our love and care for companion animals is triggered by baby schemes or other supernormal stimuli, such as the big eyes of certain dog species. Likewise, Serpell (1996, cited in: Kruger and Serpell [2006]) notes, 'it has been known since the 1950s that any stimulus which is attractive or which concentrates the attention has a calming effect on the body' (27).

This suggests that alternative, and non-biophilic explanations for our positive relations with companion animals are possible. But let us assume for a moment that positive human-animal bonds are a genuine sign of biophilia, and more particularly, that they are a remnant of evolution in a world where animal contact was frequent. This broadens our discussion about pets and other cute animals to the

question of whether it would have been adaptive to display affective responses to animals during the Pleistocene. The answer is a definite yes: animals have been (potential) predators and prey during all of human evolutionary history. Given the fact that biophilia is embedded in an evolutionary psychology framework, it is quite probable that adherents of the hypothesis will contend that at least moderately specialised perceptual, attentional and recognition mechanisms, which were guided by, and interacted with affect, have evolved.

Does this not come close to biophilia? In order to give a nuanced answer to this question we should determine whether these mechanisms have evolved to favour particular *animal species* as their proper input, or whether their proper input are *perceptual* and *behavioural* cues that are characteristic of animals. The first option (i.e., particular animal species as proper input) is problematic. One reason for this is that if such mechanisms existed, one would expect a dominance of predator over prey mechanisms, because of a negativity bias in evolution (see also section 2.4.2.). However, even for human predators, such highly specialised mechanisms seem very rare and are only found for the few threats that remained invariably present throughout human evolutionary history (e.g., spiders) (Rakison and Derringer, 2008). It seems that the most viable option for biophilia is to state that mechanisms have evolved that are specialised in a number of constant or invariable (constituent) characteristics of predator and prey. These could, for example, include morphological traits; motion patterns characteristic of predator or prey; contingency or distant reactivity; eyes and teeth (for a discussion, see: Barrett, 2005).

An adherent of biophilia might try to save the hypothesis by claiming that such low-level features are all characteristic of *living* entities. The problem with such a view is that it leads to a kind of pan-naturalism: everything sharing some of these features with predator or prey then becomes, in a sense, life-like and an object of biophilic responding. It is obvious that as long as some features aren't life-like, we can test the strength of our affective responses to the things with life-like features, and compare them to the things with no life-like features. But then again, one of the recurring problems in the biophilia-literature is the absence of explicit criteria to discern what counts as life-like. This further contributes to the falsification/disconfirmation problem that we discussed in the first section.

Even if one accepts this as supporting evidence for the biophilia theory, the difficulty remains that there is a wide gap between the basic affective attitudes required to handle predator and prey, and the characterisation of biophilia as 'the innate need to relate deeply and intimately with the vast spectrum of life about us' (Kellert, 1993: 42). This gap seems to suggest that the bulk of the 'philia' in 'biophilia' is the result of culture and (social) learning. While some may consider such a stripped down version to still be a viable variant of biophilia, the mere fact that its meaning can be stretched that far should raise suspicions about the scientific merits of the concept.

2.3. Positive affective attitudes to vegetative elements

A third line of empirical support for biophilia is drawn from environmental psychology, and in particular from those studies inquiring human affective responses to vegetated scenes and vegetative elements (e.g., trees and plants). Interestingly, there is a vast literature which consistently reports that vegetative elements (e.g., trees, flowers, and plants) and vegetated environments are able to (a) elicit aesthetic responses in human beings (for an extensive review see: Ulrich, 1993), and can have (b) a stress-reducing or 'restorative' effect on them, as opposed to urban or man-made environments (see for example: Ulrich, 1979; Ulrich, 1983; Ulrich et al., 1991; Parsons et al., 1998; Hartig et al., 2003). These research findings have initially been linked to the biophilia hypothesis by Roger Ulrich (1993). In agreement with biophilia, these effects are often claimed to be the result of ancestral evolution in *natural* vegetated landscapes, where vegetation is presumed to have been an important source of food (e.g., fruit, nuts) and protection. In particular, preference reactions are considered as having guided early humans to these elements. The stress reducing potential is explained by the fact that the presence of greenery (as a source of food and protection) could mitigate the stress resulting from food scarcity or insecure situations (e.g., threats from predators). Individuals who genetically retained such responses are claimed to have had better survival chances than those who did not (Ulrich, 1993). While these evolutionary explanations are usually uncritically accepted within environmental psychology, there are reasons to doubt them.

Let us touch upon three empirical difficulties following from this body of research. A first concern relates to the alleged universality of these findings, viewed as support for the hardwired character of preferences for vegetative life – and by extension – for biophilia (see especially: Ulrich, 1993). While the subjects involved in these preference studies undeniably have different cultural backgrounds, Lewis (2005) notes that they are often historically and ethnically related. And when they are not, it still often concerns urban or suburban residents, who have had highly similar experiences with nature. Hence, it cannot be ruled out that the 'biophilic' responses to vegetated settings are to a large extent the result of cultural learning processes.

A second issue is that recent research indicates that it is still far from clear whether biophilic responses toward vegetated settings are entirely the result of any attraction to the actual life-like contents (i.e., vegetative elements) or whether such reactions are a side-effect of the fact that certain geometrical qualities are differentially present in (non-vegetated) urban versus vegetated scenes. Recent research by Caroline Hagerhall, for example, indicates that the fractal characteristics typical to natural contents like greenery contribute to the biophilic responses observed in environmental psychology research (Hagerhall, Purcell and Taylor, 2004; Hagerhall et al., 2008). This finding suggests that more

informed and fine-grained research is needed before one can conclude that a genuine 'nature effect' is at the root of preferential and restorative responses. While we do not exclude fractal forms from the class of 'life-like' things, again there is the difficulty that biophilia theorists remain silent about possible criteria to differentiate between qualities that are life-like and those that are not.

A third difficulty relates to the evolutionary explanation for the stress-reducing or 'restorative' capacities of green environments. In agreement with the adaptationist commitments of biophilia, stress reduction is claimed to be an adaptive reaction, triggered by very *particular* natural elements and environments (Ulrich, 1993; Heerwagen and Orians, 1993; e.g., savanna-type environments, verdant vegetation, flowers, water-features). In contrast to this, restorative effects have been observed in response to almost *any* kind of nonthreatening nature, from single plants and plain grasslands to idyllic waterfalls and dense forests (see for reviews: Velarde, Fry and Tveit, 2007; Van den Berg, 2009). Several studies (Ulrich, 1981; Ulrich et al., 1991; Van den Berg, Koole and Van der Wulp, 2003) have also not reported differences in restorative effects between settings with and without water, even though settings with water are generally assumed to have adaptive and thus, superior restorative qualities. The fact that after three decades of research no unmistakable superior restorative effects of 'adaptive' natural settings have been found warrants at least some caution in considering these research findings as firm support for the adaptive claims of biophilia.[10] We are not claiming that there can be no innate component to such a general reaction pattern[11] but we are concerned about the fact that biophilia preferentially cites 'confirming' evidence, while glossing over the difficulties associated with that evidence and with the related adaptationist framework.

As the three foregoing arguments suggest it is still not settled to what extent preferential and restorative responses toward greenery are (a) universal, (b) triggered by life-like qualities and (c) are evolved adaptations. This is troubling for biophilia because the psychological research into these responses perhaps constitutes the best and most widely studied and cited line of empirical support for the hypothesis. We do, however, agree that a presupposition underlying these critical points is that biophilic attitudes toward vegetative life had an *adaptive* function in ancestral environments. Perhaps a part of the foregoing critique can be undone by proposing that life in a natural, vegetated world should rather be considered as the human 'default situation' or 'natural state' (Parsons, 1991). This line of thought is (among others) pursued by Peter Kahn Jr.:

> Imagine that your favourite food item is the only source of an essential nutrient and that without it everyone suffers from low-grade asthma and increased stress. Now imagine a generation of people who grow up in a world where this food item does not exist. In such a world, it would seem likely that people would not feel deprived by the absence of this tasty food (it was never in their minds to

> begin with) and that they would accept low-grade asthma and increased stress as the normal human condition. Nature is like that food. (Kahn, 2002: 109-110)

According to this argument, when humans have contact with nature (and its constituent elements, like vegetation) a return to our 'default position' takes place, with the result that biophilic responding is observed in experimental settings.

Although this account has intuitive appeal, it also raises a number of theoretical and empirical issues. A first problem is that such a non-adaptive version of biophilia sits uncomfortably with the fact that most biophilia theorists believe that biophilia had an adaptive function. Second, the claim that inhabiting natural, vegetated landscapes is, in a sense, our 'natural' state is highly controversial. There are just as good reasons to assume that it is our natural state to be able to flexibly adapt to *different* types of environments, ranging from natural to urban settings (e.g., Richerson and Boyd, 2005). Third, even if one accepts the 'natural' situation as default, it does not logically follow that this baseline should necessarily be preferred over other conditions, or that 'natural places', i.e., vegetated landscapes, will necessarily be experienced as good places for living. Fourth, natural environments are also inherently complex, which makes it difficult to ascertain whether biological elements (like vegetative life) and not some other property (e.g., information rate) contributed to the alleged 'goodness' of the default condition. Fifth, even *if* vegetation played a positive role, it still needs to be explained *why* it specifically acquired this role and not another one (and this brings us – again – quite close to questions about adaptive function). These problems ultimately suggest that making recourse to a 'default position' has only marginal explanatory power.

2.4. The biophilia-biophobia argument revisited

While the notion of biophilia may seem to suggest that our overall basic attitude towards living entities is a positive one, most biophilia theorists emphasise that such a view is unwarranted (e.g., Wilson, 1993). In their view, biophilic tendencies are only to be expected today if those tendencies were beneficial for our ancestors' reproductive fitness. The absence of a care-taking or loving attitude towards dangerous organisms does not refute the biophilia hypothesis. According to Ulrich, the inverse is the case: since our innate and evolved human nature contains defence mechanisms against natural dangers, it would be only logical to assume that natural selection has also provided us with mechanisms that make us approach those organisms or elements that were beneficial for our (ancestors') reproductive fitness. Or, as Ulrich puts it:

> A general argument [...] is that theoretical propositions for an innate predisposition for biophilia gain plausibility and consistency if they also postulate a corresponding genetic predisposition for adaptive biophobic responses to

> certain natural stimuli that presumably have constituted survival-related threats throughout human evolution. (Ulrich, 1993: 75)

The problem, however, is that this argument can cut both ways: if it is found to be implausible, it could make the case for biophilia less compelling. If there is no or only a weak genetic predisposition for adaptive biophobic responses, an innate predisposition for biophilia becomes less plausible. We believe that the latter is the case. First of all, the scientific evidence for biophobic responses (*sensu* Ulrich) is inconclusive. Secondly, neither evolutionary reasoning, nor empirical findings support the assumed symmetry between positive and negative responses toward nature.

2.4.1. Biophobia

'Prepared learning' has become one of the key concepts in evolutionary psychology. The proponents of evolutionary psychiatry, a subfield of evolutionary psychology, have claimed that biologically prepared learning offers the best explanation for the content of current phobias. According to Marks and Nesse:

> [F]actors that have shaped anxiety-regulation mechanisms can explain prepotent and prepared tendencies to associate anxiety more quickly with certain cues than with others. These tendencies lead to excess fear of largely archaic dangers, like snakes, and too little fear of new threats, like cars. (Marks and Nesse, 1994: 57)

Indeed, many experiments on human and primate behaviour seem to validate biologically prepared fear of snakes and spiders (Mineka, Keir and Price, 1980; Öhman and Mineka, 2001).

Although this evolutionary explanation of phobias has become a paradigmatic example of the power of the evolutionary psychiatric perspective, many theorists still contend that fear of spiders, snakes, and other natural dangers is not so fine-tuned as to exclude modern, more cultural dangers. It may be somewhat easier to learn fear of spiders than to learn fear of cars, but it almost goes without saying that nearly all pedestrians try to avoid collisions with cars and trucks, and some individuals do indeed develop phobias for cars and trains. This given may be seen as evidence for a rather general fear acquisition device: snakes, spiders, and other predators fit the input condition of this device, but so do motor vehicles and other modern dangers. Natural dangers probably shaped a large part of our anxiety-regulation mechanisms, but most cultural dangers fall within the actual domain of these mechanisms (Sperber, 1994). Moreover, recent research (Blanchette, 2006) indicates that the results used to conclude the existence of a prepared fear-mechanism are also shown by (evolutionarily) new cultural objects, like syringes and guns. In fact, Blanchette (2006) sometimes observed stronger fear responses for modern than for evolutionary-relevant threats. Other researchers arrived at much the same conclusion when they tested the human psychology of fear detection (Fox, Griggs and Mouchlianitis, 2007).

This research reveals that the mechanism underlying fear is primarily triggered by threats, regardless of the threat's phylogenetic relevance. The fear mechanism is probably much more plastic than evolutionary psychologists and biophilia theorists like Ulrich suspect.

We are not claiming here that the human fear mechanism hasn't evolved by natural selection. But what we do claim is that the empirical evidence certainly does not show a point-by-point match between the selective features of the ancestral environment(s) and specific fear mechanisms guiding our adaptive behaviour. Furthermore, the jury is still out on the question how general the relevant evolved fear mechanism is, that is, whether or not it has primarily to do with aversion of personal injury and imitative learning or classical conditioning. The fact that it is still unclear whether it is part of our evolved nature to be more fearful toward living (or 'life-like') dangers than toward cultural threats partially undermines the plausibility of at least some elements of the biophilia hypothesis.[12]

2.4.2. Symmetry between biophobia and biophilia.

Ulrich (1993) claims that if there is such a thing as hardwired biophobia, the existence of a genetic predisposition for adaptive biophilic responses would become more plausible. Yet, as we have shown, it is far from sure whether biophobia is as hardwired as he supposes: much of our fear's content and range seems to be culturally determined (Lutz, 1988). But if biophobia was a domain-specific and (relatively) content rich psychological adaptation, could it then really serve as supporting evidence for a hardwired version of biophilia? In other words, is it safe to claim that there is an evolutionary symmetry between positive and negative emotions or attitudes? We believe that there is reason for scepticism about this alleged symmetry.

Negative emotions can be seen as reactions to (real or imagined) situations with a negative cost-benefit outcome. Generally, they motivate the individual to do something about the current situation or to avoid similar situations in the future (Nesse, 1990). There is little doubt that positive emotions have a roughly similar adaptive function. However, and this is problematic for Ulrich, numerous papers in the (neuro)psychology literature point out that humans and many other animals have a higher sensitivity to potentially threatening events (Peeters, 1971; Baumeister et al., 2001; Carretié et al., 2009). In all likelihood, this negativity bias was favoured by evolution: the ultimate negative event, death, is much more negative, and much more final, than any positive event (Rozin, 2006). This clearly points toward an evolutionary asymmetry between positive and negative emotions or attitudes. It follows from the negativity bias that if biophobia exists, biophilia will probably be much weaker than biophobia. Given the already limited number of biological entities that are alleged to trigger innate

fear mechanisms (e.g., snakes, spiders), one can safely assume that an even more limited number of biological entities activates evolved biophilic tendencies.

3. ENVIRONMENTAL ETHICS AND BIOPHILIA.

Some biophilia-theorists contend that one can get insight into the nature of biophilia by studying natives' attitudes toward the natural world. The underlying assumption is that 'native peoples offer us a way to understand what is most basic to our being' (Kahn, 1997: 14). This line of argument is followed by Nelson (1993), among others, in his description of the *Koyukon* of Northern Alaska. Because such people are deeply knowledgeable of, and sensitive to their local natural environment, the conclusion seems inescapable: biophilia is an essential part of human nature, which is just suppressed by modern life. Furthermore, the conservation practices of the *Koyukon* suggest that non-ecological behaviour 'may not reflect a human condition so much as a cultural condition brought about by agriculture and domestication' (Nelson, 1993: 224). In other words, caring for nature is to a large extent 'in our genes', and (our western) culture is the prime culprit for perverting this natural tendency. Hence, both the aims of conservation biology and an all-around ethical treatment of our environment would come about almost automatically, if we would only cut ourselves loose from our learned 'unnatural' thinking and behaviour. Moreover, because responding to innate biophilic needs and desires 'feels good', respect for the environment, and for all the organisms in it, would greatly enhance our emotional and existential welfare.

Most adherents of biophilia are more cautious in their ethical reasoning. They understand that Nelson's representation of the *Kuyokon* as ecologically noble savages is not representative for other 'native' people. There is solid evidence that many 'native' cultures are non-conservationist, even though they have not been 'corrupted' or 'perverted' by practices like agriculture and animal domestication (Hames, 2007; Diamond, 1993). However, despite their reluctance to follow Nelson, the ethical arguments or assumptions put forward by the majority of biophilia-theorists are strikingly similar. First, they claim that ethical attitudes and behaviour toward the natural environment are more easily learned than unethical attitudes and behaviour. Second, they claim that such ethical behaviour would be beneficial for us in terms of immaterial happiness (Wilson, 1993; Kellert, 1993). In this section, we will evaluate these arguments and assumptions. In the light of our argumentation thus far, most readers will not be surprised by the fact that our evaluation is mostly negative.

Wilson's biophilia hypothesis is thought to be helpful for normative environmental ethics (Levy, 2003), primarily because it shows us why and how our emotional welfare depends on the gratification of our deep-seated biophilic

needs. If it is accepted that normative rules should result in the (broadly utilitarian) ideal of the greatest welfare for the greatest number, then those normative rules should necessarily include rules that protect the natural environment. Since these rules are at the same time coded for in our genome, a mild optimism is warranted about their being accepted by the general public.

At first sight, this seems reasonably convincing. However, even adherents of the theory have already remarked that because biophilia consists of several relatively distinct hypotheses, its normative sword can cut different ways. The savanna-hypothesis, for example, seems to lead to the conclusion that we should reshape the tropical rainforest into a savanna-like (or park-like) environment (Ulrich, 1993; cf., also: Levy, 2003). It would also suggest that the removal of many threatening entities in nature (spiders, snakes, mosquitoes, fleas, toxic mushrooms) would reduce stress, while their flourishing, at least on or nearby humans, would result in lower emotional welfare for individuals of our species. Of course, theorists like Kellert and Ulrich would say that this is just the other side of the coin. Biophilia may not result in a robust anthropocentric defence of biodiversity, since biophobia is also part of our evolved nature. Nonetheless, at the same time they seem to think that biophilia at least shows that it is in our own emotional and material interest to preserve certain life forms and certain habitats. Moreover, biophilia would explain *why* people are keener on the conservation and ethical treatment of certain environments and species than others. This, more modest, defence of a biophilia-based environmental ethics is what Levy (2003) argues for. Although he is critical about the argument that the biophilia-hypothesis supports a 'robust, anthropocentric environmentalism', he also asserts that several specific bio-need hypotheses

> buttress, to some extent, traditional anthropocentric arguments for at least some environmental protection. Indeed, they help confirm what many of us have long believed from our own experience, that humans benefit from contact with a non-human world in ways that are reasonably called 'aesthetic' and 'spiritual'. (Levy, 2003: 246)

We believe that even such a modest version of a biophilia-based environmental ethics is difficult to keep up. For brevity's sake, we will limit ourselves to two important criticisms.

The first criticism relates to the negativity bias (see section 2.4.2). Most likely, biological evolution programmed us to be more sensitive to potentially threatening events than to positive events. This means that if an anthropocentric normative environmental ethics could be derived from our evolved natural psychology, it would most likely contain many more rules that say things like 'wipe species X out' or 'change the original environment' than rules saying to protect a species or the original environment.[13] Obviously, such rules strongly echo the claims of an anthropocentric negative utilitarianism, but they are also

perfectly in line with any anthropocentric preference utilitarianism, since our strongest evolved preferences are risk-aversive preferences.

A second important reason for scepticism concerns the preferences for nature that may have evolved. The conservation ethic envisioned by biophilists would work better if biophilia should imply an affective orientation to *actual* life-like elements (i.e., we want to preserve *real* forests). On the basis of our critical discussion, however, we have found that the most plausible version of biophilia is one that posits interest in patterns, conditions, and characteristics *of* living entities. (Is it not more plausible to assume that humans are endowed with a capacity for '*biomorphilia*' instead of biophilia?) Probably some will argue that its 'realness' makes actual living nature superior to simulations. What is actually surprising is that even adherents of biophilia implicitly acknowledge the relative unimportance of the issue of 'realness' when they argue for including biologically-inspired forms and patterns in architectural design to satisfy our biophilic needs (Kellert, Heerwagen and Mador 2008; Joye, 2007). They do not seem to realise that they are thereby moving away from a conservation ethic for biodiversity, and toward a conservation ethic for the diversity of life-like forms.[14] As many non-biological items are characterised by life-like characteristics, the conservation ethic then becomes directed to a much larger set of elements than originally envisioned, and as such, it runs the risk of becoming trivial. Our biophilic tendencies can then be equally gratified by, say, watching *National Geographic* documentaries that bring wildlife and picturesque views and landscapes into our homes, and are usually much more enthralling and beautiful than the real wilderness. Ironically enough, the occurring replacement of biophilia by 'videophilia' in the US is exactly what many biophilia theorists could have predicted (Pergams and Zaradic, 2008).

It must be clear by now that we think that biophilia has interpreted its supposedly supporting evidence too optimistically and we therefore consider the ethical and/or conservational implications of biophilia to be limited. Probably this will not be regarded a philosophical disaster by environmental ethicists and conservation biologists. After all, none of them rest their case for conservation *entirely* on biophilia and they might still get a few things out of biophilia research. For instance, if it is indeed the case that we have a more or less innate affective orientation toward life and life-like *shapes*, conservation biologists could make the pragmatic argument that the cheapest and easiest way to get life-like things is by preserving actual (living) nature. Perhaps it is also morally the most warranted way to preserve the experience of life and life-like processes[15].

4. CONCLUSION.

Edward O. Wilson's impact on environmental ethics has been enormous. He launched the concepts of biodiversity and biophilia that have quickly become very popular within the community of conservation biologists. The popularity of these new concepts has much to do with the fact that they are thought to solve many of the problems with more traditional conservation concepts (Tackacs, 1996). Quite a few conservation biologists saw biophilia and biodiversity as good scientific foundations for a committed environmentalism (Soulé, 1991). Moreover, these concepts provided another benefit to conservation biologists: they could claim the position of central authority in the debate on the protection of the (natural) environment. Perhaps rather ironically, this may also explain the apparent lack of enthusiasm for Wilson's work among many environmental ethicists. Robert Elliott and Eric Katz, to name two, hardly ever mention biodiversity or biophilia. They seem to believe that a scientific turn is not what the field of environmental ethics needs. Although we are not quite sure that a scientific turn is necessarily bad for the academic field of environmental ethics, we do agree that biophilia is not the right starting point for a more science-based approach.

As our critical review shows, a diverse and vast number of research fields study the human relationship with living nature. This research provides compelling evidence that people indeed affectively relate to life-like elements and processes (e.g., animals, landscapes, greenery and so on) and derive (among others) meaning, enjoyment and health benefits from those relations. In our view, there is nothing wrong with emphasising these benefits, and we do not doubt that such positive feelings can be utilised for the good cause of conservation. However, biophilia theory goes awry in placing positive human feelings for life and life-like processes in a narrow evolutionary psychology framework. It seems that the theory has overestimated the evolutionary origins of these feelings and has neglected arguments and research that speak against it. Evolutionary psychology cannot be the scientific ally of a broad anthropocentric environmental ethics, not so much because evolutionary psychology is disputed as a science, but rather because the more robust findings of evolutionary psychology do not clearly point in the direction of evolved needs and preferences for life and life-like processes. We hope that future research will sketch a more well-balanced and informed image about the possible (evolutionary) origins and scope of human-nature relationships and about biophilia's potential contribution to understanding those relationships.

NOTES

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[1] In this paper we will interpret and discuss biophilia in agreement with this definition.

[2] It should be mentioned that biophilia theorists are sometimes sloppy in this regard. In the first pages of *Biophilia* (1984) Wilson initially defines biophilia in terms of a 'focus', whereas a few paragraphs later he also refers to the construct in terms of 'affiliation'.

[3] The nine values are: utilitarian, naturalistic, ecologistic-scientific, aesthetic, symbolic, humanistic, moralistic, dominionistic, negativistic.

[4] For example, Kellert (1993: 50) notes that the '... biological advantage of the ... aesthetic response [to nature] could reflect a human intuitive recognition or reaching for the ideal in nature ... [it] could further be associated with derivative feelings of tranquillity, peace of mind ... [it] may also reflect an intuitive recognition of the greater likelihood of food, safety, and security...' It must be obvious that the vagueness speaking from this 'analysis' heavily contrasts with the detailed adaptationist analyses that evolutionary psychologist try to provide for certain phenomena (cf. Barrett's [2005] analysis of human adaptations to predator and prey).

[5] A possible criticism is that it is unfair that we are just criticising *particular* versions of biophilia (i.e., Kellert's or Wilson's version). Kellert and Wilson are, however, the prime theorists on the topic. Thus, if there are versions that are to claim a sufficient degree of generality then it must be theirs. And if not, that again seems to illustrate the theoretical underdevelopment of the biophilia hypothesis.

[6] Wilson initially defined biophilia as an innate *focus* on life and life-like processes. The literature on biophilia often equates this focus with an interest in life and life-like processes (Milton, 2002), thereby referring to psychological research that considers interest to be a basic emotion (for a review of the psychological literature on interest, see: Silvia, 2006).

[7] Some will perhaps argue that the human species is biased to prefer savannas because of the mere fact that it has always lived in savanna-type settings. It is, however, not always true that we prefer a certain condition because we have been living in a world where this condition has always been present. For example, although humans have evolved in a world teeming with, say, insects and predators, it does not logically follow from this that we now necessarily like insects or predators. It thus still needs to be explained why evolution in savanna-type environments has translated into a preference for that environment.

[8] Obviously savannas contain many living elements, but that does not distinguish them from other types of biomes, such as, for example, rainforests.

[9] On the other hand, the human relation with animals can also be characterised by cruelty and abuse, not to mention the fact that animals can cause aversive, phobic reactions. While this remains consistent with a broad interpretation of biophilia, we have already discussed the problems associated with such a view (see section 1).

[10] Many thanks to Agnes Van Den Berg for pointing this out to us.

[11] Note in this regard that one of the authors has recently proposed an alternative evolutionarily-based model for restorative responses based on the concept of 'perceptual fluency'.

[12] This argument gains further force from the fact that biophobia research is *deliberately* designed to test the hardwired character of fearful responses to animal threats, whereas the research supporting biophilia is largely indirect and circumstantial.

[13] Of course, we are not claiming that our natural tendency to change implies that we would like to change our environment in such a way that food or water supply becomes more unreliable.

[14] Attempts at saving the conservation ethic by arguing that we still need life and life-like processes to 'learn' such form grammars does not provide a way out here. After having learned them, there is no necessity to preserve the living elements that are the basis of such creative learning.

[15] Many thanks to one of the reviewers for pointing this out to us.

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