

Developmental Psychology and the Biophilia Hypothesis: Children's Affiliation with Nature

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A venturesome hypothesis has been put forth by Wilson (1984), Kellert (1996), and others and has been receiving increasing support. The hypothesis asserts the existence of biophilia, a fundamental, genetically based human need and propensity to affiliate with other living organisms. A review of the biophilia literature sets into motion three overarching concerns. One focuses on the genetic basis of biophilia. A second focuses on how to understand seemingly negative affiliations with nature within the biophilic framework. A third focuses on the quality of supporting evidence and whether the biophilia hypothesis can be disconfirmed. Through this critical examination, biophilia emerges as a valuable interdisciplinary framework for investigating the human affiliation with nature. Yet it is clearly a nascent framework, and some of its potential lies in charting a stronger ontogenetic course. Toward this end, in the second half of this article a structural-developmental approach is framed for investigating biophilia. Support for this approach is provided by discussing the author's recent studies—conducted in the United States and in the Brazilian Amazon—on children's environmental reasoning and values. © 1997 Academic Press

What is biophilia? And why is it important for developmental psychologists to understand and study it? As for many questions, there is a short answer and a long answer.

The short answer is this. The biophilia hypothesis asserts the existence of a fundamental, genetically based, human need and propensity to affiliate with life and lifelike processes. Consider, for example, that recent studies have shown that even minimal connection with nature—such as looking at it through a window—increases productivity and health in the workplace, promotes healing of patients in hospitals, and reduces the frequency of sickness in prisons. Other studies have begun to show that when given the option, humans choose landscapes such as prominences near water from which parkland can be viewed that fit patterns laid down deep in human history on

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the savannas of East Africa. Wilson (1992) points out that people crowd national parks to experience natural landscapes, and “travel long distances to stroll along the seashore, for reasons they can’t put into words” (p. 350). According to Wilson (1984), the biophilic instinct emerges, often unconsciously, in our cognition, emotions, art, and ethics, and unfolds “in the predictable fantasies and responses of individuals from early childhood onward. It cascades into repetitive patterns of culture across most or all societies” (p. 85). Thus, what makes the hypothesis particularly important is that it provides an overarching framework by which new scientific ground across many disciplines can be charted that bear on understanding the human relationship with nature.

The long answer—which is not nearly as tidy—is the subject of this article. It is my hope to bring this line of inquiry more fully into the field of developmental psychology.

In the first section, I sketch some of the promising research that supports the biophilia hypothesis. This task is important, for the idea of biophilia becomes compelling not by any single study, but by the confluence of research from diverse fields. This body of research also sets into motion the concerns that are at the forefront of current debate, and that I take up in the second section. One concern arises if biophilia is understood largely as a genetically determined affiliation. A second concern arises through a seeming contradiction. At first blush, biophilia would seem to mean something like “love of nature” or at least something that accentuates a positive affiliation. Yet most proponents of biophilia agree that people at times find nature unlikable and unfriendly, if not threatening and harmful, and that such negative affiliations comprise a part of biophilia. How can these ideas be reconciled? A third concern—or actually a set of problems—arises when biophilia is understood to be vigorously shaped by experience, learning, and culture. How good is the supporting evidence? Can the biophilia hypothesis be disconfirmed?

Through this critical examination, biophilia emerges in my interpretation as a valuable interdisciplinary framework for investigating the human affiliation with nature. Yet it is clearly a nascent framework, and some of its potential lies in charting a stronger ontogenetic course. It is here I will suggest that structural–developmental theory has much to offer. Not that this theory eclipses all others, but in terms of biophilia it powerfully frames some new ideas, and recasts others in interesting directions. Finally, I discuss four structural–developmental studies colleagues and I have recently conducted on environmental reasoning and values. This research can stand apart from biophilia. But in its own way it supports the biophilia hypothesis, fleshes it out developmentally, and challenges us with difficult questions. Perhaps the broadest question is as follows. If understanding the human affiliation with nature cuts across traditional disciplinary lines, how are we to work, move,

and shape our research programs? I have but partial answers, and hope this article will help others to generate more.

THE BIOPHILIA HYPOTHESIS: EMPIRICAL SUPPORT AND AMPLIFYING EVIDENCE

Aesthetics and Habitat Selection

By most evolutionary accounts, human beings lived for most of 2 million years on the savannas of East Africa. During this time, it is believed that certain features of landscape offered greater chances for individual and group survival. For example, bodies of water not only provided a physical necessity to individuals, but presumably they provided a perimeter of defense from most natural enemies. Bodies of water also drew forth other animals and plant life on which humans depended. Prominences overlooking grass lands presumably afforded views of approaching threats posed by certain animals or inclement weather. Trees with relatively low trunks presumably allowed accesses for climbing, while those also with relatively high canopies did not block the view. Flowers presumably indicated food sources.

Based on such an evolutionary account, Wilson (1984) asks rhetorically: “[I]s the mind predisposed to life on the savanna, such that beauty in some fashion can be said to lie in the genes of the beholder?” (p. 109).

Research bears on this proposition. Kaplan and Kaplan, for example, have conducted extensive research on individuals’ preferences for different sorts of landscapes (Kaplan & Kaplan, 1989; see also, e.g., R. Kaplan, 1973, 1977, 1985; and S. Kaplan, 1983, 1987, 1992). In the process, they faced numerous methodological challenges: to be able to determine, for example, whether participants’ preferences were due to general environmental features represented by a photograph (e.g., that involve low-action water scenes) or something particular to the specific photograph (e.g., a picture of a boat within such a scene). In response, Kaplan and Kaplan (1989) have highlighted initial strategies that guided their research, and that of their students and colleagues. Namely, (a) avoid scenes with unusually striking stimuli, (b) use four to five scenes of any environmental category under investigation, (c) span the range of preferences available in each category, and (d) if “a scene too important or too interesting to drop could be interpreted in a variety of ways, include several scenes that fit each of the alternative interpretations to permit subsequent hypothesis testing” (p. 209).

Based on their research, Kaplan and Kaplan found, in general, that people preferred natural environments more than built environments, and built environments with water, trees, and other vegetation more than built environments without such features. Cross-cultural studies by other researchers continue to support this finding (see Ulrich’s, 1993, review), not that all natural environments are equally preferred. Kaplan and Kaplan (1989) found, for

example, that low-action waterscapes were “a highly prized element in the landscape” (p. 9). So were landscapes that were open, yet defined, with “relatively smooth ground texture and trees that help define the depth of the scene” (p. 48). According to Kaplan and Kaplan, such landscapes “can be called parklike or woodlawn or savanna” (p. 48). In contrast, they found that people consistently reported low preferences for settings that were blocked, such as a dense tangle of understory vegetation dominating the foreground of a scene. Such findings did not appear to be directly attributable to a wide variety of competing explanations, such as knowledge about an environment, urban versus rural upbringing, or race.

Early research by Wohlhill (1968) had provided tentative evidence that middle levels of complexity—the richness or number of different objects in the scene—largely explained environmental preferences. Kaplan and Kaplan found partial support for this hypothesis in so far as people did not prefer scenes that lacked complexity. Yet a high degree of complexity did not by itself increase preference. Thus, it “is now quite clear that there is more to experimental aesthetics than optimal complexity” (S. Kaplan, 1992, p. 595). Kaplan and Kaplan (1989) found, for example, that in judging landscapes people appear “to be heavily influenced by the potential for functioning in the setting. Thus indications of the possibility of entering the setting, of acquiring information, and of maintaining one’s orientation emerge as consistently vital attributes” (p. 38). In particular, two important landscape characteristics emerged in their research. One characteristic they call “legibility”—that one could find one’s way back if one ventured further into the scene depicted. Such scenes offer visual access, but with distinct and varied objects to provide notable landmarks. A second characteristic they call “mystery”—that one could acquire more information by venturing deeper into the scene and changing one’s vantage point. Such scenes include winding paths, meandering streams, and brightly lit areas partially obscured by some foliage.

Kaplan and Kaplan write (1989, p. 7) that these findings can stand apart from evolutionary theory in so far as the psychological affects for preferences for certain landscapes appear real—perhaps “as close to universals as one can find” (p. 150)—and do not require evolutionary theory to be accepted as valid phenomena. Yet, in recent years, S. Kaplan has increasingly recognized that the findings are not only consistent with evolutionary theory, but are partly explained by it. S. Kaplan (1992) writes, for example, that because trees and water support human survival, “selection pressures in this direction [to prefer trees and water] would hardly be surprising” (p. 587). Moreover, there is “reason to believe that selection pressures in early humans favored acquiring new information about one’s environment [Mystery] while not straying too far from the known [Legibility]” (p. 585).

Along similar lines, Orians and Heerwagen have explicitly drawn on evolutionary theory to frame their research hypotheses on landscape aesthetics.

They write: "What we are suggesting . . . is that people have a generalized bias toward savanna-like environments. If this bias does, indeed, exist, then people should react positively to savannas even in the absence of direct experience" (Orians & Heerwagen, 1992, p. 560). To investigate this issue, they conducted, for example, a cross-cultural study with subjects in the United States, Argentina, and Australia (see Orians and Heerwagen, 1992, for a preliminary report). Through a photo questionnaire, they asked subjects to rate the attractiveness of each of the trees shown in photographs. They found that the trees rated as most attractive by all three groups matched the prototypic savanna tree where canopies are moderately dense and trunks bifurcate near the ground. The trees rated as least attractive by all three groups had high trunks and skimpy or very dense canopies. In another study, Orians and Heerwagen (1992) analyzed the changes in landscape that were recommended by a well-known eighteenth century British landscape architect, Humphrey Repton. They hypothesized that if "humans have an intrinsic bias for particular kinds of landscapes and landscape elements, it should be possible to see this bias in the features and elements that are added to environments to enhance their appeal" (p. 19). Their results supported this hypothesis. Repton, for example, regularly added groups of trees to pastures; and not just any type of tree, but trees that, according to Orians and Heerwagen, resemble the prototypic trees of the savanna.

The savanna hypothesis was tested more directly in a developmental study by Balling and Falk (1982, and summarized by S. Kaplan, 1992, and Orians & Heerwagen, 1992). Subjects from the eastern United States were asked to rate five different biome stimuli, representing rain forest, mixed hardwood forest, boreal forest, East African savanna, and desert. Based on the savanna hypothesis, Balling and Falk hypothesized that the younger children (8- and 11-year-olds) would prefer the savanna over the other four biomes. In turn, because familiarity with an environment is a factor in environmental preference, and because increasing age would correspond to children's increasing familiarity with their surrounding hardwoods, it was also hypothesized that the older children would equally prefer the hardwood forests and savanna, and prefer both biomes over the other three. In support of the savanna hypothesis, this pattern of environmental preferences was found.

Taking a somewhat different tact on investigating environmental aesthetics, an unusual study was conducted in a psychiatric hospital in Sweden on the effects of the visual representation of nature. Based on records kept during a 15-year period, it was found that patients often complained of many of the paintings and prints that the psychiatric hospital displayed. Seven times over this 15-year period patients attacked a painting or print (e.g., tearing a picture from a wall and smashing the frame). Each time the painting or print substantially consisted of abstract art. In contrast, there was no recorded attack on wall art depicting nature (see Ulrich, 1993). These findings are consistent with a study by Ulrich (1993) where it was found that short-

term psychiatric patients responded favorably to wall art that involved nature (a rural landscape or a vase of flowers) but tended to react negatively to abstract painting and prints in which the content was either ambiguous or unintelligible.

Physiological and Psychological Well-Being in Response to Natural Landscapes

If through evolution certain natural landscapes have promoted human survival and reproductive success, then it may have come to pass that such landscapes nurture the human physiology and promote a sense of emotional well-being. Research also bears on this proposition. Findings from over 100 hundred studies, for example, have shown that stress reduction is one of the key perceived benefits of recreating in a wilderness area, especially in those settings that resemble the savanna (Ulrich, 1993).

Other studies have examined the relative effects of natural and urban settings to reduce stress. For example, in one study (Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991), 120 subjects were exposed to a stressful movie, and then to videotapes of either natural or urban settings. Data were collected not only by means of self-report, but through a battery of physiological measures that included heart period, muscle tension, skin conductance, and pulse transit time. Overall, findings showed greater stress recovery in response to the natural than urban settings.

Other studies conducted in prisons, dental offices, and hospitals point to similar effects. For example, E. O. Moore (1982; cited in Ulrich, 1993) found that prison inmates whose cells looked out onto nearby farmlands and forests needed less health-care services than inmates whose cells looked out onto the prison yard. In a dental clinic, Heerwagen (1990) presented patients with either a large mural depicting a spatially open natural landscape or no mural at all. Patient data included heart-rate measurements and affective self-ratings. Results suggest that patients felt less stressed on days when the mural was present. Others have studied the effects of displaying different ceiling-mounted pictures to presurgical patients who were lying on gurneys (Coss, 1990, summarized in Ulrich, 1993). Systolic blood pressure was measured in three different conditions. In one condition, a picture depicted a nature scene that included water; a second condition portrayed an "exciting" outdoor scene that involved a sailboarder leaning into the wind; a third condition involved no picture at all. Findings show that after a relatively brief period of exposure (3 to 6 min) presurgical patients had systolic blood pressure levels that were 10–15 points lower in the condition that involved the serene nature picture than in the other two conditions.

Studies conducted in other hospitals have shown related findings. In one fascinating study, for example, Ulrich (1984), examined the potential differences in the recovery of patients after gall bladder surgery depending on whether the patients were assigned to a room with a view of a natural setting

(a small stand of deciduous trees) or a view of a brown brick wall. Patients were paired on relevant variables that might effect recovery (e.g., age, sex, weight, tobacco use, and previous hospitalization). The results shows that “patients with the natural window view had shorter postoperative hospital stays, and far fewer negative comments in nurses’ notes (“patient is upset,” “needs much encouragement”) and they tended to have lower scores for minor postsurgical complications such as persistent headache or nausea requiring medication. Moreover, the wall-view patients required many more injections of potent painkillers, whereas the tree-view patients more frequently received weak oral analgesics such as acetaminophen” (Ulrich, 1993, p. 107).

In extending this research, Ulrich and Lunden (1990) randomly assigned 166 patients undergoing open-heart surgery with visual stimulation of two different types of nature pictures (either an open view with water or a moderately enclosed forest scene), an abstract picture, or a control condition consisting of either a white panel or no picture at all. Their findings suggest that the patients exposed during surgery to the picture of an open nature view with water experienced much less postoperative anxiety than the control groups and the groups exposed to the other types of pictures. This finding not only points to the effect of natural scenes in promoting recovery, but it is consistent with the savanna hypothesis, given the lack of recovery when patients were exposed to the enclosed forest picture.

In Kaplan and Kaplan’s (1989) reading of the literature of hundreds of studies, they conclude that the “immediate outcomes of contacts with nearby nature include enjoyment, relaxation, and lowered stress levels. In addition, the research results indicate that physical well-being is affected by such contacts. People with access to nearby-natural settings have been found to be healthier than other individuals. The longer-term, indirect impacts also include increased levels of satisfaction with one’s home, one’s job, and with life in general” (p. 173). Later, Kaplan and Kaplan (1989) write that as “psychologists we have heard but little about gardens, about foliage, about forests and farmland. . . . Perhaps this resource for enhancing health, happiness, and wholeness has been neglected long enough” (p. 198). “Viewed as an amenity,” Kaplan and Kaplan (1989) write, “nature may be readily replaced by some greater technological achievement. Viewed as an essential bond between humans and other living things, the natural environment has no substitutes” (p. 203).

Affiliation with Animals

If biophilia is understood as an affiliation with life and lifelike processes, then analyzing our relations to animals should provide data consistent with the biophilia hypothesis. Lawrence (1993) provides one such line of analysis in a lively essay titled “The Sacred Bee, the Filthy Pig, and the Bat Out of Hell: Animal Symbolism as Cognitive Biophilia.” She reasons that if hu-

mans have a deeply grounded affiliation with animals, then such affiliation should find pervasive expression in our language and cognition. Even cursory passes at our everyday language point to rich examples. We use “expressions like porker, hogwash, male chauvinist pig, gas hog, road hog, living high on the hog, happy as a pig in muck, going hog wild, piggish, and crying like a stuck pig. There are fascist pigs and Nazi pigs; prostitutes and policemen are called pigs” (p. 325). Claude Levi-Strauss says that animals are “good to think” as well as good to eat; Lawrence shows that this dictum holds true not only for primitive cultures but for complex modern societies.

Like with landscapes, perhaps even more so, it appears that human contact with animals promotes physiological health and emotional well-being. Consider, for example, the common aquariums that—at least in years past—inhabit waiting rooms in many dental offices. Does the conspicuous placement of these aquariums reflect but an arbitrary cultural convention? In a simple experiment, Katcher, Friedmann, Beck, & Lynch (1983) found that watching an aquarium resulted in significant decreases in blood pressure below the resting level in both hypertensive and normal subjects. In a more detailed experiment, Katcher, Segal, and Beck (1984) examined the influence of aquarium contemplation on patients about to undergo oral surgery. After the surgery, assessments of the patients’ comfort level during surgery were made by the oral surgeon (who was unaware of the nature of the pretreatment), an observer, and the patient. Results showed that aquarium contemplation was as effective as hypnosis in relaxing patients and in increasing their comfort level during surgery.

More generally, it has been found that experience with animals positively affects human welfare, especially for people who have organic or functional mental disorders (see Katcher & Wilkins, 1993 for a review). For example, hundreds of clinical reports show that when animals enter the lives of aged patients with chronic brain syndrome (which follows from either Alzheimer’s disease or arteriosclerosis) that the patients smile and laugh more, and become less hostile to their caretakers and more socially communicative. A number of studies show similar findings with autistic children. Through interactions with animals (such as a dog, cat, bird, dolphin, or even small turtle), it has been shown that autistic children have more focused attention, social interaction, positive emotion, and speech. Similar results have been found for people with various functional mental disorders. Moreover, according to Katcher and Wilkins (1993), “all the desirable responses to animals in therapeutic situations reflect the influence of interaction with companion animals within the general population” (pp. 180–181).

In response to this body of research, Shepard (1996) offers grudging acceptance:

Incarcerated incompetents, handicapped outpatients, plain folks who are just getting old, impoverished or stressed executives and their lonely children—all are happier

or live longer in the regular presence of friendly animals. There is also less suicide or aggression among the criminally insane, calming among the bereaved, quicker rehabilitation by alcoholics, improved self-esteem among the elderly, increased longevity by cardiac patients and cancer victims, improved emotional states among disturbed children, better morale of the blind or deaf, more cheer among the mental and physically handicapped, faster learning in the retarded, solace for the terminally ill, and general facilitation of social relationships. (p. 148)

There is a bite in Shepard's tone because, according to Shepard, domestic animals are also, in effect, "biological slaves who cringe and fawn or perform" as we wish (p. 151). Domestic animals "are not a glorious bonus on life; rather they are compensations for something desperately missing," "vestiges and fragments from a time of deep human respect for animals, whose abundance dazzled us in their many renditions of life" (p. 151). Shepard, like Lawrence, believes that wild "animals were among the first objects of classificatory thinking" (p. 97), and that "the human species emerged enacting, dreaming, and thinking [wild] animals and cannot be fully itself without them" (p. 4). Thus, according to Shepard (1993), toward understanding biophilia, the human affiliation with animals needs to be investigated in not only its domestic but also its wild forms.

Valuing Nature

Another important line of research that bears on the biophilia hypothesis emerges from Kellert's investigations of people's attitudes and values of nature. From over 20 years of research, Kellert (e.g., 1980, 1983, 1985, 1991, 1993, 1996a) has refined a typology of nine values, which he suggests "reflect a range of physical, emotional, and intellectual expressions of the biophilic tendency to associate with nature" (Kellert, 1996a, p. 26).

While it is difficult to capture briefly the substance of these nine values, definitions provide a starting point. (See Kellert, 1996a, for his book-length discussion of each value and its place in a larger account of the value of life.) (1) The *utilitarian value* emphasizes the material benefit that humans derive from exploiting nature to satisfy various human needs and desires. (2) The *negativistic value* emphasizes feelings of aversion, fear, and dislike that humans have for nature. (3) The *dominionistic value* emphasizes the desire to subdue and control nature. (4) The *naturalistic value* emphasizes the many satisfactions people obtain from the direct experience of nature and wildlife. (5) The *ecologicistic-scientific value* emphasizes the systematic study of the biophysical patterns, structures, and function of nature. (6) The *aesthetic value* emphasizes a primarily emotional response of intense pleasure at the physical beauty of nature. (7) The *symbolic value* emphasizes the tendency for humans to use nature for communication and thought. (8) The *humanistic value* emphasizes the capacity for humans to care for and become intimate with animals. Finally, (9) the *moralistic value* emphasizes the right and wrong conduct toward the nonhuman world.

Based on this typology, Kellert investigated a wide range of differences in values toward nature by age, culture, education, income, ethnicity, gender, and place of residence (urban/rural). Two of these variables are particularly germane to this paper: age and culture. In terms of age trends, Kellert (1996a) says "that children under six years of age were found to be egocentric, domineering, and self-serving in their values of animals and nature, a tendency reflected in especially high utilitarian and dominionistic scores" (p. 47). This young age group also revealed little recognition or appreciation of the autonomous feelings and independence of animals, and expressed the greatest fear of the natural world and indifference toward all but a few familiar creatures. Between the ages of 6 and 9, Kellert found that children became more aware of animals as possessing interests and feelings unrelated to themselves, and that animals might suffer pain and distress. Between the ages of 9 and 12, Kellert found the most dramatic increase in children's factual understanding and knowledge of animals and the natural world. Finally, between the ages of 13 and 17, Kellert found a sharp increase in ecologicistic and moralistic values. For example, adolescents became acutely concerned with conservation and treating other creatures with moral consideration.

In terms of culture, Kellert (1996a) considers whether perspectives of the natural world constitute relative expressions of the human condition, or whether there are "only a limited number of ways people can value the living world in a healthy, functional, and sustainable manner?" (p. 132). Toward investigating this issue, Kellert embarked on a series of cross-cultural studies. In his research in Japan, for example, Kellert found that in comparison to American populations, the Japanese scored high on a dominionistic value of nature and wildlife. That is, as a whole the Japanese often sought to manipulate and control nature, and to cultivate preferred natural elements. Thus, traditional Japanese "nature appreciation activities—bonsai, haiku, flower arranging, the tea ceremony, rock gardening—reflect a refined appreciation of nature, even at times its veneration, but also a belief that wildness requires the creative hand and eye of humans to achieve its perfection" (Kellert, 1996a, p. 139). Not surprisingly, Kellert found a lack of interest in Japan in wild nature and ecological processes, and limited support for wildlife conservation and protection. In another contrast to the Japanese, Germans demonstrated more pronounced moralistic and ecologicistic values, and a greater willingness to subordinate practical needs to maintain pristine nature and protect wildlife. Germans also appeared to romanticize wild nature, stressing its ennobling qualities while having few direct experiences with it, mostly in recreational settings. In short, cross-cultural variability emerged in values of nature and its conservation. "This variability appears to be more a matter of degree, however, than any fundamental difference in each nation's basic perspectives of the living world" (Kellert, 1996a, p. 145).

Kellert's characterization of these nine values has led to a rich analysis of the human affiliation with nature: biophilia, broadly construed. In recent

years, Kellert has also developed the biologically adaptive underpinnings of these values. Insofar as this latter account is successful, it further supports the evolutionary component of the biophilia hypothesis. For example, Kellert suggests that in earlier times many utilitarian activities (e.g., the ability to identify and pick edible berries) provided an unequivocal adaptive advantage by increasing the likelihood of survival (e.g., by increasing nutritional intake). Similarly, the negativistic value presumably helps keep humans a safe distance from dangerous parts of nature, such as poisonous snakes and spiders, large predators, and precipices. The aesthetic attraction to varying species and landscapes may reflect, as Orians and others have suggested, “a recognition of the increased likelihood of finding food, safety, and security in nature” (Kellert, 1996a, p. 17). Naturalistic experiences often reduce stress, sharpen sensitivity to detail, enhance creativity, provide intellectual stimulation and physical fitness, and so on. Even the moralistic value, according to Kellert, may provide adaptive advantage by fostering certain forms of kinship, loyalty, and cooperation.

In Kellert’s account, while evolutionary biology has an important place, it should not be construed as rigid or deterministic, but rather as setting loose parameters in human lives. As Kellert writes: “Although the values of living diversity have been depicted as biological tendencies, experience and culture, as noted, exert a profound influence on their content, direction, and intensity” (p. 37). It is this working of biology, experience, and culture, coupled with his sustained empirical research program, which has led Kellert to eloquent indictments of modern times. “People can survive the extirpation of many life forms,” Kellert (1996a) writes, “just as they may endure polluted water, fouled air, and contaminated soils. But will this impoverished condition permit people to prosper physically, emotionally, intellectually, and spiritually?” (p. 32). According to Kellert, we destroy nature at our peril, and deceive ourselves in the process: “[N]o society can retain for long its economic or cultural prosperity if it is built upon a despoiled natural world . . . We must dispel the great fallacy of the modern age that human society no longer requires varied and satisfying connections with the nonhuman world” (pp. 216–217).

“Native” Biophilia in Native Peoples

Many people besides Kellert have argued that the modern world has substantially lost diverse and satisfying connections with nature (to name but a few, Abram, 1996; Berry, 1977; Leopold, 1970; Muir, 1976; Mumford, 1970; Nabhan and Trimble, 1994; Roszak, 1993; Shepard, 1996; and Strong, 1995). Based on this assumption, it is reasonable that many have looked to native peoples as a means to understand if not rekindle that connection. This line of reasoning has its parallel in terms of the biophilia hypothesis and can be set up in the following way: “It’s all well and interesting to study biophilia in modern times, but don’t you know that many native people never had to

study biophilia because they lived it; their lives were deeply connected to nature, their affiliations pervasive across most if not all aspects of their lives. Thus, if you want to study biophilia in any complete sense, study the ‘native’ biophilia of native peoples.’”

One of the most sensitive inquiries of this kind has been developed by Nelson (1983, 1989, 1993) in his extensive study of the Koyukon in Northern Alaska. As partial support for the ways in which the Koyukon affiliate with nature, Nelson points to these people’s detailed, extensive, and accurate knowledge of their natural environment. Volumes could be written based entirely on Eskimo knowledge, according to Nelson (1993, p. 208), about the behavior, ecology, and utilization of arctic animals, including polar bear, walrus, bowhead whale, beluga, bearded seal, ringed seal, caribou, musk, and ox. Indeed, Nelson suggests that “the expert Inupiaq hunter possesses as much knowledge as a highly trained scientist in our own society, although the information may be of a different sort” (p. 208).

The Koyukon not only have knowledge about animals but appear to learn from them and cooperate with one another for mutual advantage. Eskimo methods for hunting seals, for example, are essentially identical to those for hunting polar bears. Nelson wonders whether this is a case of independent invention, or even convergent evolution, or whether—as I suspect Nelson believes—“Eskimos learned the techniques by watching polar bears, who had perfected an adaptation to the sea ice environment long before humans arrived in the arctic” (Nelson, 1993, p. 210). Or consider another example: The raven is often considered to bring luck if sighted during a hunt and has been known to lead hunters to their prey. Coincidences? Folklore? Nelson (1989) asks:

Does the raven really care about things, does he really know, does he move with the power Koyukon elders hold in such great regard? . . . if the raven has power, does he recognize it himself and use it consciously? Koyukon hunters say he does. If the raven brings you luck it’s to serve himself, because he will eat whatever you leave for him from the kill. (p. 25)

Thus, the Koyukon appear to enter with animals into something like a symbiotic relationship.

Such affiliations with animals are woven into the moral and religious fabric of Koyukon life. According to Koyukon elders, no animal should be considered inferior or insignificant. Each deserves respect (Nelson, 1989, pp. 23, 160). Nelson (1993) records that a “Koyukon woman described praying to a raven when she was desperately sick, then explained: ‘It’s just like talking to God; that’s why we pray to ravens’ ” (p. 214). And Nelson (1989) comes to recognize that when Koyukon speak to the Raven, they draw on emotions as elemental as devout Christians feel when they pray to God” (pp. 242–243).

According to Koyukon teachers, all are part of a living community. It is

a community that includes not only humans and animals, and not only plants, but mountains, rivers, lakes, storms—the earth itself. Nelson (1989) writes:

According to Koyukon teachers, the tree I lean against feels me, hears what I say about it, and engages me in a moral reciprocity based on responsible use. In their tradition, the forest is both a provider and a community of spiritually empowered beings. There is no emptiness in the forest, no unwatched solitude, no wilderness where a person moves outside moral judgment and law. (p. 13)

Thus, according to Nelson, the Koyukon worldview expands the very meaning of biophilia. It “carries us beyond the idea that humans have a tendency to affiliate with other life . . . to the possibility that our fellow creatures also have a tendency to affiliate with you” (Nelson, 1993, pp. 214–215).

Nelson is trained as a Western anthropologist and is all too aware of the skepticism that greets his research. Yet he persists. He argues that for 99% of our history human beings lived exclusively as hunter-gatherers. On a relative time scale, agricultural societies have existed only briefly, urban societies even more briefly.

From this perspective, much of the human lifeway over the past several million years lies beyond the grasp of urbanized Western peoples. And if we hope to understand what is fundamental to that lifeway, we must look to traditions far different from our own . . . Probably no society has been so deeply alienated as ours from the community of nature, has viewed the natural world from a greater distance of mind, has lapsed to a murkier comprehension of its connections with the sustaining environment. Because of this, we are greatly disadvantaged in our efforts to understand the basic human affinity for nonhuman life. Here again, I believe it's essential that we learn from traditional societies, especially those in which most people experience daily and intimate contact with land. . . . (1993, pp. 202–203)

THE BIOPHILIA HYPOTHESIS: CONCEPTUAL DIFFICULTIES, EMPIRICAL WEAKNESSES

In the previous section, I sought to amplify what is meant by biophilia and to make the hypothesis compelling. Thus, I reviewed a wide range of literature. No single line of evidence is meant to stand alone. But taken together, the research is reasonably impressive, especially because none was conducted under the rubric of the biophilia hypothesis.

The research suggests, for example, that people often prefer natural environments more than built environments, and built environments with water, trees, and other vegetation more than built environments without such features. These preferences may fit patterns laid down deep in human history on the savannas of East Africa. Experience with or even a visual representation of such landscapes, or key features of landscape, appears to work powerfully within the human physiological and psychological systems. It appears that even minimal experiences with nature can reduce immediate and long-term stress, reduce sickness of prisoners, calm patients before and during

surgery, and promote healing after surgery. Direct contact with animals has been shown to greatly benefit a wide range of clinical patients: from adults with Alzheimer's disease to autistic children. Animal images and metaphors appear woven into the fabric of the English language, if not the human mind. Moreover, if native peoples offer us a way to understand what is most basic to our being, then the evidence from the Koyukon of Northern Alaska speak to pervasive affiliations with nature that run deep in our evolutionary history.

No wonder, then, that Wilson (1984) points out that real estate prices are comparatively high for bluff-top land that overlooks bodies of water (lakes, rivers, oceans). If cost is commensurate with desirability, such a finding follows from a biophilic account of aesthetics and habitat selection. Or no wonder, as Wilson notes, that in North America each year more people visit zoos than all sporting events combined. And it would appear far more than just a cultural convention that flowers are often sent to sick people in a hospital. The need and propensity to affiliate with nature appears great.

But biophilia remains largely at this point a conjecture, a hypothesis, one with problems, conceptually and empirically. And if biophilia has the potential to provide a framework for a full-bodied interdisciplinary research agenda on understanding the human relationship with nature, then at this point a critical perspective needs to be brought to bear. In this section I do so by focusing on three overarching concerns.

Biophilia and Genetic Determinism

One of the fundamental concerns that has been voiced about the biophilia hypothesis centers on the extent to which biophilia is genetically shaped, if not determined. In a review, for example, in *Science* of Kellert and Wilson's (1993) edited book *The Biophilia Hypothesis*, Fischer (1994) opens by saying that "Wilson and his colleagues have identified yet another human behavior they suspect is governed by genes—nature appreciation" (p. 1161). According to Fischer, to the extent the biophilia hypothesis embodies a genetic determinism, the hypothesis is deeply flawed; to the extent it does not, the hypothesis is "largely hollow" (p. 1161). Most critiques of this sort follow on the heels of a more general critique of sociobiology. Thus, it will be useful if we first attend to this broader literature.

The sociobiological program is often said to have been launched with the publication of Wilson's (1975) *Sociobiology: The New Synthesis*. In this book, Wilson argues that our complex behavioral responses are little more than genetically programmed behaviors to maximize genetic fitness. This perspective can be well illustrated by sketching the answer to what Wilson and others call "the problem of altruism." The problem is this. If it is true that people act so as to increase their reproductive fitness, how can altruistic behavior be explained, because it seemingly reflects behavior that decreases an individual's reproductive fitness for the sake of others. Sociobiologists have suggested two types of answers: reciprocal altruism and kin selection.

Roughly stated, Trivers (1971) has proposed that often when we help others we do so because at some point we ourselves may be in need of help. In other words, because of reciprocal altruism a certain amount of helping behavior is in fact in our best interest. Other times we also help genetically related family members because they share common genes, and to help them is to increase the reproductive success of our common gene pool. "This enhancement of kin-network welfare in the midst of a population is called kin selection" (Wilson, 1975, p. 116; cf. Hamilton, 1964).

Accordingly, Wilson (1975) says that it may well be "that the time has come for ethics to be removed temporarily from the hands of the philosophers and biologized" (p. 287). Elsewhere, Wilson says that "[m]orality, or more strictly our belief in morality, is merely an adaptation put in place to further our reproductive ends. . . . In an important sense, ethics as we understand it is an illusion fobbed off on us by our genes to get us to cooperate" (Ruse & Wilson, 1985, pp. 51–52). In other words, we have been genetically programmed to think and feel as if we freely make ethical choice; but such thoughts and feelings are epiphenomenal in that they play no authentic causal explanation for our behavior.

Moving beyond ethics, Wilson boldly concludes his 1975 treatise by saying that in the final analysis psychology, sociology, and the other human sciences will be reducible to neurobiological processes: "Cognition will be translated into circuitry. Learning and creativeness will be defined as the alteration of specific portion of the cognitive machinery. . . . To maintain the species indefinitely we are compelled to drive toward total knowledge, right down to the levels of the neuron and gene" (p. 575). According to Wilson, when "we have progressed enough to explain ourselves in these mechanistic terms," the result—"a world divested of illusions"—might be hard to accept, but true (p. 575).

Wilson anticipated rightly. Such a result has been hard for many people to accept. Over the last 2 decades, at least two approaches toward critiquing sociobiology have emerged.

Through one approach, critics have gone after the sociobiological program directly and taken it to task for substantive flaws in its methods, science, logic, and use of evidence. Consider a common method that sociobiologists employ to build their theory. Some pattern of behavior in animal species is found that appears similar to what people do. Then both pieces of behavior are named the same thing. Then evidence is acquired for the existence in animals of a genetic predisposition to the behavior, and then sociobiologists announce the general result that there is genetic basis for this type of behavior in humans (see Kitcher, 1985, p. 185).

In the literature, for example, sociobiologists have used "rape" to describe not only human behavior, but the behavior of scorpions, flies, and ducks. Barash (1979), for example, says that among ducks "sometimes strange males surprise a mated female and attempt to force an immediate

copulation, without engaging in any of the normal courtship ritual and despite her obvious and vigorous protest. If that's not rape, it is certainly very much like it" (quoted in Kitcher, 1985, p. 185). Barash then suggests that through "rape" male ducks might maximize their genetic fitness and that perhaps "human rapists, in their own criminally misguided way, are similarly doing the best they can to maximize their fitness" (quoted in Kitcher, 1985, p. 186).

The problem is that an enormous and often unsubstantiated jump occurs in moving from animals to humans. In a counterargument, for example, Kitcher (1985) suggests that rape has complicated social and not just genetic origins that involve prevalent social conceptions of the role of female and male status. Applying the term rape to certain instances of copulation among ducks is to misunderstand the distinctly human origins of rape and to trivialize such explanations. Moreover, even on genetic grounds Kitcher calls into question whether male hominids would increase their genetic fitness through rape. After all, rapists are frequently attacked or punished, and accordingly there should be a decrease in their reproductive success. In addition, rapes frequently take place on humans who cannot conceive (e.g., children, women past the age of menopause, and members of the same sex). "Of course," Kitcher writes, "sociobiologists could contend that such behavior is a by-product of mechanisms that were selected under different conditions" (p. 187). But Kitcher remains unconvinced in that such "special pleading takes cover in our ignorance of the hominid social environment, in an effort to accommodate troublesome facts that are all too obvious" (p. 187). Many others have similarly been concerned with the sociobiological bent to tell "just so" stories—post hoc accounts without enough specificity to rule out competing and seemingly more compelling explanations (Diamond, 1993; Katcher & Wilkins, 1993; Fischer, 1994).

While one approach seeks to critique the sociobiological program directly, another approach seeks to reinstate the primacy of nonbiological constructs. For example, imagine three situations where a fellow named Bob goes for a walk in the woods. In situation 1, a boulder above Bob is dislodged by an earth tremor; it falls on Bob and kills him. As unfortunate as this situation is for Bob, we would not normally say that the boulder acted immorally. In situation 2, a lion on the hunt pounces from out of the woods and kills Bob (and feeds her family on him). Again, from Bob's standpoint this situation is most unfortunate; but we would not normally say that the lion acted immorally, even though the lion is a biological animal. Finally, in situation 3, a bandit jumps out of the woods and kills Bob in the process of robbing him. It is only in this last situation that we normally would say something unethical or immoral has occurred.

Why do we say this? Presumably because we believe that ethics is something distinctly human and that an account of our ethical judgment extends

beyond our biological base as an animal. Granted, there may be no way ultimately to prove such an account, in the same way there may be no way to prove that you, the reader, are not actually at this moment a brain in a vat being stimulated by electrical currents. But the phenomenological experience of our lives speaks against the latter position, as does the phenomenological experience of our ethical judgments speak against the reduction of ethics to biology. Thus, in critiquing sociobiology this other approach seeks to reinstate the primacy of such central human constructs as altruism, morality, free will, and human agency—to reinstate them in the sense that such constructs play authentic causal roles in human lives.

Concerns like these just begin to touch on the enormous quantity of critical literature on sociobiology. It is this literature that will increasingly bear down, justifiably so, on the biophilia hypothesis if the hypothesis is conceived in stringent biological terms. Yet it is not clear that Wilson or his colleagues do so. For example, in an unpublished response to Fischer's (1994) critique of biophilia noted above, Kellert (1994) argues strongly that Fischer has "oversimplified and exaggerated the biological determinism articulated" in the book.

Kellert's point is well taken, for Wilson at times seems to recognize the paramount importance of learning, cognition, and culture in explaining human nature. For example, Wilson (1993) says that biophilic behavior, "like other patterns of complex behavior, is likely to be mediated by rules of prepared and counterprepared learning," and that the multiple strands of the biophilic emotional response "are woven into symbols composing a large part of culture" (p. 31). Furthermore, just consider the diverse range of contributions that Kellert and Wilson solicited for their edited volume on the biophilia hypothesis. Many of the contributions focused on the religion and practices of native peoples (Diamond, 1993; Gadgil, 1993; Nelson, 1993; Nabhan & St. Antoine, 1993), myths (Shepard, 1993), language symbolism (Lawrence, 1993), cognitive processing (Ulrich, 1993), and environmental philosophy (Rolston, 1993). Hardly a reductionist collection. Moreover, Wilson writes—often eloquently—of seemingly irreducible qualities of human life; that is, qualities largely unleashed from their biological components. For example, Wilson (1992) writes that an "enduring environmental ethic will aim to preserve not only the health and freedom of our species, but access to the world in which the human spirit was born" (p. 351). Before that he writes that we "do not understand ourselves yet and descend farther from heaven's air if we forget how much the natural world means to us. Signals abound that the loss of life's diversity endangers not just the body but the spirit" (p. 351). Elsewhere, Wilson (1984) writes that "our spirit is woven from it [biophilia], hope rises on its currents" (p. 1). Freedom, spirit, heaven's air, and hope rising on biophilic currents. These are not human constructs easily understood in terms of a genetic biological determinism.

At the same time, what are we to make of other parts of Wilson's even recent writings? In one of his books Wilson (1993) asks how biophilia could have evolved. He answers that the

likely answer is biocultural evolution, during which culture was elaborated under the influence of hereditary learning propensities while the genes prescribing the propensities were spread by natural selection in a cultural context . . . a certain genotype makes a behavioral response more likely, the response enhances survival and reproductive fitness, the genotype consequently spreads through the population, and the behavioral response grows more frequent. (pp. 32–33)

This explanation embodies the hard biological stance of the early sociobiological program: Genes that lead to behaviors that enhance survival tend to reproduce themselves (because they are in bodies that procreate more rather than less), and thus these genes and correlative behaviors grow more frequent. In this sense, human behavior (including biophilic behavior) is orchestrated if not directed and determined by genes.

Thus, in different places, Wilson offers differing accounts of biophilia and its genetic basis. But, be that as it may, the more important issue is this: If biophilia is understood in stringent biological terms, it will increasingly run up against the opus of formidable critiques that have been extensively leveled against the sociobiological program, especially the program in its early forms. And there is no need for biophilia to be understood in this way. Rather, there are softer biological accounts of biophilia, and they need not be "largely hollow."

Biophilia and Biophobia: A Contradiction?

Poisonous snakes and spiders often frighten people. So do grizzly bears, mountain lions, and other large predators. Mosquitoes are nuisances, at best. Bogs and swamps can seem unappealing, precipices scary, dark woods forbidding. Thus, as S. Kaplan (1995) says in his review of Kellert and Wilson's (1993) edited volume on biophilia: while "there does appear to be evidence for special feelings" for nature, "some are negative rather than positive" (p. 801). What then becomes of biophilia that, as a word, connotes only the positive? Do negative affiliations with nature contradict the biophilia hypothesis? Such questions lead S. Kaplan to write that it "is hard to shake the feeling that more wishful thinking is going on [with the biophilia hypothesis] than is healthy in competent scholars confronting a difficult problem" (p. 801).

One response has been to separate biophilia (a positive affiliation with nature) from what becomes called "biophobia" (a negative affiliation with nature). Orr (1993), for example, says that biophobia "ranges from discomfort in 'natural' places to active scorn for whatever is not man-made, man-aged, or air-conditioned . . . [It is the] urge to affiliate with technology, human artifacts, and solely with human interests regarding the natural

world'' (p. 416). Elsewhere, Orr says that in the same way that love stands in contrast to hate, and life to death, so must we choose biophilia over biophobia. Biophobia ''is not OK because it is the foundation for a politics of domination and exploitation'' (p. 420). Thus, by this separation, Orr is able to speak of both positive and negative affiliations with nature, and to value each differently.

Ulrich (1993) similarly contrasts biophilia and biophobia, but he does so in order to try to provide a clean empirical method for their investigation. Ulrich, for example, reports on numerous conditioning and counterconditioning experiments using biophobic stimuli (e.g., pictures of snakes, spiders, heights, closed spaces, and blood). The research suggests that ''humans are biologically prepared to acquire and especially to not 'forget' adaptive biophobic (fear/avoidance) responses to certain natural stimuli and situations. . . . Moreover, recent findings suggest that processing of biologically prepared fear-relevant natural stimuli can be very fast and may often occur automatically or 'unconsciously' '' (p. 85). In his article, Ulrich provides a remarkable synthesis of hundreds of studies on negative affiliations with certain aspects of nature (biophobia) and he contrasts those studies with emerging research (summarized earlier) on positive affiliations with nature (biophilia).

Interestingly, however, Wilson himself sets up a different relation between biophilia and biophobia. Recall that Wilson defines biophilia as an *affiliation* with life and lifelike processes. In this framing of biophilia, people have both positive and negative affiliations with life. These complex feelings ''fall along several emotional spectra: from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety'' (Wilson 1993, p. 31). Thus, according to Wilson, biophilia says something about the sense of integration of life-affirming and life-disaffirming propensities.

Now, if we take seriously that biophilia subsumes both life-affirming and life-disaffirming propensities, a puzzle arises. How can we know which actions are part of the resulting conservation ethic? Consider, for example, a vivid anecdote that Diamond (1993) provides of his experiences with native peoples in New Guinea:

I found men intentionally inflicting pain on captured live bats for no other reason than amusement at the reactions of the tortured animals. The men had tied twenty-six small *Syconycteris* blossom bats to strings. They lowered one bat after another until it touched the red-hot embers of a fire, causing the bat to writhe and squeal in pain. The men raised the bat, lowered it again for another touch to the red-hot embers, repeated this process until it was dead, and then went on to the next bat, finding the whole proceedings funny. (pp. 263–264)

Can one torture animals and say that through disaffirming that animal's life one is biophilic? Why not? Presumably it is this sort of problem that led Orr to separate biophilia from biophobia and argue for the ethical superiority of the former. Or consider a situation that might appear justifiable on evolution-

ary grounds; namely, logging the virgin timber in the Amazon rain forests. After all, as Ulrich (1993) notes, the Amazon forests are associated with greater risks than the African savannas because of the rain forest's "higher levels of biophobic properties, including spatial enclosure and higher probabilities of encountering close hidden threats, including snakes, spiders, and other fear-relevant stimuli" (p. 118). Thus, it would "naturally" follow that humans would want largely to clear-cut the dense forests and recreate them into savanna-like settings. Does such a biological account justify the current deforestation of the Amazon?

I assume Wilson has answers, and they would go something like this: Because certain life-affirming actions (perhaps feeding one's dog) and life-disaffirming actions (perhaps shooting a rabid animal) can promote our genetic fitness, whenever we seek to determine which actions to pursue, all we need to determine is which actions do so. Thus, for example, swatting mosquitoes may promote our genetic fitness, torturing bats may not; sustainable logging might, clear-cutting rain forests may not; and so on. This is what I take Wilson (1984) to mean when he says that the "only way to make a conservation ethic work is to ground it in ultimately selfish reasoning—but the premises must be of a new and more potent kind" (p. 131). To this point, the sophistication of Wilson's theorizing illuminates in the sense that we are better positioned to understand and investigate the complex psychological coordinations of seemingly disparate reactions to nature ("from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety").

But Wilson's account also reduces biophilia to the selfish gene and thus becomes weakened by various forms of the counterarguments to the early sociobiological program sketched in the previous section. Namely, a problem arises in trying to use biophilia as a biological proposition to justify biophilia as a normative or moral proposition. To do so is to commit the naturalistic fallacy (cf. Hume, 1751/1983; Moore, G. E., 1903/1978): to reason that an account of what "is" necessarily leads to an "ought," that natural forms necessarily make the moral. To underscore this problem, consider Wilson's position on aggression. According to Wilson (1978), "primitive warfare evolved by selective retention of traits that increase the inclusive genetic fitness of human beings" (p. 112). At some point in human warfare, aggression is counterproductive, according to Wilson; that is, the energy expended and the risk of injury and death outweigh the energy saved and the increase in survival and reproduction. But until that point—at which aggression no longer confers genetic advantage—a good deal of blood-filled battles can be fought, women raped, children killed, with "moral" sanction. The word moral is in quotation marks because Wilson, in effect, suggests that if an action confers genetic advantage it is moral, which appears to trivialize the term. For biophilia to have moral standing it needs a theoretical foundation that extends beyond its genetic base.

Mediated Biophilia

If biophilia only involved genetic explanations, then the conceptual difficulties and disconfirming evidence would be, in my estimation, insurmountable. Of course, Wilson (usually), Kellert, and others would agree. As noted earlier, Kellert counters the critic who goes after a hard-wired, deterministic conception of biophilia by responding that that conception is a straw man and not at all what is meant by biophilia. Fair enough. But what happens with biophilia in this biologically weaker form?—what I will refer to as “mediated” biophilia—where, in Kellert’s (1996a) words, “experience and culture . . . exert a profound influence on [the] content, direction, and intensity” of “biological tendencies” (p. 37). How well does mediated biophilia withstand scrutiny? I consider five critiques.

(1) *Biophilic symbolism.* One line of evidence for the biophilia hypothesis reviewed earlier is that animals (and more broadly nature) find pervasive expression in our language and cognition. Indeed, some proponents of biophilia suggest that the

human need for metaphorical expression finds its greatest fulfillment through reference to the animal kingdom. No other realm affords such vivid expression of symbolic concepts. The more vehement their feelings, the more surely do people articulate them in animal terms, demonstrating the strong propensity that may be described as cognitive biophilia. Indeed, it is remarkable to contemplate the paucity of other categories for conceptual frames of reference, so preeminent, widespread, and enduring is the habit of symbolizing in terms of animals (Lawrence, 1993, p. 301).

In other words, not only is it proposed that animals (and nature) have an important role in human language and cognition, but that “no other realm affords such vivid expression of symbolic concepts.” Is Lawrence correct?

Consider but one counterexample developed by Lakoff (1987) that involves concepts of lust. This example seems particularly relevant because according to adaptive evolutionary theorists humans should and do think a lot about sex, including lust (Buss, 1992; Ellis, 1992; Wilson, 1978). Thus, if Lawrence is correct, concepts of lust should find expression through animal imagery. And they do. Lakoff (1987, pp. 409–411, in collaboration here with Zoltan Kovecses) notes some of the following expressions: “Don’t touch me, you animal!” “He’s a wolf.” “Stop pawing me!” “Hello, my little chickadee.” “You bring out the beast in me.” “He preys upon unsuspecting women.” “Wanna nuzzle up close?” “She’s a tigress in bed.”

But, as Lakoff demonstrates, the concept of lust also finds rich expression through nonanimal metaphors. *Lust is heat*: “I’ve got the hots for her.” “She’s an old flame.” “Hey, baby, light my fire.” “She’s frigid.” “She’s hot stuff.” “Don’t be cold to me.” “I’m burning with desire.” *Lust is insanity*: “I’m crazy about her.” “I’m madly in love with him.” “You’re driving me insane.” “He’s a real sex maniac.” “She’s sex-crazed.” *Lust is a game*: “I think I’m going to score tonight.” “I struck out last night.” “She

wouldn't play ball." *Lust is a machine*: "You turn me on." "I got my motor runnin', baby." "Don't leave me idling." *Lust is a force*: "I was knocked off my feet." "When she grows up, she'll be a knockout." "She bowled me over." "She sparked my interest." "I could feel the electricity between us." And so on.

This game (if I can use that metaphor) of trading metaphors to speak for or against the biophilia hypothesis could go on for some time. Critics might more productively offer an alternative theory that subsumes animal symbolism, as Lakoff does. In Lakoff's (1987) account, thought "is embodied, that is, the structures used to put together our conceptual systems grow out of bodily experience and make sense in terms of it; moreover, the core of our conceptual systems is directly grounded in perception, body movement, and experience of a physical and social character" (p. xiv). Thus, it would follow in Lakoff's view that human symbolism involves animals because they (animals), along with so many other things—body parts, colors, emotions, and the enormous range of human artifacts, for example—are part of the human experience. If Lakoff's account of categorization is even roughly correct, it calls into question Lawrence's (1993) assertion that no other realm besides animals "affords such vivid expression of symbolic concepts" (p. 301). Accordingly, such support for mediated biophilia is weakened.

A biophilia rejoinder. The response here seems relatively simple and, in my view, correct: Lawrence just goes too far. That is, I assume a great deal more evidence than I have reviewed here—indeed overwhelming evidence—could be marshaled to show that animals (and nature) have an important place in human language and cognition. That is the key proposition. This proposition does not preclude the importance of other categories. Indeed, in this framing of the biophilia hypothesis, Lakoff's work could potentially be used to help ground what Lawrence calls "cognitive biophilia." Granted, Lakoff subsumes concepts of animals within a larger framework that posits structuring categories of the mind. But because such cognition according to Lakoff is embodied—literally, as in a biological organism—it would appear only a modest stretch to evolutionary theory in general, and the biophilia hypothesis in particular.

(2) *The attraction of the "unnatural."* Another critique follows on the heels of the previous one and can be set up in the following way: Even if we grant that people have an affinity for nature, it would seem equally clear that people have an affinity for human artifacts (Partridge, 1996; Rothenberg, 1993). People enjoy looking at cityscapes from a distance: of Manhattan, Paris, and San Francisco. People enjoy visiting specific buildings: the Eiffel Tower or Lincoln Memorial. People (or should I say usually men) can spend lavish amounts of money buying cars, polishing them, and looking at them. People go to great efforts to learn musical instruments and to perform for appreciative audiences. People paint, sculpt, and write novels. People spend

hours each day watching television or within the World Wide Web, garnering information, computer chatting, playing games.

The point is this: If people have an affiliation with nature and nonnature, then the very construct of biophilia becomes increasingly difficult to understand in a meaningful way. More so, because according to Wilson, biophilia can include negative affiliations: aversions to snakes, spiders, precipices, stagnant water, dark caves. Similarly, it could be said that humans have aversions to standing in front of moving cars, guns, and certain other human artifacts. Thus, the critic might say, the biophilia hypothesis reduces to the following proposition: People affiliate sometimes positively, negatively, and/or neutrally with things natural and human-made, outside of their own bodies, and including their own bodies. In turn, the critic might argue, such a proposition becomes almost a tautology, and says virtually nothing meaningful about the human condition.

A biophilia rejoinder. Consider the proposition that humans affiliate with members of the opposite sex. This proposition seems patently true. Yet, presumably there is a tremendous amount to say about such affiliations. Presumably a man can love a woman, or hate her, or maybe even both at the same time, and vice versa. Maybe the way men affiliate with women is somewhat different than the way women affiliate with men. Presumably the nature of such affiliations has a tremendous range of expressions (trust, intimacy, passion, flirtation, tenderness) in a vast array of different relationships (between new friends, old friends, lovers, in-laws, co-workers). Maybe such affiliations have an evolutionary basis. Maybe such affiliations are mediated by culture, context, and experience. My point is that there are a lot of important questions that involve understanding the nature of the human affiliation between members of the opposite sex. Those questions are not trivialized by showing the range or complexity of the affiliations, or by showing that such affiliations occur alongside (or are integrated with) other sorts of affiliations (e.g., that a woman might choose to live with a man and a cat). Rather, the affiliations need to be characterized and explained.

The same with biophilia. To say that people affiliate with nature is not to say that people only affiliate with nature. This rejoinder parallels the previous one. Moreover, it could be said that people often find human-made artifacts more appealing when the artifacts are portrayed, encompassed, or used in a natural setting. To take but one example, while it is true that some people can spend lavish amounts of money buying cars, think of the diverse range of natural settings employed by car advertisers (Armstrong, 1996): the Jeep Wrangler alone on a bluff top in the southwest deserts of the United States; the Cadillac Seville passing through pastoral farmland—a horse lopes up to the car; the Toyota Tacoma on the beach, on the edge of sand and water. Again and again, advertisers use nature to sell human artifacts. Such an observation does not trivialize the human affiliation with nature, but speaks for

it, however it is to be understood. Accordingly, proponents of biophilia will say that what is needed are rich, textured characterizations of, and then explanations for, the human affiliation with nature, and then to integrate those accounts into a wider analysis of culture and human development.

(3) *The savannah hypothesis.* The critic might agree with at least some of the research reviewed earlier that provides tentative support for the savanna hypothesis—that our affiliations with landscapes fit patterns laid down deep in human history, on the savannas of East Africa. The same critic, however, might also point to what appears to be a great deal of disconfirming evidence. What of people who travel great distances to spend time, not on savanna-like bluff tops, but on tropical beaches? In snow-covered alpine resorts? In the rain forests of Costa Rica or Brazil? People spend sizable amounts of money to sail on Alaskan cruise ships, and appear to enjoy watching glaciers calve amidst the land of the midnight sun. Other people build houses deep in the redwood forests of the Pacific Northwest. Again and again, people appear to have affinities for diverse natural landscapes far removed from the African savannas. Such observations seem to disconfirm the savanna hypothesis.

A biophilia rejoinder. There are a handful of possible responses. One response is to suggest that affiliations with nonsavanna landscapes often mimic key features of the savanna. For example, beaches provide wide open landscapes (visibility), a barrier for protection, and water; and alpine areas provide the elevation, relief, and (often) visibility associated with the savanna. Another response is to suggest that certain regions are attractive for reasons largely independent of the landscape itself. A biologist, for example, might take delight in an upcoming trip to the Amazon, with visions of discovering hundreds of new species of some insect. A cultural anthropologist (or traveler of similar ilk) might look forward to refreshingly different cultural experiences. But how many people actually consider a trip to the Amazon landscape as rejuvenating—as a desirable place, for example, to retire? Very few. Another response is to make the case that for people living for many thousands of years in an unsavanna-like setting (such as the Amazon river basin) that, genetically, changes occur such that aspects of those landscapes that promote survival benefits become aesthetically pleasing, and rejuvenating. Diamond (1993) develops this response when he says: “I am puzzled, in other discussions of the biophilia hypothesis, by what seems to me an exaggerated focus on savanna habitats as a postulated influence on innate human responses. Humans spread out of Africa’s savannas at least 1 million years ago. We have had plenty of time since then—tens of thousands of generations—to replace any original innate responses to savanna with innate responses to the new habitats encountered” (pp. 253–254). In other words, the evolutionary account can hold, but the savanna hypothesis needs to give way to a broader account of genetic predispositions to inhabited landscapes.

A final approach—if and when the evolutionary biology comes up short—is to recognize the place of culture, experience, and learning, all of which can profoundly mediate the attraction to savanna-like landscapes.

(4) *Can the biophilia hypothesis be disconfirmed?* The above possible counterexplanations regarding the savanna hypothesis highlight a particularly troubling aspect of the biophilia hypothesis: the seeming inability to provide disconfirming evidence. In other words, when an initial biophilic hypothesis is not confirmed, a post hoc explanation is offered. Each explanation may well be reasonable, but there is an uncomfortable proliferation of them; moreover, when the going gets rough proponents of biophilia can just wave the wand of culture, experience, and learning.

It is a familiar problem, one that critics have articulated powerfully and repeatedly in seeking to discredit Freudian theory (see, e.g., Blight, 1981; Crews, 1995; Grunbaum, 1984; Nagel, 1959). The charge is that psychoanalytic theory can accommodate virtually any set of findings. A conscious desire for a boy to kill his father is evidence for the Oedipal complex. If such a desire is not recognized, that becomes evidence for the construct of repression, and of the unconscious. So it goes with psychoanalytic theory, time and again, some claim. Ditto, the critic may charge, with biophilia. The biophilia hypothesis is slippery, and difficult to grasp and understand except in metaphorical (unscientific, nontestable) terms.

A biophilia rejoinder. Notice the language Kellert and Wilson (1993) use in titling their edited volume. They call it *The Biophilia Hypothesis*, not something like *The Biophilia Revolution*. Why? Because they want to encourage scientific investigations of biophilia across the natural and social sciences. So, yes, I assume they would agree that the biophilia hypothesis should move forward by means of both framing testable hypotheses and critiquing the existing relevant literature for, at times, insufficient methods.

Yet I think this scientific orientation will only go so far. To illustrate this limitation, recall one experiment reviewed earlier. Katcher et al. (1984) found that watching an aquarium resulted in significant decreases in blood pressure below the resting level in both hypertensive and normal subjects. Is this really evidence for biophilia? Where are the control conditions? Well, let us imagine for a moment that with adequate controls it was found that not just not fish in an aquarium but “slow-moving globs of multicolored light” decreased blood pressure. Would this disconfirm the biophilia hypothesis? No, at a minimum the finding would simply not support the biophilia hypothesis. After all, many activities presumably lower blood pressure, such as listening to a Mozart sonata or running on a treadmill. The biophilia hypothesis does not preclude such effects, no more so than it precludes—as discussed earlier—human artifacts from playing an important role in human cognition and symbolism. It is equally possible in our imaginary experiment that slow-moving globs of multicolored light decrease blood pressure be-

cause such blobs mimic natural states (fish in water). In this case, nature is primary, the artifact secondary, and one more notch would be added to the biophilic repertoire of evidence. Even if experiments could distinguish between these two interpretations—and I am not convinced this is an empirical issue—it would still not satisfy the empirical scientist. For as long as a nature effect is found in enough relevant situations, biophilia cannot lose. In other words, no single experiment of this sort provides disconfirming evidence, but at best only nonconfirming evidence.

(5) *Evidence that tugs at the evolutionary component of biophilia.* Even in mediated biophilia, evolutionary theory has an important—albeit reduced—place in an account of the human affiliation with nature. Yet several lines of research tug even at that reduced place. For instance, from decades of ornithological research in New Guinea, Diamond (1993) suggests that while the New Guineans have a profound knowledge of nature, they exhibit virtually no positive emotional responses to it: no ‘love, reverence, fondness, concern, or sympathy’ (p. 262). Earlier, I quoted Diamond’s account of the New Guineans who found enjoyment in torturing bats. Diamond also reports on the young New Guineans who left behind the Stone Age technology of their parents to find work in urban areas. According to the Diamond, these young people exhibit little interest in the surrounding national parks and zoos, ‘negligible interest in the natural heritage with which their ancestors lived so intimately for tens of thousands of years’ (p. 269), and fear of the forest. Where, then, is the strength of the biology if an interest for nature can be so easily lost in a single generation—nay, even within a few years?

These parts of Diamond’s essay have been attracting the attention of critics of the biophilia hypothesis (Fischer, 1994). Yet, while Diamond’s credentials as an ornithologist are undisputed, he appears to have little training as an anthropologist or cross-cultural psychologist insofar as he reports only anecdotal social-scientific data. Thus, his conclusions, while suggestive, remain suspect.

That said, research by Nabhan and St. Antoine (1993, see also Nabhan and Trimble, 1994, chap. 5) provides supporting evidence. Nabhan and St. Antoine investigated responses to the natural world across two groups of UtoAztec cultures along the U.S./Mexico desert borderlands: the O’odham and the Yaqui. Within each culture, they compared responses between ‘tribal elders, who have engaged in considerable hunting and gathering activities during their lifetimes, with those of their grandchildren who have grown up fully exposed to television, prepackaged foods, and other trappings of modern life’ (p. 230). By holding constant the genetic lineages, their study provides a means to assess the place of cultural and environmental influences on the expression of biophilia.

Based on a variety of measures, Nabhan and St. Antoine found that the

O'odham and Yaqui children's knowledge of, interest in, and appreciation for their natural world was strikingly at odds with that of their grandparents. For example, despite access to open spaces, the majority of the O'odham and Yaqui children had never spent more than half an hour alone in a wild place. Television provided children with more exposure to wild animals than did their natural surroundings. And large percentages of children did not know basic facts of desert life: that it is possible, for example, to eat the fruit of the prickly pear cactus—a major food source in their lands for more than 8000 years.

In terms of the genetic component of the biophilia hypothesis, what is striking is that within one or two generations seemingly deep and pervasive affiliations of the O'odham and Yaqui with nature have been considerably extinguished. Thus, perhaps Diamond is correct after all; perhaps the genetic basis of biophilia is smaller than initially proposed by Wilson, and more needs to be said about culture, experience, and learning.

A biophilia rejoinder. Those who are committed to a genetic account of biophilia will seek an alternative explanation. In interpreting their findings, for example, Nabhan and St. Antoine suggest that the genetic predisposition for biophilia exists, but its expression needs to be triggered by the culture and environment. Specifically, they propose that the O'odham and Yaqui have been losing three requisite triggering mechanisms: the loss of biodiversity in the deserts; the loss of hands-on, visceral contact with nature; and the loss of the oral traditions of plants and animal stories. Nabhan and St. Antoine may be correct, but a lot of work is being asked of the undeveloped notion of “triggering.” Usually a trigger involves something simple (like the trigger on a gun) that then sets into motion complicated, extensive, and/or powerful happenings. But Nabhan and St. Antoine seem to offer the substance on the cultural and environmental level, and the simplicity on the level of the gene. More troubling, their specific data, as far as I can tell, provides no direct evidence for a genetic influence. In other words, a theorist working biophilia exclusively on the level of environment, experience, and culture could look at Nabhan and Antoine's results and say “yes, that's exactly what I would have expected.”

A STRUCTURAL–DEVELOPMENTAL FRAMEWORK FOR BIOPHILIA

Where do we now stand in an assessment of the biophilia hypothesis? In my interpretation, the research literature speaks relatively strongly for the proposition that people have a need and propensity to affiliate with nature, and that such affiliations can be of both a positive and negative kind. Such negative affiliations do not, in my estimation, undermine the biophilia hypothesis. Rather, following Wilson's lead, the challenge is to integrate both positive and negative affiliations within a larger framework. I also think it

goes without saying that we are biological beings with an evolutionary history. Thus, I believe that any account of the human affiliation with nature needs to build on, or at least dovetail with, evolutionary theory. It is what Cosmides, Tooby, and Barkow (1992) refer to as “conceptual integration,” which “refers to the principle that the various disciplines within the behavioral and social sciences should make themselves mutually consistent, and consistent with what is known in the natural sciences as well” (p. 4).

Finally, I think it is abundantly clear that biophilia needs to be investigated in ways that take experience, learning, and culture seriously. Yet, to speak plainly, I do not think most evolutionally inclined theorists understand how their psychological theories limit them from doing so. Let me explain. Most theorists working within the evolutionary framework hold to a mechanistic conception of the human mind. Cosmides et al. (1992), for example, write of “*information-processing mechanisms* situated in human minds” (p. 3), and of the brain as “a *computer* made out of organic compounds” (p. 8). Tooby and Cosmides (1992) characterize the human organism as “integrated collections of *problem-solving mechanisms* organized to propagate their designs” (p. 77). Pinker and Bloom (1992) argue that languages evolved by natural selection, and define languages as “*complex computational systems*” (p. 451). Dawkins (1976) says: “We are *survival machines—robot vehicles blindly programmed* to preserve the selfish molecules known as genes” (p. ix). Time and again, the evolutionally inclined theorist articulates a conception of human mind that is of a piece with Wilson’s (1975) original treatise. Recall its ending: that in years to come, “cognition will be translated into *circuitry*. Learning and creativeness will be defined as the alteration of specific portions of the *cognitive machinery*. . . . [When] “we have progressed enough to explain ourselves in these *mechanistic terms*,” the result—“a world divested of illusions”—might be hard to accept, but true (p. 575) (emphasis added).

Of course, at times it may well be useful to think of the mind as if it were a piece of machinery. But we should not lose sight of a clear distinction. As Searle (1990) notes, for certain purposes it can be useful to model water molecules with ping pong balls in a bath tub. But no one should confuse those balls with actual water. Similarly, we should not confuse mind with machine. As long as theorists do, their psychological theories will be substantially inadequate. Granted, here I am simply stating my own position. The evolutionally inclined theorist might disagree. That would be fine, and then the discussion would rightly shift to the adequacy of our divergent theories.

But the point I want to make is that usually evolutionally inclined theorists—while holding to mechanistic conceptions of human psychology—buy into descriptions of human behavior, cognition, and possibility that can only be achieved through a nonmechanistic psychological theory. Here are but a few examples (emphasis added). Wilson (1992) says that the “best of science doesn’t consist of mathematical models and experiments, as text-

books make it seem. Those come later. It springs fresh from a more primitive mode of thought, wherein the hunter's *mind weaves ideas from old facts and fresh metaphors* and the scrambled crazy images of things recently seen" (p. 5). Lovely writing, and it seems to convey a nonmechanistic mental model. So does the belief that emotions exist. Orians and Heerwagen (1992), for example, believe that personal interaction with landscapes "over a lifetime creates a wealth of knowledge and meanings that provide the basis for *emotional attachment* to places" (p. 560). In Kellert's work, the nine values he investigates are "thought to reflect a range of physical, *emotional*, and intellectual expressions of the biophilic tendency to associate with nature" (p. 26). "People," Kellert (1996) writes, "need to rekindle their capacity for experiencing *wonder, inspiration, and joy* from contact with the natural world" (p. 209). Wilson (1992) says: "What makes us people and not computers is *emotion*" (p. 348). In addition, these theorists accept some account of free will. Based on the savanna hypothesis, there should be, as noted earlier, an innate predilection to clear-cut the Amazon jungle, to transform the Amazon into the innately desirable landscape of earlier times. Most evolutionally inclined theorists who accept some account of the savanna hypothesis want people to choose otherwise, and believe people can. Wilson (1992) says that an enduring environmental ethic will aim to preserve, among other things, the "*freedom of our species*" (p. 351). And, in a response to Budiansky's (1995) critique of Kellert's work, Kellert (1996b) says: "In his [Budiansky's] effort to dismiss what he perhaps fears as genetic determinism, he neglects the acknowledged role of social context and *free will* in the development of our affinity for the natural world."

The issue, then, is what sort of psychology can best support concepts of intentionality, free will, emotion, and meaning, for the weaving of "ideas from old facts and fresh metaphors," and for the possibility for individuals to shape—from a humane and ethical stance—cultural practices? It is here that I think structural–developmental theory has much to offer. For the developmental reader, little in preface needs to be said about structural–developmental theory, as it is rich in history (Baldwin, 1897/1973; Piaget, 1929/1960; 1952/1965; 1932/1969; Piaget & Inhelder, 1973), and in current literature (Chapman, 1988; DeVries & Kohlberg, 1990; DeVries & Zan, 1994; Lourenco, 1990, 1996; Lourenco & Machado, 1996; Noam & Fischer, 1996; Reed, Turiel, & Brown, 1996). For other readers, perhaps it can be of assistance to contrast structural–developmental theory to traditional learning theory, because often the latter runs in tandem with a mechanistic conception of the mind.

Traditional learning theorists believe that for students to learn, teachers must properly sequence curriculum content, drill students on correct performance, correct mistakes, test for achievement, and otherwise impart knowledge using four types of reinforcement procedures: positive reinforcement, punishment, response cost, and negative reinforcement (Medland & Vitale,

1984; Sulzer & Mayer, 1972; Wynne & Ryan, 1993). Granted, one might note a few sidewise embraces of critical thinking and cognition. But, if push comes to shove—if, for example, test scores go down—the call is clear. Back to basics.

In contrast, from the structural–developmental perspective, learning involves neither simply the replacement of one view (the incorrect one) with another (the presumed correct one), nor simply the stacking, like building blocks, of new knowledge on top of old knowledge, but rather transformations of knowledge. Transformations, in turn, occur not through the child’s passivity, but through active, original thinking. As James Mark Baldwin (1897/1973) said, a child’s knowledge “at each new plane is also a real invention. . . . He makes it; he gets it for himself by his own action; he achieves, invents it.” Or, as Dewey (1916/1966) said: “We sometimes talk as if ‘original research’ were a . . . prerogative of scientists or at least of advanced students. But all thinking is research, and all research is native, original, with him who carries it on, even if everybody else in the world already is sure of what he is still looking for” (p. 148). Think of it this way. On a daily level, children encounter problems, of all sorts: logical, mathematical, physical, social, ethical, environmental. Problems require solutions. The disequilibrated state is not a comfortable one. Thus, the child strives toward a more comprehensive, more adequate means of resolving problems, of synthesizing disparate ideas, of making sense of the world.

Notice the implication. It is not only the gifted scientist who “weaves ideas from old facts and fresh metaphors and the scrambled crazy images of things recently seen”—we all do, children too.

I want to suggest that structural–developmental theory can provide a fresh way of taking on what sociobiologists call their biggest problem—the problem of altruism, reviewed earlier—and that it can recast how we understand and investigate biophilia. But to do so I first need to articulate two more ideas. One idea is that of hierarchical integration. The terms “hierarchical” and “integration” have their place in biological thought. Drawing on Simon (1969), Pinker and Bloom (1992) suggest that “hierarchical organization characterizes many neural systems, perhaps any system, living or nonliving, that we would want to call complex” (p. 485). Integration of perspectives is exactly what Cosmides et al. (1992) argue for across the disciplines. But in structural–developmental theory the two ideas come together. It is assumed not only that children and adults reason, and that reasoning is largely coherent and organized (structured), but that through development later structures reflect increasingly adequate transformations of earlier structures.

As a case in point, consider this idea in light of Kohlberg’s (e.g., 1969, 1971, 1984) theory of moral development. I should note first, however, that like the work of many other pivotal theorists in a field, Kohlberg’s theory has been critiqued often and hard. It has been argued, for example, that Kohlberg’s moral stage theory fails to take adequate account of regression (e.g.,

Selman, Jaquette, & Lavin, 1977), is not as universal as claimed (e.g., Shweder, Mahapatra, & Miller, 1987; Snarey, 1985), confounds conventions with morality (e.g., Turiel, 1983), and provides an inadequate characterization of moral caring (e.g., Gilligan, 1982; Noddings, 1984), moral character (e.g., Campbell & Christopher, 1996), and prosocial behavior (e.g., Eisenberg-Berg, 1979). Most of these critiques have some merit; a few of the critiques have a great deal. But without worrying about the validity of Kohlberg's actual stages, Kohlberg's orientation to studying moral development through structural analysis remains highly influential today (see, e.g., the edited volumes on moral development by Killen & Hart, 1995; Kurtines & Gewirtz, 1991; and Puka, 1995); and Kohlberg's approach, at least in this author's judgment, withstands the torrent of over 3 decades of criticism.

With that said, Kohlberg's stage characterizations reflect hierarchical integrations. For example, consider but a thumbnail's sketch of an aspect of the development of moral reasoning. In stage 1 of Kohlberg's theory there is moral consideration only for the self (punishment avoidance). In stage 2, there is consideration for another person, but only instrumentally (instrumental hedonism), as in "I'll scratch your back if you scratch mine." Interestingly, this second stage reflects what Wilson and other sociobiologists view as a central feature of morality: reciprocal altruism. Wilson (1975) says that such ideas are "expressed in the familiar utterances of everyday life," which take the form: "Come to my aid this time, and I'll be your friend when you need one" (p. 553). Like Wilson, Kohlberg would agree that such reasoning is essentially selfish. But based on scores of developmental studies, Kohlberg would also say that such reasoning does not reflect a developmental endpoint. Rather, by stage 3, genuine caring and consideration emerges for family members and friends. As stage 3 can be seen to correct for limitations of stage 2 (a tit-for-tat morality), so does stage 4 correct for the limitations of stage 3. After all, what of a judge who presides over a case that involves family members or friends and who gives them preferential treatment? Is that fair? What of our moral obligations to strangers whom we meet (the homeless mother on the street) or do not meet (political prisoners tortured in China)? Stage 4 morality addresses these concerns by codifying the demands of justice through largely impersonal rules and laws within organizational systems. Yet the limitation here is that such rigid systems fail to articulate underlying moral principles that allow for their flexibility and judicious application. Thus the movement toward stages 5 and 6, toward the articulation of a generalizable theory of human rights and justice.

Notice the idea of hierarchical integration. Stage 1, for example, builds on a conception of self, albeit selfishly. Stage 2 involves the selfishness of stage 1, but works it in a broader framework (instrumentally helping others). Stage 3 incorporates the relational exchange aspects of stage 2, but grounds that in a genuine care and concern for the interpersonal relationship. Stage 4 includes considerations for self, others (instrumentally), and family and

friends, but attempts to correct for the unfairness that can arise from basing moral judgments only on them. It is in this sense—in which the central organizing principle of an earlier stage, such as selfishness, becomes an element in a more inclusive organizational framework—that stages represent transformations of moral knowledge, rather than simple replacements of one moral view with another.

Let us hold in place this idea about hierarchical integration, and turn briefly to the second idea. Consider a situation where a man spends every weekend helping his elderly and cranky aunt, and in the process forgoes his pleasurable weekend activities. His actions appear altruistic. But let us say that the aunt is quite wealthy, and that the person says that the only reason he helps his aunt is because he hopes to inherit millions of dollars when the old lady finally dies. Given such a reason, the act now appears selfish. It is nothing new of course to say that an agent's reasons are needed to assess the moral quality of an act. It is this point that distinguishes, for example, structural–developmental from behavioristic approaches to studying moral development. But, even with this framing, it sets up an “either/or” analysis. Either the person is helping his elderly aunt altruistically, out of a benevolent desire to help a person in need; or he is helping for the purely selfish reason that he hopes to inherit a lot of money (or to promote the survival of his genes, or any other “selfish” reason that one might want to substitute).

Drawing on Baldwin (1897/1973), from a psychological standpoint such a situation is framed wrongly. For, according to Baldwin, egoism and altruism are fundamentally linked.

The ego and the alter are thus born together. Both are crude and unreflective, largely organic. And the two get purified and clarified together by this twofold reaction between project and subject, and between subject and eject. My sense of myself grows by imitation of you, and my sense of yourself grows in terms of my sense of myself. Both ego and alter are thus essentially social. (p. 9)

That is, from the start, a child is neither entirely selfish nor entirely altruistic: both go together, because both depend on one another in the child's development. It is part of the very dialectic (the back and forth movement) between self and other that is part of Baldwin's larger ontogenetic theory (involving what he calls the projective, subjective and ejective processes). Thus, Baldwin is attempting to reshape the very nature of the either/or question. It is not that people are either altruistic or egoistic, but both.

Let us now bring together the two ideas sketched above, and apply them to “the problem of altruism.” Instead of following sociobiologists and trying to reduce altruism to selfishness (“the selfish gene”), it is possible to account for both, but in a hierarchically integrated sense. As the “self” expands to include not only one's brother or family, but friends, community, nation, and world, the “self” is not lost, but embedded in a larger “alter.” Indeed, in specific circumstances, the self can still assert itself in “individualistic”

ways. For example, when being attacked by a rapist, a woman may well lash out with fury and fight. Such “self-oriented” action need not be interpreted as a “regression,” but the assertion of self in a context-specific situation. Thus, in terms of structural–developmental theory selfishness does not disappear, but gets transformed into a more complex and adequate—and qualitatively different form of—ethical understanding.

In terms of biophilia, we can make a similar move. Recall one of the difficult problems for the biophilia hypothesis: of how to understand the relationship between individuals’ negative and positive affiliations with nature. The research shows (and common sense confirms) that people can fear and dislike aspects of nature, particularly those that are threatening to the self, physically and psychologically. People can also enjoy controlling and subduing nature. Both this negativistic and dominionistic orientation—using Kellert’s typology—need not disappear through the lifespan. But if “biophilia development” occurs, it is possible that these orientations become hierarchically integrated into a more comprehensive orientation. Along these lines, consider Nelson’s (1989) description of his experience after killing a deer in his homeland in Alaska:

I whisper thanks to the animal, hoping I might be worthy of it, worthy of carrying on the life it has given, worthy of sharing in the larger life of which the deer and I are a part. Incompatible emotions clash inside me—elation and remorse, excitement and sorrow, gratitude and shame. It’s always this way: the sudden encounter with death, the shock that overrides the cushioning of the intellect. I force away the sadness and remember that death is the spark that keeps life itself aflame. (p. 263)

Nelson notes his feelings of “elation” and “excitement” in the kill, in the domination over nature, except it is no longer domination but an affiliation with nature that weaves his own life into that which he has killed: “worthy of sharing in the larger life of which the deer and I are a part.”

On a philosophical level, Rolston (1989) works similar ideas. He says:

[W]e must judiciously blend what I call “natural resistance” and “natural conductance.” Part of nature opposes life, increases entropy, kills, rots, destroys. Human life, like all other life, must struggle against its environment, and I much admire the human conquest of nature. However, I take this dominion to be something to which we are naturally impelled and for which we are naturally well-equipped. Furthermore, this struggle can be resorbed into a natural conductance, for nature has both generated us and provided us with life support—and she has stimulated us into culture by her resistance. Nature is not all ferocity and indifference. She is also the bosom out of which we have come, and she remains our life partner, a realm of otherness for which we have the deepest need. I resist nature, and readily for my purposes amend and repair it. I fight disease and death, cold and hunger—and yet somehow come to feel that wildness is not only, not finally, the pressing night. Rather wildness with me and in me kindles fires against the night . . . Environmental life, including human life, is nursed in struggle; and to me it is increasingly inconceivable that it could, or should, be otherwise. If nature is good, it must be both an assisting and a resisting reality. We cannot succeed unless it can defeat us. (pp. 49–50)

Rolston keenly recognizes that parts of nature are to be feared (as it “opposes life,” “kills,” and “destroys”), and parts of nature are to be dominated (an activity for “which we are naturally impelled” and “naturally well-equipped”). But, in Rolston’s account, both are hierarchically integrated in an orientation in which humans live and have their being. Moreover, following Holmes, this integration is life affirming, if not good: Biophilia.

I am not saying that the above account characterizes a developmental aspect of biophilia, although it might. That proposition would need the support of developmental research. But I am trying to quicken interest for studying biophilia based on structural–developmental theory.

RESEARCH THAT ADVANCES A STRUCTURAL– DEVELOPMENTAL ACCOUNT OF BIOPHILIA

Colleagues and I have recently conducted four structural–development studies that bear on the biophilia hypothesis. Briefly, the studies involve the following populations and issues: *The Houston Study*. Seventy-two African-American children across grades 1, 3, and 5 were interviewed on their conceptions and values of nature. The children came from an economically impoverished area of Houston, Texas (Kahn & Friedman, 1995). *The Parent Study*. 24 parents from the same African-American community were interviewed on their views toward the environment and environmental education (Kahn & Friedman, 1996). *The Brazil Study*. The methods from the Houston study were modified, and 44 fifth-grade Brazilian children were interviewed in Portuguese. The children lived along the Rio Negro in either the city of Manaus (the capital of the state of Amazonas) or a small remote village a day’s journey upriver (Howe, Kahn, & Friedman, 1996). *The Prince William Sound Study*. The moral and ecological reasoning of 60 children across grades 2, 5, and 8 was assessed about the Prince William Sound oil spill that occurred in Alaska in 1989. The interviews took place within 1 year of the actual oil spill (Kahn, 1996).

The Interview Methodology

A brief description of structural–developmental methods is in order, as they may be unfamiliar to some readers. The methods draw on what is called the semistructured interview, which was pioneered by Piaget (e.g., 1929/1960, 1932/1969, 1952/1965) and has been extended by a large number of more recent researchers (e.g., Colby & Damon, 1992; Damon, 1977; Helwig, 1995; Killen, 1990; Kohlberg, 1984; Laupa, 1991; Nucci, 1981; Saxe, 1990; Smetana, 1995; Tisak, 1986; Turiel, 1983; Wainryb, 1995). On a basic level, the interview methodology simply involves asking questions to understand a person’s reasoning—which, of course, is nothing new. Socrates was fond of questions himself. But as a formal research methodology, it presents challenges. Piaget (1929/1960), for example, said that it

is so hard not to talk too much when questioning a child, especially for a pedagogue! It is so hard not to be suggestive! And above all, it is so hard to find the middle course between systematisation due to preconceived ideas and incoherence due to the absence of any directing hypothesis! The good experimenter must, in fact, unite two often incompatible qualities; he must know how to observe, that is to say, to let the child talk freely, without ever checking or side-tracking his utterance, and at the same time he must constantly be alert for something definitive, at every moment he must have some working hypothesis, some theory, true or false, which he is seeking to check . . . When students begin they either suggest to the child all they hope to find, or they suggest nothing at all, because they are not on the look-out for anything, in which case, to be sure, they will never find anything. (p. 9)

Thus, in interviewing, Piaget advocates for the middle course wherein the researcher neither nudges the child into saying things nor allows the child to ramble aimlessly; rather, the researcher directs the conversation in order to understand the child's understanding about whatever issues are under investigation.

Our four studies were based on this approach. We generated theory-guided interview questions that we asked of every subject, while allowing ourselves the freedom to follow the questions so as to tap each subject's own understandings. Interviews were conducted one-on-one, tape recorded, and then transcribed. Analysis of the transcripts proceeded by many readings of half of the data set, as we sought to understand the diversity and meaning of responses. Then, for each study, there was a long process of generating a systematic and conceptually relevant and defensible means for coding the qualitative data (a coding manual). The entire data sets of each study were then coded.

One of the main limitations of the interview methodology is that it takes a great deal of time. Consequently, it is difficult to obtain large sample populations. In our studies we typically garnered only between 20–25 subjects in each population of interest (e.g., in each grade level). What suffers is the degree of confidence in the generalizability of one's findings. But what prospers is the depth of understanding people's reasoning, and its developing organization. As a point of contrast, Kellert's research on people's attitudes and values of nature (described earlier) is based on surveys. Surveys more easily allow for large sample sizes. Of course, then Kellert (1996a) notes the opposite problem that arises with the survey methodology:

Although the [attitude] scales have been statistically corroborated, they represent only crude approximations of the underlying values. Surveys permit the efficient gathering of information from a large number of people, but they represent a blunt instrument for exploring the complexities of how people perceive nature. (p. 38)

Thus, one's methods depend on one's questions.

With that said, a potential problem arises in coding qualitative interview data: namely, how can one trust that what the researcher sees in the data are the same thing other people would see? We address this problem in three

ways. First, in reporting our results we try to provide enough qualitative examples such that readers can decide for themselves whether we have provided good qualitative characterizations. Second, our characterizations are themselves grounded in philosophical theory. This move follows Piaget's (1970, 1971a, 1971b, 1971c) view that epistemology can inform on ontogeny because theories of knowledge can reflect provisional endpoints of development. Conversely, Piaget also argued that ontogeny can inform on epistemology—that philosophy cannot stand apart from psychology in discovering valid knowledge because such knowledge is tied to its psychological genesis and requires scientific methods of verification—and I shall come back to this idea in the conclusion.

Third, in each of our studies, an independent coder recoded about one-third of the data. Cohen's Kappa was used as the test of statistical significance for the interreliability between coders. Typically, in our studies we coded three types of data: evaluation responses (e.g., all right/not all right; aware/not aware of environmental problems; matters/does not matter that insects would be harmed), content responses (e.g., animals, plants, garbage, water pollution, and air pollution), and justifications for the evaluative responses (e.g., an appeal that animals have rights). Percentages of intercoder agreement typically fell around the following numbers: evaluations, 95%; content responses, 80–85%; and justifications, 75–80%. Justifications were relatively difficult to code for several reasons: (a) the subject's justification must be matched to a dozen or so overarching conceptual categories; (b) often a justification must be teased apart from a longer stretch of a subject's words and reasoning; and (c) because we coded multiple justifications, it was often easy to find agreement with a solid justification, but then to miss another one embedded in the same passage. These reliability percentages are representative for published research of this type.

Initial Developmental and Cultural Support for the Biophilia Hypothesis

From quantitative results of the evaluations and content responses, the Houston study showed specific ways in which these African-American inner-city children (1) were *aware* of environmental problems, (2) *discussed* environmental issues with their family, (3) *valued* aspects of nature, and (4) *acted* to help the environment. For example, 96% of the children said that they thought about nature and then mentioned animals (59%), plants or trees (54%), various types of pollution (20%), and garbage (20%). Eighty-four percent of the children said that animals were an important part of their life, 87% for plants, and 70% for parks. Children's interest in nature also extended into aspects of their family life and activities. For example, 72% of the children said that they talk about the environment with family members. Children reported on conversations with their family that included litter or garbage (47%), air pollution (25%), plants (23%), water pollution (17%), and

animals (13%). Roughly half of the children (57%) have themselves started such conversations.

Assessments were also made of children's judgments of throwing garbage in a bayou (their local waterway) in six different conditions. Three conditions focused on the magnitude of harm. Consider, for example, that one person camping in a wilderness area causes virtually no environmental harm; millions of people in the same area do, as the environmental degradation of many national parks in the United States attests to. Thus, of the first three conditions, two involved negligible environmental harm: of a single person who throws garbage in a bayou in the child's own cultural context and in a context that legitimates the practice. The third condition involved more substantial harm: of an entire community that routinely throws its garbage in a bayou. Results showed that virtually all of the children judged these acts to be wrong (96, 96, and 94%, respectively).

The remaining three conditions focused on children's proximity to harm. Across a diverse range of literature, including studies on obedience to authority (Milgram, 1974), conceptions of genetic engineering and nuclear power (Fleming, 1984), and conceptions of computer property and privacy (Friedman, in press), research shows that the more remote an individual from the resulting harm, the more likely is the individual to cause or permit that harm to occur. A similar environmental finding often appears in the popular press. People seem to object to environmentally degrading acts more often when those acts occur close to their homes than in other parts of their country or globe. Correspondingly, a common popular expression has arisen—NIMBY (Not In My Back Yard). Thus, the final three of the six conditions examined judgments about throwing garbage in a bayou in a distant geographical location. Paralleling the first three conditions, the fourth and fifth conditions involved a single individual who throws garbage in a bayou. The sixth condition involved an entire community that routinely throws its garbage in a bayou. Results also showed that virtually all of the children judged these acts to be wrong (96, 87, and 91%, respectively).

By design, assessments based on these six conditions played a dual role, and informed on whether children conceived of throwing garbage in the bayou as a violation of a moral obligation. Drawing on the moral philosophical literature (e.g., Gewirth, 1978; Rawls, 1971) and moral-developmental literature (e.g., Kahn, 1991, 1992; Kahn & Turiel, 1988; Nucci, 1981; Smetana, 1983; Turiel, 1983), a moral obligatory judgment is prescriptive, independent of local cultural practices and laws, and generalizable to other people and cultures with different practices and laws. Based on these criteria, 87% of the children viewed polluting a bayou as a violation of a moral obligation. Moreover, the large majority of children believed that throwing garbage in a local bayou would cause harmful effects to birds (94%), water (95%), insects (80%), local people (91%), and the view (92%). In addition, children said

that it would matter to them if such harm occurred to birds (89%), water (91%), insects (77%), local people (83%), and the view (93%).

As noted earlier, Wilson (1984) suggests that one excellent way to investigate biophilia is through studying the landscapes that wealthy individuals inhabit when free from their work (e.g., where they go to vacation, where they build summer residences, and so forth). His reasoning is that people who are largely free from economic and time constraints would most exhibit “natural”—genetically based—inclinations, and inhabit landscapes that from an evolutionary standpoint contribute to survival and reproductive success (e.g., water access, bluff tops, and savanna-like landscapes). It also seems the case, however, that further support for biophilia could come by studying people who are not wealthy but, on the contrary, extremely poor and living in an inner city. For if an affiliation with nature can be shown to exist even in those people most encumbered by economic and urban constraints, then that would speak to pervasive and deeply abiding biophilic characteristics.

The Houston study provides such support for the biophilia hypothesis. Foremost, our results suggest that the serious constraints of living in an economically impoverished urban community cannot easily squelch these children’s diverse and rich appreciation for nature, and their moral responsiveness to its preservation.

The Development of Environmental Moral Reasoning

According to its proponents, biophilia is believed to emerge in our cognition, emotions, art, and ethics, and to unfold in the predictable “responses of individuals from early childhood onward” (Wilson, 1984, p. 85). Yet to date little research has investigated children’s “biophilic” cognition, and more specifically their reasoning about nature, and ways in which such reasoning takes shape, becomes organized, and develops. Our four studies begin to do so.

From our studies, two overarching forms of environmental reasoning emerged: homocentric and biocentric. Homocentric reasoning focused on the interests of humans to justify protecting the environment, and included appeals to personal interests, aesthetics, and the physical welfare of humans. For example, consider the following justifications children provided (in the Houston study) about why it is wrong to pollute a bayou:

[It’s not alright to pollute the bayou] because if it’s dirty I might get sick.

[It’s not alright] because some people that don’t have homes, they go and drink out of the rivers and stuff and they could die because they get all of that dirt and stuff inside of their bodies.

In these responses, children say that the underlying reason why environmental degradation is wrong lies in the environment’s harmful effect on human welfare: sickness and death.

A less direct form of homocentric reasoning can be seen in the aesthetic justifications. Here an appeal is made to ways in which the natural environment can render pleasure to humans in terms of its beauty.

[It is not alright to throw trash in the local bayou because] the bayou, it should look beautiful . . . Because like if my relatives or something come over, I could take them to the bayou and see, and show them how beautiful it is and clean.

A better one [bayou] is a cleaner one, is the best because . . . if you live around dirtiness then it won't look good around your house.

This reasoning appears to turn centrally on how humans appreciate the aesthetic experience of the natural environment. Thus, for example, the first child reasons that it is not alright to throw trash in the bayou because a bayou should look beautiful and that other humans (his relatives) would also like to see a beautiful bayou.

In contrast to homocentric reasoning, biocentric reasoning highlights that the natural environment has moral standing that is at least partly independent of its value as a human commodity. For example, children occasionally argued that nature has intrinsic value, and they established that value by means of what could be called a naturalistic fallacy in its most literal form.

Because water is what nature made; nature didn't make water to be purple and stuff like that, just one color. When you're dealing with what nature made, you need not destroy it.

I think that neither one should throw their trash in the bayou because the bayou has been clear for a whole lot of years.

Both children highlight that what is ("what nature made") ought to remain ("you need not destroy it"). Thus an "ought" is derived from what "is."

Table 1 provides an overview from the Prince William Sound study of the justification categories that comprise both homocentric and biocentric reasoning. In interesting ways, these categories at times mesh with Kellert's typology of attitudes toward nature. Notably, it would appear that what Kellert calls a "utilitarian" value (which emphasizes the material benefit derived from exploiting nature to satisfy various human needs), we would code as physical, material, or economic "welfare." The "naturalistic" value (which emphasizes the many satisfactions people obtain from the direct experience of nature and wildlife) we would code as either "personal interests" or "educative," or even "welfare," depending on the specific type of satisfaction which the respondent mentions. The "ecologicistic-scientific" value we would presumably often code as a form of "welfare." For example, in the Prince William Sound study, one child argued that it was wrong for an oil spill to occur in other far-off countries "because like if it [the oil spill] was in Australia or somewhere it would eventually pass on to us and mess us up, because we're all the world, you know, and it's going to eventually come to us." Notice that this reasoning is still homocentric, because it fo-

TABLE 1
Summary of Environmental Justification Categories
(from the Prince William Sound Study)

1. <i>Homocentric</i> : An appeal to how effects to the environment affect human beings. In other words, the environment is given consideration, but this consideration occurs only because harm to the environment causes harm to people.	
Personal interests	An appeal to personal interests and projects of self and others, including those that involve recreation or provide fun, enjoyment, or satisfaction ([it matters] “because they can’t have their favorite food or do their hobby”); “because I like to go fishing”; “[because] no one would be able to go swimming in Alaska”).
Welfare	An appeal to the physical, material, and psychological welfare of human beings, including that of <i>self</i> (“yes, it [the oil spill] really does matter to me because of the spreading it might damage me, damage my body”), of <i>other individuals</i> (“now more people will die because they can’t support themselves [because the fish died]”), and of <i>individuals within a larger systemic social context</i> (“it’s not all right because we’re killing the fish, we’re killing the economic process of that state”) or <i>ecological context</i> (“it wouldn’t be all right because like if it was in Australia or somewhere it would eventually pass on to us and mess up, because we’re all the world, you know, and it’s going to eventually come to us”).
Educative	An appeal to the potential for humans to learn from nature (“because if we lost the endangered species of the fish in the oil spill, we won’t be able to learn physically and mentally from them”; “[because] one species might have something really neat about it that people really like, but they never got to study it”).
Justice	An appeal to fairness or the rights of other humans (“it’s not all right because everyone has a right to work”), including a focus on locus of responsibility (“because it goes back to morals and ethics, if you make a mistake, clean it up; it doesn’t matter where you are or who you are, if you make a mistake, clean it up”) and unjustified harm (“because these innocent people and all of a sudden they don’t have any recreation because of some fault we did”).
Aesthetics	An appeal to preserving the environment for the viewing or experiencing pleasure of humans (“because we might not see them beautiful fish no more if they were killed”; “I don’t really enjoy looking at a dead fish”).
2. <i>Biocentric</i> : An appeal to a larger ecological community of which humans may be a part.	
Intrinsic value of nature	An appeal that nature has value which is derived not only from human interests, including a focus on <i>biological life</i> (“because fish are just as important as other things, if the fish dies, then we won’t have any fish, and fish are part of this earth, and I think they should be treated as well as anything else”), <i>establishing value equivalencies between other life forms and humans</i> (“because if it was human lives, then it would still be the same thing, it wouldn’t be all right because it’s, you know, it’s lives”; “like an animal, you can’t just make one that’s exactly like it was before, that’s like a human being, they have brains, they’re alive, they suffered, just like we suffer like an animal—we are an animal”), a focus on <i>natural processes</i> (“it isn’t part of nature to make an accident and kill the fish”), or a focus on the <i>teleos of nature</i> (“without animals the

TABLE 1—Continued

Justice	<p>world is like incomplete, it's like a paper that's not finished"; "animals are part of the environment, if you have a car, and you have everything but the motor, it's no good—it's kind of like the environment").</p> <p>An appeal that nature has rights or deserves respect or fair treatment ("it's not all right because I think every creature, people, or thing or whatever has a right to live"), including appeals to <i>unjustified harm</i> ("It's not all right that the oil spill killed many animals because I don't think it was their fault"; "it killed the animals that were living, the innocent little creatures"); or established by means of a <i>direct relation between humans and nature</i> ("because I think fish and animals have a right to live just like we do, and it's not fair to have killed them this way"), a <i>compensatory relation</i> ("just because of their appearance and they can't talk, they're animals, and I don't think that's right, they could be people if they could talk, a form of people, well not human beings but something like it, just a degree of level and that's it, that's the only difference); a <i>conditional relation</i> ("it's not all right because they're dead living things just like we are, you wouldn't want anybody to kill you like that"); or a <i>hypothetical perspective-taking relation</i> ("you put yourself in the animal's position and you wouldn't like that and so if you just kind of trade places and think about it and everyone would think it wasn't right").</p> <p>3. <i>Unelaborated Harm to Nature</i>: Although no reference is made to whether appeals for nature derive from a homocentric or biocentric orientation, such appeals include a focus on <i>animals</i> ("it could harm other animals that live in the sea that I don't know about"), <i>plants</i> ("if he chopped down too many trees there would be no forest"), <i>nonliving parts of nature</i> ("the sand and the water got contaminated"), <i>species</i> ("because lots of animals are being extinct—there won't be anymore"), <i>food chains</i> (because "it could break the food web, or let's say a land animal ate birds, well the birds died because of the oil spill, see if you break up the food chain the higher predators up pay for it"), and <i>ecosystems</i> ("it wouldn't be all right because if the animals die, the land wouldn't be fertilized to grow plants, and animals need plants to eat, and when the animals give out carbon dioxide, plants suck it in to make oxygen, and the animals need oxygen to live").</p>
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cuses on how harm to nature harms human welfare. But the child understands that such harm can occur because of interconnected ecological systems ("because we're all the world, you know").

Even given such similarities between Kellert's coding system and our own, there are reasons for our different labels and characterizations. First, colleagues and I are in part tapping different phenomena (attitudes versus reasoning). Second, our categories have been shaped by the social and cognitive developmental literature to help us tap the developing structure of children's reasoning. I shall come back to this issue shortly.

Third, our categories also have been shaped by the moral–philosophical and moral–developmental literature. For example, an important debate in

both fields is whether—and if so how—personal interests have moral standing (Berkowitz, Kahn, Mulry, & Piette, 1995; Nucci, 1981, 1996; Scheffler, 1992; Turiel, 1983; Williams, 1985; Wolf, 1982) insofar as morality has often been said to be other-regarding, about how we ought to treat other people. Thus, to speak to this debate, in our coding systems we have distinguished between personal interests (that affect only the self) and other's interests (other's welfare). Along these lines, our sensitivities to moral reasoning about nature help us to extend Kellert's analysis of "moralistic" values. Recall that Kellert described this value as focusing on the "right and wrong conduct toward the nonhuman world." From the standpoint of moral theory, this definition is too broad. After all, in Kellert's own system, right treatment could hinge on aesthetic values ("because I like the pleasing effect of a penguin"), humanistic values ("because pets are my friends"), utilitarian values ("because nature harbors the cure to cancer"), and so on. The question that needs to be asked is: What is the reasoning underlying each of the respondent's judgments about what constitutes right or wrong treatment of nature? Is the reason even a moral one? And, if so, of what form?

Our research begins to answer such questions insofar as it begins to characterize forms of environmental moral reasoning. Given their importance to a structural account of environmental reasoning, and to larger debates across disciplines, it is worth sketching a few of these forms in more detail.

Intrinsic value of biological life. In the philosophical literature, substantial efforts have been made to ground an environmental ethic based on the intrinsic value of nature (e.g., Callicott, 1985; Katz, 1987; Rolston, 1981, 1989). What emerges from our developmental studies may be the early cognitive forms of such an orientation in terms of reasoning based on the intrinsic value of biological life. For example, one child in the Prince William Sound study said: "Animals can't be replaced like an oil. Animals are so much more special than oil. They are alive and oil isn't." Here there is the focus on life itself ("they [animals] are alive and oil isn't), and its irreplaceability ("animals can't be replaced like an oil").

Teleos of nature. Aristotle (1962) begins *Nicomachean Ethics* by asserting that "the good, therefore, has been well defined as that at which all things aim." Aristotle then develops a teleological account of the good, wherein each kind of inanimate object (e.g., a clock) and animate being (e.g., a human) has an ideal way of functioning. Moreover, in humans, according to Aristotle, all the excellences of moral character can fit together into a harmonious self (Williams, 1985). Something of this Aristotelian orientation emerged from the data. Consider two examples from the Prince William Sound study:

Yea, because it looks better . . . Well, I mean without any animals the world is like incomplete—it's like a paper that's not finished.

There's people, nature, and animals. That's what I think makes up the environment. And you're killing one-third of the environment that way. I don't think that's right. If you have a car, and you have everything but the motor, it's no good; it's kind of like the environment.

Both children offer a moral conception of the proper endpoint of nature, and that the good arises with nature reaching that end and being complete (“without any animals the world is like incomplete, it's like a paper that's not finished”; “If you have a car, and you have everything but the motor, it's no good; it's kind of like the environment”).

Aesthetics. It is possible that the development of an aesthetic sensibility helps foster the move from homocentrism to biocentrism. As noted above, we defined aesthetic reasoning as an appeal to the preservation of the environment for the viewing or experiencing pleasure of humans. Framed in this way, it is a homocentric justification. But it also seems plausible that many biocentric concepts—such as those that focus on the intrinsic value of nature—depend on valuing the natural environment in some experientially aesthetic way. For example, consider again the teleological reasoning just quoted.

Yea, because it looks better . . . Well I mean without any animals the world is like incomplete—it's like a paper that's not finished.

Here aesthetic reasoning (“it looks better”) may help form the teleological reasoning, because the notion of incompleteness appears to arise through a value-laden perception.

Rights of nature. While theorists often debate the scope of the moral domain, very few contest that moral theory appropriately seeks—among other things—to ground an understanding of human rights (Dworkin, 1978; Gewirth, 1978; Kant, 1785/1964; Rawls, 1971). What is frequently contested is whether rights offer a viable approach to establishing an environmental ethic (Baxter, 1986; Elliot, 1991; Hargrove, 1992; Singer, 1988; Stone, 1972; P. W. Taylor, 1986). For example, some philosophers argue that rights are grounded in sentience, and because animals are sentient, their rights should follow (Regan, 1983). Others argue that rights depend on the recipient having correlative duties, which does not make sense for animals and the wider biotic community (Shepard, 1996). Our research begins to articulate some developmental aspects of environmental rights reasoning. Namely, two forms of establishing rights emerged. In one way, natural objects (usually animals) are compared directly with humans. For example, a fifth-grade child in the Houston study said:

Bears are like humans, they want to live freely . . . Fishes, they want to live freely, just like we live freely . . . They have to live in freedom, because they don't like living in an environment where there is much pollution that they die every day.

Thus an animal's desire ("to live freely") is viewed to be equivalent to that of a human's desire, and because of this direct equivalency animals merit the same moral consideration as do humans. In turn, a second way of establishing rights for nature occurs through establishing indirect compensatory relationships. Here is an example from a fifth-grade child, Arnold:

Fishes, they don't have the same things we have. But they do the same things. They don't have noses, but they have scales to breathe, and they have mouths like we have mouths. And they have eyes like we have eyes. And they have the same co-ordinates we have. . . . A co-ordinate is something like, if you have something different, then I'm going to have something, but it's going to be the same. Just going to be different.

Arnold struggles, quite eloquently, with the idea of a "co-ordinate" by which he seeks to explain that while animals are in some respects not the same as people (they don't have noses like people do), that in important functions (such as breathing and seeing) they are the same. In other words, Arnold moves beyond a reciprocity based on directly perceivable and salient characteristics to be able to establish equivalences based on functional properties.

In Piagetian terms, Arnold's reasoning could perhaps also be understood as on the cusp of reversibility, involving the simultaneous coordination of operations. As Chapman (1988) writes, psychological processes are reversible "to the extent that successive moments in those processes are linked together such that in the passage from one state to another, the first state is not lost but retained as a simultaneous possibility that could potentially be reinstated" (p. 45). In Arnold's case, he appears not to lose sight of the differences between fish and humans while he affirms their functional equivalences.

Initially—from the Houston data—we found tentative evidence to support the proposition that biocentric reasoning might arise through the hierarchical integration of homocentric reasoning. The analysis was difficult because comparatively little biocentric reasoning actually emerged. In about 900 coded justifications in that study, biocentric justifications comprised around 4%. I suspect, in general, that this figure underrepresents these children's biocentric reasoning because many of the stimuli focused on issues of pollution, which seems to push toward a homocentric response. On other types of questions (e.g., in the Prince William Sound study one question focused on the killing that occurs in the food chain), biocentric responses represented over 15% of the total justifications. That said, the quantitative results from the Houston study showed that while homocentric reasoning cut across the ages, biocentric reasoning—when it was used—was used almost exclusively by the older children (first graders, 7%; third graders, 37%; fifth graders, 56%). Moreover, qualitatively, biocentric reasoning often appeared to incorporate homocentric elements into a wider perspective. For example, when children accorded rights to animals, such reasoning was not in contradiction

to according rights to humans, but often enlarged the scope of what has moral standing (e.g., “bears are like humans, they want to live freely”). Similarly, biocentric relational reasoning often extended the idea of caretaking to include not only humans but animals and plants.

Based on these initial results, it was expected in the Prince William Sound study, which included a population of eighth graders, that (a) further categories of biocentric reasoning would emerge that had embedded within them homocentric elements, and (b) the use of biocentric reasoning would increase with age, particularly with the oldest group. The results supported the first expectation. For example, in biocentric reasoning, human-oriented considerations sometimes were embedded in a wider ecological context of what has moral standing (“there’s people, nature, and animals . . . you’re killing one third of the environment that way [killing animals]. I don’t think that’s right.”). (See Table 1 for other illustrative examples.)

However, on the age issue, the results were slightly different and more complex than expected. They were slightly different than expected because while biocentric reasoning increased with age, the shift occurred between the children in grade 2 compared to those in grades 5 and 8. They were more complex than expected because while biocentric reasoning increased with age, so did homocentric reasoning (with the diminution of unelaborated concerns for the well-being of nature). In other words, it does not appear to be the case that, as children develop, biocentric reasoning simply subsumes homocentric reasoning, but that through development unelaborated concerns for the well-being of nature can give way to both human-oriented and nature-oriented considerations.

Young Children as “Deep Ecologists”: Fact or Romanticization?

Our data on a possible developmental movement from homocentricism to biocentrism do not directly speak to the more speculative proposition advanced earlier: that through development biophilia may hierarchically integrate biophobia. For homocentrism cannot be equated with biophobia, or biocentrism with biophilia. Yet, while our research on children’s environmental moral reasoning was not designed to assess that specific proposition, it does speak more generally to one’s very conception of young children’s relationship with nature.

Often two such competing conceptions are tendered. One suggests—in almost the tradition of Rousseau—that young children have a deep connection to the natural world which then, in time, becomes largely severed by modern society. A second suggests that people only develop a deep connection to the natural world, if at all, in adolescence or later. Indeed, both conceptions may be right. As the above results suggest, young children do not appear to demonstrate biocentric concepts, particularly those that draw on rights, reciprocity, compensatory relationships, and a moral teleos. On this point, our results are in agreement with Kellert (1996a) who found that ado-

lescents witness a sharp increase in abstract and conceptual reasoning about the natural world. But Kellert also says that only by adolescence does ethical reasoning about nature emerge, and that it “seems pointless to focus on teaching very young children ecology and ethical responsibilities for conserving nature at a time when they are incapable of internalizing this type of abstract and compassionate thinking” (p. 49). On the contrary, our results show that young children (at least by the ages of 6 to 8 years) have moral commitments to nature, albeit often framed in homocentric terms. Moreover, young children (although less often than for older children) view harm to nature as a violation of a moral obligation, based, as defined earlier, on the criteria of prescriptivity, rule contingency, and generalizability.

But it is a difficult issue, to be sure. Young children as “deep ecologists”? Maybe yes, maybe no. Part of what makes for such ambivalence is that the problem cuts across two major areas of development: reasoning and values, or more broadly cognition and effect. To this point, I have framed the structural–developmental project in terms of cognition. This move follows the traditional emphasis of structuralism. Yet, even for Piaget, affect was never divorced from structure. That means more than that emotions can stimulate or retard the development of intellectual operations, although they can. In addition, children reflect on emotions, and through such reflections, emotions provide the “raw material” for the construction of knowledge and principled reasoning (Arsenio & Lover, 1995). As DeVries and Kohlberg (1990) write: “For Piaget, objects are simultaneously cognitive and affective. An object disappearing behind a screen is at the same time an object of knowledge and a source of interest, amusement, satisfaction, or disappointment” (p. 33). If this is true for physical objects, like a ball, how much more so for the animate world. For a child, a dog can be a source of knowledge (both the dog and the child need to eat to live), and a source of pleasure, comfort, security, playfulness, and companionship.

It is for this reason that in our four structural developmental studies we broadened our analysis to focus not just on people’s knowledge, but on their values (cf. Jarrett, 1991). Sometimes we pursued the distinction directly, as when we asked children whether forms of pollution hurt various parts of nature (knowledge), and also whether the children cared that each type of harm occurred (values). Other times, cognition and affect could not be disassociated from each other. To take a common example, when children reasoned that pollution is wrong because it harms the welfare of animals, the knowledge that animals can be harmed by pollution is essentially linked with the value that one cares about that harm.

All of this is to say that in investigating children’s affiliations with nature, a developmental focus needs, in a sense, to be reversible. That is, one must be able to tease apart cognition and affect, and thereby open oneself to ways in which they provide different ways of characterizing the human affiliation

with nature. At the same time, one must hold cognition and affect together, recognizing their strong linkages and mutual dependencies.

Culture and Context

The African-American children we interviewed in the Houston study were clearly aware of the harsh realities of economically impoverished inner-city living. When asked, for example, what they thought about in terms of nature, 7% of the children responded with issues pertaining to drugs and human violence. When asked about what environmental issues they talk about with their families, 17% of the children responded with issues pertaining to drugs and human violence. These findings surprised us when interviewing, because we ourselves had not thought to classify drugs and human violence in this way. Or consider the following short segment of an interview with a third-grade girl, where we first sought to establish that she knew what a bayou was before proceeding with the structured interview questions.

TELL ME TRINA, DO YOU KNOW WHAT A BAYOU IS? Yes . . . It's where turtles live and the water is green because it is polluted. People—some people need to um, some people are nasty. Some people, you know, like some people go down there and pee in the water. MM HMM. Like boys, they don't have nowhere to pee, and drunks, they'll go do that, too. OKAY. And sometimes they'll take people down and rape them, and when they finished, they might throw 'em in the water or something. SO, WHAT DOES IT LOOK LIKE? HOW WOULD YOU DESCRIBE IT? A BAYOU? It's big and long and green and it stinks. . . . And turtles live in it.

Trina clearly knows what a bayou is and provides a vivid description of its polluted state (“It’s big and long and green and it stinks”). But such environmental knowledge is joined with how such “natural” states are used in the inner city: people such as boys and drunks urinate in the bayou, rapes occur alongside it, and bodies are thrown in it.

Other times, children’s conceptions of environmental stewardship engaged urban constructs. Here are two responses from the same child:

[Plants are important] because we’re supposed to keep—take care of all the plants and everything like people have plant stores and they take care of plants.

[I care about animals because] those are animals that everyone must take care of. . . . Because God put the animals on earth for people to, like for pet stores. To keep and take care of them.

Notice that this child does not say that to take care of plants and animals we should “thank God for wilderness,” but, in a sense, “thank God for plant stores and pet stores.” Which is not surprising, since wide-open farmlands and wilderness are not centrally part of this child’s experience.

The stimuli that focused on plants, animals, and parks/open spaces all bear directly on important features of nature from the standpoint of the biophilia hypothesis. In this regard, it is worthwhile to turn briefly to one of the chil-

dren we interviewed in the Houston study who seemed least concerned and connected with nature. She was a second-grade girl, whom I shall refer to as Eboni. Early in the interview, Eboni said that she had a pet cat. The interviewer then asked if her cat was important to her. Eboni says: "No. I have other things that's important to me. If I eat or not. Or if anybody in my family is gonna die, because I don't want nobody in my family to die."

Eboni's reasoning might appear to support a common view based on Maslow's theory of a "hierarchy of needs": that "someone whose needs for food, shelter and physical security are barely met is not likely to spare the energy—physical or emotional—to maintain concern about [environmental issues]" (Hershey and Hill, 1977–1978, quoted in Mohai, 1990, p. 747). Yet Eboni's stark rejection of animals exists alongside of their attraction. For elsewhere in the interview Eboni said that she liked dogs, that two of her previous dogs had died, and that she wished she could have another one. Or take the issue of parks and open spaces. On first blush, Eboni rejects them. Eboni never climbs trees. Why? "Cause it's dangerous. Cause if they fall the grass might have glass and then they fall on they face in the glass and then they'll cut their nose or eyes and they they'll be blind." Eboni never walks anymore in the parks. Why? "Because I used to go, now the people go in there and they be throwing glass and they have guns and stuff and they might shoot me." Indeed, Eboni does not even like to play in her back yard. Why? "Nothin' can get me. Like a stranger or something." Is it the case that biophilia has no place in a characterization of Eboni's relationship with nature? Does she, for example, have no affiliation for animals, plants, and parks/open spaces? Rather, our data suggest that her economically impoverished and violent surroundings have made nature largely inaccessible.

Like the children, the parents we interviewed in the Parent study all too keenly described urban problems. A case in point. In their children's school, drug education had a visible and important presence. Parents, for example, helped patrol the playground during school hours to keep drug pushers from entering school grounds, and the school participated in antidrug educational programs. Our research confirmed that parents strongly supported such programs. On a 10-point scale (with 10 the most important), parents' mean ranking for drug education was 8.5. One parent, for example, who had ranked drug education as a 10 said: "With the drugs, we're nothing. Drugs is something I see every day. Um, there are dealers across the street from me. So, I see this everyday and it's just killing us. . . . We're not going to have any youth." Another parent said, "Drugs is everywhere. You know, even in prekindergarten, they're selling drugs to kids."

Yet, even in this context, these parents demonstrated a range of environmental sensitivities and commitments. Parents said, for example, that animals, plants, and parks played an important part in the lives of their families. Parents were also aware of the negative effects of environmental problems,

such as air pollution, water pollution, and garbage dirtying their urban landscape. Their knowledge was often direct, visceral. As one parent said:

[The air] stinks, 'cause I laid up in the bed the other night. Kept smelling something, knew it wasn't in my house, 'cause I try to keep everything clean. Went to the window and it almost knocked me out. The scent was coming from outdoors into the inside and I didn't know where it was coming from. . . . Now, who'd want to walk around smelling that all the time?

Parents talked about such issues with their children, often in response to direct experiences. These conversations were often poignant:

Yesterday, as my son and I were walking to the store and we were walking down Alabama [street] and for some reason, I think they're getting ready to widen the street. And it's a section of Alabama that I thought was so beautiful because of the trees and they've cut down all the trees. And you know it hurts me every time I walk that way and I hadn't realized that my son had paid attention to it, too. So, he asked me, he said, "Mama, why are these, why have they cut down all the trees?" And then he asked me, "Well, if they cut down all the trees everywhere, would that have an effect on how we breathe?"

The water we drink just comes out of the faucet and sometimes he'll say something like "this water doesn't look right." You know, it could have something in it that could be detrimental to us. [My son asks] "could it hurt me? How do we know what's in this water?" And to some of his questions I have no answer because I mean, I cannot tell him what's in the water 'cause I don't know. I wonder some things myself.

Such conversations point to an appreciation for nature (of trees), environmental concerns which arise through direct experience of environmental degradation (the cutting of trees and water pollution), and perhaps some sense of powerlessness in not being able to preserve what exists of their community's natural beauty and in not knowing about their environment's safety. Parents also acted to help the environment, often in terms of recycling.

We also asked parents to rank the importance of environmental science education for their children (on the same 10-point scale used for their ranking of drug education). To our surprise there was no statistical difference in parents' mean ranking for the importance of drug education and environmental education (8.5 versus 8.7, respectively). In supporting their judgments, parents sometimes reasoned that both drug and environmental education impact human well-being: "Let's put it like this here: If you don't take care of one [drugs] it's going to kill you. If you don't take care of the other [the environment] it's going to kill you."

Some previous research has suggested that economically impoverished African Americans have little interest in and concern for the natural environment and environmental issues (Hershey & Hill, 1977–1978; Hohm, 1976; Kreger, 1973; Mitchell, 1979; cf. Roszak, Gomes, & Kramer, 1995). One explanation which has been offered is that distinct qualities of the African-American experience—such as a history of slavery—have denied “blacks

the opportunity to develop appreciative attitudes toward nature and the environment” (D. E. Taylor, 1989; quoted in Mohai, 1990, p. 748). Or in the words of the political activist Eldredge Cleaver (1969): “black people learned to hate the land . . . [and] have come to measure their own value according to the number of degrees they are away from the soil” (pp. 57–58). Our research with children and parents of an African-American community in Houston, Texas, points in a different direction so far as it shows ways in which an environmental sensitivity and commitment—biophilia, broadly construed—is interwoven within the larger cultural and contextual fabric.

Universal Features of Children’s Environmental Views and Values

The Brazil study provides one stepping stone toward thinking about the universality of our findings. In this study, we interviewed in Portuguese two groups of fifth-grade children. One group lived in Manaus, that capital of the State of Amazonas, which is located 13 miles above the junction of the Rio Negro and the Amazon River. It is at this junction that the Amazon River is said to begin. Although Manaus services a growing ecotourist trade from North America and Europe, and strives to encourage national and international development, it is also a city of great poverty. In contrast, the other group of children lived in Novo Ayrao, a small, remote village with approximately 4000 inhabitants. The village could only be reached by means of an 8-hour boat ride up the Rio Negro from Manaus. The villagers’ primary economic activities included fishing and the extraction of forest products, most notably lumber. The landscape was largely pristine with only small areas cleared for housing, commerce, and dirt roads.

Our results showed that both groups of Brazilian children demonstrated environmental sensitivities and commitments based on a wide range of measures. The children were aware of various environmental problems, such as air and water pollution, and the “quemada”—the large-scale burning of the Amazon jungle. They discussed environmental issues with their family. Based on the criterion judgments of prescriptivity, rule contingency, and generalizability, the children believed that people were morally obligated not to throw garbage in the Rio Negro. Moreover, children said that throwing garbage in the river hurt various parts of the environment (namely, birds, insects, the view, and people who lived alongside the river), and they cared that such harm occurred. The children also demonstrated understandings of and sympathies toward the Amazon rain forest. They believed, for example, that the current logging practices employed in the jungle were wrong, and that the government, and they themselves, should do something to stop the deforestation.

At the same time, it is unclear the extent to which these children’s environmental sensitivities and commitments do (and as the children mature will) withstand various economic and cultural pressures. Among many people

worldwide, earning a livelihood can conflict with environmental commitments. Understanding how children and adolescents resolve such conflicts involves analyses of complex relations between judgment and action, and the coordination of multiple kinds of judgments (Blasi, 1980; Smetana, 1983, 1995; Turiel, *in press*; Turiel, Hildebrandt, and Wainryb, 1991). Still, our results show that children's environmental moral reasoning can override conventional practices (cf. Helwig, 1995; Killen, 1990; Laupa, 1991; Nucci & Nucci, 1982; Turiel, 1983).

By design, many of the data from the Brazilian study were collected so that they could be directly compared to data from the fifth-graders in the Houston study. The results from this cross-cultural comparison showed one particularly surprising difference. It was expected that because Brazilian children, particularly in Novo Ayrão, lived closer to nature than their Houston cohorts, that more biocentric reasoning—which embeds humans in a larger ecological moral community—would emerge. In contrast, Brazilian children used a greater percentage of homocentric welfare reasoning and a lesser percentage of unelaborated harm-to-nature reasoning than did the Houston children.

The comparatively heavy use of the homocentric welfare reasoning may arise because rural and urban children in the Amazon region more directly depend upon nature for their physical survival than do urban children in the United States. This explanation is further supported by the findings that more Brazilian than Houston children said that plants played an important part in their lives, and that they would not care if insects (some of which carry deadly diseases in the Amazon region) were harmed by water pollution. It is possible that biocentric reasoning does not emerge in every culture that lives close to the land. It is also possible that a developmental movement to biocentric reasoning could be found in older Brazilian adolescents and adults. Further studies with older indigenous populations would prove fruitful in addressing this issue.

But perhaps most surprising is not that such differences occurred, but that overall so few occurred. Namely, there were only two statistical differences (regarding plants and insects, noted above) between the groups across 26 separate questions (which formed a large body of both studies), and no statistical difference based on a comparison of composite scores of each group's environmental orientation. Moreover, the coding system developed from the Houston study was robust enough to account for the Brazilian data.

Indeed, the very wording of children's reasoning across cultures was often strikingly similar. For illustrative purposes, consider but the following four pairs of matched examples:

- 1A. [It is not all right to throw garbage in the river] because it causes pollution that is dangerous for us. Because now we have cholera, a very dangerous disease and there are others attacking us like the malaria. (Brazilian child)

- 1B. Because some people that don't have homes, they go and drink out of the rivers and stuff and they could die because they get all of that dirt and stuff inside of their bodies. (Houston child)

Both of the above children reason that is wrong to throw garbage in the local waterway because people might drink from polluted water, and get sick ("now we have cholera, a very dangerous disease"; "they could die").

- 2A. Because the river was not made to have trash thrown in it, because the river belongs to nature. (Brazilian child)
- 2B. Because water is what nature made; nature didn't make water to be purple and stuff like that, just one color. When you're dealing with what nature made, you need not destroy it. (Houston child)

Both of the above children base their environmental judgments on the view that nature has its own purposes ("the river was not made to have trash thrown in it"; "nature didn't make water to be purple and stuff").

- 3A. Because animals have to have their chance. They also must have to live. We should not mistreat them, because if it happens to us, we don't like it. (Brazilian child)
- 3B. Some people don't like to be dirty. And when they throw trash on the animals, they probably don't like it. So why should the water be dirty and they don't want to be dirty. (Houston child)

Both of the above children judge as wrong the mistreatment of animals based on considering whether humans would similarly like to be treated in that way ["because if it happens to us, we don't like it"; "some people don't like to be dirty . . . (so the animals) probably don't like it"].

- 4A. Even if the animals are not human beings, for them they are the same as we are, they think like we do. (Brazilian child)
- 4B. Fish don't have the same things we have. But they do the same things. They don't have noses, but they have scales to breathe, and they have mouths like we have mouths. And they have eyes like we have eyes. (Houston child)

We examined this last example earlier. That is Arnold speaking. Like Arnold, the Brazilian child recognizes that while animals are not identical to human beings ("animals are not human beings") that both animals and people have significant functional equivalences (animals "think like we do").

Thus, in accord with Kellert's (1996a) cross-cultural findings, this study suggests that there may be universal features of children's environmental moral reasoning (cf. the Hillcoat, Forge, Fien, & Baker, 1995, study in Australia).

One last example from the Houston study can extend this idea. Houston is one of the most polluted cities in the United States. Local oil refineries contribute not only to the city's air pollution, but to distinct oil smells during

many of the days. "Treated" sewage is often discharged into the bayous that run through the city of Houston, and by this means the sewage is transported to the ocean. The bayous often smell of pollution, and are not safe for swimming or wading. Within this context, our results showed that two-thirds of the African-American children we interviewed understood about ideas of air and water pollution in general. However, only one-third of the children believed that environmental issues affected them directly. How could this be? How could children who know about pollution in general, and live in a polluted city, be unaware of their own city's pollution? A possible answer is that for children to understand the idea of pollution, they need to compare existing polluted states to those that are less polluted. In other words, if children's only experience is with a certain amount of pollution, then that amount becomes not pollution, but the norm against which more polluted states are measured. Equally plausible, what we perceive in the children we interviewed might occur in all people from generation to generation. People may take the natural environment they encounter during childhood as the norm against which to measure pollution later in their lives. The crux here is that with each ensuing generation, the amount of environmental degradation increases, but each generation takes that amount as the norm—as the nonpolluted state. Thus, future analyses may do well to focus on how children and adults draw on similar processes to construct understandings about the health of their natural environments.

CONCLUSION

I began with two questions. "What is biophilia?" and "Why is it important for developmental psychologists to understand and study it?" More so than at the beginning, I am now in a position to summarize an answer that perhaps even a cautious reader may find compelling.

The research literature speaks relatively strongly for the proposition that people have a need and propensity to affiliate with nature. That is biophilia, in its least developed and least controversial form. It also is clear that humans affiliate both positively and negatively with nature. Although it is not unreasonable to call the former affiliations "biophilia" and the latter affiliations "biophobia," I think in the long run that that approach will not be as productive (let alone elegant) as following Wilson's lead. Let biophilia refer to both positive and negative affiliations, and then take up the task of integrating both within a larger framework. Following this counsel, and drawing on structural–developmental theory, I showed how through the individual's interaction with the social and natural world, biophilia might increase in scope and adequacy, and in so doing transform negative affiliations with nature into, ultimately, a life-affirming orientation. Such an account may also be normative. For if Piaget is correct that superior forms of knowledge succeed and are transformations of relatively inferior forms, and that the study of

child development helps one to discover the criteria for judging the relative adequacy of knowledge, then the upshot for an advanced form of biophilia is this: it is good, and we should study its development in children.

Empirically, my collaborative research supports the biophilia hypothesis, and fleshes it out developmentally. Our research, for example, reveals ways in which children have an abiding affiliation with nature, even in economically impoverished urban communities where such affiliations may seem least likely. We also have begun to characterize the developing structure of children's environmental reasoning and values. For example, human-oriented ways of relating to nature (homocentric reasoning) did not disappear in children's development, but at times appeared embedded in a larger ecological structure (biocentric reasoning). Such biocentric reasons included considerations based on the intrinsic value of biological life, teleos of nature, and rights of nature. Moreover, our research in the Brazilian Amazon provided some initial support that there exist universal forms of children's environmental moral reasoning and values. Thus, in line with the biophilia hypothesis, it may be that there are aspects of nature itself that help give rise to children's environmental constructions. If so, nature is not a mere cultural convention or artifact—as some cultural theorists might suggest—but part of a physical and biological reality that bounds children's cognition.

Most developmental psychologists readily agree that based on principles of genetic advantage our evolutionary history shapes and constrains developmental processes and pathways. Most evolutionary theorists as readily agree that experience and culture influence development. Yet for a variety of reasons, interdisciplinary research on what are fundamentally interdisciplinary problems is rare. Usually, at best, one can but ferret out mutually consistent propositions, as I have sought to do with biophilia. For example, aesthetic judgments of landscapes may well have been shaped by evolutionary processes. In turn, our research suggests that aesthetic judgments—while a secondary phenomenon in an evolutionary explanation—may become primary in understanding cognition and how a self moves beyond only self-centered orientations. Yet important interdisciplinary work remains. Is it possible, for example, to delineate not only mutually consistent propositions, but isomorphic processes and structures between the disciplines? Piaget sought for such ground based on principles of self-regulation, adaptation, and equilibration. These still seem like robust principles, perhaps implicated as thoroughly in evolutionary theory as I have suggested they are in cognition.

Too many areas have been logged and logged again, divided and subdivided, mined, dammed, polluted, paved, built upon, and made increasingly inhospitable to the diversity of life, ours included. Such issues can and should engage developmental researchers. In part, the challenge is to understand how environmental degradation impacts psychological development. But that is of a piece with something larger: namely, to understand how humans come to affiliate with, if not revel in, the splendor of the natural world.

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