The Native Mind and the Cultural Construction of Nature

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1 Introduction

It is the best of times; it is the worst of times. Recent years have seen stunning advances in understanding the basis of life, ranging from unraveling the human genome to discovering extraterrestrial sources of generation and extinction. Although some would argue that macrobiology has been neglected in favor of microbiology and biotechnology, there has been undeniable progress in understanding complex systems, including ecosystems. From remote sensing to environmental chemistry, scientists are delivering insights into how to protect the environment. And awareness and concern about life on our planet is widespread. A recent survey found overwhelming endorsement of the statement that we "have a moral duty to leave the Earth in as good or better shape than we found it" (Kempton, Boster, and Hartley 1995, 257). No part of the earth is untouched by advances in both the science of nature and commitments to support it.

But it is also the worst of times. There is an increasing sense of diminished human contact with nature, a phenomenon some refer to as the "extinction of experience" (Nabhan and St. Antoine 1993) and others as a "Nature-deficit disorder" (Louv, 2006). Respondents in the same survey above agreed that "the majority of people are completely cut off from nature. They spend their time indoors and when they're outdoors, nature is just an inconvenience to them."

Under such circumstances, commonsense knowledge of nature is poor, sometimes surprisingly so. As we write this, buckeyes and horse chestnuts are flowering in northern Illinois, but fewer than half of Northwestern University students surveyed say they have even heard of horse chestnut or buckeye. Below is part of an interview with a Northwestern Honors student who expressed surprise that 3- and 4-year olds were asked to give examples of plants. She was then asked to generate examples herself:

I: Tell me all the kinds of trees you know.
S: Oak, pine, spruce, ... cherry ... (giggle) evergreen, ... Christmas tree, is that a kind of tree?... God, what's the average here?... So what do kids say, big tree, small tree?
E: Tell me some plants.
S: I can't think of any plants that aren't trees ... I know a lot about angiosperms, gymnosperms, gametophytes, sporophytes ... but this is biology. It's not really about plants and trees....

It would be hard to find such relative lack of knowledge about salient local species, even—as we will see—among 4-year-old Mexican Maya. Nevertheless, this extinction of experience is not confined to technologically advanced societies. Researchers studying small-scale societies report diminishing knowledge about nature; they note that with greater formal education comes lesser knowledge (Diamond and Bishop 1999; Wester and Yongvanit 1995). A central theme of this book is tracing the cognitive consequences of this loss of knowledge.

1.1 Overview

It does not take a genius to figure out that we live in a fragile world. We are told not to eat fish more than once a week and pregnant women are advised to avoid fish altogether because of mercury contamination. Recent droughts have left Lake Powell at half its former size and the Western region of the United States faces serious water shortages. Global warming seems almost minor by comparison. And it is not just what we are doing to the earth. We live under the shadow of terrorism that threatens to escalate into nuclear, chemical, or biological warfare. Even "business as usual" involves frequent cultural clashes over natural resources, such as access to salmon, preserving spotted owls, or rights to land. This book is about both of these dimensions: first, the relationship between how people think about the natural world and how they act on it, and second, cultural differences in these understandings and how they contribute to intergroup conflict or cooperation. Our enterprise is grounded in the cognitive sciences, and relevant ascriptions include resource dilemmas, mental models, culture and cognition, folkbiology, categorization and reasoning, protected or sacred values, and environmental decision making. Each of these topics is central to our efforts. An important overarching theme is that they can best be addressed by bringing psychology and anthropology together.

Claims about the nature of human nature, with their associated policy implications, require the very best analyses that an interdisciplinary cog-

nitive science has to offer. People's behavior toward the natural world is surely conditioned in part by their ways of knowing and modeling it. What are these modes of knowledge and understanding? How are they affected by goals, theories, and intimacy of contact with the biological world? What is universal, what is not, and what are the implications of such observations for insights into the development of biological cognition? How does cognitive and cultural development lead some people to protect their environment and others to destroy it? These questions shape the present book.

1.2 Why Focus on Biological Cognition?

Much of human history has been spent (and is being spent) in intimate contact with plants and animals, and it is difficult to imagine that human cognition would not be molded by that fact. In subsistence cultures, survival depends on a detailed appreciation of the habits, affordances, and interactions linked to the biological world. In technologically advanced cultures, which are increasingly faced with environmental degradation and nonsustainable use of natural resources, no less may be at stake.

There are a series of mutually reinforcing reasons for studying people's understanding of the biological world. First, biology represents a natural unit of analysis and appears to be a core component of human cognition. To get along in the world, people need to be able to understand and predict the general properties and behaviors of physical objects and substances (physics), the more specific properties of plants and animals (biology), and the particular properties of their fellow human beings (psychology). We will argue that biology represents a distinct module of mind that is associated with universal patterns of categorization and reasoning. Some of these principles are robustly universal and some depend on having more than modest contact with nature. Yet others are highly dependent on particulars of cultural models and associated values. Each of these three classes of findings has important theoretical and practical implications.

A second reason for a focus on biology is that biological kinds provide a natural metric for cultural comparisons. Although the specific animals and plants vary considerably across the world, scientific taxonomy constitutes a structure for comparing kinds at corresponding levels of specificity (e.g., bird and fish versus duck and trout). Ethnobiologists often begin their research in some area by conducting a survey of local plants and

animals. These surveys constitute important background information for a variety of questions that one can ask in any cultural context. For example, one might ask about which species are important enough to be given distinct names and in general how folktaxonomies map onto scientific taxonomy.

Third, biological cognition may be a central factor in science education. Children do not enter the classroom free of knowledge and beliefs about nature, and these conceptions and conceptual frameworks may facilitate or interfere with classroom learning, depending on the relationship between the two spheres and the skill of the educational system in building on and otherwise taking advantage of this experience. A challenge and complication is that science education is not "culturally neutral" and, as we will see, one obstacle to success in science learning is the mismatch between the culture of science and the epistemological frameworks and worldviews associated with different cultural groups.

A fourth, closely related reason for an interest in biological cognition is that advancing technology and urbanization may be associated with a distancing of humans from nature. We are interested in the cognitive consequences of diminished contact with the natural world and, to anticipate, they are considerable and have serious implications.

A fifth motivation for research on biological cognition is its relevance for understanding environmental decision making. Knowledge, values, beliefs, and actions are often intricately interwoven in ways that render simple utilitarian models of decision making irrelevant. We will see that different cultural groups living in the same area and engaged in more or less the same activities may have strikingly different mental models of nature. These differences are associated with dramatic consequences for environmental decision making in general and sustainability of practices in particular. In many cases, they also may be at the heart of intergroup conflict over natural resources.

1.3 The Case for Interdisciplinary Approaches: Why Anthropology and Psychology Need Each Other

Critique of Cognitive Psychology

In many respects anthropology and psychology are perfect foils for each other because of their complementary strengths (and weaknesses). Initially, we focus on limitations of cognitive psychology in order to set up a contrast with anthropology.

Universality One of our psychology colleagues is fond of saying that he is only interested in studying what is "universal." Of course, universality seems transparently desirable; it represents the ideal on the dimension of "findings of broad applicability." For the moment let's not quibble; let's adopt the view that the quest for universality is good for science. Nonetheless, it must be said that if cognitive psychology thinks that universals are desirable, it has a peculiar way of going about its quest for them. Research in cognitive psychology almost exclusively targets a single, select subset of a single culture and population: college freshmen and sophomores; and not freshmen and sophomores in general, but rather those at major research universities taking introductory psychology. Only with considerable effort could one come up with a more select, narrow population to study.

To be sure, there are exceptions to this narrowness. Some cognitive psychologists do research where they try to isolate distinct subsets of participants to explore possible (subgroup) differences. For example, one might study the performance of students who score high or low on some scale of interest (e.g., need for cognition) on some other task. Surprisingly, selecting within an already select population often does yield differences. To outsiders, however, this may seem like planning two vacations to be as different as possible subject only to the constraint that one travel no more than a kilometer from home.

The other prominent exception is research on cognitive development. Even in this case, however, populations are sampled with convenience and little else in mind (witness the frequency with which the population studied is children attending a university-sponsored grade school). In short, it would not be much of a caricature to suggest that cognitive psychology does not search for universality but rather assumes it. If cognitive psychology has laws or generalizations to offer about how the mind works, it has so far shown little interest in putting them to the test of whether they fit humanity at large.

Sampling of Stimulus Materials One of the strengths of cognitive psychology is its focus on systematic, controlled comparisons. Historically, this concern was so strong that psychologists studying learning made use of nonsense syllables to limit any influence of prior experience or knowledge. Although this particular habit has been discarded in favor of using meaningful materials, experimentalists have concentrated on finding materials with particular desirable properties (in terms of controlling for

extraneous factors), with little concern for the relation between such materials and the range of stimuli over which one might wish to generalize. The idea of systematic sampling is somewhat alien, perhaps because it is not always clear how to answer the question, "systematic with respect to what?" For example, if a psychologist wants to compare reasoning involving living kinds versus human artifacts as stimuli, he or she typically would generate examples, subject only to the constraint that undergraduates be familiar with them. Rarely, if ever, would it occur to the psychologist to ask what kinds of artifacts or what kinds of living kinds there are and how one might go about selecting a representative sample.

Reference A related limitation of research in cognitive psychology is that conceptual behavior is often studied with little concern about reference. For studies involving adults, the stimuli are often words and seldom does the researcher establish any relation between these words and what their referents are. For living kinds other than mammals, college students often have little idea about reference beyond a very general level (e.g., "such-and-such is a tree"). For developmental studies concerned with living kinds, the stimuli are typically toys, which are at best representations of living kinds. Again reference is rarely established. Of course, for some questions of interest, reference may not matter, but our impression is that, as in the case of populations and stimuli, convenience and control tend to dominate a systematic analysis of the domain of interest.

Anthropology as a Contrast

The above limitations of research in cognitive psychology would strike many cultural anthropologists and ethnobiologists as odd. Consider how an ethnobiologist would undertake the study of folkbiology in some new culture. The project could hardly get underway without asking what living kinds are found in that culture, what terms exist in the language referring to living kinds, and what the relation is between those terms and what is there (the issue of reference). How does one describe what living kinds exist in some cultural context? A reasonable starting point is to use scientific taxonomy as a reference or standard. For example, one might ask whether every kind that science recognizes as a distinct species has a distinct name (Diamond and Bishop 1999). On finding that many kinds do not have distinct names it is natural to ask what principles determine whether a species has a distinct name (Berlin 1992). For instance, naming

could be driven by relevance to humans (utility), perceptual discontinuities, or even size (Hunn 1999).

Scientific taxonomies are, of course, hierarchical taxonomies and, as such, provide both a set of standards and a heuristic for asking other questions about universal aspects of folktaxonomies. There are two important analytic points involved here. One is that although the particular kinds of plants and animals to be found may vary across cultures, the abstract structure in terms of species, genus, family, order, class, division, and kingdom will be represented. Consequently, scientific taxonomy provides something of a conceptual grid for cross-cultural comparisons. The second, related point is that using a scientific taxonomy allows one to establish corresponding ranks such that it becomes meaningful to state that oak is at the same level or rank as is trout. This does not mean that they are psychologically at the same rank, but it does provide a basis for asking questions such as whether some culture differentiates mammals more than fish. As it turns out, ethnobiologists have found that folk ranks and folktaxonomies only loosely approximate scientific taxonomies but formal taxonomy has served as an effective standard for cross-cultural comparisons (Hunn 1975).

Note that the practices that are most natural for an ethnobiologist address each of the limitations that we have attributed to cognitive psychology. Folktaxonomic analyses provide a framework in which one can propose and evaluate hypotheses about cognitive universals (Berlin, Breedlove, and Raven 1973). The main criticism we can offer for the issues in question is that ethnobiologists have tended to focus first on small-scale subsistence cultures to the neglect of larger, more industrialized cultures, and second on culturally competent adults rather than children (Hirschfeld 2003). In sum, so far pretty good for anthropology.

Critique of Anthropology

We turn now to limitations of anthropological approaches to folk biology as seen through psychologists' eyes.

Where (and what) are the data? Again at the risk of caricature one might argue that ethnobiological observations often fall short of the minimum needed for scientific progress. In many cases ethnobiological facts and observations are presented in summary form with no clear indication of their source. Are the informants a representative sample or a few local wise people or experts? In some instances no mention is made at all of the informants as if the "facts" were free-floating entities in the culture. Without more precise identification of the data one cannot begin to assess basic

requirements for science such as replicability. Only in the last couple of decades have some ethnobiologists started to question the summary notion of an "omniscient informant" in favor of an analysis of variation within human populations (Boster 1986b).

Commensurable Units of Analysis in Data and Theory Philosophical argument to the contrary, cognitive psychologists bask in the belief that mental representations (and meanings) reside in the heads of individuals. To be sure, they might be sensitive to a social contribution in the construction of meaning, but they know where mental representations hang out. Not so in anthropology. Ethnobiologists seem as uncomfortable as behaviorists in talking about mental representations, whereas most psychologists do not know what to make of anthropology's talk of "cultural representations." Are cultural representations just the mental representations of some ideal informant, or are they differentially shared by the minds of several or all informants? If the latter, there are psychologically intriguing issues concerning the causal structure of such distributed knowledge (Hutchins 1995) and whether such knowledge might have emergent properties that cannot be reduced to the mental life of any single individual (Sperber 1996).

Different questions surely require different levels and units of analysis; however, there must be a measure of commensurability between psychological and anthropological analyses if there is to be cooperation and cumulative progress in understanding. To be blunt, ethnobiologists cannot make claims about how individuals perceive, organize, and act on the natural world without worrying about what is in the heads of individuals and how such mental representations are causally linked to one another and to individual actions.

An analogy may serve to make the point. Economists study systems at different levels of analysis and historically they have tended to assume that aggregate behavior derives from optimal behavior on the part of individuals. One important contribution of psychological studies of decision making and choice behavior has been to destroy the illusion of optimality and replace it with a systematic, theoretical, and empirical analysis of decision and choice (see Tversky and Kahneman 1986; Fischhoff 1997; Markman and Medin 2004). In exactly the same way, we think that ethnobiology needs to include individuals as units of analysis for claims about individuals. Anthropology cannot simply assume that culture (including language) is assimilated in something of the same way a body

warms to the sun. (See Strauss and Quinn 1992 for a critique of this view from within anthropology.)

If anything we may be guilty of downplaying this issue. At times within anthropology, the methodological point that anthropological observations are socially constructed has been elevated to a form of self-immolation that threatens to destroy the science part of anthropology as a social science and move it squarely into literature. As one of our anthropological colleagues is fond of saying, fieldwork should focus on research that is liable to "awe" our own, often complacent culture with the diversity of collective human imagination and action. We readily grant the importance of demonstrating the rich variation in human thought and experience, but we think that more rigorous science could better help to make the case.

Role of Models and Theories One tricky thing about knowledge is that there are no free peeks at mental representations. This is true both for the scientist and the informant. At one point researchers interested in developing computers as expert systems hoped that knowledge could be transferred from human expert to machine simply by asking the expert to report what he or she knew. This effort was largely unsuccessful because experts cannot, by an act of will, simply make their knowledge accessible. Artificial intelligence "knowledge engineers" and psychologists have learned to use indirect measures of knowledge and to draw inferences from patterns of behavior. This is an important operating procedure in cognitive science—that is, developing and testing methods and models that foster inferences about knowledge representation and use. Quantitatively based models and theories are not complete strangers to anthropology, but neither are they intimate friends.

Cognitive Psychology as a Contrast

The stock-in-trade of cognitive psychology is theoretical models of human cognition and a well-honed set of methodological tools for drawing inferences from behavior to internal processes. Also involved are tons of data (often from narrow, overly controlled, decontextualized settings, but data nonetheless); if anything, cognitive psychology suffers from rigor mortis.

We are convinced that a cognitive science of folkbiology that combines and integrates the strengths of its constituent subfields holds great promise for progress in understanding how people cognize the natural world.

The challenge of understanding biological cognition is daunting. Consider the presumably simpler task of understanding temperature regulation, a problem that has its own evolutionary history. Here it has been found that temperature regulation in human beings involves the integration of multiple parallel systems (e.g., shivering, sweating, putting on clothes) that vary in their refinement and redundancy (e.g., Satinoff 1983). We should not expect anything less for something as intricate as people's understanding of the natural world.

1.4 Theoretical Issues in the Cognitive Science of Folkbiology

Fortunately, progress can come in small steps. Folkbiology is a field blessed with many intriguing and important issues that lend themselves to an analysis in terms of culture and cognition. Let us turn to a sample of three of them before returning to the central themes of this book.

1. *Are folkbiological categories recognized or constructed?* A basic issue within ethnobiology concerns whether categories are recognized versus constructed (see Malt 1995; Brown 1995). One view—known within ethnobiology as the "intellectualist" view—is that the structure of kinds in nature is comprised of "chunks" that more or less impose themselves on minds (at least minds with a perceptual system like ours). This position is reinforced by the finding that folk categories often correspond to scientific species or genera and by cross-cultural agreement in folktaxonomic systems (e.g., Atran 1990; Berlin 1992). (However, Atran interprets agreement in terms of universal properties of mind rather than the structure of nature alone.) The alternative, or "utilitarian," view is that folktaxonomic systems are influenced by goals, theories, and belief systems and may be culture-dependent constructions (Hunn 1982; Ellen 1993). Other intermediate positions hold that the intellectualist and utilitarian views are not necessarily mutually exclusive. For example, their relative influence may depend on factors such as rank in the hierarchy (Bulmer 1970): cultures may differ more in the structure and use of categories such as tree or bird (corresponding roughly to class in an evolutionary scientific taxonomy) than they do for oak or robin (corresponding roughly to the generic or species level).

2. *Is reasoning from folkbiological categories similarity-based or theory-based?* Especially within cognitive psychology, folkbiology is an appealing domain from the contending standpoints of both similarity-based and theory-based views of categorization and category-based reasoning. On

the one hand, our perceptual system is surely an adaptation to the natural world, and if similarity-based models are going to succeed anywhere, it should be here. On the other hand, the biological world is apparently a world of fairly stable clusters of complex features whose remarkable endurance in the face of constant change can presumably be explained in terms of naturally occurring causal patterns. Understanding causal patterns in the world is a primary goal of theory-driven knowledge in science, and the history of science is coterminous with trying to understand biological causality in particular. If theory-based knowledge were to develop anywhere outside of science—in other cultures or in everyday thinking—it should be here.

From the perspective of similarity, there are evident patterns of covariation for biologically related attributes: toothless two-legged beings generally have wings, feathers, and fly; leaves, flowers, and fruits generally go together with stems and roots; and so on. Perhaps most people in the world are aware of these covariations without necessarily understanding their causal origins or interrelations, such as the role of feathers in flight or of leaves in stem development. In other words, there could be quite a bit of biologically relevant data that is stored but not theoretically assimilated.

Nevertheless, people in different cultures acknowledge, and often try to better understand, at least some of the causal interrelations among covariant biological attributes. These include irreversible patterns of biological growth (maturation); the apparent constancy of covariant morphological, anatomical, and behavioral patterns across generations (reproduction and inheritance); the success of mutually constraining actions of interrelated attributes in maintaining life (bodily functioning); and the breakdown of interrelated bodily functions (illness and death). Moreover, these "naive" attempts at causal explanation are themselves interrelated, often with the sort of resultant explanatory bootstrapping and integration of the database that could help to kick off the development of science.

Suppose, as ethnobiologists generally agree, people everywhere witness certain covariant biological patterns (roughly corresponding to perceptually salient species or genera), but interpret the causal relationships underlying these patterns in different ways. This might suggest that similarity-based reasoning is prior to theoretically based reasoning, at least in the biological domain. This was a message of developmental studies in the 1980s (Carey 1985; Inagaki and Sugiyama 1988; Keil 1989). More recent studies have lowered the age at which children are thought

to reason causally about biological kinds. But the origins of causal reasoning in folkbiology remain a matter of controversy.

A closely related question concerns which factors shape the acquisition of biological knowledge and the extent to which their influence extends to adult (more or less steady-state) knowledge. Researchers in the area of cognitive development have been actively studying the role of language in conceptual development (see Waxman 1999, 2004) and are increasingly turning to an analysis of the role of input conditions (Hatano and Inagaki 2003; Gelman et al. 1998), at least at intermediate stages of development.

3. *Is folk biology a "naive" form of scientific biology?* To some extent, the fact that most psychologists prefer the label "naive biology" or "intuitive biology" over the ethnobiologist's "folkbiology" implies somewhat different understandings and uses of scientific biology as a standard of comparison. For those interested in the structure and development of biological causality in our own culture, folkbiological concepts often appear to contain "rudimentary" or "inchoate" elements and clusters of more sophisticated scientific concepts. Although there has been little systematic study of the input conditions and processes by which scientific concepts are assimilated into lay thinking, there is hardly any doubt that science is pervasively involved in how people in our culture come to think about the biological world. The influence of science may be especially pronounced among the university subpopulations psychologists prefer to study, but most of the general population is heavily exposed to scientific concepts in one form another through schooling, nature programs on television, popular books, the press, and so forth.

The elaborate folkbiological inventories that ethnobiologists have shown time and again for many small-scale subsistence societies often match and occasionally even surpass in intricacy and accuracy the knowledge of field biologists working in the same locales as those societies (e.g., Bartlett 1936; Simpson 1961; Bulmer and Tyler 1968). Moreover, few ethnobiologists would consider it enlightening—but rather misleading—to characterize the significant differences between folk knowledge in other cultures versus science in terms of relative degrees of intuition or naïveté. Admittedly, ethnobiologists might well agree with psychologists about referring to lay biology in our culture as "naive" in comparison to the relative sophistication of science as well as folkbiological knowledge in other cultures.

A key issue is whether basic folk concepts, such as folk species or generics, are different in kind from contemporary scientific concepts,

such as the idea of a species as a logical individual (i.e., a lineage of connected parts) rather than a logical class (i.e., a meaningful collection of individuals) (Ghiselin 1999). If they are not really different in kind, but only in degree of sophistication, then there may be no reason for holding on to the lay concept at all, except perhaps as an optional psychological convenience for navigating the everyday world (see also Kripke 1972; Putnam 1975). If, however, folk and scientific concepts are different in kind, then perhaps they have separate but equal—or at least different—roles to play in the attainment of knowledge (Dupre 1999; see also Braisby et al. 1996). Folk concepts would be useful for accommodating to the everyday world and scientific concepts for exploring the cosmos at large (including extended thoughts about evolutionary dimensions of space and time that would be largely irrelevant to ordinary understanding and action).

Finally, one might accept that folk and scientific concepts may be different in kind, or that folk concepts are in some sense psychologically more convenient in a given culture or at a given stage of history or development, but argue that folk concepts ought to be replaced by scientific concepts (Hull 1999; cf. Russell 1948). For example, if it is true that people ordinarily believe that living kinds (including humans) have underlying essences (see Hirschfeld and Gelman 1994), then it is also likely that people will treat natural variation as deviance. If so, then the essentialist folk concept should be discarded along with other outworn "commonsense" myths, such as belief in witches or races, no matter how hard it is to unlearn them. Even if this should be case, however, understanding how people do in fact think about biological kinds (and other biologically related phenomena discussed in this book, such as diseases) may help us all to better cope with them.

Summary What is at stake in the interdisciplinary study of people's understanding of biology? A lot. Can human beings make the transition from locally sustainable adaptation to (technologically driven) global economies without irreparably damaging our environment or destroying local cultures? To address such issues researchers may need to integrate questions about the structure of biological cognition with systematic analyses of how knowledge is linked to action in diverse ecological and cultural contexts (Atran and Medin 1997; Atran, Medin, and Ross 2005). We hope that this book provides new intellectual tools for understanding how humans come to know nature.

1.5 Themes

In this book, we describe historical, cross-cultural, and developmental research on how people conceptualize nature (naive or folkbiology) and how they act on it (folkecology). This represents the results to date of an ongoing multidisciplinary, multinational project begun in 1991. Here we concentrate on cognitive, cultural, and historical processes in the devolution of knowledge and the consequences of devolution for environmental management. Our approach integrates three disciplinary perspectives:

- For cognitive psychology, we examine how results gathered from "standard populations" in industrialized societies often fail to generalize to humanity at large. This leads us to an account of several fundamental human processes of categorization and reasoning that differ substantially from current accounts. An important factor motivating our experiments, and our interpretation of them, is how plausible the results appear in light of evolutionary biology and psychology.
- For developmental research, we find that usual study populations represent instances of impoverished experience with nature. This has serious implications for science education in our own society. Perhaps even more vital, this may help to reverse today's dismal prospects of integrating science and folk knowledge in other societies in ways that do not denigrate or destroy valuable and often irreplaceable local understandings of nature.
- For cultural and environmental studies, we show that even groups living in the same habitat can manifest strikingly distinct behaviors, cognitions, and social relations relative to it. Understanding why some people work in a way that degrades the environment while others manage to preserve and even enhance ecological diversity and resilience has critical implications for environmental and political decision making. It bears directly on how our species might deal with increasingly dire problems of sustaining our common environment as globalization advances. This line of research suggests a novel way of studying culture and culture processes and it points to a perspective on decision making that emphasizes values and meanings over probabilities and utilities.

We argue that cultural transmission and formation does not consist only, or even primarily, in the inheritance of shared codes of thought and behavior, but in complex distributions of causally connected representations across minds. Instead of viewing culture as a "top-down" structure that imposes itself on individual minds, we focus on modeling microprocesses

at the level of individual cognitions, decisions, and actions. This allows us to trace how macrostructural cultural norms and other social regularities emerge from decentralized local interactions between people. This enables us to avoid essentializing culture, treating it as an independent variable, or using it as a circular source of explanation for differences between groups. This approach also contrasts markedly with "influence models" that are common to economics and political science. Such models seek to "explain" sociocultural macrophenomena (e.g., political conditions, religious ideology) in terms of the "influences" of other sociocultural macrophenomena (e.g., economic conditions, material mode of production), where the causal nature of these influences remains materially unanalyzed and inscrutable.

1.6 Book Summary

In this book we argue that the combination of cross-cultural research with conceptualizing biological cognition as a privileged, domain-specific competence provides a new perspective on a range of fundamental issues in cognition. This perspective includes

- A need to revise current models of categorization and reasoning, which have been developed on a narrow empirical base, culturally speaking
- An analysis of the relative contributions of universal versus culturally specific processes to people's conceptions of biological kinds
- A shift in the appraisal of the role of so-called standard populations from constituting a norm to seeing them as reflecting the cognitive consequences of diminished contact with nature
- An appreciation of the role of values and meanings in decision making and environmental management

Our civilization is currently in the midst of a conceptual, technological, and moral revolution with regard to biological knowledge and its uses. World political and scientific leaders have called for a concerted effort to improve public understanding of what likely will be one of the most important domains of human inquiry and endeavor in the coming century, if not millennium. This book is about that "public understanding" viewed from a cultural perspective.

The remainder of the book is organized as follows. The next chapter provides a further introduction by examining folktaxonomies in detail, describing their relation to scientific taxonomy from a historical perspective, and providing an analysis of devolution in cultural support for

learning about the natural world. The introductory material concludes with chapter 3, which takes up methodological issues.

Chapter 4 presents a summary of our work on the role of culture and expertise in biological cognition and links these findings to theories of categorization and reasoning. Chapter 5 continues in this vein, focusing on developmental studies and corresponding implications for theories of cognitive development.

In chapter 6 we take up different approaches to the study of culture, and we argue for a cultural epidemiological approach to it. Chapters 7 through 9 illustrate our approach by presenting two intensive case studies, one focused on agroforestry among three cultural groups living in the lowland rainforest of Guatemala and the other focused on resource conflict between Native American and European-American fishermen in north-central Wisconsin. The final chapter summarizes conclusions and implications growing out of our work and points to some new and somewhat surprising directions in which our research is now headed.