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Learning Without Teaching: Its Place in Culture*

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Laymen and psychologists alike agree that some human learning takes place with the help of teaching and some takes place unhelped. Yet, as Jerome Bruner (1986) indicates, most experimental studies of "learning" ignore the role of real-life teaching and consider only the kind of drill provided in the experimental setting. This drill is usually seen as simulating repeated encounters with the evidence, rather than a deliberate teaching process.

By contrast social psychologists and educators are prone to focus almost exclusively on teacher-learner interaction and to ignore spontaneous learning. This is particularly true of L. S. Vygotsky whose pioneering work on the relations between the mental and the social is somewhat marred by his neglect of "natural" (as opposed to "cultural") development (Wertsch, 1985; cf. Fodor, 1972). As Wertsch points out:

> In his discussion of the relationship between development and instruction, (Vygotsky) argues that learning cannot be reduced to learning in instruction, yet that is precisely the interpretation that seems most compatible with his comments about the emergence of intrapsychological from interpsychological functioning. (Wertsch, 1985, p. 73)

Anthropologists, being primarily concerned with culturally transmitted knowledge, often take for granted that most learning directly or indirectly involves sustained interaction with others. But the equation, implicit in Vygotsky's work, of culturally transmitted knowledge with knowledge learned through instruction is ethnocentrically biased. In most human societies children become competent adults without the help of institutionalized teaching: There are no schools, no syllabus, no appointed teachers. Parents and other elders don't see their duty towards children as primarily one of education. They may, over the years, end up spending some time instructing the child in various skills, but actions carried out with the purpose of teaching are rare. Most learning is achieved as a by-product, in the course of interactions that have other purposes.

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All human life, hence all human learning, takes place in a social and cultural setting and is affected by that setting. This does not mean, however, that all human knowledge is socially transmitted: Individuals also learn from idiosyncratic experiences. Nor is all socially transmitted knowledge, properly speaking, taught: Some transmissions takes place without the help of the older generation, for instance by unencouraged imitation.[1] Transmission can even take place in spite of contrary teaching, as when parents teach one thing and practice another and are imitated rather than heard. The study of traditional societies, where rich cultures may be transmitted with very little deliberate teaching, suggests that some very basic learning abilities may need social interaction, but not teaching, in order to be effective.

In Western folk psychology, though, learning and teaching (sometimes expressed by the same word, e. g., *apprendre* in French) are considered as one and the same process seen from two complementary perspectives. When learning is achieved without apparent teaching, some kind of teaching is nevertheless assumed to have taken place. Thus we say "experience taught me. . . ," "he has taught himself. . . " These metaphorical extensions of the notion of "teaching" are carried over from ordinary language, where they are relatively harmless, into scholarly anthropology or psychology, where they beg many questions, as witnessed by the following exchange:

Papert: I would like to say something about Sperber's reference to abilities that appear in a child without having been *taught*. It is wrong to identify *teaching* with a standard situation in which a teacher stands in front of a class or a mother interacts with her child. There are much more indirect ways in which society transmits knowledge to its young. For instance we see many examples of one-to-one correspondence in our social life. The system of monogamy teaches many things; among them a precursor of arithmetic, that is, the idea of one-to-one correspondence. Is it not plausible that some forms are selected for this kind of function by some evolutionary process?

Sperber: One must distinguish between explicit, direct instruction, which in itself can account for the learning process, and objects of reflection, which can suggest to the subject a systematic development only if he has the equipment for that. An organism that constructed the one-to-one relationship from observing monogamy would not owe his learning to any kind of "teaching" but rather to his own faculties. (Piatelli-Palmarini, 1981, pp. 250-251)

[1] Imitation is far from the simple, unreflective phenomenon it is usually thought to be. Rochel Gelman, who was a discussant for this chapter at the Tel-Aviv workshop, plausibly suggests that imitation involves the novice (child, apprentice) "setting standards." The imitator selects a definite segment of behavior from (logically speaking, indefinitely) many possible behavioral segments, then uses that selection to further interpret and monitor the behavior of others. This allows the imitator to compare other behavior with the standard so as to master its implications. To a significant extent, therefore, even in imitation the mind may operate as a fairly autonomous mechanism that sets up and drives the use of a well-structured cognitive standard for processing behavior in the imitator's environment.

From an anthropological point of view, a social practice or an institution is characterized by the purpose the social actors attribute to it. From this viewpoint, teaching is a social practice aimed at causing learning (i.e., "education" in a broad sense). Teaching must be distinguished from other kinds of social practices that are not aimed at causing learning. Of course, the actual effects of a practice may be very different from its culturally recognized purpose. A teaching practice may, in fact, cause very little learning. Conversely, a ritual activity, say, that is not aimed at causing learning may nevertheless greatly contribute to learning because it displays a good deal of socially relevant information in an intelligible form.

Although teaching may fail in causing learning, where other institutions succeed, we expect teaching and learning to be on the whole—an in certain respects, essentially—correlated. But this correlation, which is an important anthropological and psychological topic, must be studied and not simply postulated.[2] From a psychological point of view, "learning" is a medley of problems and mysteries. The fact that learning is sometimes helped by teaching, or is dependent upon it, makes for a further problem rather than a solution.

The study of learning and its relation to teaching may be clarified by moving from a discussion of learning in general—a level at which few, if any, useful generalizations are to be expected—to learning in specific cognitive domains. The idea we want to advance is that not all concepts are equal. Different conceptual domains may require or tolerate different kinds of supporting environments. Some domains, particularly those where more or less spontaneous learning takes place, may need supporting environments with only a minimum of previous, culturally imposed structure. The environment's role would be merely to provide the physical targets that trigger the learner's attention. To say in such cases that we actually learn from the exemplars that occasion learning obviously begs the question of what may count as a legitimate datum. It is the conceptual structure of the domain that tells us what the entities are and how they are to be organized and interpreted.

But how are specific domains to be identified? Several well-known kinds of considerations can be brought to bear on the issue. Conceptual analysis can suggest domain-specificity by showing that the structures to be learned are very different, as between, say, arithmetic and color classification. The presence of much greater individual difference in performance in some fields (e.g., understanding mathematics) than in others (e.g., language comprehension) provides another source of evidence. An additional source is the study of specific cognitive losses, such as various forms of aphasia and agnosia, examples of which will be discussed later on.

[2] David Premack (1984) may be right in claiming that the human species has a unique pedagogic disposition. In other words, humans may well seize the chance to demonstrate or to correct performance in a way no other earthly species does. Thus, the distinction between learning *with* and learning *without* teaching may not be all that radical, with the boundary between the two being fuzzy or shifting. Even so, at this stage it seems to us more important to debunk the unreflective equation of "learning" with "being taught" by pointing to some major forms of learning without teaching and outlining the roles these play in culture.

One barely tapped source of evidence on the demarcation of cognitive domains is the study of cultural transmission: some bodies of knowledge have a life of their own, only marginally affected by social change (e.g., color classification, folktales), while other bodies of cultural knowledge (e.g., liturgy, advanced algebra) depend for their transmission, and hence for their very existence, on specific institutions. This suggests that culture should not be viewed as an integrated whole, relying for its transmission on undifferentiated human cognitive abilities. Rather, it seems that human cognitive resources are involved in different ways in the many more or less autonomous psychological subsystems that go into the making of culture.

With a few examples, let us illustrate how this simultaneously cognitive and anthropological approach might help demarcate those specific cognitive domains where spontaneous learning takes place.

Spontaneous Learning

Until recently, in anthropology as in education theory and developmental psychology generally, all human knowledge was assumed to be acquired essentially in the same way. Learning was seen to derive from a unitary system of cognitive structure, with some complexity in its organization over time, but not in its procedures at any given stage (Leach, 1964; Inhelder & Piaget, 1964; Vygotsky, 1965). Pathology aside, individual and cultural differences presumably owed to differences in the particular experiences the developing system was intended to interpret. By manipulating individual and collective experiences, then, people might be led to acquire different bodies of knowledge. Teaching could reasonably be seen as a deliberate manipulation of that kind, potentially effective in all domains.

There is now a good deal of plausible speculation and empirical evidence against such views. Work in theoretical linguistics and experimental psycholinguistics posed the first, and still the most significant, challenge to the idea of a single unspecialized learning ability (Chomsky, 1965, 1986; Pinker, 1984). For the first time in the study of the human mind, formally integrated and highly articulated systems of principles were proposed to account of significant aspects of human linguistic competence and for its development in the individual. No other psychological domain appears to reflect the peculiar kinds of empirical regularities that might suggest a wider operation of these linguistic principles in human cognition.

Furthermore, it takes extremely severe pathology or total deprivation of human interaction to prevent linguistic development. So far as we know, absence of language teaching (understood, in the widest reasonable sense, as interaction specifically aimed at helping language learning) is no hindrance at all. What role language teaching may play (when it actually occurs) is, as we have already suggested, very unclear. In a society with many social dialects, it may ensure that a socially more valued dialect is being learned. It may bring about a marginal difference in linguistic proficiency which, in a very competitive society, may turn out to be of real social significance. Other linguistic niceties are probably favored by some kind of language teaching. But basic linguistic abilities seem to develop spontaneously, given a modicum of ordinary linguistic interaction. This constitutes strong evidence not just for the innate, but also for the specialized, character of human language learning ability.

While language may provide the best and richest example of a specialized learning mechanism, it is not the only one. Take the case of color. Until the 1970s the dominant view of color categorization was that advanced in linguistics by Saussure (1916/1972), in anthropology by Benjamin Whorf (1956), and in philosophy by Willard Quine (1960). According to that view, innate human abilities impose no particular organization on the color continuum. Each culture apprehends this continuum and divides it into named zones as it wishes. Hence, there should be no universals in color categorizations—a prediction corroborated by a superficial look at color terms across languages.

To the contrary, more recent, methodologically sounder cross-cultural studies of color categories have indicated that basic color foci are perceptually invariable across cultures (Berlin & Kay, 1969; Heider, 1972; Kay & McDaniel, 1978). Thus, we find that in all languages having at least three basic color terms, there is one term whose meaning is best instantiated by focal red (a small region of the spectrum definable as a particular combination of hue, saturation, and brightness), and essentially the same holds for all basic colors. Moreover, variations in identifying the best instance of, say, "red" are individual rather than cultural.

Taken together, the cross-cultural and developmental evidence suggest that deliberate manipulation of the learning situation (other than deprivation of relevant input) could not fundamentally alter the content or development of color categorization. In other words, teaching is largely irrelevant to the learning of this very basic cognitive ability. In particular, different color terminologies, far from determining different color categorizations, all accommodate to the existing universal one. They differ merely in providing richer or poorer means of verbally encoding preexisting basic color categories. To be sure, what takes place once we move beyond *basic* color categories and look at elaborate terminologies linked to special uses of color (e.g., dyeing or painting) largely remains an open empirical question. In this regard, it would not be surprising if we found important cultural differences together with a regular involvement of teaching in transmission.

Nowadays cognitive scientists often take for granted the specific and spontaneous character of language learning abilities and are willing to acknowledge the cognitive specificity of each sensory modality. At the same time, there is still a widespread tendency to consider that our nonmodality-specific concepts are all learned and processed in the same way. In particular, it is often assumed in the cognitive literature that a single semantic theory uniformly holds for all terms, however much the kinds of objects or events they denote might differ. For instance, it is generally taken as

> [a] working assumption . . . that in the domains of both man-made and biological objects, there occur information rich bundles of attributes that form natural discon-

tinuities [and] these bundles are both perceptual and functional. (Rosch & Mervis, 1975, p. 586; see also Smith & Medin, 1981)

Consequently, when interesting results are found for, say, living kinds, as a matter of course they are extended to, say, artifacts. This not only applies to the adult's conceptual system. Because the initial mental state associated with concept formation is assumed to be uniform across domains, theories of cognitive development may conflate analyses of different domains (e.g., Anglin 1977; Markman & Hutchinson, 1984).

If we look at the anthropological evidence, however, we find cross-cultural regularities within domains and domain differences within cultures. In the next section we illustrate the point in detail with the case of living kinds, and signal in a more cursory manner some interesting psychological findings about this domain and others.

An Example: The Classification of Living Kinds

Two decades of intensive cross-cultural study in ethnobiology seem to reveal that people's ordinary knowledge of living kinds is spontaneously ordered as a taxonomy whose structure is unique to the domain. Lay taxonomy, it appears, is universally and primarily composed of three transitively tiered levels, which are absolutely distinct ranks: the levels of *unique beginner*, *basic taxa*, and *life-form* (cf. Berlin, Breedlove, & Raven, 1973).

The unique beginner refers to the ontological category of plants or animals. Some cultures use a specific marker for the unique beginner, like the numerical classifier *tehk* for plants, as with the Tzeltal Maya (Berlin, Breedlove, & Raven, 1974). Others use a descriptive phrase, such as "the hairs of the earth" (*muk gobul nor*) for the Bunaq of Timor (Friedberg, 1984). Yet others have no word or ready-made phrase for *plant* or *animal*, although from an early age all humans seem to distinguish these categories conceptually, as indicated by studies of young Mayan (Stross, 1973) and American children (Dougherty, 1979; Macnamara, 1982), New Guinea highlanders (Hays, 1983), Indonesian natives (Taylor, 1984), and so on.

The basic level is logically subordinate, but psychologically prior, to the life-form level. Ideally it is constituted as a *relational* partitioning: an exhaustive and mutually exclusive segregation of the local flora and fauna into well-bounded morpho-behavorial gestalts (which visual aspect is readily perceptible at a glance) (Hunn, 1976). For the most part, taxa at this level correspond, within predictable limits, to the species distinguished by the modern field biologist in the local environment.

This basic folk kind also generally conforms to the modern conception of the genus, being immediately recognizable both ecologically and morphologically. In fact, the scientific distinction between genus and species is largely irrelevant in any local area since most local genera are represented by a single species. This is why

the confused and seemingly inexhaustible controversy over whether the genus (Bartlett, 1940; Berlin, 1972) or the species (Diamond, 1966; Bulmer & Tyler, 1968) constitutes the psychologically and historically primitive grouping has remained inconclusive. In fact, the basic folk-biological kind may be properly designated "generic-specieme" (Atran, 1987a).

The life-form level further assembles generic-speciemes into larger exclusive groups (tree, grass, moss, quadruped, bird, fish, insect, etc.). Life forms appear to partition plants and animals into a contrastive lexical field: a pre-theoretical *division* of positive features that are opposed along one or more perceptible dimensions (size, stem habit, mode of locomotion, skin covering, etc.) (cf. Brown, 1984). By and large, plant life forms do not correspond to scientific taxa, while animal life-forms approximate modern classes, save the phenomenally "residual" invertebrate groups ("bugs," "worms," etc.).

A consequence of division and ranking at the life-form level is that phenomenally and ecologically marginal groups may assume the status of monogeneric life forms. The phenomenally peculiar (though taxonomically regular) characteristic of monogeneric life forms is that they have intuited aspects of both generic-speciemes and life forms. As generic-speciemes their facies are readily perceptible at a glance. As life forms they occupy a distinctive role in the economy of nature. Because they are so distinctive, they may be easily marked off by characters chosen from dimensions spanning other life forms: For example, "cactus" for many American and French folk, as well as for the Aguaruna of Peru (*ikamas*), can be segregated from "tree," "grass," and the like by a rather simple set of diagnostic oppositions (Atran, 1985; cf. Sperber, 1975a).

Taxonomic ranking of living kinds is apparently peculiar to that domain. The field structure for artifacts, while often confounded with that of living kinds, is quite different. For one thing, that taxa of the same category are disjoint precludes artifact groupings entering into ranked taxonomies. There can be no absolute artifact *ranks*: Not only can artifactual items belong to more than one "taxon" within an inclusion series (a wheelchair as both "furniture" and "vehicle") but a given item may belong to different series (the same item as a crate for packing furniture or as a table used as furniture). It would also be senseless to think in terms of "monogeneric" artifact categories.

Talk of artifact "natures" is idle as well. For example, one and the same item can literally *be* an instance of "wastepaper basket" in one context and "stool" in another if oriented differently (cf. Dougherty & Keller, 1985). It is the fact that artifacts are defined by the functions they serve, rather than by any inherent perceptual properties, that allows a given (morphologically self-same) item to belong to different categories of artifacts in different circumstances (cf. Miller, 1978). But, for example, a dog is always a dog.[3]

[3] Still, according to Rosch (1973, p. 111), just as "some colors to which English speakers apply the word 'red' or 'redder' than others[,] some breeds of 'dog' (such as the retriever) are more representative of the 'meaning' of dog [than a Pekinese]." But the analogy with color is untenable. If a Pekinese is not

The transitive structure of groupings ranked according to their presumed underlying natures thus hardly applies to artifacts. For example, "carseat" may be judged varities of "chair," but not of "furniture," even though "chair" is normally thought of as a type of "furniture" (cf. Hampton, 1982). By contrast, although for ancient and modern Greek folk some instances of herbaceous mallow might resemble trees and some stunted oaks might not look like trees at all, tall-growing mallow would not be classified under "tree" while stunted oaks would be (cf. Theophrastus, 1916). Similarly, among the Tobelo of Indonesia (as most other cultures), "one hears of a particular small sapling. . . 'this weed (*o rurubu)* is a tree (*o gota)* . . . or of the same sapling . . . 'this is not a (member of the) herbaceous weed class, it is a tree' (*o rurubu* here contrasts with *o gota*" (Taylor, 1979, p. 224).

The claim for universal principles of folk-biological taxonomy is not for the universal status of particular *taxa*, only for taxonomic *categories*. The categories of generic-specieme and life form are universal. The delimitation and placement of particular taxa is not. To claim that life forms are fundamentally pragmatic notions (Randall & Hunn, 1984) is belied by obvious fact; for instance, children—be they 3-year-old Americans (Dougherty, 1979) or Mayans (Stross, 1973)—certainly don't learn "wood-use" when they learn "tree" (Atran, 1987c). Also, claims as to any "universal principles" governing the sequence in which life forms appear in the language of any given society (Brown, 1984), whether or not such principles are related to societal complexity, may have little to do with *taxonomic* principles. A persistent empiricist bias confounds the a priori nature of abstract taxonomic schema with substantive patterns derived from experience. Categories as such have no historical dimension, even though particular sorts of taxa may.

Linked to the cross-cultural stability of the living kind conceptual domain, we find that the learning of ordinary living kind terms is remarkably easy and needs no teaching. At a limit, one need only once point to an animal (even in a zoo or book) and name it to have young children immediately classify and relationally segregate it from all other taxa. The naming might, of course, be done (and in a zoo is likely to be done) with pedagogic intent ("this, children, is a sheep"); however, it may just as well occur in an utterance not at all aimed at teaching ("let's feed this sheep") and provide the required input. Such basic human knowledge of living kinds does not depend on teaching, nor is it gradually abstracted from experience. It is spontaneously acquired in accordance with innate expectation about the organization of the everyday biological world.

properly, or only peripherally, a dog, what other kind could it be confused with? It may be difficult to decide where "red" ends and "orange" starts, or where "cup" leaves off and "bowl" begins (cf. Labov, 1973; Kempton, 1978); however, this is certainly not so for "dog," "oak," or any other such living kind. Perhaps there is a lesser degree of confidence in the judgment (especially the child's judgment) that a Pekinese or Boston terrier is a dog and not another basic kind such as a cat, than in the judgment that a retriever or German shepherd is a dog rather than a cat. But Pekinese and Boston terriers cannot *be* anything but dogs.

The reason is that members of a living kind, but not an artifactual kind, are presumed to have the same essential underlying natures regardless of the extent to which those members actually differ in physical appearance. This presumption underpins the taxonomic stability of ordinary types of living kinds despite obvious token variation among exemplars (Atran, 1987b; cf. Sperber, 1975a). It is why, for example, legless tigers may still be classed with animals defined as "quadrupeds by nature." Note, however, that it is senseless to say of a beanbag chair that it lacks "its" legs, or of a legless table suspended from a ceiling that it lacks "its." For the "legs" of a tiger advert necessarily to the tiger's presumed underlying nature. By contrast, those of a table or chair are merely plausible or likely—not necessary—means for those artifacts to realize their defining functions.

Appreciation of artifacts, too, might be governed by innate expectations: "Even preschoolers clearly believe that artifacts tend to be human made and that natural kinds are not" (Gelman, 1988, p. 88; cf. Keil, 1986). Although, for lack of systematic analysis, the character of these expectations is wide open to speculation, it seems that in this domain as well humans are able to categorize fragmented experiences and, with little or no "trial and error," extend the resulting categories to an indefinitely large set of complexly related experiences. As in any other area of cognitive endeavor, it is difficult to imagine how such spontaneous learning could succeed without a powerful set of innate organizing principles.

A bit more evidence is at hand regarding initial expectations about three-dimensional rigid bodies, and the spatiotemporally contiguous relations of physical causality between them (Bower, 1982; Spelke, 1987) and for intentional causality in animate beings (Gelman & Spelke, 1981; Gelman, Spelke, & Meck, 1983). In important respects, then, it appears that in addition to innate expectations governing the spontaneous learning of language and such basic perceptual categories as colors, humans are also endowed with the means to spontaneously develop concepts and views in accordance with "naive" theories of biology, psychology, and physics. It seems likely that the list of distinct, innately determined cognitive domains will turn out to be longer.[4]

Evidence for Domain-Specificity

Let us now return to the issue of what sorts of evidence might be brought to bear on the delimitation of basic cognitive domains. Thus far, we have relied chiefly on conceptual analysis: showing that a given domain is universally present and structured in a specific way that differs radically from the ways other domains are structured. In particular, anthropological and psychological findings clearly suggest that the mind organizes the domain of living kinds in a very different way from that of artifacts, no matter what the culture.

But the argument for universal, domain-specific cognitions does not depend exclusively, or even necessarily, on cross-cultural pervasiveness (e.g., cultural

[4] Hirschfeld (1988) argues for the domain-specificity of certain aspects of children's knowledge of social relations. Gelman (1982) suggests that counting skills are acquired early on in any society without schooling; moreover, even preverbal infants show an appreciation of the one-to-one correspondence relations that such skills require (Starkey, Spelke, & Gelman, 1983).

"universals" in the sense of Levi-Strauss, 1969). The social subordination of women, for example, appears to characterize all known cultures. It could even be argued that there is some biological grounding for this condition. There is no reason, however, to attribute the varied ways people psychologically process this pervasive social phenomenon to some universal cognitive mechanism. Conversely, the ability to develop and understand mathematics may be rooted in some fairly specific cognitive mechanisms, which human beings are innately endowed with (cf. Chomsky, 1988). But if so, many cultures do not require that people use this ability. Nor is it occasioned by every environment. Mathematics does not spontaneously arise irrespective of social context, but seems to require a richer and more sustained sequence of experience and instruction in order to flourish than, say, basic grammatical knowledge, color perception, or appreciation of living kinds (cf. Rosskopf, Steffe, & Taback, 1971).

A more revealing indication of basic, domain-specific knowledge comes from study of cultural transmission. Admittedly, the acquisition of all cultural knowledge depends upon its mode of transmission. But the acquisition of certain basic forms of knowledge does not seem much influenced by the sequence in which it is communicated; that is, *what* is learned does not much depend on *how* it is passed along. Taxonomic knowledge of living kinds, for instance, is roughly comparable across similar physical environments regardless of whether it is "ideologically formless' in one society or has a "high rhetorical profile" in another. Thus, the Hanunóo of the Philippines possess detailed basic botanical knowledge that they take every occasion to demonstrate and pontificate upon (Conklin, 1954); but the Zafimaniry of Madagascar, whose tropical environment and swidden technology are rather similar to that of the Hanunóo, appear to pass on their equally detailed basic botanical knowledge quite informally and with scarce commentary (Bloch, 1988).[5]

An additional source of evidence for domain-specificity stems from developmental psychology. For it is logical to suppose that the basic structures of human cognition are those which severely constrain, and therefore greatly facilitate, the rapid acquisition of cultural knowledge. Experiments in the field indicate accordingly that young children—be they American (Keil, 1986) or Yoruba (Jeyifous, 1985)—categorically distinguish *artifacts* from *living things*, and come to presume that only the latter constitute "natural kinds" with underlying essences.

Concerning notions of underlying nature, more recent studies by Keil (1988) and his colleagues show that even preschoolers have some presumptions, however rudimentary. In other words, the youngsters clearly "have some beliefs about what are not likely to be biologically relevant properties, regardless of salient characteristics." Thus, most of the kindergartners tested did not allow temporary and intermittent alterations (e.g., paint that wears off a tigerized lion) to signal changes in kindhood, and even 3-year-olds tended not to admit costume change (e.g., putting a horse in a zebra outfit) as a change of identity.

[5] This is not to deny that Hanunoo eloquence on general botanical matters, like specialized Zafimaniry concern with wood, relies on complex modes of transmission governing social "wisdom." Neither is it to suggest that such complex notions as "wisdom"—which comprise the traditional bread and butter of anthropologists—can be studied exclusively with the techniques typically employed by cognitive psychologists. It does suggest, however, that basic psychological analysis is pertinent to understanding the cognitive foundations of even these more traditional concerns of anthropology.

In short, the youngest children tested to date evince some knowledge that animals of a kind share properties that are not readily apparent. Moreover, earlier studies by Keil (1979) in two cultures also suggest that preschoolers are apt to categorically restrict certain predicates, such as "grow," to plants and animals only (the children thought it did not make sense to say, for example, that rocks grow). This intimates that at least some concepts are constrained to the category *living kind*, however underdifferentiated the underlying biological "theory" that unifies conceptions of animals with those of plants.[6]

Selective cerebral impairment and selective preservation of certain cognitive categories can provide further clues for domain-specificity (Warrington & McCarthy, 1983; Hart, Berndt, & Caramazza, 1985). There is an increasing body of literature in neuropsychology that refers to "category-specific" deficits in brain-damaged patients. In particular, there is considerable evidence not only for a distinct "gnostic field" of living kinds (Konorski, 1967), but also for "modality specific semantic systems" that involve both visual and verbal understanding of artifacts versus living kinds (Warrington & Shallice, 1984). More specifically, Sartori and Job (1988) describe impairments that differentially affect the basic and superordinate levels of living kind taxonomy (cf. McCarthy & Warrington, 1988)[7]

[6] Carey (1985), however, argues that an overriding notion of *living thing* that causally links all and only plants and animals in terms of "natural kinds" is acquired only with (informal or formal) instruction in biological theory. But it seems more likely that people's knowledge of the biological domain becomes "theory-driven" because they have prior presumptions of underlying organic natures than the other way around (see Atran, 1987b, 1988, for discussions of this point). Indeed, the islanders of West Futuna (Polynesia), for example, manifestly attach a notion of "material essence" (*hkano*) to "living things" (*ne mauri*); yet there appears to be no lawfully consistent theory about the underlying biology (or cosmology) of all and only living kinds (Dougherty, 1983; Keller & Lehman, 1988).

[7] Warrington and Shallice experimented with four patients affected by herpes simplex encephalitis. They performed very poorly on visual and verbal identification tasks for "animals" (e. g., deer, wasp, ostrich), "plants" (e. g., palm) and "food" (e. g., grapefruit, cabbage, egg), but as well as normal controls for "inanimate" objects, that is, artifacts: "We would suggest that identification of an inanimate object crucially depends on determination of its functional significance, but that this is irrelevant for identification of living things. We would therefore speculate that a semantic system based on functional specifications might have evolved for the identification of inanimate objects" (1984, p. 849).

Now, foods are not living kinds *per se*. Indeed, appreciation of foods clearly depends on functional distinctions, as with artifacts (cf. Wierzbicka, 1984). Thus, although preschoolers may experience similar difficulties in imposing consistent hierarchical relations on foods and artifacts (cf. Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), they seem much better at biological taxonomies (cf. Waxman, 1985). But like living kinds and unlike artifacts, foods also have nonfunctional, perceptible defining characteristics. One might thus expect that *both* category-specific impairments for living kinds and for artifacts would affect appreciation of foods. Indeed, Nielson (1946) mentions an impairment with "inanimate" objects, including foods, but not living things.

Sartori and Job (1988) report on a patient whose appreciation of taxonomic structure remains intact but who has difficulty processing basic kinds: "He adds fins to fishes, wings to birds and horns to certain

In sum, it is logically impossible that humans are able to conceptually generalize from limited experience without a priori structures that govern the projection of finite instances to their infinitely extendable classes. It is an entirely empirical question whether or not these principles cross domains, and, if they do, which domains they cross. No a priori assumption in the matter is justified. The implication for research strategies is clear: In the absence of sufficient further evidence, results from a potentially autonomous cognitive domain should not be extended to other domains. We should be prepared to discover that, after all, the structure of human concepts is a motley rather than a monolith.

The Place of Spontaneous Learning in Culture

What we have suggested so far is that some abilities, concepts, and beliefs are easily acquired, without the help of teaching, and on the basis of ordinary interactions with others and the environment. What makes this acquisition easy is an innate readiness that takes different forms for different domains, or, in other terms, a set of domain-specific cognitive dispositions. The existence of such dispositions is, of course, neither more nor less mysterious than that of any adaptive aspect of the species' genetic endowment.

Innate cognitive dispositions determine a core of spontaneously learnable representations that are highly similar across cultures. Cultures develop—with greater diversity—beyond this core. They include systems of representations that are not spontaneously learnable. On the contrary, these systems require deliberate and often long and difficult learning, which may greatly benefit from adequate teaching.

We will now consider, briefly and in a very simplified way, two types of such systems of representations, science and religion; let us see how they depart from the cultural core while nevertheless remaining rooted in it.

Core concepts and beliefs are easily acquired and tend to be adequate for ordinary dealings with the social and natural environment. Yet they are restricted to some cognitive domains and are rather rigid. Other, harder-to-learn representations may be less limited in their domain of application and less rigid. They involve different cognitive abilities, in particular, the typically human ability of forming representations of representations. This metarepresentational ability (closely linked to linguistic communication: see Sperber & Wilson, 1986) allows people to retain information that they only partly understand and to work on it in order to understand

mammals, but he has great problems in distinguishing e. g. the horn of a rhinoceros from the antlers of a deer" or in discriminating real from unreal creatures (task 15). Also, "accuracy for vegetables was poor although somewhat better than for animals" (task 18). The "somewhat better," however, may owe to the fact that vegetables, unlike animal and plant kinds as such, also generally involve functional attributes whose appreciation is not impaired. Still, the impairment does seem restricted to only living things without regard to typicality; that is, the patient's performance on typical versus atypical items was "not significant . . . which is the opposite direction of what would be predicted" if living kind categories were prototypically based (task 6).

it better. Such processing of half-understood information over time is typical of deliberate efforts to learn counterintuitive ideas, and is found in both science and religion.

A major difference between spontaneous and nonspontaneous, or sophisticated, learning is that only in the former case are the individual's newly acquired thoughts directly about the objects of the new knowledge: for example, about physical properties or animals. As for sophisticated learning, the individual's newly acquired thoughts are initially about the knowledge itself: for example, about notions and ideas in physics or in biology. Only if and when these notions and ideas become fully assimilated may the knowledge cease to be non- or even counterintuitive and become direct knowledge of, say, physical or biological facts. The passage from representation of knowledge to assimilation of knowledge is often difficult, as in the sciences. Sometimes it is not even possible, so that some forms of knowledge, such as religious ideas, remain forever metarepresentational.

In the case of the sciences, what makes this counterintuitive ideas understandable at all is that they remain rooted in common sense intuitions, however remotely (see Atran, 1986). The history of science, for instance, suggests that the breakthroughs that characterize modern theories followed a conscientious probe of the scope and limits of common sense "givens" in the corresponding naive theories. Consider evolutionary theory: Darwin (1883, p. 426) rejects the essences of species as "merely artificial combinations made for convenience"; yet the argument for natural selection would fail, in Darwin's eyes, if it failed to be a solution to the problem of the origin of species, a problem whose formulation presupposed that the term had its customary reference (Wallace, 1901, p. 1; cf. Hodge, 1987). Evolutionary biology today has gone even further against the grain of intuition in rejecting the common sense view of species as classes of organisms and substituting the notion of the species as a "logical individual" (Ghiselin, 1981). But even those axiomatizations of evolutionary theory (Williams, 1985) that treat species communities as individual spatiotemporal wholes implicitly appeal to a notion of the "nondimensional" species that closely approximates the lay conception (Mayr, 1969, p. 27).

In practice, the field biologist who is initially unfamiliar with a terrain can usually rely on local folk to provide a fairly accurate first approximation of the scientific distribution of the local flora and fauna (at least for vertebrates and flowering plants). True, genetics and molecular biology have little recourse to folk intuitions, but in these fields as well generalizations depend on the acceptance of taxonomic inferences that do make use of notions like species.

Plainly, the learning of the sciences need not recapitulate the historic process of discovery. It seems, however, that understanding at least some central notions of a science presupposes understanding the corresponding "naive" notions and relating the two appropriately. This throws some light on the role of quality of teaching in cases of sophisticated learning: The role of the teacher is not merely to present, however soundly and clearly, the scientific notions and theories; it is also to help students relate these to common-sense experience and knowledge.

In the case of religious beliefs, we take the view that they never become fully assimilated to basic knowledge. They retain an element of mystery not just for outsiders but also, though differently, for the believers themselves. In cognitive terms, this means that religious beliefs are held metarepresentationally (see Sperber, 1975b, 1985a). In sociological terms, they are displayed, taught, discussed, and reinterpreted as doctrines, dogmas, or sacred texts. The fact that religious beliefs do not lend themselves to any kind of clear and final comprehension allows their learning, their teaching, and their exegeses to go on forever.

Religious beliefs, however, are not unconnected to common-sense knowledge. They are generally inconsistent with common sense knowledge, but not at random: rather, they dramatically contradict basic common sense assumptions (see Atran, 1986). For instance, they include beliefs about invisible creatures, beliefs about creatures who can transform themselves at will or who can perceive events that are distant in time or space (see Sperber, 1975b). This flatly contradicts factual, common-sense assumptions about physical, biological, and psychological phenomena. Such dramatic contradictions contribute to making religious beliefs particularly attention-arresting and memorable. As a result, these beliefs are more likely to be retained and transmitted in a human group than random departures from common sense, and thus to become part of the group's culture (see Sperber, 1985b).

In brief, religious beliefs, too, are rooted in basic beliefs, albeit in a "dialectical" way. Thus, within a given religious text or tradition, one might "predict that the likelihood of a transformation from one thing into another should decrease as the distance . . . between the [common-sense ontological] categories of these two things increases" (Kelly & Keil, 1985). For instance, the metamorphosis of humans into animals and animals into plants may be more common than that of humans or animals into artifacts. To the extent such violations of category distinctions shake basic notions of ontology, they are attention-arresting, hence memorable. But only to the degree that the resultant impossible worlds remain bridged to the everyday world can information about them be stored and evoked in plausible grades.

Our metaphorical talk about a core of spontaneously learnable knowledge, and a periphery of further knowledge that requires deliberate learning and teaching not only suggests that the one is more stable and central than the other; it also indicates that they are functionally related: The very existence of the periphery is made possible by the core. Sophisticated knowledge elaborates or challenges common-sense knowledge but never develops in society or the individual without reference to basic common-sense knowledge. This implies that the study of spontaneous learning, of obvious interest in itself, is also a prerequisite to enhanced understanding of deliberate and sophisticated learning, and of the role teaching plays, in the acquisition of complex cultural knowledge.

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