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Does rank have its privilege? Inductive inferences within folkbiological taxonomies

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1. Introduction

Evidence from psychology (e.g., Rosch et al., 1976) and from cognitive anthropology (e.g., Berlin, 1992) suggests that taxonomies of biological categories have a single level which is privileged, or psychologically basic. However, research to date has not investigated the relation between privileged levels and inductive inference, a crucial function of catgories. Prima facie, categories at privileged levels should also be inductively strong. Moreover, given research suggesting that the privileged level for urban Americans (e.g., fish) is superordinate to the privileged level for members of traditional societies (e.g., trout), such groups might also be expected to differ with respect to inductively privileged levels. In the present studies, we examine the degree to which different levels within folkbiological taxonomies are privileged with respect to inductive inference for American college students and members of a traditional Maya village in lowland Guatemala. Inference patterns reveal consistent advantage for categories at the folk-generic level (e.g., trout) over those at other levels (e.g., rainbow trout, fish) for both groups. For the Maya, the inductively privileged level corresponds to their presumptive basic level. For the Americans, the inductively privileged level does not correspond to the basic level as pinpointed by others (e.g, Rosch et al., 1976). We show that a pure similarity-based account cannot account for this discrepancy. We argue that results for Americans suggest a dissociation of knowledge – which for Americans leads to salient folkbiological categories at the level of fish and tree – and expectation, whereby systematic patterns of nomenclature and assumptions about the inductive potential of named

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categories conspire to privilege folk-generic taxa despite Americans' relatively impoverished experience with the natural world.

Categorization is a fundamental component process of human cognition. Not only do we constantly and effortlessly assign category membership to individual objects (that thing is a ferret), but we also organize categories into larger taxonomic systems (ferrets – along with cats and dogs – are mammals, mammals – along with birds and fish – are animals, animals – along with plants and microbes – are living things). Moreover, one intermediate level in such conceptual systems tends to be especially psychologically salient, 'basic,' or 'privileged.' Although a large number of converging measures have been used to examine this notion of privileged levels, there has been little examination of the relation between inductive inference and privileged levels. This is surprising, given that induction is arguably one of the most important cognitive functions of categories (e.g., Anderson, 1990). In this paper we draw on research from cognitive anthropology and experimental psychology to explore this notion of privilege with respect to inductive inferences, focusing on folkbiological taxonomy – commonsense categories of plants and animals. Our goal is to see how induction may or may not concide with other measures of privilege, such as those noninferential (e.g., perceptual or knowledge-based) measures used to target the 'basic level.' First we review evidence from anthropology and psychology as to the nature of the basic or privileged level, and tie this to ideas about the basis for privilege to category-based induction. Next, we review evidence on cultural differences in privileged levels in folkbiological taxonomy, and then present a series of studies examining inductive reasoning at different levels in folkbiological taxonomy among two populations – a traditional Maya community in Guatemala and North American college students – in an attempt to pinpoint the relation between taxonomic level and inductive inference. Finally, we provide a framework for understanding our pattern of results in terms of expectations about biological kinds.

1.1. Privileged levels in folkbiological taxonomy

Ethnobiologists studying systems of classification among traditional peoples (e.g., Berlin, 1976, 1978, 1992; Berlin et al., 1973; Brown, 1984; Bulmer, 1967; Bulmer and Tyler, 1968; Hunn, 1977; Hays, 1983) have argued that taxonomies of living kinds are organized into ranked systems. Not only are categories related to each other via class inclusion, but categories (taxa) at a given level in the system also share taxonomic, linguistic, biological and psychological properties with other categories at that level. The core of any such taxonomy, according to Berlin, is the folk-generic rank[1]. Folk-generics are named by primary lexemes (unanalyzable names,

[1] Locally, these taxa tend to correspond to biological species, and more generally they correspond to biological genera because the majority of genera in a given local biome are represented by a single species (Atran, 1987, Berlin, 1992). In keeping with this observation, Atran (1987) refers to Berlin's folk-generic rank as the rank of 'generic-specimen,' both to capture the fact about global distributional properties of biological genera and species, and to highlight the fact that the extension of a folk-generic taxon is usually a biological species. We acknowledge the importance of this observation, but retain Berlin's terminology throughout for clarity.

e.g., tiger, trout, oak), and tend to correspond to biological genera or species. Berlin (1992) argues that:

> … in the categorization of plants and animals by peoples living in traditional societies, there exists a specifiable and partially predictable set of plant and animal taxa that represent the smallest fundamental biological discontinuities easily recognizeable in any particular habitat. This large but finite set of taxa is special in each system in that its members stand out as beacons on the landscape of biological reality, figuratively crying out to be named. These groupings are the generic taxa of all such systems of ethnobiological classification, and their names are precisely the names of common speech (p. 53).

According to Berlin, folk-generic categories are perceptually salient and identifiable without close study. Generic names are the first offered and most used in everyday discourse. Among the traditional societies studied by Berlin and colleagues, folk-generic taxa may be among the first learned by children (Stross, 1973).

Berlin also proposed other folkbiological ranks. Going upwards in the proposed ethnobiological taxonomic system, most folk-generic taxa are included in life-form taxa (e.g., tree, bird). Like folk-generics, most life-form taxa are named by primary lexemes; biologically, members of a life-form are diverse; psychologically, members of a life-form share a small number of readily-perceptible biological characteristics (e.g., wings). Life-form categories may represent general adaptations to particular ecological zones (Atran, 1985; Hunn, 1982) or even utilitarian groupings (Randall and Hunn, 1984). The most general rank is the folk kingdom (e.g., plant, animal). Although such categories are often not explicitly named, they nevertheless represent the broadest divisions of the biological world. Moving downward in the taxonomy, folk-generic taxa may be further subdivided at the folk-specific rank. These taxa are often named with secondary lexemes (‘red oak,’ ‘rainbow trout’), compound names which make the hierarchical relation between the taxa transparent. Rarely, an extremely important folk-specific taxon will be differentiated into folk-varietal taxa (northern red oak). In general, whether a folk-generic taxon is further differentiated depends on the cultural significance of the organisms involved (Berlin, 1992; Brown, 1984; Hunn, 1982). In sum, for anthropologists studying folkbiological classification among traditional people, categories of living things are organized into ranked taxonomies, and folk-generic taxa are the psychologically-privileged heart of that taxonomy.

In a now classic paper, Rosch, Mervis, and their associates (Rosch et al., 1976) set out to test Berlin’s notion that a single taxonomic level is psychologically privileged. They argued that ‘in the real world information-rich bundles of perceptual and functional attributes occur that form natural discontinuities and that basic cuts in catgorization are made at these discontinuities’ (p. 385). In a series of experiments, they present evidence that, among other things, the ‘basic level’ is the most inclusive level at which (1) many common features are listed for categories, (2) consistent motor programs are employed for objects in the category, (3) category members have similar shapes, and (4) it is possible to recognize an average shape of the category. In all of these experiments, the logic of locating the basic level was the

same; the basic level was the level above which much information was lost, and below which little information was gained. For instance, in a feature-listing task, subjects listed a mean of 3 common features for the superordinate category furniture, a mean of 9 features for basic level furniture categories (e.g., table) and an average of 10.3 features for subordinate furniture categories (e.g., kitchen table). There was a large gain in information when going from the superordinate to the basic level (6 new common features are added, in this example), and only a slight gain going from the basic to the subordinate (1.3 features). Although subsequent research has not tended to employ the variety of converging measures educed by Rosch et al. (1976), the basic level phenomenon has proven to be quite robust (e.g. see Lassaline et al. (1992) for a review; see also Mervis, 1987; Murphy and Smith, 1982; Murphy and Wisniewski, 1989; Tversky and Hemenway, 1984; Waxman, 1991). Thus, evidence from both cognitive anthropology and cognitive psychology supports the notion of a privileged taxonomic level.

One way to characterize categories at a privileged level is in terms of similarity relationships – patterns of common and distinctive properties or features create and define within- and between-category similarity. Specifically, people have argued that basic level categories maximize within-category similarity relative to between-category similarity (e.g., see Murphy and Brownell, 1985). A privileged category is one in which catgory members are very similar to each other and not very similar to members of other coordinate categories. (Rosch et al. (1976) discuss essentially the same principle, in terms of cue validity; members of basic categories share many features with each other, and few with members of other categories.) For example, consider the embedded categories.) Airedale–dog–mammal. Within-category similarity alone is maximized at the most specific level; Airedales are more similar to other Airedales than Airedales are to beagles (similarity within dog) or dogs are to ferrets (similarity within mammal). However, between-category similarity is also high at that level (Airedales are more similar to beagles than dogs are to ferrets or mammals are to birds). Between-category similarity (i.e., category distinctiveness) is minimized at higher levels (mammals are more distinct from birds than dogs are from ferrets or Airedales are from beagles) but within-category similarity also falters at this levels (dogs are not really very much like ferrets). In practice, therefore, when both criteria are considered simultaneously, within- and between-category similarity must be traded off against each other (e.g., Gluck and Corter, 1985). This tradeoff may allow the intermediate level, dog, to emerge as privileged – dogs are all fairly similar to each other (more so than mammals) but also fairly distinct from other mammals (more so than Airedales are distinct from other dogs). Thus, a privileged level is one at which within-category similarity is high relative to between-category similarity.

1.2. Privileged levels and inductive inference

One critically important function of categories is supporting inductive inferences (Gelman, 1988; Holland et al., 1986; Rips, 1975; Sloman, 1993; Osherson et al., 1990, 1991); indeed, some have argued that induction is the primary function of

categories (Anderson, 1990). Categories extend knowledge via inferences; if we know a property is true of a subset of a given category, we can make an educated guess as to whether that property is true of the entire category. In fact, since we rarely experience all members of a category directly, most knowledge about a category derives from inductions to the entire category from a limited number of instances. For example, generalizations like 'dogs bark,' or 'pomegranites are edible' are necessarily based on inductive inferences from experience with a subset of dogs or pomegranites. Likewise, if you learn that rainbow trout have a certain chemical in their blood, you might (or might not) infer that all trout, or perhaps all fish, have that same chemical in their blood. Thus, induction is a very important way in which categories allow us to generalize from experience.

Although the converging measures listed above that support the notion of a privileged level in folk taxonomy is impressive, surprisingly it has not, so far, included induction. In this paper, we use inductive inference to futher examine the nature of privileged levels. Neither Berlin (1992) nor Rosch et al. (1976) specifically studied induction, but inductive potential is nevertheless central to their ideas of psychological privilege. If, as argued by Rosch et al. (1976) and Berlin (1992) a privileged level is the one that carries the most information, categories at that level should support many inferences about commonalities among members; inductive inferences to a privileged category should be relatively strong. By inductive strength, we mean the likelihood that all members of a category will be judged to exhibit a property, given that a subset of the category does. In other words, most properties that are true of a subset of a privileged category should readily generalize to the entire category.

The same distribution of features or properties that create patterns of between and within category similarity also provides the backbone for category-based induction, according to current theories of induction (Osherson et al., 1990; Sloman, 1993). Categories that are perceived to have high within-category similarity should be seen as inductively strong, and the same distribution of knowledge that reduces within-category similarity should also reduce inductive confidence. The large drop in informativeness observed above the privileged level should lead to a corresponding drop in inductive strength. Thus, induction provides us with yet another convergent measure of the extent to which a taxonomic level is psychologically privileged. However, induction differs from previous informational measures of privileged levels because it involves expectation as well as factual knowledge. Categories carry with them knowledge of common features or properties, but they can also carry with them expectations of rich but as yet unknown commonalities among members (Gelman and Coley, 1991; Medin and Ortony, 1989). As we will see, this is a critical distinction. Nevertheless, we see inductive inference not as a privileged measure, but rather as one important – albeit understudied – index of taxonomic privilege among many.

1.3. Differences in location of the privileged level

Although the work of both Berlin (1992) and Rosch et al. (1976) points to a

privileged level in category hierarchies, there remains a serious puzzle that in part motivates the present studies. Rosch et al. (1976) made initial guesses about which level in a hierarchy would prove to be basic (e.g., screwdriver, guitar, maple, trout), and these guesses were generally correct. For biological taxonomies, however, the initial guesses were based on the anthropological observations reviewed earlier in this paper (Berlin et al., 1966, 1973) and in each case these guesses turned out to be wrong. For example, instead of maple and trout, Rosch et al. (1976) found that tree and fish functioned as basic-level catgories for Berkeley undergraduates. Berlin (1992) argues that plant and animal categories of the folk-generic level (e.g. maple) are psychologically privileged; however, the basic level for living kinds in Rosch et al. (1976) corresponds to Berlin's life-form level, which is superordinate to the folk-generic level. Why do anthropological and psychological observations fail to converge?

One frequently cited possibility is that differences in the location of the basic level could be a function of differences in expertise (e.g., Dougherty, 1978; Mervis and Rosch, 1981; Tanaka and Taylor, 1991). If members of traditional societies – like those that make up the bulk of subjects of ethnobiological research – have more expertise than the Berkeley undergraduates that were Rosch's subjects, and expertise leads to more specific privileged levels, then the apparent discrepancy may be an expertise effect. This assumption has not been directly tested, but predicts corresponding differences in the privileged level for induction when comparing a traditional culture and a modern, urbanized one. If such differences were found, however, it would challenge the view that basic-level categories reflect natural discontinuities in the world. Alternatively, apparent differences in the location of the basic level might represent different methodologies rather than differences in the psychological experience of the world. Although Rosch et al. (1976) pinpointed the basic level with a range of converging measures, to our knowledge, no one has studied the basic level in traditional societies using measures comparable to those from laboratory studies. Therefore, the apparent discrepancy may be methodological.

The goal of this research is to assess the degree to which folk biological categories at different taxonomic levels are privileged with respect to induction. Rosch et al. (1976) characterize 'basic' categories as those where (1) a great deal of information is gained relative to more general categories, and (2) little information is lost relative to more specific categories. We explicitly extend this logic to inductive reasoning; inductive inferences to a privileged category should be significantly stronger than inferences to more general categories, and not significantly weaker than inferences to more specific categories. To return to the example of furniture, if table (as opposed to kitchen table or furniture) is the basic level, then inferences about tables should be roughly as strong as inferences about kitchen tables, and much stronger than inferences about furniture. In effect, we are looking for the most specific level in folkbiological taxonomy above which a significant breakpoint in inductive strength occurs.

The organization of the remainder of this paper is as follows. We first ask whether patterns of category-based induction in a traditional society fit with Berlin's claims

about the primacy of folk-generic categories. To answer this question, we present an experiment providing the first psychological evidence that indeed, folk-generic categories (e.g., trout, oak) are privileged with respect to induction for residents of a traditional Itzaj Maya village in rural Guatemala. Having shown that our inductive inference measure fits with claims from the cognitive anthropological literature on privileged levels, we then present 3 experiments examining patterns of induction with folkbiological hierarchies among urban American college students, to examine how induction patterns fit with psychological research on the basic level. We expected that, as with the Itzaj, the inductively privileged level would correspond to knowledge-based measures of the basic level. By using the very same measure with members of a traditional society (the Itzaj Maya of the northern Guatemalan rainforest) and members of a modern urban society (American college students), we hope to shed new light on the relation between expectation, knowledge, and privileged levels in conceptual taxonomy.

EXPERIMENT 1

Although many of Berlin's claims about folkbiological categories are psychological in nature, to our knowledge, no direct examination of the psychological reality of Berlin's notion of folkbiological rank has been carried out among indigenous members of traditional cultures. Such an examination provides an important jumping-off point for our investigation. Berlin's formulations are largely based on linguistic evidence, elicitation of names for instances, and in-depth ethnological interviews with informants. By showing that predictions based on anthropological fieldwork are supported by psychological investigation, we simultaneously validate Berlin's claims about the psychological reality of folkbiological rank, and category-based induction as a tool to examine the structure of folkbiological taxonomy.

In this study we investigate inductive inferences to folkbiological taxa of various ranks among the Itzaj, a group of Maya native to the lowland rainforest of the Petén region of northern Guatemala. Although their environment and circumstances are rapidly changing for the worse, the Itzaj still preserve a vast amount of knowledge about local plants and animals (see Atran, 1993, 1994; López et al., 1997). In general, the methodology is similar to that used in other psychological studies of category-based induction (e.g., Osherson et al., 1990). Participants were told that an unfamiliar property was true of all members of a category, and then asked how likely it was to be true of the members of a more general category. Using Rosch's logic for diagnosing the basic level, inferences to a privileged level should be judged more likely than those to more general levels, and no less likely than those to more specific levels. If Berlin is correct about the primacy of folk-generic categories, this pattern should center on taxa of the folk-generic rank. Specifically, we would expect inferences to folk-generic taxa to be relatively strong, inferences to taxa of lower order only marginally stronger, and inferences to taxa of higher rank to be relatively weak. That is, there should be a breakpoint or elbow between the folk-generic level and higher levels.

2. Method

2.1. Participants

Fifteen Itzaj Maya men and women living in the village of San José, Petén, Guatemala participated in the study. The Itzaj are Mayan Amerindians living in the Petén rainforest region of Guatemala. Men devote their time to shifting agriculture and hunting, and women concentrate on the myriad tasks of household maintenance. The Itzaj were the last independent native polity in Mesoamerica to be conquered by the Spaniards, and have preserved virtually all ethnobiological knowledge recorded for Lowland Maya since the time of the initial Spanish conquest (Atran, 1993). Informants ranged in age from 54 to 80 years. All were bilingual in Itzaj and Spanish. Some participated as part of a larger project on comparative folkbiology, while others were recruited especially for this study. All were acquainted with the third author, and at relative ease in the testing situation.

2.2. Materials

Based on linguistic and taxonomic criteria in the ethnobiological literature (Berlin, 1978, 1992; Brown, 1977, 1979, 1984) and extensive fieldwork with the Itzaj (Atran, 1993, 1994, 1995), we chose a set of Itzaj folkbiological categories of the varietal, specific, generic, life-form, and folk-kingdom ranks. Three life-form categories each of plants (che' [tree], ak' [vine], pok~che' [herb/underbrush]) and animals (b'a'al~che' kuximal [mammal], ch'iich' [birds including bats], käy [fish]) were selected. Three folk-generic taxa were chosen from each life-form such that each folk-generic had a subordinate folk-specific, and each folk-specific had a salient subordinate division (some of these were authentic folk-varietal taxa, some were other salient subdivisions of folk-specific taxa).[2] Categories used and their approximate English glosses are presented in Fig. 1.

Pretesting and previous fieldwork with the Itzaj (e.g., López et al., 1997) showed that participants were willing to make inferences about hypothetical diseases at various taxonomic levels. The properties chosen for animals were diseases related to the 'heart' (puksik'al), 'blood' (k'ik'el) and 'liver' (tamen). For plants, diseases related to the 'roots' (motz), 'sap' (itz) and 'leaf' (le'). These properties were chosen in accordance with Itzaj beliefs about the essential, underlying aspects of life's functioning. Thus, the Itzaj word puksik'al denotes both 'heart' and 'essence' in both plants and animals, although only with animals is it identified with a single biological organ. The term motz, denotes 'roots,' which is considered the initial locus of the plant puksik'al. The Itzaj term k'ik'el denotes 'blood' and is conceived of as the principal vehicle for conveying life from the puk'sik'al throughout the body. The term itz denotes 'sap,' which functions as the 'blood of a plant.' The tamen, or 'liver,' helps to 'center' and regulate the animals' puksik'al. The le', or

[2] For the herb life-form, we were only able to locate two folk-generics that had both folk-specific and varietal distinctions.

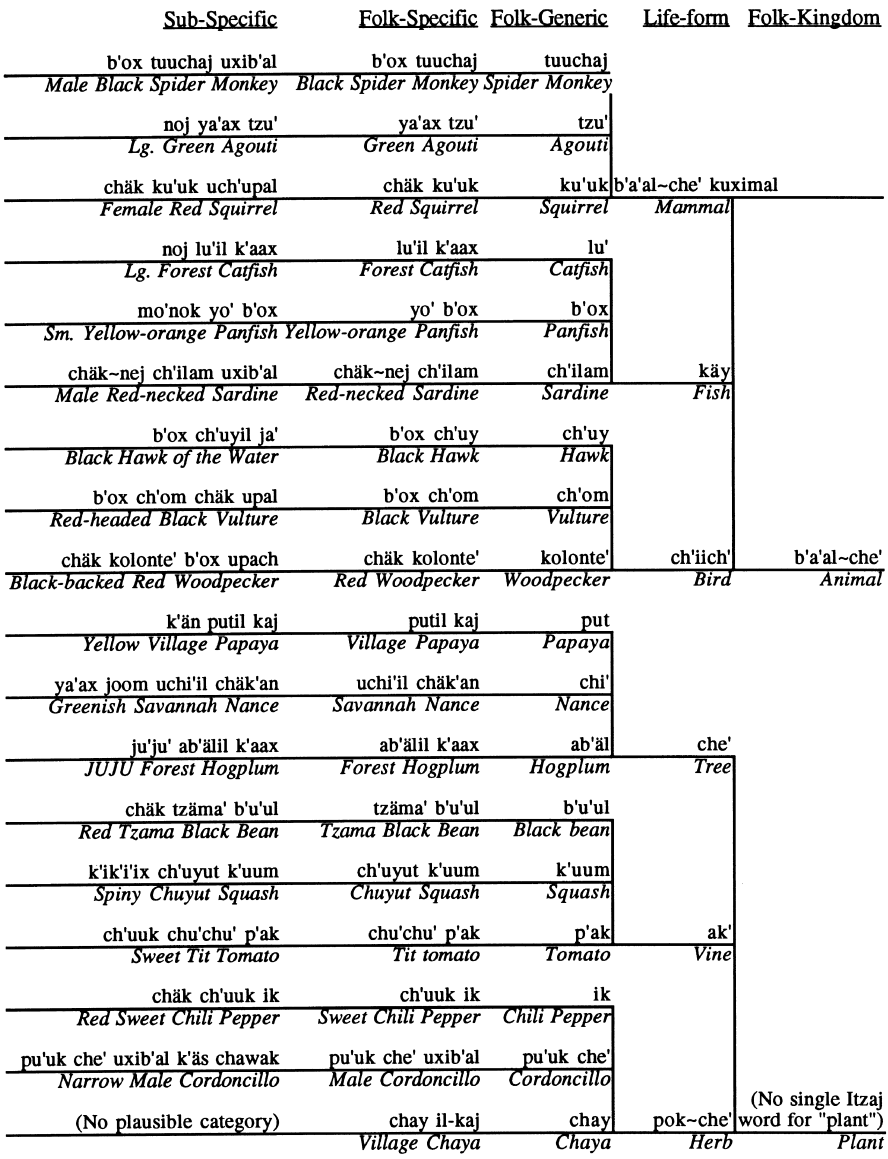

Fig. 1. Categories used in Study 1.

'leaf,' is the final locus of the plant puksik'al. Properties used for inferences for animals had the form 'Is susceptible to a disease of the blood called X,' 'Is susceptible to a disease of the heart called X,' and 'Is susceptible to a disease of the liver called X.' Each kind of disease (blood, heart, liver) was paired with an animal life-form (counterbalanced across participants). Similarly, properties used for inferences

about plants were ‘Is susceptible to a disease of the sap called X,’ ‘Is susceptible to a disease of the root called X,’ and ‘Is susceptible to a disease of the leaf called X.’ Again, each kind of disease was paired with a plant life-form counterbalanced across participants. For each individual question, ‘X’ was replaced with a phonologically appropriate nonsense name (e.g., ‘eta’) in order to minimize the repetitiousness of the task.

Each participant responded to a total of 24 questions in which the participant was told that all members of a category had a property, and asked whether all other members of the immediately superordinate category also had that property. Thus, these questions can be broken down into four kinds of inferences about each of the six life-forms: varietal to specific, specific to generic, generic to life-form, and life-form to kingdom.

2.2.1. Varietal to specific (Vr–Sp)

For these questions, participants were given information about a folk-varietal taxon and asked about a folk-specific taxon, e.g., ‘If all red-headed black vultures are susceptible, how likely is it that all black vultures are susceptible?’

2.2.2. Specific to generic (Sp–Gn)

For these questions, participants were given information about a folk-specific taxon and asked about a folk-generic taxon, e.g., ‘If all black vultures are susceptible, how likely is it that all vultures are susceptible?’

2.2.3. Generic to life-form (Gn–Lf)

For these questions, participants were given information about a folk-generic taxon and asked about a life-form taxon, e.g., ‘If all vultures are susceptible, how likely is it that all birds are susceptible?’

2.2.4. Life-form to kingdom (Lf–Kgdm)

For these questions, participants were given information about a life-form taxon and asked about a kingdom taxon, e.g., ‘If all birds are susceptible, how likely is it that all animals are susceptible?’

Inclusion of Vr–Sp, Sp–Gn, Gn–Lf, and Lf–Kgdm inferences allowed us to assess the strength of inferences to categories at, above, and below the hypothesized privileged level from an immediate subordinate. Wording for the life-form to kingdom questions had to reflect several facts about Itzaj names for high-level folkbiological categories. In Itzaj, the term for animals (b’a’al~che’, literally ‘forest-thing’) polysemously refers to: (1) the animal kingom as a whole (including invertebrates, birds and fish); (2) more restrictive grouping of quadrupeds (e.g., b’a’al~che’ kusiit – amphibians or ‘jumping animals,’ b’a’al~che’ kujiltikub’aj – reptiles or ‘slithering animals,’ or b’a’al~che’ kuximal – mammals or ‘walking animals’); (3) the mammals alone. Furthermore, as is the case in many languages (Brown, 1984), there is no single label for the plant kingdom in Itzaj (although there is a numeral classifier, tek, used for all and only plants). Accordingly, for the life-form to kingdom inferences for plants, the conclusion was presented as a concatenation of major

life-forms not mentioned in the premise. For example, 'If all trees were susceptible to disease X of the leaves, would all herbs and vines and grasses also be susceptible?' In order to make the animal life-form to kingdom inferences comparable, those questions were asked using a similar concatenation as well as the term for animal (b'a'al~che'). For instance, 'If all fish were susceptible to disease X of the blood, would all animals, that is, all walking animals (mammals), all slithering animals (reptiles), all jumping animals (amphibians), all birds, all fish, all small animals (insects) also be susceptible?'

2.3. Procedure

All participants were tested in the Municipio of San José, Petén, Guatemala, either in a field research station or in their homes in the town. The entire procedure was carried out in the Itzaj Maya language. Participants were told that researchers from the United States wished to learn more about the plants and animals of Petén, and that they (the participant) could help in this matter. Questions were asked in the following manner: 'There is a disease of the blood that can infect the green agouti. This disease is called 'eta.' Now, what do you think? If this disease can infect green agoutis, can it infect all other agoutis? What do you think?' Pilot testing showed that a standard rating scale was inappropriate for use with the Itzaj. Therefore, responses were scaled as follows: if the informant answered 'yes,' that all members of the conclusion category would be susceptible to the disease, it was scored as a 3. If the participant responded 'no,' they were asked if 'some' members of the conclusion category would be susceptible to the disease ('If this disease can infect green agoutis, can it infect some other agoutis?'). We interpreted responses of 'yes', some other members could get the disease,' as intermediate in inductive strength; these seemed to signal that while the informant was unwilling to extend the property to the entire conclusion category, they were willing to extend it beyond the premise category. Thus, these responses were scored as a 2. If the informant was unwilling to grant that even some other agoutis would be susceptible, the response was scored as a 1.

Each participant responded to 24 questions: one question of each of the 4 types listed above for each of the 6 life-form taxa (e.g., for fish, each participant responded to a specific to generic, specific to life-form, generic to life-form, and life-form to folk kingdom question). For the first three kinds of inferences, there are a total of nine possible combinations of folk-generic taxon and inference type. For each participant, a different folk-generic taxa appeared in each type of inference for each life-form (e.g., instead of being asked to infer from red-headed black vulture to black vulture, black vulture to vulture, and vulture to bird, each participant was asked to infer (for example) from red-headed black vulture to black vulture, black hawk to hawk, and woodpecker to bird. This avoided making the hierarchical nature of the judgments completely transparent while preserving a within-subjects design. All participants were asked six life-form to folk kingdom questions, one for each life-form. Pairings of life-forms with properties were also counterbalanced. For each participant, questions about a given life-form always involved the same property; a

different property was used for each animal and plant life-form. Across participants, each property was paired with each life-form with equal frequency.

These considerations required the use of three different question sets. Each individual question set presented one instance of each kind of inference for all six life-forms under consideration. Within each question set, different folk-generic taxa were used for the specific to generic, specific to life-form, and folk-generic to life-form questions, and each life-form (within plants and animals) was paired with a different property. Each participant was given one question set. Across all three questions sets (and thus across all participants), each life-form was matched with each property an equal number of times, and each folk-generic taxon appeared in each inference type an equal number of times. All questions were presented in random order with the constraint that no more than two questions about the same life-form appeared consecutively.

3. Results

Patterns of inferences are examined separately for animals and plants using 3 (lifeform) $\times$ 4 (inference-type) within-subject ANOVAs. If the folk-generic level is privileged for induction, then inferences to folk-generic categories should be stronger than inferences to life-form or folk-kingdom categories, and no weaker than inferences to folk-specific categories. Results are presented in Fig. 2.

3.1. Animals

For animal categories, inferences conformed precisely to the pattern expected if folk-generic taxa are privileged for induction. Specifically, inferences to folk-specific and folk-generic taxa did not differ, but were seen as better than inferences to life-form and kingdom taxa ($F(3,42) = 54.44$, $MSe = 0.43$, $p < 0.0001$ and Tukey HSD post-hoc analyses; see Fig. 2). Thus, the only significant drop in inductive strength occurred between the folk-generic and life-form levels, indicating that the folk-generic is privileged with respect to induction.

Of secondary interest was a significant effect of life-form, $F(2,28) = 3.86$, $MSe = 0.19$, $p < 0.05$. Overall, inferences to fish taxa ($M = 2.00$) were rated more highly than inferences to bird taxa ($M = 1.78$). Inferences to quadruped taxa differed from neither ($M = 1.93$). This was qualified by a life-form by inference interaction, $F(6,84) = 2.53$, $MSe = 0.17$, $p < 0.05$. Tukey HSD analyses revealed that there were a few differences between Gn–Lf inferences and Lf–Kgdm inferences, but none affect the degree to which the results fit the predicted pattern regarding privileged levels for induction.

3.2. Plants

The Itzaj showed the same pattern for plants as they did for animals; inferences to folk-specific and folk-generic taxa did not differ, but were seen as better than

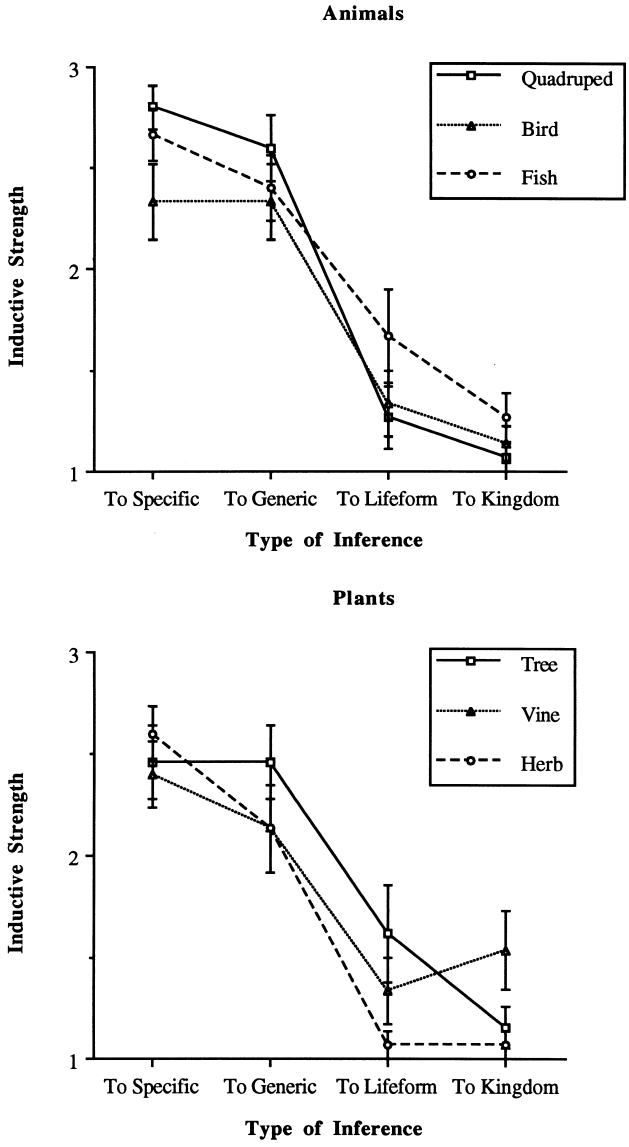

Fig. 2. Induction patterns for Itzaj Maya.

inferences to life-form and kingdom taxa ($F(3,42) = 39.80$, $MSe = 0.47$, $p < 0.0001$, and Tukey HSD analyses; see Fig. 2). As predicted, the only significant drop in inference strength occurred between the folk-generic and life-form levels, indicating that folk-generic plant taxa are privileged for induction. No other significant effects were found.

4. Discussion

These results offer psychological support for Berlin's contention – based on linguistic and anthropological evidence – that folk-generic categories are the core of folkbiological taxonomy, at least among members of a traditional culture. Inferences to folk-generic categories were rated as reliably higher than inferences to more general life-form and folk-kingdom categories, and as no lower than inferences to more specific folk-specific categories. Thus, the gain in information was greatest in moving from the lifeform to the folk-generic, exactly the pattern one would expect if the folk-generic were the psychologically 'basic' level for the Itzaj. For a traditional group of Itzaj Maya living in close contact with nature, categories at the folk-generic level are privileged with respect to induction.

These results validate inductive inference as a tool for investigating privileged levels in conceptual hierarchies, and reinforce the notion that folk-generic categories are privileged for members of a traditional culture. For the Itzaj, the inductively privileged level corresponds to the presumptive basic level. We now ask whether the same relation applies to patterns of inductive inference within folkbiological taxonomy among American college students, using essentially the same task that we used with the Itzaj.

EXPERIMENT 2

Experiment 1 offers evidence that – in accord with Berlin (1992) – folk-generic categories are psychologically privileged with respect to induction for members of a traditional society. In contrast to this finding, there are a number of reasons to predict that more general categories may be privileged for members of a more urbanized society. Knowledge and experience may change the privileged status of particular folkbiological ranks. Dougherty (1978) argues that historically, as relevant experience with nature and the cultural importance of nature diminishes, folkbiological taxonomies decay, or 'devolve' from the bottom up. Thus, members of a culture for which living things play an important role in daily life (e.g., the Itzaj) may prefer to draw inferences to the folk-generic level, and find taxa of higher rank not to have much inductive potential. For members of another culture with little day-to-day commerce with living things (e.g., American college students), this pattern may shift upward in the taxonomy. On Dougherty's account, one might expect the life-form rather than the folk-generic level to be privileged for Americans, reflecting a degradation of folkbiological knowledge that accompanies increasing distance from the natural world.

This prediction is consistent with findings of Rosch et al. (1976) for Americans with respect to the biological categories bird, fish, and tree (see also Tversky, 1986; Tversky and Hemenway, 1984). For biological categories, Rosch et al. (1976) report no gain in informativeness in moving from life-forms (tree, fish, bird) to folk-generics (oak, salmon, robin). Tversky and Hemenway (1984) replicated these findings, but did find an increase in informativeness when moving from the folk-

kingdom (animal, plant) to the life-form level. These results suggest that – at least for non-mammals – the rank of life-form rather than folk-generic may be psychologically privileged for urban Americans.

If so, again following Rosch's logic, we hypothesize that inductive inferences to life-form categories should be significantly stronger than inferences to more general (folk-kingdom) categories, and not significantly weaker than inferences to more specific (folk-generic) categories. Thus, the breakpoint in this case should occur between the life-form level and higher levels.

5. Method

5.1. Participants

Thirty male and female undergraduate students at Northwestern University participated for class credit.

5.2. Materials

Three categories each of plants (trees, bushes, flowers) and animals (mammals, birds, fish) were selected for use in this experiment. These are relatively broad classes of organisms chosen to correspond to taxa of the life-form rank as discussed by Berlin (1992) and others (e.g., Brown, 1977, 1979, 1984).[3] From each life-form, we selected three subclasses (e.g., for tree: oak, maple, pine). These were chosen to correspond to taxa of the folk-generic rank (Berlin, 1978, 1992), predominantly on linguistic grounds. Specifically, folk genera are salient taxa often named by simple primary lexemes (unanalyzable names such as oak or trout) whose immediate superordiates (life-form taxa) are also named by primary lexemes (tree, fish). We also selected a subclass of each folk-generic – a folk-specific taxon, in Berlin's nomenclature – again on linguistic grounds. The prototypical folk-specific taxon is named by a secondary lexeme, that is, a transparently productive binomial compound name clearly marking members of the folk-specific taxon as members of the more inclusive folk-generic taxon, e.g., rainbow trout or red oak. A complete list of categories used is presented in Fig. 3.

[3] Bird, fish, tree, and bush are widely accepted as taxa of life-form rank (Brown, 1984). Mammal and flower may be more problematic. The term 'mammal' may be an import from scientific biology rather than a true folk category; nevertheless, it appears to refer to roughly the same group of organisms picked out by the folk usage of the term 'animal' (that is, relatively large quadrupeds) while avoiding the polysemy of 'animal' (which can refer to either that class exclusively or the larger class of mammals, birds, reptiles, fish, and perhaps insects). 'Flower' is explicitly excluded from the inventory of life-form terms by Brown (1977) who considers it a functional category. However, because there is no term referring exclusively to relatively small green leafy growing things ('plant' suffers from the same polysemy problem as 'animal'), because most Americans are familiar with several subtypes of flowers, and because the properties used make it clear that the questions are about the entire organism and not solely the blossom, we feel flower meets most of Berlin's criteria for a taxon of life-form rank, at least for relatively urbanized Americans.

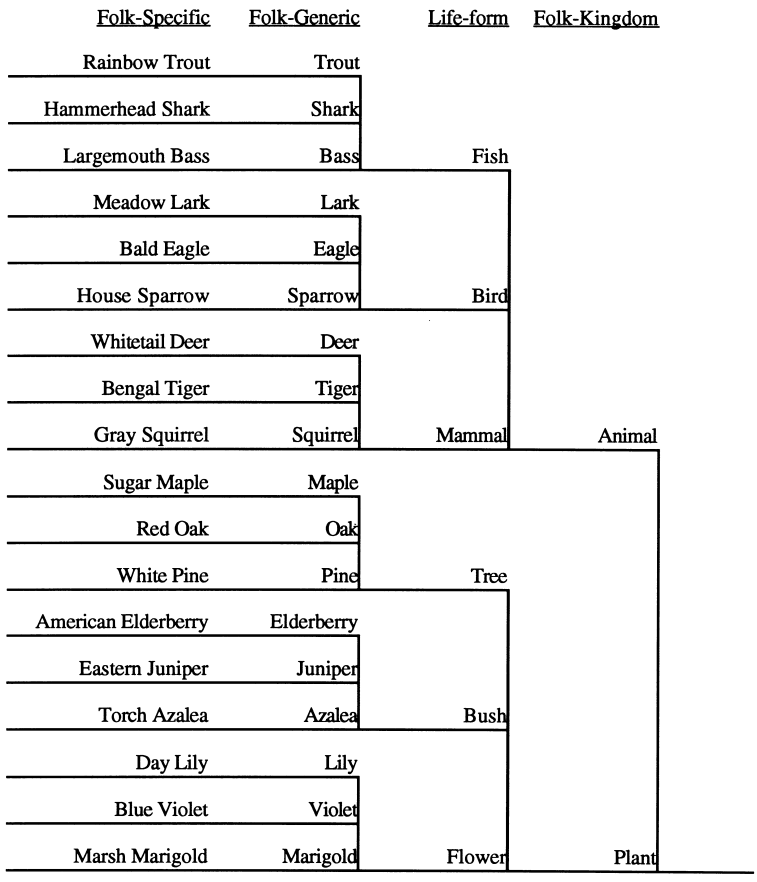

Fig. 3. Categories used in Study 2.

Three kinds of properties were used to generate the questions. These were of the form 'have protein X,' 'have enzyme Y,' or 'are susceptible to disease Z.' These properties were chosen to be internal biologically-based properties intrinsic to the kind in question, but abstract enough so that participants would be making inductive inferences rather than answering what amounted to factual questions. Such properties are likely to lead to inductions based on taxonomic category membership (Heit and Rubinstein, 1994). Moreover, we chose these properties because they could potentially be distributed either narrowly or broadly within biological hierarchies; other research suggests that participants find inferences about comparable properties to plausibly apply to different hierarchical levels (e.g., López et al., 1997; Osherson et al., 1990, 1991).

The general form of each question was 'If all A's have property P, how likely is it that all B's have property P?' where A was always a subset of B. Participants indicated their responses on a likelihood scale ranging from 1 (all Y's are 'very

unlikely' to have P) to 9 (all Y's are 'very likely' to have P). Four kinds of inferences were tested:

5.2.1. Specific to generic (Sp–Gn)

For these questions, participants were given information about a folk-specific taxon and asked about a folk-generic taxon, e.g., 'If all rainbow trout have protein A, how likely is it that all trout have protein A?'

5.2.2. Specific to life-form (Sp–Lf)

For these questions, participants were given information about a folk-specific taxon and asked about a life-form taxon, e.g., 'If all rainbow trout have protein A, how likely is it that all fish have protein A?'

5.2.3. Generic to life-form (Gn–Lf)

For these questions, participants were given information about a folk-generic taxon and asked about a life-form taxon, e.g., 'If all trout have protein A, how likely is it that all fish have protein A?'

5.2.4. Life-form to kingdom (Lf–Kgdm)

For these questions, participants were given information about a life-form taxon and asked about a kingdom taxon, e.g., 'If all fish have protein A, how likely is it that all animals have protein A?'

Inclusion of Sp–Gn, Gn–Lf, and Lf–Kgdm inferences allowed us to assess the strength of inferences to categories at, above, and below the hypothesized privileged level from an immediate subordinate. We included Sp–Lf inferences to allow us to assess the degree to which results were influenced by variations in premise category rather than conclusion category. Specifically, if the premise category were the critical variable, then Sp–Lf and Sp–Gn patterns should not differ, but Sp–Lf and Gn–Lf patterns should. Alternately, if, as we predict, the conclusion category is critical, then Sp–Gn and Sp–Lf patterns should differ, and Sp–Lf and Gn–Lf patterns should not.

5.3. Procedure

Participants were tested in groups of 3–5. Each participant responded to 24 written questions: one question of each of the 4 types listed above for each of the 6 life-form taxa (e.g., for fish, each participant responded to a specific to generic, specific to life-form, generic to life-form, and life-form to folk kingdom question). For the first three kinds of inferences, there are a total of nine possible combinations of folk-generic taxon and inference type. For each participant, a different folk-generic taxa appeared in each type of inference for each life-form (e.g., instead of being asked to infer from rainbow trout to trout, rainbow trout to fish, and trout to fish, each participant was asked to infer (for example) from rainbow trout to trout, hammerhead shark to fish, and bass to fish. This avoided making the hierarchical nature of the judgments completely transparent while preserving a within-subjects

design. All participants were asked six life-form to folk kingdom questions, one for each life-form.

Pairings of life-forms with properties were also counterbalanced. For each participant, questions about a given life-form always involved the same property; a different property was used for each animal and plant life-form (for example, a participant might respond to disease questions for fish and trees, protein questions for birds and flowers, and enzyme questions for mammals and bushes). Across participants, each property was paired with each life-form with equal frequency.

These considerations required the use of three different question sets. Each individual question set presented one instance of each kind of inference for all six life-forms under consideration. Within each question set, different folk-generic taxa were used for the specific to generic, specific to life-form, and folk-generic to life-form questions, and each life-form (within plants and animals) was paired with a different property. Each participant was given one question set. Across all three questions sets (and thus across all participants), each life-form was matched with each property an equal number of times, and each folk-generic taxon appeared in each inference type an equal number of times. Finally, each question set was presented in two different random orders with the constraint that no more than two questions about the same life-form appeared consecutively.

6. Results

Preliminary analyses were performed to examine potential property differences in inductive patterns. For each lifeform, a 3 (property: enzyme, disease, protein) $\times$ 4 (inference: Sp–Gn, Sp–Lf, Gn–Lf, Lf–Kgdm) mixed ANOVA was performed. No reliable main effects or interactions involving property emerged. Accordingly, data are collapsed across question sets for subsequent analyses.

Patterns of inferences are examined separately for animals and plants using 3 (lifeform) $\times$ 4 (inference-type) within-subject ANOVAs. If the life-form level is privileged for induction, then inferences to life-form categories should be stronger than inferences to folk-kingdom categories, and no weaker than inferences to folk-generic categories. Results are presented in Fig. 4.

6.1. Animals

Contrary to expectations based on Rosch et al. (1976), the earliest and largest breakpoint in inductive strength for animal categories was observed between the folk-generic and life-form level ($F(3,87) = 83.61$, $MSe = 2.27$, $p < 0.0001$, and Tukey HSD analyses). Specifically, Sp–Gn inferences were given higher likelihood than all other inferences. Sp–Lf inferences and Gn–Lf inferences did not differ reliably from each other, revealing no evidence of an effect of premise specificity. Thus, the first significant drop in inductive strength occurred between the folk-generic and life-form levels, indicating that the folk-generic is privileged with respect to induction.

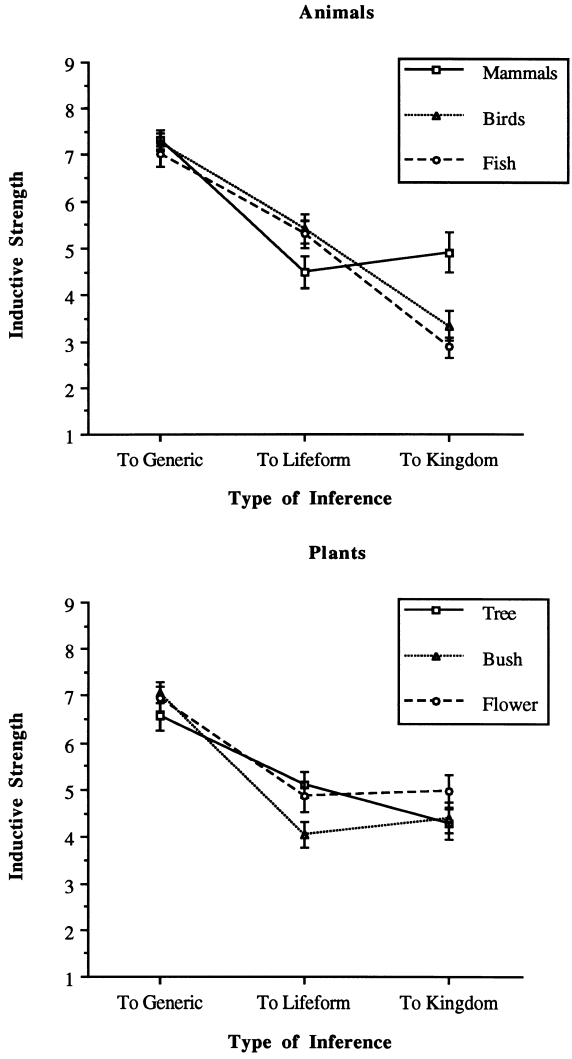

Fig. 4. Induction patterns for American students. Note: Sp–Lf and Gn–Lf inferences did not differ, and therefore are collapsed as 'to lifeform.'

Although the first and largest break occurred between the folk-generic and life-form levels, animal life-forms differed in the strength of inferences to higher-order categories, $F(6,174) = 11.16$, $MSe = 1.45$, $p < 0.0001$. Specifically, planned contrasts revealed a second significant breakpoint between inferences to life-form and folk-kingdom, for fish ($F(1,29) = 69.27$, $MSe = 1.71$, $p < 0.0001$) and for bird ($F(1,29) = 85.74$, $MSe = 1.01$, $p < 0.0001$), but not for mammal (see Fig. 4). Thus, bird and fish were inductively stronger categories than animal, but mammal was not.

6.2. Plants

As with animals, the earliest and largest breakpoint in inductive strength for plant categories occurred between the folk-generic and life-form levels, $F(3,87) = 52.03$, $MSe = 2.16$, $p < 0.0001$. Tukey HSD analyses revealed that Sp–Gn inferences were given higher likelihood than all other inferences. Again, there was no evidence of an effect of premise specificity: Sp–Lf inferences did not differ from Gn–Lf inferences. Moreover, Lf–Kgdm inferences differed from neither. Again, contrary to expectations based on Rosch et al. (1976), the folk-generic level appears privileged with respect to induction.

As in the case of animals, this pattern was qualified by a life-form × inference interaction, $F(6,174) = 6.18$, $MSe = 0.91$, $p < 0.0001$. This interaction is illustrated in the bottom half of Fig. 4. Planned contrasts revealed a second breakpoint between inferences to the life-form and Lf-Kgdm inferences for tree ($F(1,29) = 10.76$, $MSe = 1.29$, $p < 0.005$) but not for bush or flower. Finally, inferences in general were deemed more likely for flowers ($M = 5.40$) than for bushes ($M = 4.89$). Inferences for trees ($M = 5.26$) did not differ from either of the other two ($F(2,58) = 4.06$, $MSe = 2.03$, $p < 0.05$, Tukey HSD tests).

7. Discussion

Given previous findings regarding the location of the basic level among American college students, we expected to find that life-form categories such as bird, fish, and tree would be privileged for induction, i.e., we expected life-form categories to be more informative than more general categories, (e.g., plant, animal) and no less informative than more specific categories (e.g., oak, trout). Specifically, we expected the major breakpoint in inductive strength to occur between inferences to the lifeform level and inferences to the kingdom level. Contrary to these expectations, participants consistently rated inferences to folk-generic taxa (e.g., oak, trout), for both animals and plants, as more likely than any other type of inference. Above this level, ratings of inductive strength decreased sharply. This pattern suggests that for all life-forms tested, the folk-generic level is privileged with respect to induction relative to other ranks. Thus, we observe a discrepancy between induction as a criterion for identifying the psychologically basic level, and the knowledge-based criteria for the basic level used by Rosch et al. (1976), and a surprising parallel in inductive patterns between American college students and Itzaj Maya elders.

Several other results are worthy of some comment. First, in each case where direct comparisons were made, our effects were driven by the conclusion category rather than the premise category. Specifically, we found no differences between Sp–Lf and Gn–Lf inferences, but found consistent differences between Sp–Gn and Sp–Lf inferences. This is not to say that variation in premise categories are irrelevant to induction, all other things being equal (e.g., Osherson et al., 1990; López, 1995). However, the impact of this variation is rather small relative to

the phenomenon under investigation here, which centers on the nature of the conclusion category.

Second, for fish, bird, and tree, inferences to the life-form level were higher than inferences to the more general folk-kingdom level. These are all classes that Rosch et al. (1976) originally identified as potential superordinate categories, but which behaved empirically like 'basic-level' categories. It appears that fish, bird, and tree are inductively useful categories, but strikingly, not as useful as, for instance, trout, sparrow, and oak.

We will return to the implications of our results in the general discussion. First, however, two other possible explanations for the pattern of results must be addressed. Differences in the linguistic transparency of the subordinate-superordinate relations among categories, and specificity of the conclusion categories both offer alternative explanations of the observed pattern of results. These possibilities are addressed in Experiments 3 and 4.

EXPERIMENT 3

One possible explanation of the inductive privilege of folk-generic categories has to do with linguistic transparency. One of the foundational observations of ethnobiology is the nonrandomness of folkbiological nomenclature (e.g., Brown, 1984, see Berlin, 1992, for a review); the prototypical nomenclatural pattern for nested life-form, folk-generic, and folk-specific taxa is to use a primary, primary, and secondary lexeme (e.g., fish–trout–rainbow trout). Thus, folk-generics and folk-specifics often 'have the same name' in a way that folk-generics and life-forms generally do not. Because it was the basis for selection of stimuli, this nomenclatural regularity was exaggerated in Experiment 2. Moreover, research with adults, and with children as young as two years, clearly shows that shared labels are powerful guides for inductions about unfamiliar properties (Gelman and Coley, 1991; Gelman and Markman, 1986). Since Sp–Gn inferences (e.g., from rainbow trout to trout) involved categories with the same name whereas Gn–Lf inferences (e.g., trout to fish) did not, this pattern of shared labels could have exaggerated the inductive advantage of folk-generic categories such as trout.

Given this possibility, it would be useful to eliminate the nomenclatural advantage of Sp–Gn inferences, then attempt to replicate the patterns of results from Experiment 2. To do this, we used a different set of folk-generic taxa, chosen because they are transparently labeled as members of their respective life-forms (e.g., catfish). For these stimuli, Sp–Gn inferences are still supported by nomenclature (e.g., flathead catfish to catfish), but so are Gn–Lf inferences (e.g., catfish to fish). The prediction is that if linguistic transparency is completely responsible for the results of Experiment 2, then changing the nomenclatural patterns in the stimuli should change the results. Specifically, extending the 'same-name' advantage to Gn–Lf inferences should greatly reduce or eliminate the advantage of Sp–Gn inferences over Gn–Lf inferences. This issue is examined in Experiment 3.

8. Method

8.1. Participants

Participants were 30 male and female undergraduate students at Northwestern University. They all participated for class credit. None had participated in Experiment 2.

8.2. Materials

Six life-form taxa were used: snake, bird, fish, tree, bush, and grass. These taxa were chosen because of the existence of folk-generic taxa within each that are labeled with productive complex primary lexemes (Casson, 1981; see also Brown, 1984). These folk-generics are transparently marked as members of their respective life-forms (e.g., goldfish is a folk-generic taxon because it contrasts with taxa like bass and trout, but unlike those, it is transparently marked as a kind of fish). This extends the transparency of the relation between folk-specifics and folk-generics – e.g., rainbow trout and trout in Experiment 2 – to life-form level. Snake and grass were substituted for mammal and flower because of the availability of such transparently-marked folk-generic taxa. A complete list of categories used is presented in Fig. 5. Otherwise, questions, properties and counterbalancing were identical to Experiment 2.

8.3. Procedure

The procedure was identical to that used in Experiment 2.

9. Results

Preliminary analyses were performed to examine potential property differences in inductive patterns. For each lifeform, a 3 (property: enzyme, disease, protein) $\times$ 4 (inference: Sp–Gn, Sp–Lf, Gn–Lf, Lf–Kgdm) mixed ANOVA was performed. Although no reliable main effects involving property emerged, significant property $\times$ inference interactions were observed for fish and grass. Post hoc analyses revealed that for fish, Sp–Gn inferences were higher for ‘protein’ than ‘enzyme,’ and for grass, Sp–Lf inferences were higher for ‘disease’ and ‘protein’ than for ‘enzyme.’ Nevertheless, because these interactions are not directly relevant to the main question of this study, data were collapsed across question sets for subsequent analysis. Likelihood ratings for inferences were analyzed using 3 (life-form) $\times$ 4 (inference type) within-subjects ANOVAs. Analyses are presented separately for animals and plants. The key component of this analysis is the comparison of Sp–Gn and Gn–Lf inferences. If nomenclature alone is driving inference patterns, then the nomenclatural manipulation should reduce or eliminate the difference between Sp–Gn and Gn–Lf inferences found in Experiments 1 and 2. Results are presented in Fig. 6.

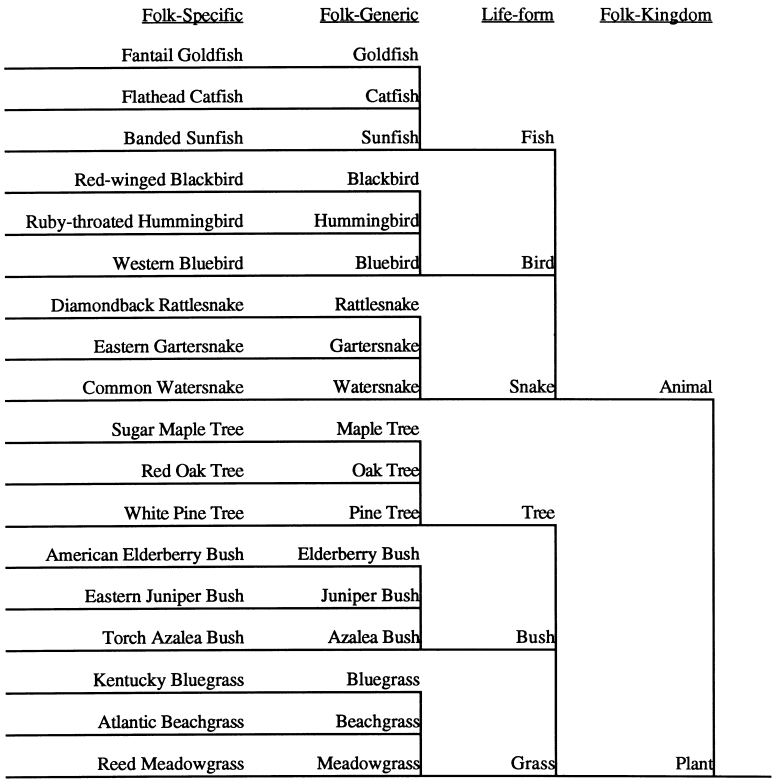

Fig. 5. Categories used in Study 3.

9.1. Animals

For animals, results mirror those of Experiment 2; making the taxonomic link between folk-generic and life-form categories linguistically explicit did not lead to a relative increase in inferences to lifeform categories. As in Experiment 2, Sp–Gn inferences were rated higher than all other inferences. Sp–Lf inferences and Gn–Lf inferences did not differ reliably from each other, but were rated more likely than Lf–Kgdm inferences ($F(3,87) = 91.60$, $MSe = 1.91$, $p < 0.0001$, and Tukey HSD analyses). No other significant effects emerged.

9.2. Plants

As with animal categories, making the taxonomic link between folk-generic and life-form plant categories linguistically explicit did not lead to a relative increase in inferences to lifeform categories. Sp–Gn inferences were rated higher than all other inferences, and Gn–Lf inferences were rated higher than Lf–Kgdm inferences. Sp–Lf inferences did not differ significantly from Gn–Lf nor Lf–Kgdm inferences ($F(3,87) = 28.41$, $MSe = 2.47$, $p < 0.0001$, and Tukey HSD analyses).

This pattern was qualified by a life-form × inference interaction, $F(6,174) = 3.68$, $MSe = 1.65$, $p < 0.005$ (See Fig. 6). Tukey HSD analyses reveal that for bush, inferences to the folk-generic rank were rated higher than inferences to the life-form or kingdom ranks ($p < 0.01$), which did not differ from each other. Results for tree and grass were more complex, and can be taken as some evidence for an effect of linguistic transparency for some plant categories. For tree, Sp–Gn inferences were rated higher than Sp–Lf inferences, but did not differ from Gn–Lf inferences. For grass, Sp–Gn inferences were rated higher than Gn–Lf inferences, but did not differ from Sp–Lf inferences.

Because of the lack of differences between Sp–Gn and Gn–Lf inferences for tree,

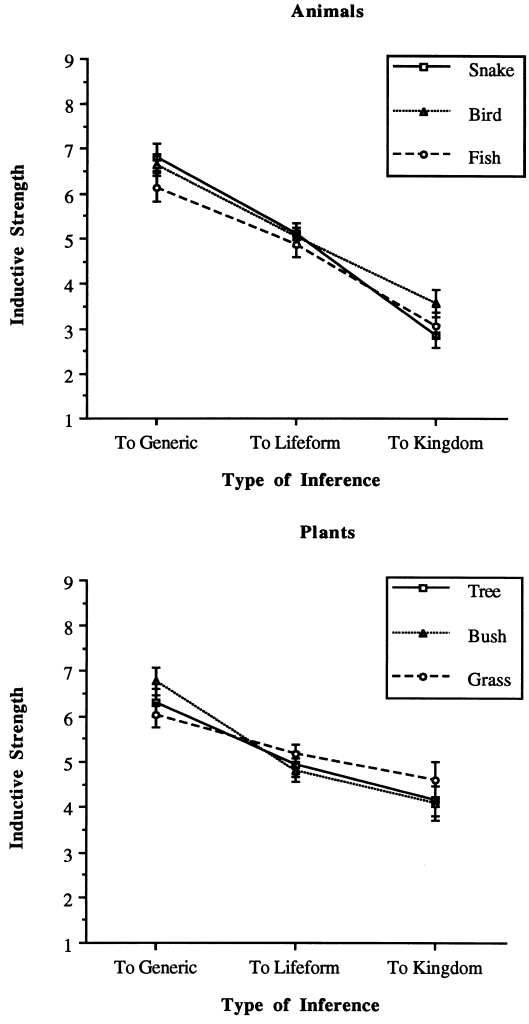

Fig. 6. Induction patterns for American students, transparent label control. Note: Sp–Lf and Gn–Lf inferences did not differ, and therefore are collapsed as 'to lifeform.'

and between Sp–Gn and Sp–Lf inferences for grass, responses for those items were further analyzed to clarify whether patterns still pointed to the folk-generic rank as privileged with respect to induction. For these analysis, likelihood ratings were averaged across Sp–Lf and Gn–Lf inferences, and ratings of inferences to the generic, life-form, and kingdom ranks were compared using separate one-way ANOVAs for tree and grass. For tree, inferences to the folk-generic rank received higher ratings than those to the life-form, which in turn were rated higher than those to the kingdom ($F(2,58) = 19.22$, $MSe = 1.87$, $p < 0.0001$ and Tukey HSD tests). Likewise, for grass, inferences to the folk-generic rank were higher than those to the life-form or kingdom ($F(2,58) = 9.29$, $MSe = 1.68$, $p < 0.001$, and Tukey HSD tests). Thus, although some specific findings may support an effect of linguistic transparency for plants, overall, patterns of reasoning for plants (and animals) were not affected by introducting linguistically-transparent links between folk-generics and life-forms.

10. Discussion

In Experiment 2, the relation between folk-specific taxa and folk-generic taxa (e.g., rainbow trout-trout) was the only taxonomic relation explicitly marked by patterns of nomenclature, and corresponding Sp–Gn inductions were strongest. In Experiment 3, stimuli were chosen so that the relation between folk-generic and life-form taxa was also explicitly marked (e.g., catfish–fish). It was hypothesized that if explicit linguistic marking was responsible for the inductive advantage of folk-generic taxa, this change should reduce or eliminate that advantage by making the link between folk-generic and life-form taxa equally explicit. However, results revealed little evidence for linguistic transparency. Overall, induction patterns in Experiment 3 were the same as in Experiment 2. This suggests that the observed inductive advantage of folk-generic taxa does not stem solely from folk-specific and folk-generic taxa sharing the same name.

This is not to say that language has no effect on induction patterns. To the degree that folk-specific and even folk-generic categories are unfamiliar, language may be a major clue to taxonomic rank. One of the important insights from research in ethnobiology has to do with the decided non-randomness of patterns of folkbiological nomenclature. Thus, language supplies an important clue to conceptual structure, but is not solely responsible for patterns of induction, and hence the psychological consequences of that structure. We return to this point in the General Discussion.

EXPERIMENT 4

In order to demonstrate that a given taxonomic level is privileged, it must be shown that categories at that level are much more informative than more general categories, and not much less informative than more specific categories. Within our

framework, the strongest demonstration of inductive privilege would involve showing that inferences to folk-generic categories are stronger than inferences to lifeform categories and no weaker than inferences to folk-specific categories, as we did in Experiment 1. A weaker but nevertheless acceptable demonstration would be to show that the drop in inductive strength is substantially greater between folk-generic and lifeform than between folk-specific and folk-generic. Either way, in order to conclude that the folk-generic is inductively privileged for American students, it is necessary to examine inferences to more specific categories. In other words, we have not yet shown that the folk-generic rank is the most specific point at which the elbow or major breakpoint in inductive strength occurs for Americans.

In Experiment 1, this was accomplished by asking the Itzaj Vr–Sp, Sp–Gn, Gn–Lf, and Lf–Kgdm questions, which allowed us to assess the induction strength of inferences to categories below, at, and above the hypothesized privileged level. The questions asked in Experiments 2 and 3 would have accomplished this goal had our prediction of inductive privilege at the life-form level been confirmed. Experiment 4 addresses this question in an American sample by presenting inferences to taxa subordinate to the folk-generic rank along with the same inferences presented in the preceding studies. The design is equivalent to that used with the Itzaj in Experiment 1. Participants were presented with inferences from folk-varietal taxa to folk-specific taxa (e.g., eastern white pine to white pine) as well as Sp–Gn, Gn–Lf, and Lf–Kgdm inferences. Normally, inferences to more specific taxa should always be rated stronger than inferences to more general taxa. However, if inferences to folk-specific categories are not significantly stronger than inferences to folk-generic categories, and the breakpoint is instead found between folk-generic and life-form categories, as with the Maya data presented in Experiment 1, then by Rosch's criterion the folk-generic level is the privileged level with respect to induction.

11. Method

11.1. Participants

Participants were 30 male and female undergraduate students at Northwestern University. All participated for class credit. None had participated in Experiments 2 or 3. An additional 30 participants were involved in pretesting the materials (see below).

11.2. Materials

This study used the same life-form taxa that were employed in Experiment 2: mammals, birds, fish, trees, bushes, and flowers. The folk-generic and folk-specific taxa from Experiment 2 were also used, with the exception that eastern juniper was replaced with rocky-mountain juniper so that 'eastern' could be used as a subspecific prefix (see below). In order to test the hypothesis that conclusion specificity was responsible for observed patterns of results, it was necessary to come up with

another level of categories subordinate to the folk-specific taxa used previously. Berlin (1992) includes such a rank in his scheme; taxa of the folk-varietal rank are rare and generally used for domesticated species of high cultural value only (e.g., beans, maize, manioc). As such, folk varietal taxa were not readily available for all categories used in the previous studies. In order to generate categories that would be perceived as subordinate to the folk-specific taxa used previously, folk-generic prefixes that could be taken as denoting subtypes were added to the folk-specific category names used in Experiment 2. For animals, these were 'northern,' 'brown-backed,' and 'white-collared.' For plants, they were 'spotted,' 'common,' and 'eastern.' These were not intended to denote actual living kinds (although in some cases, e.g. eastern white pine, they name true biological taxa), but instead were chosen to unambiguously convey taxonomic subkinds of the folk-specific categories used previously. A complete list of these categories is presented in Fig. 7.

In order to ensure that these categories were perceived as valid subkinds of the folk-specific categories used previously, the items were pretested. Thirty participants were shown 24 pairs of categories; members of each pair were in immediate subordinate-superordinate relation to each other (e.g., plant-tree, tree-pine, pine-

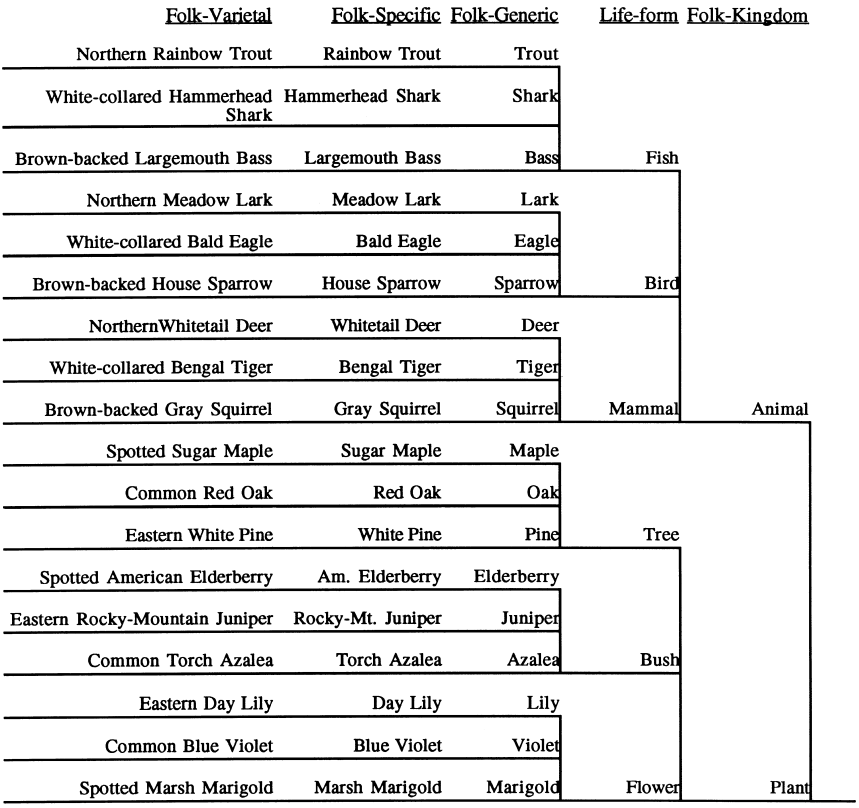

Fig. 7. Categories used in Study 4.

white pine, white pine-eastern white pine). For each pair, participants were asked to 'circle the name of the more specific category.' On 94% of folk-specific-folk-varietal pairs, participants correctly circled the folk-varietal name as the more specific category. Thus, the use of varietal markers clearly indicated subkinds of folk-specific categories for the participants in this experiment.

As before, participants in the main experiment were asked to make inferences from folk-specific to folk-generic, folk-generic to life-form, and life-form to kingdom ranks. In addition, participants were also asked to make inferences from varietal to folk-specific (Vr–Sp) taxa. For these questions, participant were given information about a varietal taxon and asked about a folk-specific taxon, e.g., 'If all Northern rainbow trout have protein A, how likely is it that all rainbow trout have protein A?'

As in Experiment 2, each participant responded to one inference of each of the four types for each of the six life-forms. For varietal to folk-specific inferences, the same six prefixes were used for each participant, but they were paired with taxa from different life-forms. So, for example, one participant might be asked to make inferences from Northern Rainbow Trout, Brown-backed House Sparrows and White-collared Bengal Tigers, whereas another might be asked to reason about Northern Meadow Larks, Brown-backed Grey Squirrels and White-collared Hammerhead Sharks. Thus, each participant saw the same six varietal markers, and across all participants each varietal marker appeared with each life-form the same number of times. Otherwise, properties and counterbalancing were the same as in Experiment 2.

11.3. Procedure

The procedure was identical to that used in Experiment 2.

12. Results

As in Experiments 2 and 3, preliminary analyses were performed to examine potential property differences in inductive patterns. For each lifeform, a 3 (property: enzyme, disease, protein) × 4 (inference: Sp–Gn, Sp–Lf, Gn–Lf, Lf–Kgdm) mixed ANOVA was performed. No reliable main effects or interactions involving property emerged. Accordingly, data are collapsed across question sets for subsequent analyses. Likelihood ratings were analyzed using 3 (life-form) × 4 (inference Type) within-subjects ANOVAs. Analyses are presented separately for animals and plants; the important question is whether or not Vr–Sp inferences are reliably stronger than Sp–Gn inferences. If not, the inductive privilege of the folk-generic level receives further support. Results are presented in Fig. 8.

12.1. Animals

Induction patterns for animals support the finding that folk-generic categories are

inductively privileged. Vr–Sp and Sp–Gn inferences did not differ reliably from each other, but were stronger than all other inferences; Gn–Lf inferences were in turn rated more likely than Lf–Kgdm inferences ($F(3,87) = 98.72$, $MSe = 2.59$, $p < 0.0001$, and Tukey HSD analyses). These results provide evidence against a specificity interpretation; inferences to folk-generic categories were higher than inferences to life-form categories and no lower than inferences to folk-specific categories.

This pattern was qualified by a life-form by inference interaction, $F(6,174) =$ b7.93, $MSe = 1.00$, $p < 0.0001$. This interaction is illustrated in Fig. 8. As in

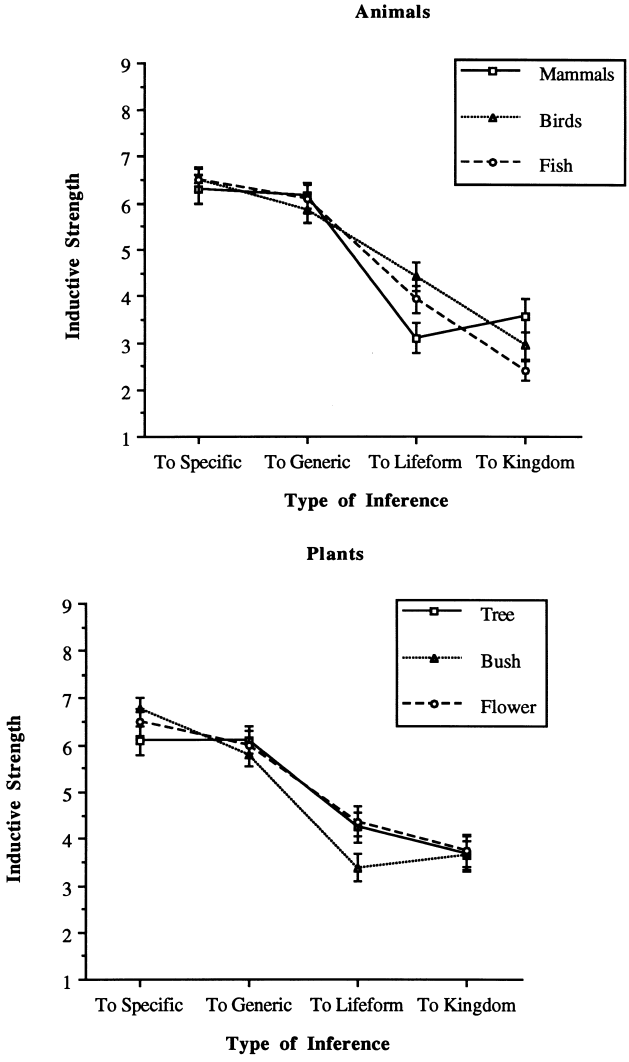

Fig. 8. Induction patterns for American students, including inferences to sub-generic categories.

Experiment 2, planned contrasts revealed that Gn–Lf inferences were rated higher than Lf–Kgdm inferences for fish ($F(1,29) = 28.62$, $MSe = 1.23$, $p < 0.0001$) and for bird ($F(1,29) = 24.02$, $MSe = 1.40$, $p < 0.0001$), but not for mammal. Thus, as in Experiment 2, bird and fish represent secondary loci of inductive potential.

12.2. Plants

Overall, findings for plant categories also support the inductive privilege of folk-generic categories. As with animals, Vr–Sp and Sp–Gn inferences did not differ reliably from each other, but were stronger than all other inferences; Gn–Lf inferences did not differ from Lf–Kgdm inferences ($F(3,87) = 72.17$, $MSe = 2.42$, $p < 0.0001$, and Tukey HSD analyses). As with animals, in general inferences to folk-generic categories were stronger than inferences to life-form categories, and no weaker than inferences to folk-specific categories.

One minor exception to this pattern occurred for bush. A life-form by inference interaction, $F(6,174) = 3.10$, $MSe = 1.18$, $p < 0.01$) indicated that whereas for tree and flower, Vr–Sp inferences were no stronger than Sp–Gn inferences, for bush, Vr–Sp inferences were stronger than Sp–Gn inferences ($p < 0.05$, Tukey HSD). In sum, folk-generic taxa are clearly privileged for tree and flower; for bush, there is some effect of specificity, but there was nevertheless a larger gap between Sp–Gn and Gn–Lf inferences than between Vr–Sp and Sp–Gn inferences, indicating that for bush the gain in informativeness going from folk-generic to folk-specific is relatively small compared to that in going from life-form to folk generic, which in turn suggests that the folk-generic is privileged for bush as well.

13. Discussion

The results of Experiments 2 and 3 suggested that folk-generic categories may be privileged for induction, because inferences to folk-generic categories were stronger than inferences to more general categories. However, these results were not decisive because – based on original expectations that inductive privilege should reside at the life-form level – inferences to categories subordinate to the folk-generic level were not examined. By Rosch et al.'s logic, we must show that the folk generic is more informative than higher-order categories, but no less informative than lower-order categories.

In Experiment 4 we remedied this by examining inferences from folk-varietal to folk-specific categories – as in Experiment 1 – in addition to Sp–Gn, Gn–Lf, and Lf–Kgdm inferences as in Experiments 2 and 3. Results provide strong evidence that folk-generic categories are privileged for induction. Folk-generic categories (e.g., oak) were inductively stronger than life-form categories (e.g., tree), and (with the sole exception of bush) were not inductively weaker than folk-specific categories (e.g., red oak). This was not attributable to a ceiling effect; mean likelihood ratings for Vr–Sp and Sp–Gn inferences hovered between 5.8 and 6.8, well below the endpoint of the 9-point scale. Thus the results of Experiment 4 reveal a

true 'elbow' in inductive strength at the folk-generic level; inductions to folk-generic categories are stronger than inductions to more general categories, and not reliably weaker than inductions to more specific categories. In other words, the folk-generic level is the most specific level above which a clear breakpoint in inductive strength occurs.

The results of Experiment 4 also replicate previous findings that some, but not all, taxa of the life-form rank are also somewhat inductively strong, relative to more general folk-kingdom taxa. For animals, inductions to bird and fish were again rated as more likely than inductions to animal. For plants, any special status of life-form taxa is less clear cut; inductions to tree were rated as marginally more likely than inductions to plant.

GENERAL DISCUSSION

We undertook these studies to better understand the relations between privileged levels in folk biological taxonomy and inductive inference. Based on the work of Rosch et al. (1976), Berlin (1992) and their colleagues, we predicted that the same principles that lead to basic-level phenomenon – high within-category similarity relative to between-category similarity – would lead to inductive privilege. As knowledge of shared features drops above the basic level, so should inductive strength. In addition, we predicted that apparent differences in the location of the privileged level across cultures would be reflected in differences in which level appeared privileged for induction.

For the Itzaj Maya, members of a traditional culture living in the lowland rainforest region of Guatemala, our results were as predicted by anthropological accounts of folkbiological taxonomy. Inferences to folk-generic categories were consistently stronger than inferences to more general categories, and no weaker than inferences to more specific categories. The gain in inductive strength was greatest moving from life-form to folk-generic categories, suggesting that folk-generic categories are psychologically 'basic' with respect to induction. Thus, for the Itzaj, the inductively privileged level corresponded to the presumptive basic level for traditional societies.

To our surprise, the inductively privileged level for American college students did not correspond to the American 'basic level.' Rosch's work suggests that 'basic object categories' for living things fall at the life-form level (bird, fish, tree), whereas our results clearly show that the folk-generic level (sparrow, trout, oak) was privileged for induction. We did find that some life-forms, notably bird, fish, and tree, were secondarily privileged, and inferences to these categories were stronger than to plant or animal. However, for Americans, results unambiguously show that the privileged level for induction was the folk-generic, subordinate to the 'basic' level.

Given the strength and clarity of our findings, and the preponderance of other evidence suggesting that for urbanized Americans, knowledge of living things is organized at the basic level of bird, fish, and tree, we are left with the question of

why the privileged level for Americans with respect to induction fails to correspond to Rosch's 'basic' level. To address this question, we first rule out what appears to be a straightforward answer involving within- versus between-category similarity. We ultimately argue that our results, when coupled with Rosch's, reveal a dissociation of knowledge and expectations in Americans' folkbiological categories. Although Americans may have little specific knowledge about sparrows, trout or oaks, language in conjunction with expectations about categories nevertheless serves to maximize inductive inferences at that level of abstraction. We propose several sources for this expectation. Finally, we consider the implications of our findings for cultural differences in folkbiological reasoning.

13.1. Discrepancy between privileged levels for Americans

13.1.1. Within- and between-category similarity

One way to account for the apparent discrepancy between results of the present experiments and those of Rosch et al. (1976) is to propose different functions for within- and between-category similarity in the sets of tasks. On this account, which is not explicitly proposed in Rosch et al. (1976) but has been discussed by many researchers since Rosch (see Lassaline et al., 1992, for a review), the inductive strength of a category is driven by within-category similarity alone, whereas status as a 'basic object category' results from maximum within-category similarity relative to between-category similarity. On this account, life-form categories (e.g., fish, tree) may be privileged on Roschian tasks because they maximize within-category similarity relative to between-category similarity, and folk-generic categories (e.g., trout, oak) may be privileged in induction because they maximize within-category similarity alone.

This view is illustrated in Fig. 9a. In Fig. 9a, the largest drop in within-category similarity occurs between the folk-generic and the life-form level, predicting an inductive advantage for folk-generic categories. However, the criterion for basic level status – within-category similarity relative to between-category similarity – is maximized at the life-form level (as indicated in Fig. 9a by the distance between the two lines). Thus, it is possible to conjecture patterns of within- and between-category similarity that yield folk-generic categories privileged for induction (as we have shown) but life-form categories privileged for knowledge-based tasks used to diagnose the basic level (as shown in previous research).

This account fails, however, when one considers logical constraints on the relation between within- and between-category similarity. A close look at Fig. 9a reveals that the similarity account requires within-category similarity at the life-form level to be much lower than between-category similarity at the folk-generic level. But note that within-category similarity at a given level is logically equivalent to between-category similarity at the immediately subordinate level. For instance, a judgment of within-category similarity for a life-form (e.g., how similar are all fish) is equivalent to aggregated judgments of between-category similarity for folk-generic subordinates of that life-form (e.g., how similar is trout to bass, shark to goldfish, etc.). This logical constraint makes Fig. 9a impossible. The major breakpoints

in within- and between-category similarity cannot both occur between the folk-generic and life-form levels, as required in Fig. 9a. On the contrary, within-category similarity at the life-form level must correspond to between-category similarity at the folk-generic level.

Fig. 9b is a revision of Fig. 9a taking this constraint into account. Ratings of inductive strength collapsed across studies are substituted in 9b for the hypothetical within-category similarity ratings in 9a, and between-category similarity at each level in Fig. 9b is estimated by projecting the approximations of within-category similarity (i.e., aggregate ratings of inductive strength) to the immediately subordinate level. As Fig. 9b indicates, if the major break in within-category similarity occurs between the folk-generic and life-form levels, then the ratio of within- to between-category similarity is necessarily maximized at the folk-generic level as well. If these observations are correct, it is impossible to simultaneously observe (1)

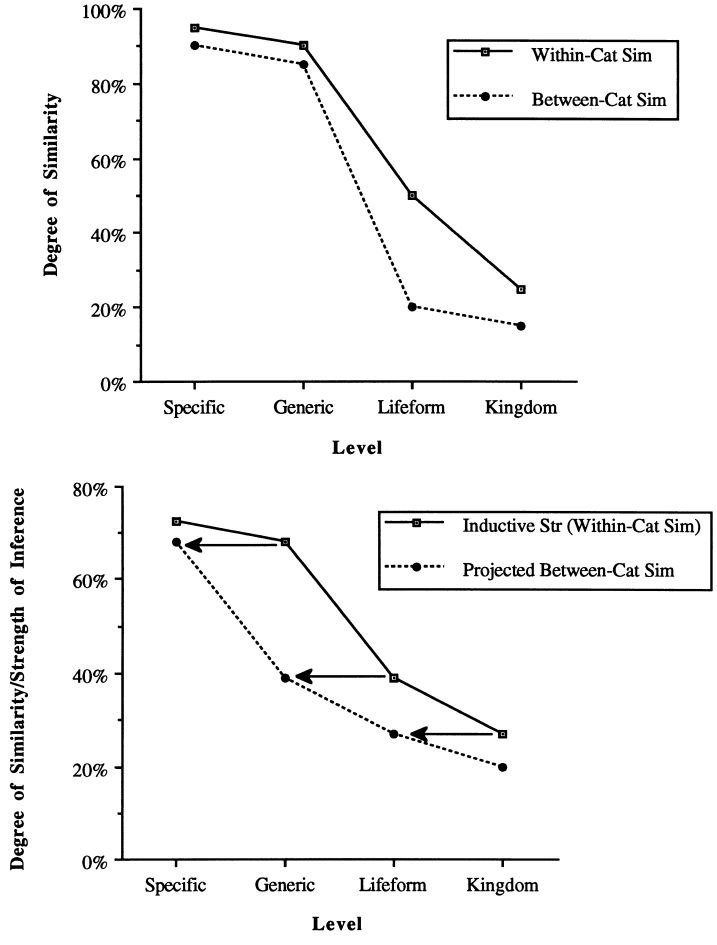

Fig. 9. Hypothetical within-category and between-category similarity.

the largest drop in within-category similarity between folk-generic and life-form categories, and (2) the ratio of within- to between-category similarity maximized at the life-form level. Therefore, different functions of within- and between-category similarity cannot explain both the present results favoring the folk-generic level for induction and Rosch et al.'s findings favoring the life-form level for categorization.[4]

13.1.2. Knowledge versus expectation

We believe a better answer to our puzzle lies in the observation that Roschian tasks measuring the 'basic level' and our induction task tap different competencies. Most of Rosch's tasks dealing with biological kinds required explicit knowledge – i.e., true belief resulting from a reliable discovery procedure – on the part of the participant. A close look at Experiments 1–4 from Rosch et al. (1976) reveals the following: Experiment 1, listing features of objects named at different levels, and Experiment 2, listing motor movements associated with objects named at different levels, are both linguistic in nature.[5] Furthermore, both are completely dependent on knowledge of the categories named. Experiments 3 and 4 are perceptual, having to do with similarity in overall shape, and recognizeability of average shape, respectively. After experiments 1–4, Rosch et al. (1976) abandoned biological categories because they did not behave as expected. Thus, for biological categories, Rosch's results show that, for urban Americans, (1) the life-form level is the locus of knowledge, and (2) the life-form level is the most perceptually differentiated level.

In contrast to Rosch's measures, ours are neither perceptual nor knowledge-dependent. Rather than having participants list features that they knew to be true of categories, we asked them to project properties chosen expressly for the purpose of being unknown. (Indeed, we have since replicated the phenomena with completely general properties, i.e., 'Has property X.') Because our participants could have few prior beliefs about the properties they were asked about, we take our results as a measure of the degree to which they expected categories at different levels to share underlying properties. Clearly, this expectation is maximized at the folk-generic level. Thus, our results, coupled with those of previous research, argue for the dissociation of knowledge and expectation for American participants. These expectations could arise from a variety of sources. Below we discuss two possibilities, although no doubt there are more.

One possibility is that nomenclatural patterns in conjunction with expectations about category essences led Americans to expect inductive strength at the folk-generic level. American participants may have known almost nothing about most of the folk-generic terms we used – e.g., they may have know little about the extension of the term 'oak' other than that it is a kind of broadleafed tree. Indeed, informal evidence supports this: when asked to name as specifically as possible 44 different plants on a campus tree walk, 75% of undergraduate responses used labels

[4] Of course, one could posit a non-linear relation between within-category similarity and inductive strength, such that inductive strength rises rapidly relative to within-category similarity in the range between folk-generic and life-form, but such a post-hoc account lacks independent motivation.

[5] We thank Sandra Waxman for the insight into the linguistic nature of many of Rosch et al.'s tasks.

at the life-form level, e.g., 'tree.' However, knowing that an oak is a tree marks oak as a folk-generic – the lowest level at which things have unique names. As Berlin (1992) documents, below the level of folk-generic, the nomenclatural pattern tends to unambiguously mark relative subordinate relationships (e.g., oak, red oak, northern red oak). Even preschoolers assume that compound names refer to subkinds, (e.g., that a 'dingo-dog' is a kind of dog, Gelman et al., 1989).

Thus, inclusion relations below the rank of folk-generic are often explicit in nomenclatural patterns. These patterns, when coupled with explicitly-learned inclusion relations of folk-generics under life-forms ('an oak is a kind of tree') may be enough to set up a semblance of a folk-biological taxonomy and to flag the folk-generic level (the lowest level at which kinds have unique names) despite little experience with members of the categories. Indeed, Rosch sums it up well: 'For humans, the major part of the classification system is probably neither biologically fixed nor created anew by each individual, but is provided by the culture and language into which the individual is born' (Rosch, 1975, p. 177).

So, language – in tandem with a bit of experience of the world – could point out which taxa are folk-generics. Once there, an assumption of essence – including expectations of many nonobvious similarities among members of named categories – could lead to the expectation that folk-generics would be inductively strong. Developmental evidence shows that for preschool children, labels are important indicators of taxonomic categories, and that children expect that individuals from the same categories, despite perceptual dissimilarities, will share underlying properties (Gelman and Coley, 1990; Gelman and Markman, 1986, 1987; Waxman, 1991; Waxman and Markow, 1995). In other words, for children labels appear to 'stake out' categories – along with a presumption of essence and rich inductive potential if the category is biological – despite lack of specific knowledge about members of that category (Gelman, 1988; Gelman and Coley, 1991; Gelman et al., 1994; Medin and Ortony, 1989). An analogous process may account for adult performance on our task. Regularities in patterns of folk nomenclature may highlight folk-generics, and assumptions about the inductive potential of living kind categories may imbue them with inductive strength despite little actual experience with or knowledge of category members.

Another possible source of Americans' expectations of inductive strength at the folk-generic level is analogy from familiar living kinds. Limited experience with a subset of biological kinds may be sufficient to fix the locus at the folk-generic level. This may be analogous to what Shipley (1993) refers to an overhypothesis (see also Goodman, 1955). For example, people may know that members of familiar folk-generics (dogs, cats, pine trees) are alike in predictable ways, and different from other familiar folk-generics in predictable ways. This knowledge may set up an assumption about novel folk-generics. For example, if people are told about some unfamiliar mammal, the Quagga, they are likely to expect that Quaggas will differ from other mammals and be similar to each other in external appearance, internal properties, behavior, and in a variety of other ways, just as tigers or squirrels are. This notion of overhypotheses, along with linguistic structure marking rank may suffice to yield a central locus for induction. The American college students in our

study may not know enough to tell an elm from a maple, but, as argued above, they may be able to pinpoint the folk-generic level on linguistic criteria, and then extend inductive privilege by analogy from a few familiar folk-generics.

Thus, our results suggest that Americans may know more features and perceptual affinities at the more abstract level of tree and fish, but still expect the strongest clusters of properties to cohere at the folk-generic level, even if they have little specific knowledge about most folkbiological categories at that level. This mismatch of knowledge and expectations has important implications for models of category-based induction. Current models (e.g. Osherson et al., 1990; Sloman, 1993) tie induction directly to the knowledge associated with concepts and the resulting patterns of similarity. For example, Osherson et al. (1991) used participants' ratings of the degree that features are true of mammal categories to set up default probabilities that in turn predicted inference about blank properties. This linkage is normatively justifiable (Anderson, 1990) and intuitively plausible. Our work, however, suggests that people may also use expectations about the distribution of properties or features to guide induction, especially in domains where their knowledge is limited. If so, then models of inductions will need to include a component associated with expectations.

13.2. Cultural differences in folkbiological reasoning

One way to conceptualize cultural differences in folkbiological thought is in terms of differences in expertise. Dougherty (1978) argues that members of traditional societies who are dependent directly on nature for survival tend to use more specific categories of living things than members of industrialized societies who no longer rely on immediate knowledge of plants and animals. This view is compatible with the differences between Berlin (1992); Rosch et al. (1976) we cited at the outset, and with more recent work showing that basic levels may become more specific with expertise (Johnson and Mervis, in press; Mervis and Rosch, 1981; Tanaka and Taylor, 1991). The implication is that members of traditional cultures are folkbiological experts relative to members of urbanized cultures, and therefore have more specific basic levels. If basic levels change with expertise, and basic level categories are also the most useful for induction, then inductively useful categories should vary with expertise. In contrast, we find the very same categories privileged for induction among folkbiologically naive Americans and folkbiologically sophisticated Itzaj Maya. These findings, clearly show that the implications drawn from previous research are an oversimplification. Rather than simply reflecting different basic levels, the cultural difference, which could still be expertise-based, appears to be one of much more complexity and subtlety. Knowledge and expectations about living kinds may show a dissociation in modern urbanized cultures, but in situations where folk are likely to be well-acquainted with local living kinds, as in 'traditional' societies like the Itzaj, knowledge apparently converges with expectations. Indeed, this convergence may well represent the default case for human understanding of living kinds under normal (evolutionarily-attuned) environmental conditions.

Thus, different paths apparently lead to the same end with respect to inductive privilege. Experience, expectation, and nomenclature conspire to privilege the folk-generic for induction. But despite the striking similarities with respect to induction patterns between American college students and Itzaj Maya, we still acknowledge that conceptual differences exist between the groups. For one, Itzaj possess a great deal more knowledge about living things in their immediate environment than do American college students (see Coley et al., 1997; López et al., 1997). This is not surprising, given the Itzaj's dependence on knowledge of the forest for survival, and the irrelevance of such knowledge for day-to-day functioning of typical American undergraduates. This difference seems to have at least some cognitive consequences. First, as mentioned above, the Itzaj do not show the same dissociation of knowledge and expectation evident among Americans. Second, Americans seemed more willing make inductive generalizations about higher-order life-form categories. Inferences to bird, fish, and tree were consistently higher than inferences to animal or plant for Americans, but not for Itzaj. Although scoring methods differed for the two groups, this result was replicated in detail by Atran et al., in press, using the 'all-some-none' scoring method for both populations. This difference could be due in part to Americans' lack of knowledge about more specific groups of living things. For the Itzaj, greater knowledge of more specific kinds may render higher-order categories less meaningful (see López et al., 1997). It remains to be seen whether this and other differences are cultural – that is, they spring from the beliefs, rituals, and daily practices specific to the groups involved – or are actually driven more be differences in levels of knowledge and expertise.

14. Conclusions

For urbanized American undergraduates, we have found that the basic level as measured by tasks tapping knowledge (e.g., Rosch et al., 1976) does not predict which level of a folk biological taxonomy is inductively privileged. For Americans, there appears to be a dissociation between knowledge, which as previous research suggests, may be organized at the life form level of tree, bird, and fish, and expectations about shared clusters of properties, which are maximized at the folk-generic level (oak, sparrow, trout). In contrast, for the Itzaj, the presumptive basic level corresponds to the inductively privileged level, both falling at the folk-generic. This suggests that for members of traditional cultures, knowledge and expectation may converge on a single privileged level, whereas for members of urbanized society, language and expectations may privilege the folk generic despite little knowledge of living things at this level. Thus, our pattern of results seems attributable to knowledge of the folk-generic taxa themselves and expectations about categories' inductive potential conveyed by the way that one's culture names categories. In sum, it appears that strikingly different experiences of the natural world lead to very similar pattens of conceptual organization and reasoning about nature.

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