5 Folk taxonomies

At the time the feature model of kinship was being developed, detailed field studies of folk biology were also being investigated by a number of anthropologists. One of the earliest systematic investigations of folk botanical knowledge – a field of study called "ethnobotany" – was carried out by Harold Conklin among the Hanunóo, a horticultural people of the Philippines (1954). He found Hanunóo ethnobotany to be an incredibly rich lexical domain, containing more than 1,800 specific plant terms. Conklin and later ethnobiologists focused much of their research effort on plant and animal terminological systems, and especially the taxonomic groupings of plants and animals.

There were good reasons for placing the primary emphasis on taxonomy rather than features in the study of folk knowledge of biology. The taxonomic relation, *x is a kind of y*, is one of the major ways in which people organize knowledge about plants and animals. It is not that features of plants and animals are irrelevant – Hanunóo or Tzeltal informants can talk at length about the features of particular specimens, and have rich vocabularies with which to do so. Rather, it is that when talking with informants about the differences between generic groupings of plants, such as the difference between oaks and orange trees, there are such a very large number of differences that, as Berlin, Breedlove, and Raven put it:

> verbal specification of distinctive features or characters is only in the roughest sense an adequate representation of what kinds of assessments our informants make in the actual identification of plant taxa . . . identification and placement of a particular specimen in some recognized class is often instantaneous and basically one of overall pattern (or undifferentiated Gestalt). (1974:154–155)

Eugene Hunn, who has worked on Tzeltal ethnozoology and Sahaptin ethnobotany, has been particularly interested in the hypothesis that the features of specific plants and animals tend to be perceived as a gestalt, or total configurational unity, rather than as a discrete list of properties. Using distinctions made by Bruner, Goodnow, and Austin in their classic work, *A Study of Thinking*, Hunn has considered the question of how, given the severe

limitations of short-term memory, people categorize multiattribute objects (1976). According to Bruner, Goodnow, and Austin, there are two major techniques for reducing the load on short term memory. The first technique is *attribute reduction.* This consists of simply limiting the number of criterial attributes or features to a very small number – five or six – and ignoring the rest of the attributes. The second technique is *configurational recoding.* In configurational recoding, a number of features are "chunked" together to form a single attribute. As Bruner, Goodnow, and Austin say:

> Such reconstruction is possible because in fact the defining features of most objects and events are redundant with respect to each other. A bird has wings and bill and feathers and characteristic legs. But . . . if it has wings and feathers, the bill and legs are highly predictable. In coding or categorizing the environment, one builds up an expectancy of all these features being present together. It is this unitary conception that has the configurational or Gestalt property of "birdness" . . . When the conception is well enough established, it takes on the property of being able to serve as a discriminable and seemingly irreducible attribute of its own. (1956:47)

From this perspective, taxonomies use relations between *kinds of things* which have been recoded into "configurational attributes." A *collie* is a kind of *dog,* and "dogginess" is a configurational attribute – a configuration of large numbers of attributes "recoded" and "chunked" into a single gestalt of "dogginess." By virtue of being *a kind of* dog, collies "inherit" all the recoded attributes that make up the chunked quality of "dogginess" – nose, tail, yelp and all.

One of the major findings of ethnobiology, stated by Berlin, Breedlove and Raven (1973, 1974), is that folk taxonomies have a limited number of levels. Typically five levels can be distinguished in a folk taxonomy. This limitation, I argued in Chapter 3, is due more to the limitations of short-term memory than to the structure of plants. According to modern biology, there are at least twelve levels distinguishable in the plant domain. For example, a *dandelion* is classified as a member of the kingdom *plantae*, subkingdom *embryophyta*, phylum *tracheophyta*, subphylum *pteropsida*, class *angiospermae*, subclass *dicotyledoneae*, superorder *sympetalae*, order *campanulales*, family *compositae*, subfamily *liguliflorae*, genus *taraxacum*, and species *taraxacum officinale.*

Each level of a folk taxonomy forms a *rank*, or level of grouping. The very top of a taxonomy is rank zero. Rank zero consists of a single term which refers to everything included in the taxonomy, called the *unique beginner*, since by itself it "begins" the taxonomy. For example, in English the term *plant* can be used to refer to all kinds of trees, shrubs, vines, grasses, etc.[1] Similarly, the term *animal* when used to refer to the entire animal kingdom is a rank zero unique beginner term, although the term *creature* is perhaps truer to ordinary usage.

It is interesting that in a number of cultures there is no rank zero term for the plant domain. For example, there is no single term for "plant" in either Tzeltal or Aguaruna. This does not necessarily mean that there is no concept for "plant."[1] The evidence that such a concept can exist without a term is quite strong for both the Tzeltal and Aguaruna. First, in the systems investigated to date which lack a zero level term, there are numerous terms for parts of plants and stages of plant growth which are applied *only* to plants. Second, as Berlin says of the Aguaruna, a Jivaroan speaking aboriginal people living in a Peruvian tropical rainforest:

> there is much informal evidence that the world of plants is recognized as a distinct domain . . . In collecting more than 20,000 specimens, informants, some of whom were monolingual, never selected organisms *other* than plants in actual field collecting situations; mushrooms and other fungi were not considered to fall within the domain. (1976:384)

Third, in pile sorting tasks, Berlin found that his Tzeltal informants always sorted plants and animals in different groups. Finally, as reported in Chapter 4, if asked most generally what kinds of things there are in the world, Metzger and Williams found that Tzeltal informants produced a classification system which partitioned the world of living things into "humans," "animals," and the polylexemic phrase "trees and plants."

Immediately below the unique beginner are the *life-form* groupings. The number of life-forms is quite small, and they always have a number of subordinate groupings below them. In English, *tree, bush, vine,* and *grass* are life-forms. In the plant domain life-forms are usually based on what Berlin calls "stem habit"; that is, the form of the trunk or stem of the plant. The Aguaruna, for example, have just four life-form terms:

numi	"trees and shrubs exhibiting woody (non-pithy) stems with erect habit"
dáek	"plants exhibiting twining stem habit, including woody liana and herbaceous vines"
dúpa	"net-leaved plants and small shrubs exhibiting herbaceous or pithy stems"
sínki	"palms, excluding the small reed-like and trunkless forms.

The life-form level tends to be based on major perceptual discontinuities – obvious differences between kinds of things like the difference between *birds* and *fishes* or *trees* and *vines*.

Below the life-form groupings at rank two are what Berlin refers to as *generics*. The generics are the basic core of the folk taxonomy. They constitute those groupings that share the most numerous characteristics of form and behavior. They are "natural kinds" of things; *dogs, mice, dandelions, oaks,* etc. It is

---

[1] The term *plant* is more commonly used to refer to a young tree, shrub, or herb that has just been planted or is ready to plant. The use of *plant* or *animal* to refer to an entire kingdom is a semi-technical use, as Anna Wierzbicka (1984) has pointed out.

knowledge about generics that makes up the greater part of folk knowledge about plants and animals.

The folk generics do not necessarily correspond exactly to the biologists' *genera* or to the biologists' *species*. It is difficult to match the folk taxonomy with the biologists' taxonomy to determine precisely how they correspond because the two different systems have different numbers of levels (Hunn 1975). However, most anthropologists who have done intensive ethnobiological research in ethnobiology have found a strong degree of congruence between folk generics and the classification system of scientific biology. Berlin found that of 471 Tzeltal plant generics, 61% corresponded to scientific species, while another 21% corresponded to two or more scientific species in the same genus (Berlin, Breedlove, and Raven 1974:102). Similarly, Hunn found 75% of Tzeltal animal generics corresponded to scientific species, and another 11% corresponded to two or more species in the same genus (1975). Boster, Berlin, and O'Neill (1986) found a tight correspondence between the scientific taxonomy of birds and the degree to which Jivaro informants were likely to use the same folk taxonomic terms to describe pairs of specimens. That is, birds which are close together in the scientific taxonomy are identified with overlapping lists of names, while birds that are distant from each other in the scientific taxonomy are identified with distinct lists of names.

Most folk generics belong to a particular life-form. A *lilac* is a *bush*, a *cricket* is an *insect*, and a *maple* is a *tree*. However, folk plant and animal taxonomies include generics which are either ambiguously classified in more than one life-form (for example, *willows* typically have a *tree* shape, but under some conditions have a *bush* shape), or are unaffiliated with any life-form term (for example, *mushrooms* are not included under any of the English plant life-forms, nor *octopus* under any of the English animal life-forms). Of Tzeltal plant generics, 4% were ambiguously affiliated, and 21% were unaffiliated.

There is some controversy about the reality of the generic level. Berlin argues that by taking linguistic, morphological, and psychological factors into account, a clear determination of level can almost always be made. Hunn (1976) has a slightly different perspective, arguing that it would be better to consider the entire field of terms as a "similarity space," rather like the spaces created by multidimensional scaling. In such a model, one could talk about the "spread" of a particular grouping as well as the "distance" between different groupings which are neither superordinate nor subordinate to each other in a way that cannot be represented in a pure taxonomy.

Below the generic level are the *specifics*. Most specifics occur in sets of two or three members. The differences between specifics in the same contrast set usually consist of a very small number of morphological features, such as color and size. Specifics are usually labelled by *secondary lexemes*. Secondary lexemes consist of binomial terms like *white oak* in which one part of the term consists of an immediately superordinate class (*oak*). For a term to be a true

Table 5.1. *Aguaruna plant generics by degree of cultural significance (adapted from Berlin 1976)*

	Cultivated	Protected	Significant	Unimportant	Total
Generic with no specifics	37 (61%)	31 (69%)	215 (80%)	177 (94%)	460
Generic with specifics	24 (39%)	14 (31%)	53 (20%)	12 (6%)	103
Total	61(100%)	45 (100%)	268 (100%)	189 (100%)	563

secondary lexeme it must occur in a contrast set in which other members are also labelled by secondary lexemes (*black oak, coast oak, cork oak*). Thus a form like *tulip tree* is a primary rather than secondary lexeme because it does not occur in such a contrast set – there are no *gladiola trees* or *marigold trees* contrasting with *tulip trees*. Instead, *tulip tree* contrasts with *oak, elm*, etc.

Most generics are *monotypic*; that is, they are not further divided into specifics. This is true for both folk and scientific taxonomies (Geoghegan 1976). Generics which are further divided into two or more specifics are called *polytypic*. The number of polytypic generics is between 10 and 20% in most folk botanical taxonomies (Berlin 1976). The likelihood that a folk generic will be further subdivided into specifics is strongly related to its *cultural significance*. Berlin has developed a four category scale of cultural significance to show this relationship. Most significant are the *cultivated forms*, followed by *protected plants* (not planted but not destroyed), *significant plants* (regarded as useful but not systematically protected), and *unimportant plants* (no known cultural utility). Table 5.1 presents the relevant data for Aguaruna plants.

From this table one can see that almost 40% of folk generics for Aguaruna cultivated plants are further subdivided into specifics, while only 6% of "unimportant" plant generics are subdivided. Comparable figures were found for Tzeltal plants (Berlin, Breedlove, and Raven 1976:389).

There are at least two possible explanations for this association. One is that there truly is more differentiation among the cultivated and protected plants, and that the scientific taxonomy for these plants would give the same results as the folk taxonomy. A second explanation is that people give more attention to plants which are important to them, and for this reason differentiate them more finely. The second explanation seems the most powerful. Berlin states:

> In fact, the actual numbers of biological species included in the generic taxa of little or no cultural importance is many times greater than those included in taxa of major cultural significance. Thus, unimportant generics exhibit more *potential* for further subdivisions than do culturally important forms. I would not discount . . . persuasive arguments that the objective genetic and morphological characters in cultivated plants caused by controlled breeding must also be considered an important factor in the recognition of subgeneric taxa. (1976:394)

At the most detailed level of folk taxonomy are the *varietals*. These are rare in any folk taxonomy. Varietals are always of strong cultural significance, and involve fine discriminations. For example, there are a number of varietals in English for highly specialized breeds of dogs, such a *toy poodle, border terrier, miniature collie*, etc. Relatively well-known plant varietals in English are *baby lima bean* and *butter lima bean*. Varietals are often trinomial in form.

In some parts of many folk botanical taxonomies there are six rather than five ranks. The additional rank occurs between life-forms and generics. Terms on this level are called *intermediates*. An example in English would be the term *pine* when used to include the *redwoods, spruces, firs*, and *pines*. (Here again we find polysemy, with *pine* having two meanings, one more inclusive, the other the "par excellence" or "focal" use for a more specific grouping.) An interesting thing about the intermediate level is that *most intermediate categories are not labelled*. For example, in English there is a recognized category of "trees with leaves" which contrasts with the intermediate level term *pine*, but there is no single term for this group. Such groupings are called *covert categories* (D'Andrade 1962; Berlin, Breedlove and Raven 1968).

Since covert categories have no single term to label them, special methods must be used to identify them. In a preliminary study of Tzeltal tree terms in 1962, I used the triads test to try to determine covert categories for a small sample of Tzeltal trees. However, the triads method requires too many judgments to be really useful with large numbers of terms. Even incomplete balanced block designs require too many judgments when the number of items is over fifty. Berlin, Breedlove, and Raven used an adaptation of the pile sort method (1974:59). The names of plants were written on slips of paper, and informants were asked to group into piles the plants that were "most like one another." Informants were first trained with a small sample of plant and animal names. Informants had no difficulty in sorting such a sample into plant and animal categories. Next, informants were given a set of plant names from the various life-forms. Again, informants had no difficulty in sorting the plants into their respective life-form categories. Once the idea of similarity sorting had been learned and demonstrated, informants were given names of generics from the same life-form. Informants again were able to do the task without difficulty. The resulting grouping produced covert categories at the intermediate rank.

Berlin, Breedlove, and Raven used a number of methods to determine the features used by informants to distinguish covert categories, including having a limited number of paired comparisons presented to informants and requesting them to state the ways in which the two plants were the same and the ways in which they were different. The results of these sorting and eliciting procedures are presented in detail in Berlin, Breedlove, and Raven's summary volume, *Principles of Tzeltal Plant Classification*. They found a total of fifty-three covert categories, ranging in size from two to six generic members.

Another method of identifying covert categories has been developed by Terence Hays, who worked with the Ndumba, an Eastern Highland people of Papua New Guinea. Using ten non-literate informants (five males and five females) Hays elicited an inventory of over 1,200 plant names, 970 of which all ten informants recognized. The average informant was found to know about 1,100 plant names. Using a standard series of queries (e.g. "Are there different kinds of ___?", "What kind of thing is ___?", "Is ___ a kind of ___?", "Are ___ and ___ the same?") the taxonomy for plants was worked out in detail. All the informants agreed on the five life-form terms. The greatest variation among informants occurred in the generic and species ranks. Hays used this variability in naming plants to identify covert categories. The basic idea is that to the extent that the same plant specimen elicits different names from different informants, these names are likely to belong to the same covert class. As Hays puts it:

> Assuming that my informants perceive their world and conceptualize it according to similar, though not identical informant processing rules (i.e., that there exists, in some sense, a "shared culture"), much of the variability in their statements and acts is likely to be patterned in discoverable ways. I suggest that one of the patterns in plant naming responses is that, far from indicating random guesses, the diverse names offered tended to form relatively small sets whose members tended to co-occur regularly. Multiple instances of such co-occurrences, I propose, may be taken as evidence of conceived similarity among the categories designated by the names such that their tokens were readily "confused" with each other . . . The categories designated by these co-occurring names, then, may be considered as conceptually grouped, whether the grouping itself is habitually named or not; when it is not, it may be referred to as a covert category. (1976:497)

Informants sometimes supported Hays' covert groupings with volunteered statements that the members of the groups "are brothers." A similar method, mentioned above, was used by Boster, Berlin, and O'Neill (1986) to identify covert classes of birds among the Aguaruna.

The diagram presented in Figure 5.1 portrays the ranks of a partial section of the folk taxonomy for *creatures* (or, in semi-technical terms, *animals*) in English. The dotted lines indicate that more terms would be included in the full taxonomy. The covert category for *wolf*, *dog*, *fox*, and *coyote* are usually called something like "animals related to the dog family." *Tigers* and *lions*, on the other hand, are *cats* – using the upper level meaning of the term. One can say "look at that cat" when referring to a tiger, but it would sound strange to say "look at that dog" when referring to a fox. Thus *cat* in its broad sense is a named rather than covert intermediate category.

The terms *Persian cat*, *Siamese cat*, *Manx cat*, etc., form a clear contrast set of secondary lexemes typical of folk specifics, as do *grey wolf* and *red wolf*. However, the folk specifics for kinds of *dogs* is not made up of secondary lexemes; *collie*, *poodle*, *terrier*, etc., are simple primary lexemes.

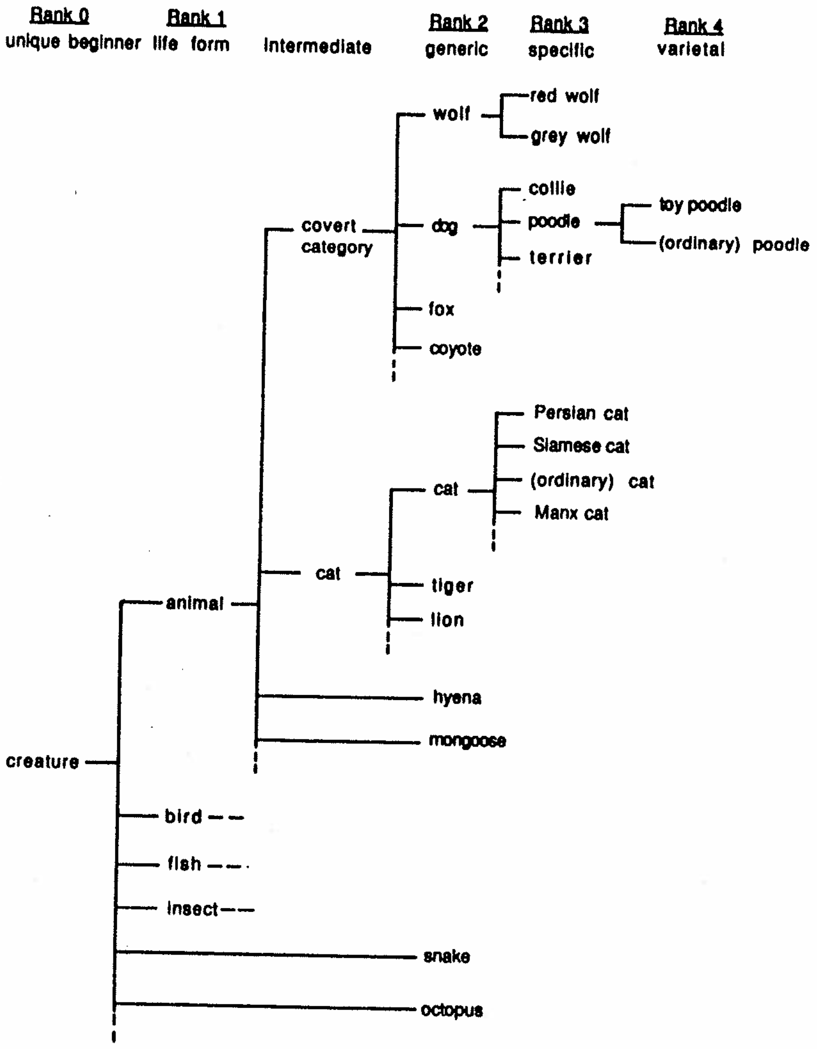

Figure 5.1 Partial taxonomy for *creatures* in English

Octopus and *snake* are generally considered non-affiliated generics; that is, generics which do not fall under any of the four life-forms. (One could argue that *octopus* and *snake* are really life-forms; there does not seem to be overwhelming evidence for either position.) In English a relatively large number of non-affiliated animal generics are found in the ocean or fresh water – *eels*, *coral*, *seahorses*, *clams*, *jelly fish*, *lobsters*,etc.

This small part of the *creature* or *animal* taxonomy displays some of the complexity of a folk rank system. One can see in this folk taxonomy the importance of the generics in folk biology; it is the generics which are the *basic level* of the category system, and which encode our intuitions about what constitutes *natural kinds* of objects. We can get along without life-form terms and even specifics tolerably well as long as the generics are present, as we do for the many forms of life which inhabit the ocean. Note that in the multidimensional scaling of animals presented in Chapter 4, all the terms which Henely selected for analysis were generics, since these were the "natural" objects to compare. The tighter clusters of animals in figure 4.3, such as the *mouse*, *rabbit*, *squirrel*, *beaver*, *rat*, *chipmunk* and *raccoon* cluster, generally correspond to covert categories – in this example the covert category of being "rodent-like."

One of the problems created by trying to place each term at a particular rank occurs when a general type of creature has specialized forms. The generic *cat*, for example, has a variety of coat colors and lengths. Then there are a number of specialized cats with distinctive colors and length of fur, such as the *Persian cat* and *Siamese cat*. The question is, at what rank should we place the ordinary house cat? In Figure 5.1 this problem is handled by creating a special term at the specific level for the "ordinary" cat contrasting directly with the specialized cats. The same kind of arrangement has been made in Figure 5.1 for the "ordinary" poodle. But it is not clear that this really corresponds to the way people think about these classes. Perhaps most people simply have a general construct for the generic cat along with constructs for the specialized forms, and the construct of an "ordinary" cat is created only at particular times by the complex operation of thinking of what remains when all the specialized cat forms are taken from the generic class of cats (see Hunn 1976 for further discussion of this issue).

The generality of the model of taxonomic ranks

The organization of plant and animal terms, worked out by Conklin, Berlin, and other ethnoscientists, has been generalized to domains outside biology. Cecil Brown, who had worked on folk botanical taxonomy among the Huastec of Mexico, was one of the first anthropologists to apply the taxonomic rank model to non-biological domains. With his associates, the taxonomic rank model was applied to "automobiles," "tools," "Finnish winter vehicles," and "Thai spirits/ghosts" (Brown *et al.* 1976). Other non-biological taxonomies have been described. Spradley (1970) elicited from tramps ("urban nomads") a taxonomy of prison *trustees*, a taxonomy of *flops* or "places to sleep," and a taxonomy of *time* referring to the lengths of jail sentences. Per Hage (1972) has described a taxonomy of *Munich beer*, and Charles Frake (1961) has described a taxonomy of illnesses among the Subanun. In general, Brown and his associates found that the non-biological domains were structured in much the same way as biological domains. They concluded:

> (1) Non-biological taxonomies, like biological ones, rarely, if ever, exceed a maximum hierarchic depth of five levels.
> (2) There are five taxonomic categories . . . [unique beginner, life-form, generic, specific, and varietal] Two of these categories, life-form and generic taxa, are as a rule labelled by primary lexemes, and two others, specific and varietal taxa, by secondary lexemes . . .
> (3) The number of life-form taxa occurring in non-biological taxonomies is small [and does not] deviate significantly from the range for biological taxonomies. (1976:83)

Brown also finds "unaffiliated generics" in non-biological taxonomies, which, like the unaffiliated generics in biological taxonomies, often exhibit "morphological peculiarities."

Brown (1976) has also applied the taxonomic rank model to *partonomies*. A partonomy is based on the relation "X *is a part of* Y." A common example is the partonomy for the human body; the *finger nail* is a part of the *finger*, which is a part of the *hand*, which is a part of the *arm*, etc. Brown examined body part data from forty-one globally distributed languages. He found that body partonomies generally resembled folk taxonomies in having the usual five ranks from unique beginner to varietal, a small number of life-forms (typically "head," "body," "trunk," "arms," "legs") labelled by primary lexemes and a number of unaffiliated generics ("blood," "bone," "skin," etc.). The body partonomy appears to be somewhat different than plant and animal taxonomies in having a complex patterning of productive lexemes (e.g. *forearm*) and secondary lexemes (e.g. *toenail*, *fingernail*) across specifics and varietal levels.

Some critiques of the taxonomic rank model

The taxonomic rank model developed by Berlin and his associates has not been without criticism. Perhaps the most radical critique has been made by Robert Randall, who worked among the Samal, a fishing and horticultural people of the Philippines. Randall questions whether the taxonomic model has the kind of psychological reality it is assumed to have. Although informants will say that a *tree* is a kind of *plant*, and that an *oak* is a kind of *tree*, and that a *black oak* is a kind of *oak*, it may be the case that informants do not have the fact that *black oaks* are a kind of *plant* stored in memory. That is, it may be that what is structured in memory is a series of simple linkages, and it is only the anthropologist's queries which create the total structure. Randall gives as an example the results of queries that he asked Samal informants about marine life:

> In a subsequent economic and ecological study among the Samal, I found it comparatively easy to elicit marine food chains from fishermen. All I had to do was take a sufficiently large marine organism, such as *kiatan* ("shark"), and ask "What are all the things sharks eat?" Then, with ready answers such as *kaitan nahut* ("small sharks"), *panit* ("tuna"), . . . and the like, I was able to apply the "What-are-all-things- X-eat?" to the "sharks" prey. The questioning process was then continued recursively until answers

> naming very small forms of marine life were given. Then, with such "primary consumers" as *daing nahut to'od* ("very small fish"), "producers" such as *lumut batu*("rock scum-algae"), and the "abiotic substance" *bohe* ("water"), my informants reached the terminal consumable of the chain.
>
> Although I elicited knowledge that was clearly stored in fishermen's memories, I do not think it correct to say that it was stored *directly*. My literate informants were much too surprised at my diagram for this to be old knowledge. Certainly, they "knew" all these facts about "sea life," but I doubt if they had even put them together in this way before. It had probably never occurred to them before that ultimately "sharks" depend for their food supply on the consumption of "water" by "rock scum-algae" . . . In this view, then, a folk taxonomy would be more like a previously undiscovered geometry theory than a basic axiom of geometry. (1976:545)

The kinds of taxonomic structures that Randall believes are stored in memory are what he calls "dwarf-trees," which are shallow, small, but well-organized sets of organisms, like the various types of *cats* in English which would include *tiger*, *lion*, *cheetah*, *leopard*, *lynx*, *ocelot*, (*house*) *cat*, etc. As part of each dwarf-tree, Randall hypothesizes that people store a configurational image – or prototype – of the various qualities of the group, such as whether it is cat-like, dog-like, has berries, or flowers, or whatever.

Some of Eugene Hunn's critique has already been presented. For Hunn, one problem with Berlin's taxonomic model is the fixity of the ranks. Hunn sees the taxonomic levels as continuous, able to grade from rank to rank. Another critical point that Hunn has been concerned with involves the character of life-forms. Hunn stresses that standard life-forms like *tree* and *grass* are not an especially important part of folk knowledge. Unlike generics they are typically composed of a relatively small number of abstract criterial features. Hunn calls such categories "deductive," and contrasts such life-forms with the concrete, inductively derived gestalt configuration of numerous features which comprise the generics – a kind of knowledge that cannot be obtained *a priori*, but only by extensive direct sensory experience (1976).

Among the Sahaptin of the Columbia River Basin Hunn found a plant taxonomy system which has few life-forms and few specifics; only 2% of all generics where further partitioned into specifics, and only *tree* and *grass* are found as standard morphologically based life-forms. The Sahaptin, who were primarily foragers prior to European contact, have extensive knowledge about their local plant and animal life, but this is not reflected in their taxonomies. Instead, aspects of Sahaptin knowledge about animals are encoded into non-taxonomic distinctions. For example, Sahaptin divide the animal world into "all the egg makers" versus "all the milk makers," The "egg makers" include birds, reptiles, fish, and insects, while the "milk makers" comprises the mammals. Hunn points out that the Saphaptin are the only people known to anthropologists outside of biologists to use the "milk-maker" criterion to define mammals as a distinct class. Cross-cutting this distinction is another dichotomy of "forage grass eaters" (herbivores) and "flesh eaters" (carnivores). A third set of cross-cutting distinctions involve locomotion and habitat; "flyers" such as birds and flying insects, "runners" such as deer and buffalo, "climbers" such as squirrels, "burrowers" such as ground squirrels and marmots, "head under water swimmers" such as fish, "head above water swimmers" such as beavers, turtles, and water striders, "creepers" such ants, bugs, spiders, and turtles, and "crawlers" such as snakes (Randall and Hunn 1984). These distinctions are cross-cutting and polylexemic, and so do not belong to a taxonomic system, but do code interesting observational attributes. Overall, the rich knowledge and sketchy taxonomy of the Sahaptin support Hunn's claim that taxonomy, *per se*, is not the center of biological folk knowledge.

Another controversial issue concerning the life-forms concerns the degree to which the criteria for defining these forms should be purely *morphological*. Morphological classes are based entirely on physical structure. *Functional* classes, on the other hand, are defined by the *use* or *function* of the object. Terms like *weed*, *flower*, *timber*, *vegetable*, and *herb* are functionals because they are primarily defined by the way the object is used or treated. Traditionally, anthropologists have excluded functionals from taxonomies, since they are not *kinds of things*, but rather *objects used in a certain way* (Wierzbicka 1984). Therefore, *weed*, *flower*, and *herb* are all excluded from the English plant taxonomy, leaving no life-form except perhaps the term *plant* in one of its many senses to refer to smallish, soft stem, "herbaceous" flora.

The problem is that not only does the removal of functional terms result in lexical gaps, but also that in many languages the life-forms have a mixture of morphological and functional features. For example, Randall finds than among the Samal there is a potential life-form, *kayu*, which is usually glossed as *tree*, but in fact seems to have as its focal meaning a plant that has wood that is good for cooking and making houses and canoe hulls (Randall and Hunn 1984). Situations of this kind appear to be relatively common and throw doubt on the degree to which life-forms are always purely botanical.

In contrast to Randall and Hunn, Brown (1977, 1979) claims that there *are* a small set of potentially universal botanical life-forms, although they may often be polysemous and have meanings that include functional features. For plants the potentially universal life-forms are *tree*, *grass*, *bush*, *vine*, *and herbaceous plant*. (Brown uses "herbaceous plant" to refer to the covert category of "small, soft stem" plants discussed above). Sometimes *herbaceous plant* and *grass* form a joint category, which Brown dubs a "*grerb*." For *creatures*, Brown finds *fish*, *bird*, *snake*, *worm/bug* (dubbed *wug*), and mammal-like *animal* are potential universals. Based on dictionaries, interviews with anthropologists, and work with native informants, Brown finds that these terms, or something close to them, occur around the world in unrelated languages. Not all these forms occur in every language, but they do show a patterned distribution. For example, if any life-form is labelled, it will be *tree*. If there are two forms, *grerb* will be the second. If there are three forms, either *bush* or *vine* will be labelled. (This kind of *implicational order*, in which terms appear in a certain order, has been extensively researched in the domain of color terms, and is discussed below.) The fact that these life-form terms sometimes contain functional features does not, in Brown's view, diminish the significance of the patterned distribution of these terms.

Other anthropologists have also discussed the ontological nature of folk taxonomies. Scott Atran (1985) has argued that humans respond in a special – probably genetically determined – way to plants and animals. According to Atran, folk taxonomies of plants and animals are not commensurate with taxonomies of artifacts like furniture and vehicles, since people recognize that plants and animals are partitioned into *natural kinds*. Thus, a table without legs and top is not really a table, but a tiger born without legs and stripes is still a tiger, because tigers are tigers by virtue of some natural essence, not because they have certain perceptual features. Atran also finds life-forms to be no more "artificial" or "special purpose" than higher order scientific groupings, such as phylum or class (1987). For Atran, the fact that folk biological life-forms do not correspond to the upper level categories of modern biology does not mean that these life-forms are not as universal, spontaneously obvious, and orderly as the generics.

These and other critiques of and refinements to the taxonomic model are discussed in detail in Berlin's *Ethnobiological Classification*. While there are a number of unresolved issues, there is now enough well-analyzed data to give a solid foundation to the study of folk biology. Berlin's *Ethnobiological Classification* summarizes over 300 folk biology studies, surveying a wide range of topics including the evolution of ethnobiological categories, sound symbolism in ethnobiological terminology, variability in ethnobiological knowledge, and cultural factors affecting the recognition of particular plants and animals. One of Berlin's general conclusions is of special interest:

> the ethnobiological data to be presented in the following sections will lend support to the claim that, while human beings are capable of recognizing many distinct patterns in nature's structure in general, in any local flora or fauna a single pattern stands out from all the rest. This overall pattern has been referred to by systematic biologists as the *natural system*. The natural system becomes manifest presumably because of the human ability to recognize and categorize groups of living beings that are similar to one another in varying degrees in their overall morphological structure, or morphological plan. This pattern-recognizing ability is probably innate. (1992:9)

Extended and focal ranges

One very general semantic phenomenon uncovered in the investigation of taxonomic systems is the *basic* (or *focal*) vs. *extended* range of terms. According to Berlin, Breedlove, and Raven "The basic range of a class includes all of its genuine referents; the extended range includes all those plants which habitually are seen as being more closely related to it than any other category." (1974:57). Typically, when an informant is confronted with an item from the extended range of a term, the informant will say "X *is like* Y." "A *panda* is like a *bear*," we say, and "a *hyena* is like a *dog*." Given that the natural world presents us with multifeature objects, and given that we create gestalt configurations of these features, the expansion of a term from its true referent to other objects which have many but not all of the features in the configuration is an efficient coding technique. According to Berlin, Breedlove, and Raven:

> General botanical collecting quickly revealed that the Tzeltal lacked legitimate plant names for much of the local flora. On the other hand, when presented with a particular plant specimen, informants rarely responded that the specimen had no name. Instead, they would systematically attempt to classify or relate the specimen under observation to one of the categories in their named taxonomy . . . these classificatory responses allowed for relatively accurate statements to be made as to the actual conceptual range of a plant category, for it provided information as to *focal* (*basic*) and *peripheral* (*extended*) ranges of each category. (1974:53)

The 471 generic names in the Tzeltal plant taxonomy refer to more than 1,750 distinct species. These 471 generics typically refer to only one or two focal specimens, while the extended ranges of these terms include a greater number of species.

The phenomena of *focal* and *extended* ranges of reference had been postulated for kin terms in 1964 in a classic paper by Floyd Lounsbury, "A Formal Account of the Crow- and Omaha-Type Kinship Terminologies" (1964). Crow- and Omaha-type terminologies are kin term systems in which there is *generational skewing* – that is, systems in which the same term is used for kin types in several different generations. In a simple Crow system, for example, where *father's sister* is called "aunt," *father's sister's daughter*, *father sister's daughter's daughter*, *father's sister's daughter's daughter's daughter*, etc., are also all called "aunt." Such systems occur primarily in matrilineal societies, where rights and duties descend through women. What happens in a Crow system is that since rights and duties descend through women, the daughter of an "aunt" is also, in a sense, conceived of as an "aunt," since she inherits her mother's position. Her daughter in turn is also an "aunt,"and so on through the generations. Lounsbury showed how a simple set of re-write rules could be used to describe such systems. In Lounsbury's treatment of Crow and Omaha systems, the *father's sister* is the focal referent of the term "aunt," while *father's sister's daughter*, *father's sister's daughter's daughter*, etc., are *extended* referents of the term created by application of special extension rules. Prior to Lounsbury's paper, it had been something of a dogma in social anthropology to deny that there were focal and extended senses of kin terms (although Malinowski had argued there were). Instead, the standard position had been that the entire range of a term determined the true meaning of that term. Behind this argument were some complex theoretical positions about the universality or non-universality of the nuclear family and the importance of kin groups versus dyadic family relations.[2]

Focal and extended ranges of color terms

In the late 1960s Brent Berlin and Paul Kay undertook a cross-cultural study of color terminology. The results are reported in their book, *Basic Color Terms*. Many of the concepts that had been developed in working with taxonomies of plants and animals were used in their investigation of the color domain. First, Berlin and Kay restricted their investigation to generic-like *basic color terms*. According to Berlin and Kay, *basic color terms* are:

1. Terms which are monolexemic; that is, terms whose meaning cannot be predicted from its parts. This criterion eliminates terms like *bluish, lemon-colored, dark brown*, and perhaps *blue-green*.
2. Terms which are not included by any other term; this principle eliminates terms like *crimson* and *scarlet*, which are kinds of *red*.
3. Terms whose application must not be restricted to a narrow class of objects, such as the term *blond*, which is restricted to hair and furniture.
4. Terms which are psychologically salient for informants, as measured by a tendency to occur at the beginnings of elicited lists of color terms and a general stability across informants and occasions of use. Examples of non-salient terms are *puce* and *magenta*.
5. Terms which have the same distributional potential as previously established basic terms. In English, for example, one can add *-ish* to basic color terms, creating forms such as *reddish, bluish*, etc. However, since *aguaish* and *fleshish* are strange or aberrant, they fail to pass this criterion.
6. Terms which have the name of an object characteristically having that color are suspect. For example *salmon, lime*, and *avocado* are suspect, and would have to pass the other criteria without doubt. *Orange* is an example which does pass the other criteria, and so is a basic term.
7. Recent loan words are suspect.
8. In cases in which the first criterion of *monolexemic* status is difficult to assess, morphological complexity is given weight as a secondary criterion. The English term *blue-green*, for example, could be argued to have a meaning not completely predictable from its constituents, but its morphological complexity eliminates it from the list of English basic level terms.

Using these criteria, there are eleven English basic level terms: *black, white, red, green, yellow, blue, brown, purple, pink, orange*, and *gray*.

---

[2] For a fine example of the anti-extensionist position, see Leach 1962.

Note that Berlin and Kay's strategy of eliminating non-basic terms grows out of the experience of determining *generics* in folk taxonomy. The assumption is that in every language there is a terminological level which names the perceptually salient objects or events – that names the things that obviously need names.

To investigate basic color terms, Berlin and Kay used as stimulus materials the Munsell array of 320 "chips." A Munsell color chip is a small rectangle of cardboard painted with a highly standardized color. The full Munsell Book of Color contains several thousand chips. Each page contains chips of a single *hue*. There are forty pages in the book, representing forty equally spaced hues, beginning with the red end of the spectrum and ending with the purple end of the spectrum. On each page the chips are arranged in eight rows with the lightest chips at the top of the page and the darkest chips at the bottom. This dimension is called *lightness*. The chips are also arranged by level of *saturation* across the page, with the most saturated chips at the far edge of the page and the least saturated towards the spine of the book. Saturation is hard to explain in words alone, although it is easy to demonstrate with a page of the Munsell book. For a chip to be highly saturated means that the color is "brilliant" or "vivid." Unsaturated chips are perceived as "dull" or "weak," and as the level of saturation decreases the chips finally become almost achromatic – white, gray, or black, depending on the level of brightness.

The array used by Berlin and Kay used only the most saturated chips for each hue and level of lightness. There are eight levels of lightness and forty hues, plus nine achromatic chips ranging from black through gray to white, making a total array of 329 chips. The chips were mounted on stiff cardboard and covered with clear acetate.

Berlin and Kay also used nine extra achromatic chips ranging from black through gray to white. Figure 5.2 presents the general setup of the array. Data was gathered in two stages. First, the basic color terms were worked out using the kinds of interviewing techniques which have been described in the last two chapters. Second, each subject was asked to select "all those chips you would under any conditions call *x*" (the extended use of the term), and "the best, most typical example of *x*" (the *focal* use of the term). The informants were native speakers of their languages who were living in the San Francisco Bay area (except for the Tzeltal informants). Twenty diverse languages were investigated.[3]

The focal choices for basic color terms for the twenty languages are presented in Figure 5.2. The focal choices have been normalized; that is, where more than one chip was chosen as a focal color, the chip mid-way between the chosen chips was selected to represent the focal point.

---

[3] The languages were Arabic, Bulgarian, Catalan, Cantonese, Mandarin, English, Hebrew, Hungarian, Ibibio (Nigeria), Indonesian, Japanese, Korean, Pomo (California), Spanish, Swahili, Tagalog (Philippines), Thai, Tzeltal, Urdu (India), and Vietnamese.

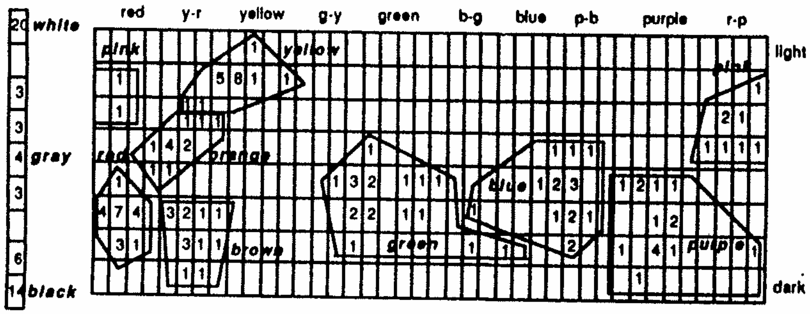

Figure 5.2 Normalized foci of basic color terms in twenty languages (adapted from Berlin and Kay 1969).
Numerals refer to the number of societies selecting that chip as the focal example of that color term.

The distribution of frequencies shown in Figure 5.2 make apparent the high degree to which different languages select similar areas of the color space for the focal points of basic color terms. *There is a high level of agreement across languages about where the best or most typical color chips are located.* This is especially true for "red" and "yellow." There is somewhat more dispersion for "green," "blue," and "purple," but the distributions are still impressively discontinuous. The focal points of basic level color terms are certainly not a random sampling of the color space.

While the focal colors were very similar across languages, the boundaries for the extended uses of color terms were found to be quite different across languages. Sometimes the extended use of a particular color term in one language will cover a large area of color space, while in another language which has a color term with an identical focal point, the term will cover only a small area spread in quite a different direction. It is also the case that the same informant, when asked to do repeated mappings, is very likely to be quite reliable about the focal placements, always choosing the same chips, but to be quite unreliable about the boundaries of terms, giving different boundaries each time. So informants, like languages, show a stable, agreed upon placement of focals, but considerable variability in the boundaries for the extensions of terms.

In plotting the distribution of basic level terms in color space, Berlin and Kay uncovered a surprising finding. First, not surprisingly, they found that the number of basic color terms varied – some languages had as few as two basic level color terms, while others had as many as eleven. What was surprising was that basic color terms appeared in a particular order. If a language had just *two* basic color terms, the focals for these terms were always "black" and "white." If a language had *three* basic color terms, the focals were always "black," "white," and "red." If a language had *four* basic color terms, the focals were always "black," "white," "red" and "green" *or* "black," "white," "red," and "yellow." That is, as new basic level color terms were added to a language, they appeared in a fixed order. Berlin and Kay found a total of seven ordered stages for focals:

Stage I: black, white
Stage II: black, white, red
Stage IIIa: black, white, red, yellow
Stage IIIb: black, white, red, green
Stage IV: black, white, red, yellow, green
Stage V: black, white, red, yellow, green, blue
Stage VI: black, white, red, yellow, green, blue, brown
Stage VII: black, white, red, yellow, green, blue, brown, purple, pink, orange, gray

This kind of ordering is called an "evolutionary sequence" because it predicts the sequence in which languages will develop new basic level terms. Thus if a language has a stage IV color term system, one can predict that when a new basic level color term enters the system, the focal for the new term will be blue. Further, there is a correlation between the number of basic level color terms and a society's level of technological development. All of the languages from highly industrialized societies are at stage VII, while all languages at stage III or lower are found in societies with small populations and limited technology.

Since languages have a larger number of color terms than just the basic level terms, it may seem that selecting just basic level terms for analysis is psychologically arbitrary. However, there is good evidence that the basic level terms are psychologically different than the non-basic terms. For example, Robert Boynton and Conrad Olson (1987) carried out a reaction time color naming experiment with English speaking Americans which showed that *respondents are quicker to use the eleven basic terms than non-basic terms.* In this experiment respondents were presented with 424 single chips from the Optical Society of America's collection of Uniform Color Scales. Upon presentation of a chip, respondents were asked to name the chip with a single color term as quickly as possible. Respondents' mean response time for the eleven basic level terms was approximately half a second faster than for non-basic terms. (Non-basic color terms used at least six times by one or more respondents were *tan, peach, olive, lavender, violet, lime, salmon, indigo, cyan, cream, magenta, turquoise, chartreuse, rust,* and *maroon.*)

Boynton and Olson not only found that respondents were faster in naming chips with basic level terms, they also found that respondents were more consistent in using basic level terms. That is, since each chip was presented twice to each respondent, that respondent's naming could be either consistent, with the same name being given both times, or inconsistent, with different names used on each presentation. Respondents were consistent more than 80% of the time when using basic level terms, but only 46% of the time when using non-basic terms.

Boynton and Olson further found that respondents show much more *consensus* using basic level terms compared to non-basic level terms. A chip was considered to have been labeled with consensus when *all* the respondents gave the same name to the chip. (There were seven respondents in total, but one of them used only basic level terms, and his results have been removed from the appropriate figures.) Approximately 30% of the chips labeled with basic level terms showed consensus. However, there were *no* chips labeled with non-basic names which showed consensus across all six respondents.

There was considerable critical reaction to Berlin and Kay's book. The major criticism was that the Berlin and Kay results could not be trusted because the informants were all bilinguals, living in an English speaking environment. The similarity in selection of focal chips for basic terms might, it was argued, be due to the informants all having learned the English color term system. Partially to answer this criticism, and partially to obtain larger samples of informants for each language, Berlin, Kay, and William Merrifield of the Summer Institute of Linguistics began in 1975 an intensive study of the color system of over 100 languages. Linguists from the Summer Institute systematically elicited color terms from 25 respondents in each of 130 languages in 18 countries. The field procedure began with having informants label each of 329 Munsell chips presented individually in random order. The next step was to present informants with a mounted fixed array and ask them to point out the best example of each color term elicited in the naming task. This procedure takes more time than the procedure used by Berlin and Kay in *Basic Color Terms* (approximately two hours per informant), but allows the elicitation of both basic and non-basic terms and a more natural determination of the boundaries of terms.

With the additional information generated by the new procedures and the larger number of informants for each language, the evolutionary stages were found to be more complex than indicated in *Basic Color Terms*. Earlier work by Eleanor Rosch (1972) with the Dani of Indonesian New Guinea had found that a stage I system did not actually divide the color space up into *white* vs. *black*. Although the focals were pure white vs. pure black, the extensions of these terms took into account something other than just the lightness or darkness of the chips. Roughly, the "black" term included both the "dark" and the "cold" colors (the blue-green area), while the "white" term included both the "light" and "warm" colors (red, yellow, and orange). These two terms covered 80% of all the chips, with the remaining 20% given non-basic term names.

While English does not contain any terms with extensions like the Dani terms, the later research of Berlin, Kay, and Merrifield (1985) found that this division of the color space into cool colors and warm colors was relatively common. Consider, for example, the stage III system of the Nafaanra of Ghana presented in Figure 5.3. The system has only three basic terms whose focals are black, white, and red. Figure 5.3 presents the full extensions of each of these terms, with the modal name given to each chip (i.e., the name used by the largest number of informants).

```
white
  -        red   y-r  yellow   g-y  green  b-g   blue   p-b  purple  r-p
  -        --+-------+-+---------------------------
  -        ++++++++++++###########-#--#-#------++++
  -        +++++++++++#####################--++++++
  #        ++++++++++########################++++++
  #        +++++++++#########################++++++
  #        +++++#+###########################++++++
  #        ++++++#############################+++++
  #        ++++################################++++
black

           - finge "white"     + nyie "red"     # waaw "cool"
```

Figure 5.3 Modal color names for Nafaanra (Ghana) stage 2 (adapted from Berlin, Kay, and Merrifield 1985)

The term *waaw* is a good example of a "dark/cool" color term. It includes all the black chips, but also all the green, blue, and purple-blue chips except at their lightest levels. *Nyie*, whose focal point is a pure red, extends into orange and yellow and can be considered a "warm" term. If we put together the total range for *nyie* and *finge*, the combined total would have the extension typical of a "dark/cool" stage I term.

"Cool" and "warm" also occur in the mapping of Stage IIIa systems. The basic terms for Stage IIIa have as focal points black, white, red, and green. However, when the full ranges of the terms are examined, the term with the red focal point actually covers the "warm" part of the color space (red, yellow, orange), and the term with the green focal point covers the "cool" part of the color space (green, blue, and purple-blue). A Stage IIIa system is presented in Figure 5.4.

The larger sample of the World Color Sample has added complications to the understanding of the way in which color systems have evolved.[4] However, the major findings presented in *Basic Color Terms* have been strongly supported. The focal points for basic level terms collected for a world wide sample of language are found in the same small areas mapped in Figure 5.2 by Berlin and Kay. The focal points for basic terms tend to be highly shared, and to be differentiated in an evolutionary order. The various stages occur in unrelated

---

[4] More specifically, three additional varieties of Stage III systems and two additional varieties of Stage IV systems have been found. Also, there are cases in which the secondary hues *brown* and *purple* are encoded before the complete differentiation of Stage V has been achieved (Kay, Berlin, and Merrifield 1991).

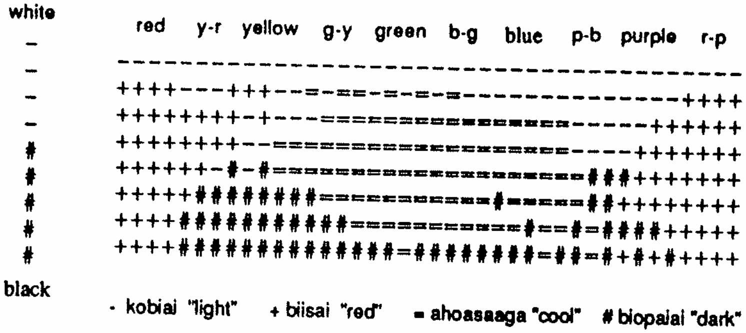

Figure 5.4 Modal color names for Mura Pirahã (Brazil) stage IIIa (adapted from Berlin, Kay, and Merrifield 1985)

languages and in geographically distant parts of the world. The findings reported in *Basic Color Terms* are clearly not the result of the bilingual acculturation of informants or of simple diffusion.

The use of more informants has also made possible the study of variation within a language community. One of the most interesting results has been the demonstration that very often when there is disagreement in a community on the basic level color terms, the disagreement is due to the fact that some of the sample have moved or are in the process of moving to the next evolutionary stage (for example, see Dougherty 1975; Kay 1975; Burgess, Kempton, and MacLaury 1985). In the case of the Aguaruna Berlin and Berlin (1975) found that thirty-four of their fifty-five informants had a basically stage IIIa system (with the exception that the focal point for the "cool" term was in blue rather than green), while five had a stage IV system and sixteen had a stage V system. In the Aguaruna case the aboriginal system had been influenced by loan terms from Spanish. The terms which were borrowed from Spanish were exactly those predicted by the normal evolutionary sequence ("yellow" was first added to make the stage IV system, and "green" was added to make the stage V system). Spanish terms for "purple," "brown," "grey," "orange," and "pink," representing more advanced evolutionary stages, have not yet been adopted.

While the evolutionary stages postulated by Berlin and Kay have stood up reasonably well, there has been the discovery of a new type of color system which does not fit in the Berlin and Kay sequence. This system, found among the Shuswap of Canada and a number of other tribal groups in the Pacific Northwest, has been explored in detail by Robert MacLaury (1987). What MacLaury has found is a system in which there is a composite category of *yellow and green*. The difficulty presented by the Shuswap system is that it cannot be accounted for by the theory presented by Kay and McDaniel (1978) to explain the evolutionary sequence presented in *Basic Color Terms*. The Kay and McDaniel theory links findings concerning the opponent process of color perception to the evolutionary sequence of color terms. The determination of opponent process in color vision is a result of relatively recent work in visual physiology. According to the theory proposed by a number of vision specialists, the three types of cones in the retina are synaptically paired into higher level "opponent process cells" such that input from one kind of cone increases the firing rate of these cells while input from a different kind of cone decreases their firing rate. Four kinds of opponent process cells have been found; these are labelled +red/–green, –red/+green, +yellow/–blue, and –yellow/+blue. The actual physiology is still not fully understood, and a number of psychological models have been proposed (De Valois and De Valois 1993). In the standard theory, pure yellow, for example, is perceived when the incoming light on the retina does not activate the red/green opponent cells, but does activate the +yellow/–blue cells. Color mixtures, like orange or purple, are the result of both the red/green and blue/yellow cells being activated to various degrees. The result of opponent processing is thought to produce four *pure* colors, red, green, yellow, and blue, and *blends* of these colors, such as orange, aqua, purple, etc.[5] Black and white are also pure sensations, and appear to use an achromatic opponent processing system.

According to Kay and McDaniel, the evolutionary sequences begin by dividing the color space into its most salient "pure" sensations; first the "light/dark" division, then the primary pure colors, beginning with red, followed by green and yellow, and then blue. After the primary colors have been differentiated, various blends of the primaries are recognized, such as purple, brown, pink, and gray. The problem with Shuswap is that the yellow-green term groups together hues which are separate in earlier systems. One possibility is that the yellow-green term is a result of the reorganization of a IIIa system, which has terms for white, red/yellow, green/blue, and black, in which the yellow has been incorporated into the range of the green/blue term. In fact, a composite term for yellow/green/blue does occur in at least three of the societies of the World Color Sample. The next stage would then separate blue from the yellow/green/blue term, leaving a yellow/green term. While this is a possibility, no physiological basis for such a reorganization is known.[6]

---

[5] A question immediately arises: do people *experience* the pure hues as *pure*? The issue is complex. Berlin and Kay's data is usually taken as evidence that they do, since red, green, yellow, and blue are found in the early stages of the evolutionary sequence. However, the hypothesis that people everywhere experience these four hues as pure does not explain the very early evolutionary stages, nor why the distribution of focals is just as restricted for the non-primary colors as for the primary hues. My own belief is that the major factor at work is the irregularity of the color space, which has an unusual shape with a number of "bumps" and "indentations" (D'Andrade and Egan 1974). I believe that this irregularity creates the observed sequence of color terms and the restriction of the focals to small areas, with successive splits of the color space being made according to a rough maximum distance principle.

[6] MacLaury has also directed attention to a number of languages in which there are terms which appear to code a particular degree of brightness without respect to hue (MacLaury 1992).

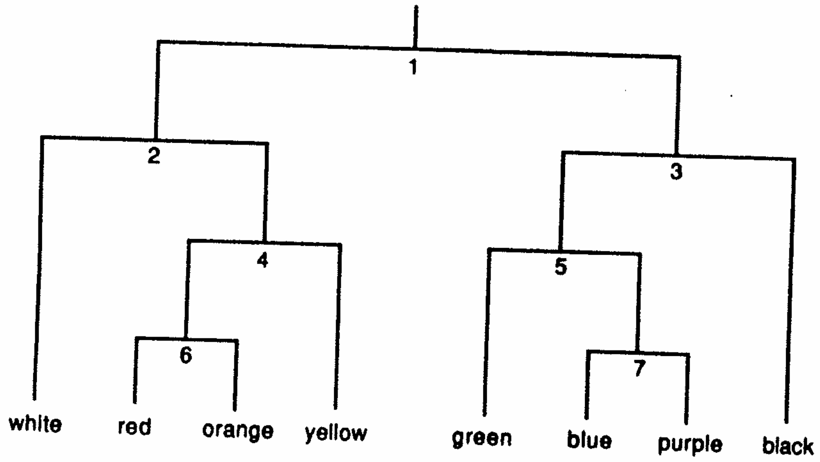

Figure 5.5 Cluster analysis of color chip sorting data (adapted from Boster 1986)

A simple but strong source of support for the Berlin and Kay general evolutionary theory has been provided by an experiment by James Boster (1986). In this experiment Boster selected a sample of eight color chips which were the typical focals for the colors red, orange, yellow, green, and blue, plus pure black and white. Using a sample of twenty-one young adults from the Berkeley area, Boster individually presented his respondents with the following instructions:

> What I would like you to do is sort these colors into two groups on the basis of which colors you think are most similar to each other . . . try to make two natural groupings. Imagine you speak a language which has two color words, how would you choose to divide up the colors and which colors would you put together in each group.

After the first sort, respondents were then asked to subdivide each of the two groups they had created. Respondents were then asked to subdivide again until all chips were separated. Results for all respondents were combined by calculating from each respondent's taxonomic tree how may splits separated each pair of terms, then averaging across respondents. A mean link cluster analysis was carried out on the resulting similarity scores and is presented in Figure 5.5. The numbers indicate the order in which the clusters are split; the first split (1) was between the "light/warm" color chips and the "dark/cool" color chips, the last split (7) was between *blue* and *purple* at the bottom of the tree.

The successive divisions of this tree reflect almost exactly the major Berlin and Kay evolutionary stages. The first split is between the "light/warm" colors and the "dark/cool" colors of stage I systems. The second split separates *white* off from the "warm" colors, *red* and *yellow*, typical of stage II systems. Stage IIIa systems then make a split between *red* and *yellow* (4), while stage IIIb systems leave *red* and *yellow* undivided but split *black* from the "cool" *green* and *blue* colors (3). Stage IV systems make both split 3 and split 4. Stage V systems split *green* from *blue*, and stage VII systems split *purple* from the blue region. (Stage VI systems differentiate *brown* from *red* or *black* areas, but *brown* was not included in Boster's sample of colors.)

Overall, these results strongly support the idea that there is a relationship between the perceptual qualities of the color space and the evolutionary order of color terms. About this relationship Boster states:

> it is important to emphasize the task-dependent nature of this result. These results should not be interpreted as evidence that English speakers have proto-color categories in their heads, only that they will reconstruct them if faced with an appropriate task . . . the experimental results reported here do not prove that primitive color systems lurk in the deep recesses of our minds. Instead it appears that if an individual tackles a task analogous to the one that communities face in the course of color lexicon evolution, one of successively sub-dividing color categories, the individual will tend to solve the problem in much the same way that cultural communities do. This is probably no accident; communities are made up of individuals employing the same sorts of strategies tapped in these experiments. These results support the generalization that cultural universals result from pan-human communalities in individuals' responses to structure. In this case, that structure has its source in the physiology of human color vision. (1986:71)

The Roschian synthesis

Eleanor Rosch, a psychologist trained in Social Relations at Harvard, was involved in cross-cultural work on color and related nomenclature systems among the Dani, a highland people of New Guinea (1972). The Dani have only two color terms; a cool/dark term and a warm/light term. However, in testing the Dani on their memory for color, she found that they remembered best the color chips that corresponded to the focals of the basic color terms discovered by Berlin and Kay. These results, plus her discussion with Berlin about the psychological centrality of generic level terms in folk taxonomies, lead her to a radical reformulation of the feature model of folk categorization.

Rosch's reformulation (1978) was based on the notion that the generics, or following Berlin and Kay, the *basic level* terms, corresponded to *psychologically basic level objects*. These objects are perceived and remembered not as a list of features, but as a *gestalt* or *configurational whole*. She based her argument on two main propositions. The first proposition is that the category system of humans and animals is characterized by an attempt *to provide maximum information with the least cognitive effort*. The second proposition is that *the perceived world consists of structured information rather than a random or arbitrary collection of attributes (or features)*. Her examples are similar to those quoted above by Bruner, Goodnow, and Austin.

> the perceived world is not an unstructured total set of equiprobable co-occurring attributes. Rather, the material objects of the world are perceived to possess high correlational structure. That is, given a knower who perceives the complex attributes of feathers, fur, and wings, it is an empirical fact provided by the perceived world that wings co-occur with feathers more than with fur. And . . . it is a fact of the perceived world that objects with the perceptual attributes of chairs are more likely to have functional sit-on-ableness than objects with the appearance of cats. In short, combinations of what we perceive as the attributes of real objects do not occur uniformly. (1978:28-29)

The conjunction of these two principles results in the formation of idealized or prototypical representations of those objects which correspond to the most commonly co-occurring sets of attributes or features.

With respect to taxonomic levels, or levels of inclusiveness, Rosch, following Berlin, argued that not all levels are equally informationally useful. The best level would be the most inclusive level at which the categories can mirror the structure of attributes perceived in the world.

To test these ideas, Rosch constructed a series of simple experiments. She used simple three level taxonomies. Two examples of these taxonomies are presented in Table 5.2. A total of nine such taxonomies were used; taxonomies for trees, birds, fish, fruit, musical instruments, tools, clothing, furniture, and vehicles.

To show that the basic level terms correspond to the most efficient information categories, Rosch investigated the distribution of attributes across the three levels for each taxonomy. The first test was to ask respondents to list all the attributes they could think of that were true of all of the items in each taxonomy. The general results were as expected. Few attributes were listed for the superordinate categories, a significantly greater number for basic level categories, and not significantly more attributes for the subordinate level than for the basic level. However, for the biological categories there was an exception to this general trend; the superordinate terms elicited as many attributes as the basic level terms. Rosch interpreted this result as due to the lack of salience of these categories for her respondents – unlike Tzeltal Indians, they did not know much more about *oaks* than they knew about *trees* in general.[7] In contrast, Brian Stross (1973) found that Tzeltal Indian children first learned the generic terms for plants. By the age of four the average Tzeltal child could correctly identify more than 100 botanical terms, the great majority of them generics. Tzeltal children later acquired life-forms, specifics, and even later varietals and intermediate botanical terms. Janet Dougherty Keller (1978), comparing Berkeley children with Tzeltal children, found that these American children first acquired life-forms and intermediate level distinctions. Not until the age of eight did the average child know more than a dozen folk generic plants such as *eucalyptus*, *redwood* and *maple*. Dougherty suggests that a kind of *devolution* has occurred with modern urban folk who do not experience the kind of interaction with the natural environment which would give salience to generic forms, and so learn only the abstract features found at the life-form level.

Table 5.2. *Three level taxonomies*

Superordinate	Basic level	Dining room table
Furniture	Chair	Kitchen chair Living room chair
	Table	Kitchen table Dining room table
	Lamp	Floor lamp Desk lamp
Tree	Oak	White oak Red oak
	Maple	Silver maple Sugar maple
	Birch	River birch White birch

Rosch also tested her respondents for attributes other than perceived attributes. She asked informants to describe in as much detail as possible the sequences of motor movements made when interacting with each object. Again the same pattern of results was found. There is not much we can say about what we do with a *tool*. There is a lot we can say about what we do with a *hammer*, but not much more that we can say about what we do with a *ball-peen hammer*. For a non-verbal test of this hypothesis Rosch had two dimensional silhouettes made of each of the items, and then measured the degree of similarity in shape by the proportion of overlap which occurred when silhouettes (normalized for size and orientation) were juxtaposed. Again the same pattern of results was found; when two objects from the same basic level term were juxtaposed (e.g. two *chairs*) there was a greater degree of overlap than when two kinds of furniture were juxtaposed (e.g. a *chair* and a *lamp*). A lesser gain in overlap was observed when two objects from subordinate levels were juxtaposed.

Concerning the psychological composition of the basic level objects, Rosch developed the notion of *prototypes*. As she states:

> In terms of the principles of categorization . . . cognitive economy dictates that categories tend to be viewed as being separate from each and as clear-cut as possible. One way to achieve this is by means of formal, necessary and sufficient criteria for category

---

[7] Anna Wierzbicka (1984) has questioned whether Rosch's results are really due to a lack of cultural salience, or to the fact that the superordinates for the non-biological categories are not truly superordinates in the strict taxonomic sense of the term. However, Berlin and other ethnobiologists find a pattern similar to Rosch's using informants who are very knowledgeable about plants (see above).

Table 5.3. *Prototypicality (goodness of example) ratings for birds (adapted from Rosch 1975)*

Member	Mean	Member	Mean	Member	Mean
Robin	1.02	Hummingbird	1.76	Owl	2.96
Sparrow	1.18	Seagull	1.77	Pelican	2.98
Bluejay	1.29	Woodpecker	1.78	Goose	3.03
Bluebird	1.31	Pigeon	1.81	Vulture	3.06
Canary	1.42	Thrush	1.89	Stork	3.10
Blackbird	1.43	Falcon	1.96	Buzzard	3.14
Dove	1.46	Crow	1.97	Swan	3.16
Lark	1.47	Hawk	1.99	Flamingo	3.17
Swallow	1.52	Raven	2.01	Duck	3.24
Parakeet	1.53	Goldfinch	2.06	Peacock	3.31
Oriole	1.61	Parrot	2.07	Egret	3.39
Mockingbird	1.62	Sandpiper	2.40	Chicken	4.02
Wren	1.64	Pheasant	2.69	Turkey	4.09
Redbird	1.64	Catbird	2.72	Ostrich	4.12
Finch	1.66	Crane	2.77	Titmouse	4.35
Starling	1.72	Albatross	2.80	Emu	4.38
Eagle	1.75	Condor	2.83	Penguin	4.53
Cardinal	1.75	Toucan	2.95		

> membership. The attempt to impose such criteria on categories marks virtually all definitions in the tradition of Western reason . . . *Another way to achieve separateness and clarity of actually continuous categories is by conceiving of each category in terms of its clear cases rather than its boundaries* . . . Categories can be viewed in terms of their clear cases if the perceiver places emphasis on the correlational structure of perceived attributes such that the categories are represented by their most structured attributes . . .
>
> By prototypes of categories we have generally meant the clearest cases of membership defined operationally by people's judgments of goodness of membership in the category. (Italics added) (1978:35–36)

To get ratings of prototypicality, Rosch (1975) asked respondents (Berkeley undergraduates) to rate instances of different categories of objects on "the extent to which each instance represented their idea or image of the meaning of the category term." Table 5.3, presents prototypicality ratings for the category term *birds*. Respondents were asked to rate on a seven point scale how good an example of the category each instance was. A rating of "1" corresponded to a very good example, while a rating of "7" corresponded to a very poor example. Terms with high prototypicality ratings for the category term *birds* are *robin* and *sparrow*, while *emu* and *penguin* have low prototypicality ratings. In between are ratings for terms like *crow* and *parrot*.

Prototypicality ratings have been shown to be correlated with a wide range of cognitive effects. People are more apt spontaneously to list objects with high prototypicality ratings when asked to give examples of objects in a category (Rosch, Simpson, and Miller 1976). Subjects can make judgments about whether an object belongs to a particular category much more rapidly for prototypic than non-prototypic objects (Rosch, Simpson, and Miller 1976). Young children learn category membership of prototypic objects before non-prototypic objects (Anglin 1976). Priming by use of the category name facilitates responses in a matching task to prototypic more than non-prototypic objects (Rosch, Simpson, and Miller 1976). People are much more likely to use "hedges" like "technically" and "actually" for non-prototypic objects in sentences like "A penguin is actually a bird" (Rosch 1976). It sounds odd to say "A robin is actually a bird" since a robin is a bird *par excellence*.

These psychological experiments give ample testimony to the psychological reality of prototypes. But what makes one object more prototypical than another? Why is a robin a prototypical bird while a penguin is not? James Boster (1988) investigated this question among residents of the San Francisco Bay area. He compared information on which birds people saw most frequently using the National Audubon Society's bird counts for communities in the San Francisco Bay area, information on which bird terms occurred most frequently in texts such as newspapers and books, and information on the biological taxonomic relations among these birds. He found that text frequency was only weakly correlated related to ratings of prototypicality ($r = .17$). The frequency with which different kinds of birds can be seen in the Bay area was moderately correlated with ratings of prototypicality ($r = .41$). However, ratings of prototypicality were strongly related to the taxonomic relations among birds. Boster measured the degree of taxonomic similarity of each bird to other birds by using a count of the number of species in the same scientific order and family. Thus a bird that came from a large order and family with respect to the number of species in that order and family would have a high similarity rating because it would be closely related to a large number of other species of birds. The r between this measure of taxonomic similarity and ratings of prototypicality was .70.

In general, the birds that are considered most prototypic are the *passerines*, the largest order of birds that includes the robin, sparrow, and bluejay. Except for the dove and the parakeet, the sixteen most typical birds are all passerines. These birds are closely related to each other and similar in shape and behavior. It is as if people *averaged* across the properties of all kinds of birds that they knew and developed a representation of a generalized profile of a bird. Since the family of passerines contains the greatest concentration of kinds of birds occurring in the area, the average bird is a passerine.

A similar pattern of results was obtained by Rosch and her associates. Rosch and Mervis (1975) found that the more prototypical members of categories shared more attributes with other members of the category than did less prototypic members. Using artificial stimuli (dot patterns, stick figures, letter strings) Rosch, Simpson, and Miller (1976) found that stimuli which had the greatest number of shared attributes were rated most typical, were most easily learned as members of a category, and were generated first when subjects were asked to produce members of the category.

In summary, the work by Rosch and others on prototypes and basic level objects generalizes and synthesizes the findings of the research on folk taxonomies. Field research on folk taxonomies found that there were cognitive differences between different hierarchical levels. Upper level terms such as the life-forms and intermediates are typically composed of a relatively small number of features, often relatively formal and schematic in character. This can be understood as an efficient means of making broad distinctions – simplification by reduction in the number of attributes. Such a strategy is most effective in a world which is structured into broad and distinct kinds of things – trees vs. bushes vs. grass. Taxonomic generics, on the other hand, are composed of a large number of attributes formed or "chunked" in configurational gestalts. These are what Rosch calls "basic level objects." Such a cognitive strategy is most effective in a world in which objects are composed of a large number of attributes, and these attributes are at least partially correlated with each other. Patterns of attributes can be discovered by the human ability to form configurational gestalts – even though many objects may not fit the patterns perfectly. These patterns are then used to classify particular objects into kinds of things. Finally, basic level objects which have the greatest number of attributes shared by other members of the same superordinate category are considered to be the best examples of that category and often serve as the cognitive representation of that category.

It is as if the human cognitive system were a structure seeking device. At the appropriate level of detail, it finds which attributes of a class of instances are most strongly correlated, and creates generic or basic level objects by forming a gestalt configuration of these attributes. As a result, the cultural and individual systems of thought are made up of more than just a list of features or attributes varying in salience. Features are grouped together into object-like things, making for greater cognitive efficiency in categorization. Once formed, these objects can then be extended to cover instances which have some commonality with the prototypic examples of the category.

Sometimes the attributes of the basic level objects are physically salient features, sometimes they are features which become salient because of the way humans interact with these objects, and sometimes these features become salient only because of cultural meanings which are imposed on these objects, like the "holy" nature of the bible compared to the ordinary secular nature of most books. These kinds of mental objects can be quite abstractly relational, as, for example, the "demotion" of an army *corporal* to a *private*. Humans have a remarkable ability to treat events and relations as if they were objects. Cultural systems of meaning build on and enhance this ability.

Thus the work on taxonomies shifted cognitive anthropology from an exclusive interest in features to an interest in configurations of features which create psychological objects. It is not that features had become irrelevant. But the new interest in the way a combination of features forms an object gave rise to the idea that some combinations of features have greater salience than others. The prototype, as such a combination, was a psychological entity of a new type.