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HIERARCHY AND UTILITY IN A FOLK BIOLOGICAL TAXONOMIC SYSTEM: PATTERNS IN CLASSIFICATION OF ARTHROPODS BY THE KAYAPO INDIANS OF BRAZIL[1]

DARRELL ADDISON POSEY
Laboratório de Etnobiologia
a/c Departamento de Biologia
Universidade Federal do Maranhão, 65.000 São Luís, Maranhão (Brazil)
and
Carnegie Museum of Natural History
Section of Man
5800 Baum Boulevard, Pittsburgh, Pennsylvania 15206 (U.S.A.)

ABSTRACT.–Kayapó Indian classification of insects and related Arthropods is characterized by named Basic Object Level (BOL) categories that recognize "natural discontinuities" in gross morphological form. Organization of BOL groupings is a continuum of overlapping or contiguous sets called "morphological sequences." Hierarchical structures emerge when BOL categories (or sequences) are of utilitarian and/or symbolic significance. Named subordinate differentiations are indicators of "utility;" named superordinate groupings are indicators of symbolic significance. Hierarchical structures are, therefore, indicative of utility, suggesting that current hierarchical and utilitarian models are not contradictory as assumed but rather complementary.

INTRODUCTION

Recent papers by Hayes (1982) and Hunn (1982) have attempted to provide a utilitarian/adaptionist framework for folk biological classification studies. Hunn (1982: 830) outlines a "fundamental contradiction" between his utilitarian "natural core model" and the traditional, formal hierarchy model of Berlin (1973, 1976) and Berlin, et al (1966, 1973). Hunn correctly points out that ethnobiologists have woefully ignored the practical, utilitarian aspects of folk classification; he is, however, unnecessarily polemic in his critique of hierarchical models.

This paper presents data to suggest that there is no "fundamental contradiction" between hierarchical and utilitarian models, but rather confusion between *process* of classification and *purpose* for classification. All societies classify some natural phenomena utilizing processes of culturally influenced categorization (cognitive categories) organized in logical patterns distinctive to that society (taxonomic structures). These processes can be studied as cognitive/perceptual phenomena (eg., Hunn 1976, Kay 1971, Rosch 1978) or as classificatory/logical phenomena (eg. Berlin, 1972, 1973, 1976; Brown 1977, 1979). The latter inevitably demonstrates hierarchical characteristics of ethnotaxonomic rank.

Description and analysis of classification processes, however, do not explain *why* in any given society certain natural domains are classified and named while others are not. This question is best investigated from the utilitarian/adaptionist approach.

Data in this paper show a correlation between the degree of subordinate differentiation (i.e., differentiation below the Basic Objective Level) and utilitarian significance. Superordinate categories (i.e., groupings above the Basic Object Level) are of two types: (1) named categories that appear to be indicators of epistemological (symbolic or mythological) significance, and (2) generally unnamed (covert) categories that reflect "chain-

ing" (i.e., loose groupings based on perceived similarities in morphology, behavior or use). Utilitarian significance is therefore encoded at the subordinate level, while symbolic importance of a domain is signalled by named superordinate categories. Thus hierarchical structures in the Kayapó taxonomic system are indicative of "utility", either practical or symbolic.

BASIC OBJECT LEVEL FORMS AND MORPHOLOGICAL SEQUENCES

Data analyzed in this paper were collected in Gorotire, the largest of the northern Kayapó villages (7°48's, 54°46'w), in the Brazilian State of Para. Consult Posey (1979) for a detailed description of research design and methods used for folk taxonomic and ethnoentomological investigations.

For the Kayapó all visible things are divided into four categories: (1) things that move and grow, i.e., animals; (2) things that grow but do not move, i.e., plants; (3) things that neither move nor grow, i.e., minerals; and (4) humans—creatures that are akin to all animals, yet unique and more powerful than animals because of their social organization.

It is the first covert (unnamed) category of "animal" with which this paper is particularly concerned. All animals are sub-divided into two named groups: those with "flesh" (called ***mry***, or flesh), and those with "shells" and no flesh (called ***mry kati*** or no flesh).[2] This latter group, animals with shells and no flesh, coincides with the scientific phylum Arthropoda.

The most psychologically salient of the taxonomic units in the Kayapó ethnobiological classification system are Basic Object Level (BOL) categories. BOL categories reflect "natural discontinuities" in nature (cf. Hunn 1975, 1976, 1977) by classifying natural units characterized by variations in morphological forms. Other characteristics—such as color, sound, smell, texture, movement, etc.—may be simultaneously encoded, but general shape or form is the fundamental criterion for BOL discrimination.

As previously described (Posey 1981), four "morphological sequences" are found for ***mry kati (maja)*** in the Kayapó system. The term morphological sequence describes a continuum of morphological traits that unites a series of BOL categories. The sequence may be an uninterrupted continuum with overlapping members between contiguous BOL categories, or there may be interruptions in the continuum marked by an unusual (aberrant) morphological feature. Figure 1 illustrates the morphological sequences for the Kayapó system of Arthropod classification (numbers refer to BOL categories in Table 1).

The Kayapó system shows four types of BOL categories: (1) Focal Forms – specimen that are always classified in the same BOL category and are considered typical of that category. (2) Transitional Forms – specimen that are frequently classified in more than one BOL category, indicating shared morphological characteristics with other BOL groups. These are always members of the same "morphological sequence." (3) Aberrant Forms – specimen that are consistently classified in the same BOL category, but are given special names because of distinctive morphological characteristics. These form subgroups of the BOL category. (4) Collective Forms – specimens too small to be classified based on morphological characteristics. Table 1 lists Kayapó BOL categories by form types and includes their scientific equivalents.

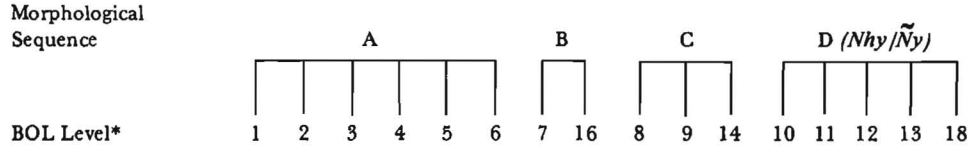

FIG. 1.—Organization of BOL categories into 4 morphological sequences, only one of which is named *(Nhy/Ñy)*.*

Named, "undifferentiated utilitarian categories" are also sometimes found that group animals of the same BOL category into a collective class because of their similar utilitarian significance. ***Kikre-kam-mȁrȁ***, "house beetles," is an example in which all house "pests" that are beetles receive the same name, although morphologically they are said to be different.

TABLE 1.—Levels of correspondence for insects.

BOL Categories[1]	Common Name	Correspondence Levels	Correlation[2]
Focal Forms:			
(1) màrà	beetle	Order (Coleoptera)	1:1
(2) ipoi	true bug	Order (Hemiptera)	1:1
(3) kapo	roach	(Family: Blattidae)	+
(4) krytkañet	grasshopper, cricket	Order (Orthoptera)	1:1
(5) wewe	butterfly, moth	(Various Orders)	—
(6) kañeñet	dragonfly	Order (Odonata)	1:1
(7) kokot	leafhopper, cicada	Order (Homoptera)	1:1
(8) pure	fly	Order (Diptera)	1:1
(9) kopre			
(10) rorot	termite	Order (Isoptera)	1:1
(11) mrum	ant	(Family: Formicidae)	+
(12) amuh	social wasp	(Family: Various)	+
(13) mehn	bee	(Family: Apidae)	+
Collective Forms:			
(14) ngoire	minute insects	(Various)	—
Aberrant Forms:			
(15) karere	earwig	Order (Dermaptera)	1:1
Transitional Forms:			
(16) kapoti	giant roach, mantid	Order (Dictypotera)	+
(17) kungont	solitary bee and wasp	(Various)	
(18) mehnkamamuh	honey wasp	(Genus: Brachygastera)	+

[1]BOL (Basic Object Level) Categories

[2]Correlations state in relation to correspondences at the scientific level of *Order* (+ indicates an over-differentiation; — is under-differentiation).

SUBORDINATE TAXONOMIC GROUPINGS

Groupings subordinate to BOL categories are subject to distinctive processes of characterization. Through what Hunn (1976: 512-512) calls "attribute reduction," certain of the nebulously encoded criteria of Basic Object Level categories are selected out as distinctive features for sub-groupings. These criteria often predict co-occurring sets of (for example, presence of hard wing covers always co-occurs with the presence of wings; the presence of scaly wings always co-occurs with the presence of fuzzy-elongaged abdomen, etc.). This type of "feature redundancy" is referred to as "configurational recoding" (cf. Hunn 1976:513; Bruner et al 1956:47). These criteria can be expressed in a limited number of componential features and are more easily expressed verbally by the Kayapó than are the BOL characteristics.

The degree to which a Basic Object Level category is subject to subgroupings indicates the following: (1) the importance of that particular set of organisms to the culture as a whole, or (2) the particular importance of that set of organisms to cultural "specialists."

Specialized knowledge is acquired in two ways: (1) from relatives as a part of one's ***nê kretx*** (inheritance), or (2) from another "specialist" through apprenticeship.

In a materialistic sense the Kayapó are egalitarian, but only in a materialistic sense. The "secrets" or rights one inherits as part of one's ***nê kretx*** do much to determine one's status. This specialized information usually deals with rights to perform certain songs, dances, or rituals. But one's ***nê kretx*** might also include specialized knowledge about curing or witchcraft.

There are many types of shamans for the Kayapó. Some are more powerful than others, depending partially upon the degree of specialized knowledge.

Shamans are able to "talk to" certain animal spirits ***(karon)***. Some animal spirits are considered to be more powerful than others. The more powerful the shaman, the more powerful the animal spirit to which he can speak. It is through "talking to" animal spirits ***(mry karon kaban)*** that a shaman can cause or cure illnesses, predict the future, or talk to the spirits of ancestors. Only the most powerful shamans can talk to all animals.[3] This means that knowledge about animals is specialized and as a result, the subordinate classification system of animals is specialized.

Two major problems are evident in eliciting subordinate insect classification systems: (1) to understand the totality of the subordinate groupings would require investigating the knowledge of each shaman, and (2) much of this specialized knowledge is highly secretive in nature.

A third factor must also be considered. There is a large group of men and women who also are "curers" ***(mê-kute-mekane-mari)***. These people specialize in the treatment of a number of native diseases. Their cures are effected through concoctions of plants and animal parts; no manipulation of animal spirits is utilized. There are dozens of these in any village. My partial inventory of such curers in Gorotire alone yielded a list of 154 individual specialists, which was over 25 percent of the population. Thus, the elaboration of subordinate classification that follows reflects my very limited knowledge of the *total* Kayapó system of specialized insect classification.

The categories that do show exceptional internal differentiation, either by specialists or the culture as a whole, inevitably represent categories of great cultural significance to the Kayapó. Category specialization (internal differentiations) has been shown to be a useful methodological tool and provides an *emic* guide to significant cultural phenomena (Posey 1981, 1983d).

Following are the BOL Categories with a brief outline of the subordinate taxonomic groupings that characterize each category.

Màrà: **Beetles and Kin.** The Kayapó use the term "relative" ***(ombikwa)*** with variable

degrees of inclusiveness. All *ombikwa* are in some degree of relatedness one to the other. Thus *màrà (n) ombikwa*, relatives of beetles, are grouped together because of general features of relatedness. Each grouping of *ombikwa* is thought to have a "father" *(bam)*. The father is generally distinguishable as the largest specimen of the group; for most BOL categories no particular organism is consistently labeled as *bam*. For the category *màrà*, however, the rhinoceros beetle *(Stataegus* sp.) is specifically thought of as the father of all *màrà* and, indeed, of all things with shells and no flesh. The rhinoceros beetle is one of the bulkiest insects found in the tropics and sometimes reaches over 15 cm in length; its distinctive large "horns" make it one of the most morphologically distinctive insects. The Kayapó call this beetle the *krã-kam-djware*, the beetle with teeth on its head.

The *krã-kam-djware* cannot be considered a separate class of *màrà*, but rather is a distinctive representative of the subclass *mingugu*. All Scarabaeidae collected in Gorotire was classified as *mingugu*.

The *mingugu* (also called *màràti*, or "big màrà") are subdivided further into two groupings: (1) *mingugu*, and (2) *mingugu-ti*. The "*-ti*" affix denotes "largeness;" thus, the *mingugu-ti* are the large scarabs (of which the *krã-kam-djware* is the most notable example). The *mingugu* are the smaller scarabs and are sometimes said to be "children" of the larger *mingugu-ti*.

The category *màrà* has ten major subdivisions that follow to some extent the subdivisions of the scientific Order Coleoptera (Fig. 2).

(1) *mingugu* are characterized as having shiny, tough black shells and well-defined wings underneath. The shape of the scarab is distinctive and inevitably the key non-verbalized basis for this subgrouping. When consultants are asked how the *mingugu* differ from other beetles, they emphasized that *mingugu* are found around dung. The collection of *mingugu* made in Gorotire yielded only specimens of the superfamily Scarabaeoide (families including Passalidae, Lucanidae, Scarabaeidae). Some small scarabs collected were co-classified with the folk taxon *ipoi*.

(2) *ngoi-kam-màrà* are beetles characterized as living on, in, or under the water. The name of this group means "water beetles" and includes the scientific families Dytiscidae and Gyrinidae. The fact that these beetles can swim, as well as walk and fly seems to pose no problems of anomaly for the Kayapó, who are nonetheless fascinated by such abilities.

(3) *pyka-kam-màrà* are ground dwelling beetles as the name implies ("*mara* of the earth"). Beetles in this category are believed to be carnivorous because they are frequently found near carrion. Specimens from the following scientific families were collected as part of this folk taxon: Rhysodidae, Carabidae, Tenebrionidae, Cleridae, Cucujoidae, Cerambycidae, and Chrysomelidae.

(4) *ngrot* are beetles classified as being somewhat elongated and having shiny shells. The *ngrot* are said to live in tree bark and include all the Buprestidae or wood borers.

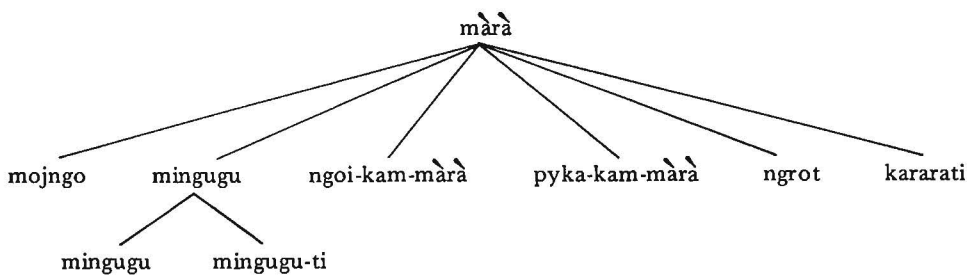

FIG. 2—Subdivisions of *màrà*.

(5) *mojngo* are weevils. These beetles are said to live on trees and shrubs. Their elongated snout serves as the diagnostic feature for this folk subclass, which coincides with the scientific families Curculionidae and Brenthidae.

(6) *kàràràti* are elongated beetles that coincide with the scientific families Elateridae and Lampyridae (click beetles and fire flies). The name means light-colored, translucent, glowing, or shiny-winged beetles.

(7) *kikre-kam-màrà* is an "undifferentiated utilitarian category" of beetles that live in the house and attack stored products. Most of these beetles are Dermestidae, but various other household insects are also lumped into this category.

(8) *màrà-re* is yet another undifferentiated category that includes a wide variety of beetles, including representatives of families Bostrychidae, Lyctidae, and Dermestidae.

(9) *kapran-karon* are the small, rounded and colorful insects we call "lady beetles." The name literally means "turtle image" beetles; this group consists mostly of small coccinellids (Coccinellidae). These are principal crop pests and are sorted by female informants into a variety of covert sub-classes based upon their preferred plant hosts.

(10) *màrà-puni* are the hairy rove and carrion beetles. The name means "ugly" or "repulsive" beetles, referring to their attraction to dead and decaying animals. These beetles are sometimes co-classified with *ipoi* (Hemiptera) because of their poorly developed wings and elongated bodies. The scientific families of Silphidae and Staphylinidae are represented in this category.

Continuous category set overlap occurs mostly with the blister beetles (Meloidae and Mordellidae), which are co-classified with *ipoi* (mostly Hemiptera). The reason for this appears to be the soft-wing covers (*kà*, or elytra) that more closely resemble wings of *ipoi* than the hard "shells" of true beetles.

Except for the *krã-kam-djware* (rhinoceros beetle), there is little evidence of any particular use for beetles, nor any special symbolic or ceremonial significance. The palm weevil *(Rhynchophorus ferrugineus)* is given a special name, *riño-krê-kam-màrà*. The larvae of this large beetle is said to have been an important food of the ancient Kayapó and is still eaten by some children and old people. These larvae reach a considerable size (three or four ounces) and have excellent food value. A large green metallic wood borer (Buprestidae) is also given a special name, *màrà-ñibumpre*. The elytra of this beetle is commonly used in the tropical lowlands for decorative purposes.

A series of descriptive affixes is used in conjunction with the name *mara* to describe a certain specimen. These refer to color, shape, size, or texture and are used only as loose descriptive labels. Examples of name combinations are found in Table 2.

TABLE 2.—A list of affixes used in the description of various *màrà* specimens.

Affix	Translation	Affix	Translation
"-re"	diminuitive	"kakrãtyk"	jet black
"-kryre"	tiny	"kamrek"	red
"prĩre"	small	"ngrãngrã"	bluish
"tire"	large	"tyk"	black
"kra"	child (small)	"jaka"	white/gray
"kàprĩre"	short shell	"jadjen"	shiny

Common examples:		
	màrà-tyk-ti	(large, black beetle)
	màrà-pri-tire	(medium size beetle)
	màrà-kamrek-ti	(big, red beetle)

Ipoi: **True Bugs and Kin.** *Ipoi* are seen as having shells *(kà)* or wing covers that are not so tough *(tytx)* as most of the beetles *(màrà)*. The *ipoi* are thought to live and feed on leaves of plants. The most typical of the *ipoi* are stink bugs (Pentatomidae) that are said to cause one's eyes to burn *(me nô kang rô)* and are called *ipoi kumrenx*, the "true" *ipoi*.

There are four subgroupings of *ipoi* (Fig. 3).

(1) *ipoi (kumrenx)* are "true" *ipoi*. The Kayapó have little to do with these insects because of the fear of being blinded by them. Shamans utilize *ipoi kumrenx* in various concoctions to induce or cure blindness and burning eyes. Informants easily recognized and grouped Pentatomidae specimens into this grouping on the basis of gross morphology, insisting that all insects in this group could cause harm to the eyes.

(2) *ipoi (ka 'àk)* are "false" *ipoi*. These do not cause the eyes to burn, but are said to inflict painful bites. The ridged thorax of these *ipoi* is the generalized morphological feature that characterizes the group. These are the Reduviidae or assassin bugs.

(3) *ipoi-tikà* are the giant water bugs (Belostomatidae). Indians believe the *ipoi-tikà* can cause paralysis of anyone bitten by it. It is feared and avoided, except by shamans who utilize it in their crafts.

(4) *ipoi-re* is an undifferentiated category that includes other Hemiptera as well as a few Coleoptera (families Meloidae and Mordellidae).

The following descriptive affixes were elicited for *ipoi: "-jaka"* (white), *"-ngrãngrã"* (light color), *"-tyk"* (black, *"-kamrek"* (red), *"-kryre"* (small), *"-ti"* (large). Only the giant water beetle *(ipoi-tikà)* is given any specific polylexemic distinction.

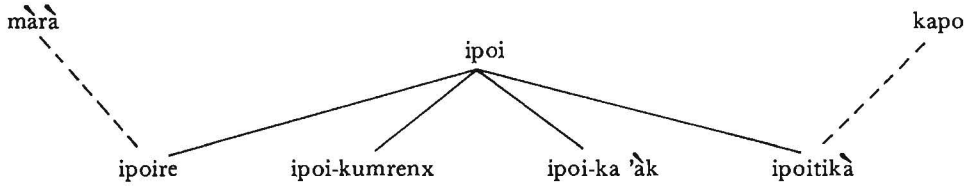

FIG. 3—Subdivisions of *ipoi* showing some subclass overlap between *màrà* and *ipoi, ipoi* and *kapo* (indicated by dotted lines).

Kapo: **Cockroaches and Kin.** Cockroaches, mantids, walking sticks, crickets, and grasshoppers are generally grouped into the scientific Order Orthoptera, though some authors prefer to place cockroaches and mantids into a separate Order Dictoyptera. Regardless of which system is preferred, entomologists agree that these insect groups are closely related. The Kayapó likewise view these insects as closely related, and utilize three BOL groupings to distribute them: (1) *kapo*, (2) *kapoti*, and (3) *krytkañet* (mantids, grasshoppers, and crickets).

Kapo and *kapoti* should perhaps be viewed as two subgroupings of *kapo;* that is, as *kapo (kumrenx)* and *kapoti* as in Figure 4-A. Informants consistently group *kapoti* at a level of contrast with *kapo* and *krytkañet;* therefore *kapoti* is probably best treated as a separate Basic Object Level category rather than a subclass of *kapo* (as in Figure 4-B). The

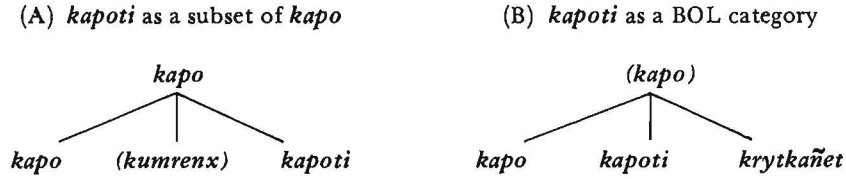

FIG. 4.—Two possible models of set relationships between *kapo, kapoti,* and *krytkañet.*

grouping ***kapo*** includes all insects of the suborder Blattaria, except for the extremely large winged forms of family Blattidae.

The ***karêre***, earwig (Dermaptera), is seen as a special type (aberrant form) of ***kapo***. It is shaped like a ***kapo***, but does not have the same type of wings or abdomen. The ***karere*** are associated with dark, damp places and are believed to be an omen of illness or death. ***Karêre*** are associated with spirits of the dead and whenever too many ***karêre*** are seen in a house, it is assumed to be a sign of spirits in the house. The Kayapó traditionally abandon and burn a house after several deaths have occurred because of fear of spirits returning to their old homes.

Kapoti: **A Transitional Form.** Little can be said about the ***kapoti***, except that they are some of the largest insects encountered in the Kayapó area. Large cockroaches of the scientific suborder Blattodea are grouped with pyranus beetles (Prioninae) in this category. The bodies of the ***kapoti*** are like those of the ***kapo***, except that their impressively large wings cause them to be considered as relatives of ***krytkañet*** (grasshoppers).

Kapoti are ground into a powder and used by various shamans to cause or cure illness and blindness. Specimens of this group are hoarded by shamans to prepare various concoctions.

Krytkañet: **Grasshoppers and Kin.** Grasshoppers are one of the most numerous forms of life in the Kayapo area, especially in the grasslands and transitional forest. Eight major subdivisions can be described within the category ***krytkañet*** (Table 3).

(1) ***moi 'ô' ja 'àrà*** are the katydids or long-horned grasshoppers (Tettigonioidea). An extremely large species occurs in the area and is given the special name ***krytkañet-kàràràti.*** Its legs are used to treat aching or weak joints. The spiny part of the back legs are removed and scratched over the afflicted joints, sometimes until blood is drawn. Contact with the strong legs of the ***moi 'ô' ja 'àrà*** is believed to impart its strength to the user. The name means "leaf-like" ***krytkañet***, referring to its protective coloration and leaf imitative wing veination.

(2) ***chỳrê-chỳrê*** are the large grasshoppers of the family Acrididae. During the dry season these huge insects appear in great abundance. It is said that in the ancient days the Kayapo ate these as delicacies, but there is no evidence that they are still eaten today. The legs of the ***chỳrê-chỳrê*** are utilized for curing in the same manner as the

TABLE 3.—Subgroupings of ***krytkañet*** with analagous scientific classifications.

	Krytkañet (Orthopteriods)	
Subgroupings	Common Names	Scientific Taxons
(1) moi 'ô' ja 'àrà	Katydid	Tettigonioidea
(2) chỳrê-chỳrê	Grasshopper	Acridoidea
(3) Pàt-karoñ	Mantis	Mantodea
(4) wêjaputchô	Walking stick	Phasmatoptera (or Cheleutoptera)
(5) ngra-rêrêmex	Mole cricket	Gryllotalpoidea
(6) krytkañêre	Cricket	Grylloidae
(7) krytkañet-ka 'àk	Grouse locust	Tetrigoidea
(8) krytkañet (kumrenx)	"Locust"	Acridoidea

legs of the *moi 'ô' ja 'arà*. The large rib vein of the upper wing is also removed from the rest of the wing and used in shamanistic ceremonies that are intended to cause or cure paralysis of victims. The name of this category is derived from the flight sound made by a focal member of the category.

(3) *pàt-karõn* are the mantids (Mantodea), some of which reach six inches or more in length. The name means "anteater image" and refers to the similarity perceived between the front legs of the mantis and those of the giant anteater. Indians say the mantis holds it prey in the same manner as the *pàt* (anteater).

(4) *wêjaputchô* are the walking sticks (Phasmatoptera or Cheleutoptera). The Kayapó say contact with these can cause blindness and shamans use the ground-up parts of certain species to inflict blindness. In many ways the walking stick is aberrant morphologically, particularly because of its wings. The body, head, and legs, say the Kayapó, are those of *krytkañet*. I do not know the meaning of the name for this class.

(5) *ngra-rêrêmex* are the mole crickets (Gryllotalpoidea). Their name means "pretty paca" and refers to their similarity in shape and coloration to the rodent "paca." Because these crickets are heard and seen at night, they are associated with death and ghosts and are harbingers of disaster.

(6) *krytkañêre* are the true crickets (Grylloidea). These are distinguished by the Kayapo because of their songs and their distinctive wings. Crickets are common in Indian fields and are associated with good crops and abundant rains. They are favored fish bait for Indian boys, who spend hours chasing them for that purpose.

(7) *krytkañet-ka 'àk* are the grouse locusts (Tettrigoidea). The morphological form of these is distinctive and easily recognized by the Kayapó as being "false" *krytkañet*.

(8) *krytkañet-kumrenx* are the true locusts (Acridoidea). There are five unnamed (covert) subdivisions of this group.

a. those found in the grasslands *(kapot)*
b. those found in the transitional forest *(bà-ràràrà)*
c. those found in the high forest *(bà-tyk)*
d. those found near rivers *(ngô-kôt)*
e. those found in or on the ground *(pyka-kam)*

No generic or specific scientific determinations were made for these subgroupings. It is interesting to note, however, that the Indian recognize certain forms (morphological types) as more "typical" of the various ecological zones. There are five ecological zones recognized by the Kayapó that correspond to the five groupings of *krytkañet-kymrenx* listed above. Informants made minimal grouping "error" in sorting *krytkañet-kumrenx* despite the specimens being "out of ecological context."

The noted acridologist Uvarov (1977:371-444) has attempted to group grasshoppers and crickets into "life forms" based on generalized morphological adaptations to particular ecosystems or "life zones." Five basic "life zones" recognized by Uvarov are: (1) "terricoles," those living on the ground and feeding on herbs; (2) "aquacoles," those living in or on the water; (3) "arboricoles," those living on trees and woody shrubs; (4) "herbicoles," those living in dense thickets of shrubs and herbs; and (5) "grammicoles," those living in grasslands. This attempt to account for phylogenetic relationships between morphological adaptation and the functional success of a species associated with ecological zones appears to coincide with the Kayapó system.

The term "life form" as used by Uvarov is confusing for ethnobiologists because of the current use of the same term as a general folk taxonomic unit. Perhaps "ecoform" would be a less ambiguous word that could be adopted by ethnobiology. Whatever the term, I believe ethnobiologists need to follow lines of investigation that analyze native perceptions of adaptive associations between species morphology and ecosystem.

Wewe: **Butterflies and Kin.** The Basic Object Level category *wewe* could be considered as a collective form. Six orders of insects are subsumed under this one label: Neuroptera,

Ephemeroptera, Plecoptera, Mecoptera, Trichoptera, and Lepidoptera. The focus of the entire category is the giant morpho butterfly *(Morphinae)*.

Seven folk subgroupings occur within the basic category so that in the overall scheme the underspecialized category *wewe* becomes a focal category differentiated by the degree of morphological feature recognition. The subdivisions are as follows:

(1) *wewe (kumrenx)* are butterflies and moths (Lepidoptera). Wing scales are the distinguishing characteristic, and scales are used by shamans to treat diseases of lethargy. A covert differentiation within this category is found between night-flying and day-flying species. Moths and other night-fliers are considered omens of death or illness.

(2) *wewe-jaka* are the mayflies (Ephemeroptera). The suffix *"-jaka"* ("whitish") is often used loosely as a descriptive affix. In this case, however, *wewe-jaka* labels a specific subclass of *wewe*. Although these appear at night, the Kayapó do not find them disturbing; on the contrary, they are always a sign of abundant fish and good fishing.

(3) *wewe-ja 'àrà* are the stoneflies (Plecoptera). The suffix *"-ja 'àrà"* denotes a translucent quality of the wing. This subclass defines the particular set of Plecoptera.

(4) *wewe-ka 'àk* are the "false" *wewe*. This category coincides with the scientific Order Mecoptera, scorpionflies.

(5) *ngôi-kam-wewe* are the caddisflies (Trichoptera). The name refers to the affinity of this set of organisms for the water and areas surrounding lakes and rivers.

(6) *pingôkrã̀* are the fish flies and dobson flies (Corydalidae). The name literally means "worm head" and refers to the sometimes elongated thorax and head of the family.

(7) *pi 'ô' ja 'àrà* are the lacewings and kin (all Neuroptera, except Corydalidae). The name literally means "leaf wings" and is descriptive of the delicate, transparent veined wings for which the Order is named.

Though generally oblivious to insect life cycles, the Kayapó are aware of the stages of metamorphosis of Lepidoptera. The eggs they call *"ngrê;"* the larvae *"pingô;"* the cocoon or chrysalis *"kraka"* ("child cover").

The stinging larvae of various unidentified Lepidoptera are incorporated into the rituals prescribed for warriors and are smashed on the bare chests of the young men. The intense pain is believed to impart strength and remove fear. Often the ordeal leaves scars on the chest that are sported proudly as though they were battle scars.

Kokot: **Cicadas and Kin.** There are only two basic subdivision of *kokot*. The focus of the entire category is the large annual cicada (Cicadidae). The two subgroupings follow:

(1) *kokot (kumrenx)* are the "true" *kokot*. This category coincides perfectly with the scientific Family Cicadidae. The principal vein of the cicada's front wing is used by shamans in sorcery.

(2) *kokot-kryre* are the "tiny" *kokot*. This category includes the treehoppers (Membracidae), froghoppers (Cercopidae), leafhoppers (Cicadellidae), and the plant hoppers (Fulgoridae). I know of no special use or significance of this subgroup.

The usual variety of non-fixed descriptive suffixes are evident; for example: *-krôre* (painted), *-prĩre* (small), *-tire* (large, *-kamrek* (red), *ngrãngrã* (light colored), *-tyk* (black), and so on.

Ngôire, Pure and *Kopre:* **Flies and Kin.** The third sequence has three closely-related Basic Object Level Categories: *ngoire, pure*, and *kopre*. The category *ngôire* is a collective one containing a myriad of small insects too small to be distinguished morphologically by the unaided eye. I did not make a collection of the insects in this category so I can only guess at the vastness of its inclusiveness.

The category *kopre* is likewise a very nebulous category. Within this group are all flies (Diptera), except those contained in the category *pure*. All forms are known to have only two wings. There are no further subgroupings.

The category *pure* is subdivided into three groups, all of which are blood-sucking and biting species:

(1) *pure (kumrenx)* are small blood-sucking flies. This includes the punkies (Ceratopogonidae), midges (Chironomidae), and black flies (Simuliidae). The Kayapó distinguish four types of *pure kumrenx: (a) putykre* (black ones, (b) *putire* (big ones), (c) *pukrãkrôti* (spotted-headed ones), and (d) *pukrãkamrek* (red-headed ones). Distinctions among the four are not only morphological, but also biological, i.e., where they are found and the viciousness of the bites.

(2) *pute* are the mosquitoes (Culicidae). There are four sub-divisions of *pute:* (a) *pute-jaka* (whitish ones with very painful bites), (b) *putepryjaka* (greyish ones found in the forest along trails), (c) *putekamrek* (reddish ones found in open areas), and (d) *putetykre* (black ones found in the forest).

(3) *pumnuti* are the deer and horseflies (Tabanidae). There are no further subdivisions of this category.

The overall relationship between *kopre* and *pure* is represented by line diagrams in Fig. 5.

The *pumnuti* (Tabanidae) are seen as being morphologically more similar to *kopre* than *pure.* Their fierce biting habits, however, cause Indians to place them in the category with other blood-sucking and biting species. There are more detailed subclassifications of mosquitoes and pium, but collections and analyses are yet to be made.

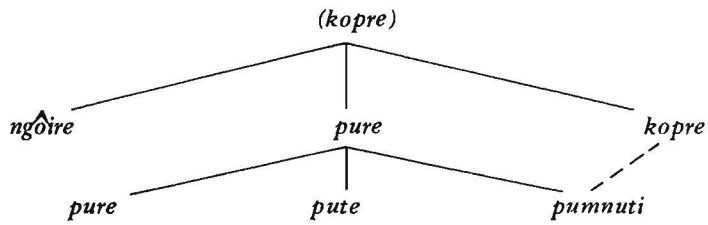

FIG. 5.—Category relationships within flies and kin *(kopre)*

Rorot: **Termites and Kin.** Termites (Isoptera) are abundant in the Kayapó area, although the Kayapó pay relatively little attention to them. Four major subdivision or *rorot* are found.

(1) *rorot-tykre* are termites that build nests in trees. These are the "black" termites and are associated with the origins of black people on the earth.

(2) *rorot-krã-kamrek-ti* are termites that nest in the wood of houses. These "red-headed" termites are associated with the origins of other Indians (non-Kayapó) in the world.

(3) *rorot-jakare* are termites that nest in the ground. These are the "white" termites that are associated with the origins of Europeans in the world.

(4) *rorotire* are termites that build large, greyish mounds. Termite mounds are numerous, especially on the campos, and all non-Kayapó *(kuben kakrit)* emerged from the underworld to the earth through these mounds.

Whereas the Kayapó have a fascination and even admiration for other social insects, the termites are thought of as useless and helpless. They are weak and non-aggressive and therefore no more "true" *ñy* (social insects) than *kubẽn kakrit* (non-Indians) are "true" people. True people (the Kayapó) originated above in the sky; not from below in the ground as did non-Indians.

Termite nests are used in house construction, since their comb construction serves as an ideal natural insulation. Nests of *Nasutitermes* are also used as fertilizers, or mixed with organic mulch to create fertile planting zones in savanna areas. On numerous oc-

casions I observed the Kayapó eating the textured nest of ground-dwelling termites and ants. No explanation was offered other than in the ancient days the Kayapó say they ate this in place of farinha (toasted manioc flour). Geophagy is not commonly reported in indigenous cultures, but was certainly common with the Kayapó and is evident today to some extent.

Mrum: **Ants and Kin.** Ants (Formicidae) are a source of great interest to the Kayapó (Posey 1981). Their social nature is thought to be similar to that of the Kayapó and, consequently, their ethology is important in classification. The major basis for subgroupings of ants is the type and location of their nests *(ũrũkwa)*. The following covert (unnamed) groupings were found:

(1) ants with nests in the ground
(2) ants with nests above ground (mound building)
(3) ants with nests inside tree trunks
(4) ants with nests outside tree trunks (have visible nests attached to the tree trunk)
(5) ants with nests inside tree limbs
(6) ants with nests attached to tree limbs or leaves
(7) ants that live with termites
(8) ants that live with bees
(9) ants that live alone (solitary forms).

The last grouping of solitary ants is often co-classified with wasps *(amuh)*. These are called "velvet ants" (Mutillidae), which are in fact wasps of the superfamily Scoliodidae. A large ant with conspicuous winged males is likewise co-classified with *rorot* (Isoptera). These two examples represent the set overlap between contiguous categories *(rorot, mrum,* and *amuh)*.

Ants are often spoken of in terms of their "power," or ability to inflict pain. The more potent the sting, the more powerful the ant. Some shamans specialize in "talking to" powerful ant species and claim to manipulate their spirits to cause harm. The shamans have a special classification of ants based on the power of ant spirits *(karon)*. To date 64 different ant folk species have been collected and described.

The abdomen of the "saũva" *(mrum-tuti; Atta sexdens* L.) is the only ant eaten. Its fat and juicy abdomen is mixed with manioc flour and baked, or whole ants may be roasted in banana leaves.

Stinging ants are often collected by the Kayapó men. Ant bodies are pounded into a paste with red urucu *(Bixa orellana)* and painted on hunting dogs. This is supposed to cause the dogs to keep their noses to the ground and to hunt with determination as the ants do.

Azteca sp. ants are thought to have a smell that repels sauva *(Atta sexdens* L.) and their nests are actively distributed near fields and gardens to produce a protective barrier against sauva. Their nests are also planted with yams and taro to increase tuber yields.

Amuh: **Wasps and Kin.** Non-honey-producing wasps and stinging bees are grouped into the category *amuh*. Subgroupings of *amuh* seem to be based on the type of nest *(urukwa)*. Variation in identification of wasps "out of environmental context" was found to be very high. Consultants were later brought to the Museu Goeldi to identify 120 wasp nests. Identification of wasp *nests* "out of context," however, was found to be extremely consistent with identifications and observations made in the field. This seems to indicate that the Kayapó pay more attention to wasp nest construction than to the morphology of the wasps themselves.

The principal dichotomy within the Basic Object Level category *amuh* is between (1) social species, and (2) solitary species (those that do not live in *ũrũkwa)*. Subgroupings of each of these are outlined in Table 4.

TABLE 4.—Subgroupings of *amuh*.

Subgrouping	Common Names	Scientific Correlate
(1) Solitary *amuh*		
(a) *ambu-poi-ti*	"ichneuman fly"	Ichneumonidae
(b) *prytumre*	"spider wasp"	Pompilidae
(c) *mỳt-te*	"sand wasp"	Sphecidae: Larrinae
(d) *'apiêt-ti*	"mud daubers"	Sphecidae: Nyssoninae
(e) *ajabamñy*	"thread-waisted wasps"	Sphecidae: Sphecinae
(f) *pyka-õ-ñy*	"potter wasps"	Vespidae: Eumeninae
(g) *amuhre*	an undifferentiated category of various families, including, Symphyta	
(h)[1] *rop-krôre-karõn*	"velvet ant"	Scoliidae, Mutillidae
(i)[2] *kungõnt*	"solitary bees"	Xylocapinae
(2) Social *amuh*		
(a) *mingugu*	"social bees"	Apidae: Apinae
(b) *mehnkamamuh*	"honey wasps"	Brachygastra sp.
(c) *amuh (kumrenx)*	"social wasps"	Vespidae

[1] *rop-krôre-karon* is co-grouped with *mrum*

[2] *kungõnt* is a transitional class between *mehn* and *amuh*; *mehnkamamuh* is a transitional class between honey-producing bees and wasps.

Most social wasps are used in some form of hunting magic. Most commonly, wasp parts are mixed with urucu *(Bixa orellana)* and painted on the warrior. Certain wasp nests are even used to rub over the noses of hunting dogs to make them brave *(akrê)*. To date 85 folk species of wasps have been identified and described.

Mehn: **Honey-Producing Bees and Kin.** Thus far 56 folk species of stingless bees (Meliponinae) have been discovered for the Kayapó corresponding to 66 scientific species (Posey 1983a). Of this number, 11 species are considered to be semi-domesticated (Posey 1983b).

Bees are grouped into 15 "families" in addition to the 56 folk species. Criteria for determining these differentiations are complex and include the following:

1. Ethological characteristics: (a) flight patterns (how the bees fly when entering the nest), (b) aggressive behavior when the nest is disturbed (aggressive or docile); (c) sound produced by bees in flight or by nocturnal behavior inside nest; (d) places bees visit, including types of flowers, dead animals, feces, sand banks, dirt, etc.

2. Nest structure and ecological niche: (a) substrate preferred (eg., tree hollows, ant nests, termite mounds, inside earth, large trees, etc. In the case of trees, external nest form and position of the entrance structure is also important); (b) ecological zone preferred (flood forest, humid forest, savanna, etc.); (c) form, texture, color and smell of

the entrance structure (eg., earth, resin, cerumen, vegetable fibers, etc.); and (e) form and texture of the batumen.

3. Morphological and biochemical characters: (a) shape of the bee's body; (b) colors of the bee; (c) designs or markings on body; (d) size and color of wings; (e) size of the bee; (f) smell of the bee (either its natural smell or when the bee is crushed); (g) secretions produced for defense.

4. Economic factors: (1) quality of honey; (b) quantity of honey; (c) quality of resins; (d) quality of wax and cerumen; (e) suitability of pollen for food; (f) suitability of larvae/pupae for food.

As this list of taxonomic characters indicates, the Kayapó also have a detailed knowledge of Meliponinae morphology, nest architecture, ontogeny, and behavior. Technologies and strategies for raiding nests and rearing bees are also well-developed (see Posey and Camargo 1984). The Kayapó use bee waxes, batumen, resin, pupae, and larvae for a variety of purposes (Posey 1983c).

SUPERORDINATE GROUPINGS

Of the 18 BOL categories found in the Kayapó system of Arthropod classification, only three show extensive differentiation at subordinate levels (*amuh*, wasps, with 85 folk species; *mrum*, ants, with 64 folk species; and *mehn*, bees, with 56 folk species). Following the hypothesis that such differentiation is indicative of emically significant cultural phenomena (cf. Posey 1983d), one would predict bees, wasps, and ants to be of particular importance to the Kayapó.

An additional indicator of the importance of these BOL categories is the named superordinate grouping of all social Hymenoptera, *nhy (ñy)*, which includes all *amuh*, *mrum* and *mehn*.[5] *Nhy (ñy)* is the only named, superordinate category in the entire domain of *mry-kati* (animals with shells and no flesh).

This phenomenon is explained by the epistomological importance of social insects to the Kayapó belief system. The Indians say that their social organization was conceived by an ancient shaman who specialized in the study of social Hymenoptera. Hoping to organize his defenseless, dispersed people against attacks from the wild beasts and enemies, the shaman had the idea to organize the Kayapó like *nhy (ñy)*. This idea came while observing a hive of wasps *(amuh-dja̰-kein)* successfully defending themselves against an eagle *(ba̰k)* hundreds of times larger.

This Kayapó belief indicates that the Indians have long been interested in social insects as a "natural model". There are still specialists who study *nhy (ñy)* and the importance of social insects is manifested, symbolically in art, music and, most dramatically, ritual (cf. Posey 1983b). The named category *nhy (ñy)*, therefore, encodes epistomological significance in the Kayapó culture and is an indicator of symbolic cultural significance.

In addition to the named, superordinate category of *nhy (ñy)*, numerous loose, nebulous groupings can be found. These "cross-cut" (cf. Gardner 1976) BOL categories recognize a variety of other characteristics held in common with other animals (Fig. 6).

Any given organism might be grouped with other organisms in numerous ways. A frog might be grouped with a water beetle because both are amphibious. A turtle, an armadillo, and a lady bettle might be grouped together because all three have round, humped shells. A caterpillar might be grouped with a snake because it is long and wriggles on the ground. Stinging caterpillars might also be grouped with wasps and ants because of the nature of their stings. A flying ant might be classified with a certain hawk because both appear at the same time of the year (the hawk is migratory; the emergence of the winged ant seasonal). A type of cricket might be classified with a tapir because its front feet are seen as similar in form.

FIG. 6.—Idealized hierarchical model showing superordinate and subordinate levels.

The list can go on and on. In observations of superordinate groupings, I have observed four types of "cross-cutting" mechanisms. Animals are grouped on the basis of:

1. similar function (eg., edibility, medicinal value, ceremonial importance, etc.)
2. behavioral characteristics (e.g., nocturnal animals, crepuscular animals, swimmers, etc.)
3. habitat (eg., water animals, forest animals, ground-dwellers, etc.)
4. special cultural concerns. The latter type of grouping deserves some further explanation.

One of the major ways the Kayapó group animals is by the "power" of their "spirits" *(karõn)*. This is an extremely difficult typology to analyze and describe, for the concepts of animal "power" and "spirit" are exceedingly complex. An animal's "power" is determined by the facility of the *karõn* in inflicting or curing illness. Every animal species has a "spirit" and, theoretically, every animal can affect the human "spirit" by causing or curing illness. Only the shamans who "talk to" the animal spirits can cure a patient of the disease provided by the spirit of that animal. Therefore, the ranking of animals based upon the "power" of their "spirits" is tantamount to ranking the power and prestige of shamans.

Superficially certain groupings seem nonsensical. For example, the Kayapó group certain lizards, some snakes, grubs, and small rodents into one category. This grouping appeared to defy reason until tribal elders were heard telling of the ancient days before the Kayapó had corn and manioc. The list of animals eaten in ancient times coincided with this grouping and is best glossed as "animals of potential use" and offers a "back-up" or emergency system that is encoded in the classification system and passed from generation to generation. Mythological principles of today can become facts of survival tomorrow.

CONCLUDING REMARKS

Classification of *mry-kati* (Arthropods) by the Gorotire Kayapó offers several interesting insights into the overall patterns of folk biological classification. The 18 BOL categories grouped in morphological sequences show very little hierarchical differentiation except for the social insects *(amuỳ, mrum,* and *mebn)*, which are the only representatives to receive a named, superordinate grouping *nhy (ñy)*.

Certain BOL categories, especially *krytkañet* (Orthopterans), seem to be distinguished based upon perceived phylogenetic relationships between animal morphological form and its ecological adaptation or niche. These "ecoforms" merit study and offer ethnobiologists additional intergrative paradigms for research.

Specialization of Kayapó knowledge points to the difficulty of an overall evaluation

of any complete biological/natural taxonomic system. This problem is accentuated when trying to determine the "utilitarian" value of any given domain.

The Kayapó data suggest that elaboration or differentiation of named subordinate (lower in hierarchical rank than BOL categories) categories, whether in the general knowledge system or only known by a few "specialists," is an accurate indicator of "utility" and cultural significance. No attempt has been made to determine if degree of difference is in direct proportion to significance or utility, but such a hypothesis seems feasible and deserves testing. Highly differentiated categories recognized by the society as a whole should be the strongest indicator of cultural utility or significance.

"Utility" is difficult to assess since it does not always include the obvious qualities of food, shelter, or medicine. In the case of *nhy (ñy)*, social insects, for example, only bees have the obvious utilitarian value of producing food, medicine and useful raw materials. Ants are utilitarian in the sense that they have qualities that are desirable to impart to hunting dogs via medicinal mixtures painted on the dogs. Wasps are important in a more abstract way as "natural models" for Kayapó society, although certainly avoidance of stinging species may be considered utilitarian and influence classification. Such avoidance, however, is not the sole reason for wasp classification since only a small percentage are aggressive.

The Kayapó data also suggest that categories of great symbolic or epistomological significance are not only differentiated and named at the subordinate level (usually only by "specialists"), but are also labeled in superordinate (groupings of greater set inclusion than BOL categories) groupings. One can hypothesize therefore that the named superordinate groupings are indicator of symbolically significant domains.

Kayapó classification of insects and related Arthropods is characterized by classification of "natural discontinuities" in nature that produce morphologically determined Basic Object Level (BOL) categories. Organization of BOL categories is seen as a continuum of overlapping or contiguous sets called "morphological sequences." Hierarchical structures emerge when any BOL category (or sequence) is of utilitarian and/or symbolic significance. Named subordinate differentiation is an indicator of "utility;" named superordinate groupings are indicators of symbolic significance.

Thus parts of the folk taxonomic system that exhibit greater hierarchical qualities reflect recognition of "utility" in its broadest sense (practical and symbolic). This resolves the apparent "contradiction" between utilitarian and hierarchical models by pointing out the difference between *process* (essentially hierarchical) and *purpose* (essentially utilitarian) in folk taxonomy. Both are at work in any folk classification system and neither excludes the other in importance nor explanatory potential.

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NOTES

[1]Funding for this research came from the Wenner-Gren Foundation for Anthropological Research.

[2]***Mry kati*** ("false flesh," or "no meat") is an animal type of ***maja*** ("unimportant things," or, in American slang, "stuff"). ***Mry kati*** could also be considered a type of ***mry kaigo*** ("empty meat"). In a previous publication (1983b), I employed the term ***Maja*** without its additional modifiers. My thanks to Cecil Brown, Terence Hayes, and Eugene Hunn for pointing out this fault.

[3]I was told that no shaman in any Kayapó village today had this power. The last shaman, a woman, had died in Gorotire in 1972. The most powerful shamans that exist today are those who speak to the water eel *(mry-kaàk)*.

[4]Termites *(rorot)* are also included in the superordinate category of ***nhy (ñy)***. The fact that they are not differentiated at the subordinate level as are other members of the group is explained in Posey, 1983b.