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an empirical method for the identification of covert categories in ethnobiology[1]

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Whether intended to elicit accurate genealogies, true accounts of events, or the vernacular names of plants or animals, ethnographers' queries often evoke variable and conflicting responses from informants. The experience can be unsettling, especially for one who has been trained to study "a society" and describe "its culture," only to find "a finite, though indefinite, number of human beings, who [give] themselves the privilege of differing from each other" (Sapir 1938:7). Confronted with daily reminders of the remark (sometimes attributed to Kroeber) that "Cultures don't paint their toenails," the ethnographer finds himself in the real world where some people paint their toenails while others do not; some used to but have given up the practice; others begin to, having been stimulated by the asking of the question; and a "key informant," perhaps thinking only of particular persons, says that no one—or that everyone—does it.

The nature and extent of "intra-cultural variation" have recently received increasing attention (e.g., Pelto and Pelto 1975), but the descriptive problem raised by informants' disagreements has more often been sidestepped by adopting either of two models of the culture (or a limited domain of it) to be described. One is that which views a culture as "the common element which all members share, or the set theoretical INTERSECTION of individual competences" (Werner 1969:333), or what I will refer to as the "shared" model. According to a second view, an ethnographic description is "an attempt to characterize the set theoretical UNION of all individual competences" (Werner 1969:333), an approach commonly used in folk biology (e.g., Hunn 1975b), where the notion of an "omniscient informant" is employed; this model of a culture I will refer to as a "composite."

Uncritical adoption of either approach can lead to descriptions which are incomplete, misleading, or simply reifications (cf. Hays 1974:17-26 and discussion below). To the extent that informants' disagreements reflect cognitive variability, moreover, failure to deal directly and explicitly with individual differences may divert attention from such important questions as how "diverse cognitive models . . . [are] articulated in a

Individual variation in plant knowledge in a New Guinea Highlands community is discussed in terms of its manifestation in plant name lexicon, folk taxonomy, and plant identifications. A method is proposed for the tentative determination of unnamed conceptual groupings of plants on the basis of the patterning of informants' disagreements in plant naming tasks. The method should be generally applicable in ethnobiological research, and especially useful where techniques which require literacy are impracticable.

functioning cultural system" (Wallace 1962:356).

An additional cost of exclusively adopting either a "shared" or a "composite" model of a culture is the resulting unlikelihood of discovering that there are patterns within the variability which, as in the analysis presented below, can lead to inferences for which there may be little or no other solid evidence. In particular, I am concerned here with the problem of discovering and describing "covert" or unnamed plant folk taxa in the ethnobotany of Ndumba, a New Guinea Highlands community.[2]

individual variation in plant knowledge in Ndumba

The people I refer to as Ndumba (but who lack an inclusive name for themselves) live in a cluster of six hamlets on the northern slopes of Mount Piora in the extreme southeastern corner of the Kainantu Subdistrict of the Eastern Highlands District of Papua New Guinea. There they claim a territory, which will also be referred to by the same name, which includes nearly twenty-four square miles, almost 80 percent of which is still in primary forest. From near the summit of Mount Piora at 11,350 feet, their forest stretches down to approximately 7,500 feet, the present limit of the grassland they have created and which covers the remainder of their land down to 5,300 feet. There a tributary of the Lamari River marks a social and dialectal boundary with their nearest neighbors to the north.

The streams which descend through Ndumba territory dissect a large portion of what may be called the Piora Basin, where a number of distinct speech communities meet. Ndumba themselves constitute approximately one-half of about 700 speakers of one of seven dialects of Tairora, a language in the Eastern Family of the East New Guinea Highland Stock (McKaughan 1973). Their closest neighbors to the west are the only other speakers of this dialect; two additional dialects are represented in three hamlet clusters abutting on the northern boundary of Ndumba, and a single hamlet cluster on their northeastern border, respectively. Directly across the ridges to the east are speakers of the Waffa language, and on the opposite slopes of Mount Piora, to the south, live Anga speakers (Baruya).

The linguistic diversity of the vicinity is paralleled by the complexity of the Ndumba physical environment. Large taro and yam plots crowd the lower river and stream banks, while sweet potato gardens dot the grassland up to the belt of hamlets at around 6,300 feet and continue to the forest edge. Remnants of a "mixed-oak" forest (primarily *Castanopsis* and *Lithocarpus* spp.) occur near this upper boundary of cultivation of the staple crop but soon give way to a "mixed-beech" forest (dominated by *Nothofagus* spp.) which extends to 9,000 feet, where it is succeeded in turn by a subalpine "moss forest," the last distinct vegetation community below the tussock grassland (mostly *Danthonia, Deschampsia,* and *Poa* spp.) on Piora's summit. The higher forest is rich in birds and marsupials, and the hunting of them, an exclusively male activity, is of great importance to Ndumba. The forest also provides abundant firewood, construction materials, and wild plant foods, as well as medicines and other useful products. In many respects Ndumba enjoy a richer biotic environment than do many Eastern Highland peoples whose territory is largely grassland (see Hays 1974:40-67 for a more detailed description).

In other ways, however, Ndumba conform to a "typical Highlands" pattern in their primary dependence on sweet potato cultivation, pig husbandry, nonhereditary "big man" political leadership, chronic warfare, patrilineal descent ideology, and a deep-seated, widely ramifying opposition between the sexes, reflected most graphically in the residential segregation of men and women. This opposition is most directly relevant to

this discussion in its effects on the distribution of labor, concomitant responsibility, and, one may presume, knowledge. The hunting and trapping of game animals and eels, the clearing of garden land and all construction tasks are the responsibilities of males, as are the tending of taro, yams, sugar cane, and bananas, and the manufacture of most implements which are used by men (e.g., bows, arrows, shields, stone adzes, and handles for steel axes). Women are charged with the planting, weeding, harvesting, and cooking of sweet potatoes and various other crops, the gathering of wild vegetable products from the grasslands and the forest edge, and the manufacture of items for their own use (e.g., infant-carrying slings and pandanus sleeping mats), as well as the reed aprons and string bags traditionally worn and used by both sexes (cf. Hays 1974:91-97).

This necessarily brief sketch is sufficient to support two observations germane to my present concern: (1) the domain of plants is neither a trivial nor an esoteric part of "Ndumba culture" but involves a part of the environment which is of profound, everyday importance; nevertheless, (2) in a social milieu such as this, the opportunity to acquire and the need to possess particular knowledge of plants is not the same for all Ndumba adults. For example, in general, plant knowledge which is relevant to gardening tasks would seem more crucial for women than would knowledge of forest plants, since the major part of the forest is the province of men (and is, in fact, forbidden to the trespass of women), who gain intimate familiarity with it during their hunting and other exploitation of its products. Thus it would be reasonable to suppose that, given the variable experiential basis for learning and the variable "need to know," this aspect of culture at least would be variably distributed among the adult population.

Patterns in this distribution related to gender, relative age, and other social variables will be explored elsewhere (see Hays 1974:202-357 for some preliminary analyses). Here I will discuss only the extent of variability discovered among a sample of ten Ndumba adults with respect to, first, plant name lexicons and individual folk taxonomic models which can be constructed and compared.

Early in the field research I chose ten adults for intensive work regarding their knowledge of plants. Constrained somewhat by practical considerations (e.g., reasonable confidence in the continual availability of the person as an informant), five males and five females were chosen, closely matched for age (from early 20s to 70s) and marital status (see Hays 1974:152-160 for details). The data relevant to the present discussion are derived from formal and informal eliciting, interviews, and plant naming tasks conducted with each of the ten informants separately.

Through the use of formal listing requests (e.g., "*Mo kaamma 'mo kaammave nutu qiane*" 'Say the names of the different kinds of sweet potatoes'), simple naming requests ("*Nraave*?" 'What is it?'), and less controlled sources of data (e.g., requested etymologies of personal names, detailed descriptions of artifacts, translations of myths), a total inventory of over 1,400 possible plant names was accumulated during fifteen months. Some of these turned out to be descriptive phrases or other kinds of constructions, leaving a total lexicon of 1,247 plant names,[3] i.e., lexical expressions which at least one of the ten informants considered to be a label for a distinguishable class of "plants."[4]

This "Composite Plant Name Lexicon" was and remains known in its entirety only by me, a fact which serves as a reminder that to say "Ndumba have 1,247 names for plants" (assuming that my sample is representative) is true only in a sense so abstract as to border on reification. On the other hand, since there is a "Shared Plant Name Lexicon" of 970 terms—i.e., all ten informants recognize 970, or 77.8 percent, of the 1,247 as legitimate plant names—we might say that "Ndumba have 970 names for plants." But this figure would be misleading in the other direction because it is significantly smaller than the size

of any individual's actual lexicon, as can be seen in Table 1.

This degree of variability among individual Ndumba adults' plant name lexicons is perhaps not surprising when one considers that the learning of such names is largely fortuitous. There are no occasions, to my knowledge, when extensive lists of plant (or any other) names are publicly recited, nor do I know of any attempts at explicit instruction in such matters. Instead, an individual learns plant names, like the rest of his vocabulary, as they are uttered in some context in which their referents are reasonably clear, through either physical or verbal contextual evidence. Given strong cultural biases toward structuring events, and thus learning opportunities, along age- and gender-related lines, we might well expect to find not only variation among individuals' lexicons but patterns within that variation, exploration of which must be deferred.

Table 1. Informant variability in plant name lexicon size.

Informant*	Number of Names Known	Percent of "Composite" Lexicon
A	1040	83.4
B	1145	91.8
C	1162	93.2
D	1146	91.9
E	1141	91.5
F	1071	85.9
G	1111	89.1
H	1112	89.2
I	1129	90.5
J	1180	94.6
Mean	1123.7	90.1
Range	1040 – 1180	83.4–94.6
"Shared"	970	77.8
"Composite"	1247	100.00

*Informants A-E are males, F-J females, in order of ascending age.

Variation in the knowledge of plant names implies some diversity among individuals' folk classifications of the plant world. That is, the variation in lexicon size which is not a simple function of variable knowledge of synonymous names may be seen as directly indicative of differential elaboration of individual folk taxonomies, at least so far as named taxa are concerned.

Distinguishing synonyms from expressions which label distinct plant categories was possible through the use of a simple eliciting frame ("_____ _____*-vaqa 'gwaave vaiso*?" 'Are _____ and _____ the same?') and additional questioning when necessary. Responses were then cross-checked, as were all informants' statements regarding semantic relations among named folk taxa, through four basic substitution frames with further discussion as required (cf. Hays 1974:170-172)[5]:

F1. "*Mo* _____ *mo* _____*-ve vaise*?"
'Are there different kinds of _____?'

F2. "*Mo* _____ *mo* _____*-ve nutu qiane.*"
'Say the names of the different kinds of _____.'

F3. "_____ *'nraaqi 'naintave vaiso*?"
'What kind of thing is _____?'

F4. "_____ _____*-ve vaiso*?"
'Is _____ a kind of _____?'

Working with each of the ten informants separately, all of the more than fourteen hundred possible plant names were inserted into the substitution frames no matter how improbable the resulting query seemed (e.g., 'Is winged bean a kind of tree?'); the frames were used repeatedly in a continual updating of the tentative lexicon and cross-checking with each informant. By recording each term in a Master Term File together with informants' responses to each of the queries, a complete record was compiled, including, for each term, (1) its status as a label for a terminal or higher-level (named) folk taxon, (2) its membership (or not) in a more inclusive (named) taxon, and (3) the degree of agreement among my informants regarding that name.

This aspect of the field research formally resembled Gillian Sankoff's (1971) attempt to clarify the social organization of the Buang, another highland New Guinea people. She asked each of forty-two adult men to assign each of a total of forty-seven men (including himself in each case) to his proper *dgwa*, or 'descent group.' Informants sometimes varied in their assignments of the same individuals (1971:394), just as my informants sometimes varied in their assignments of named plant folk taxa to superordinate taxa, which is a large part of what the formal eliciting was asking them to do. Without reviewing Sankoff's stimulating analysis in detail, I note only that she could account for little of this variation in "sociolinguistic" terms, i.e., as a result of "variation in the immediate interaction [eliciting] situation" (1971:390). Rather, she adopted a "cognitive line of explanation," which "treats variation as resulting from a lack of congruence among speakers' individual cognitive models" (1971:390).

Given the controls I imposed on the eliciting sessions with my informants, namely, by presenting them with standardized, grammatical and semantically appropriate queries in the absence of other Ndumba, variability among their responses regarding the same plant names could not easily be attributed to, or explained by, interaction or sociolinguistic factors. Instead, I consider my informants' responses to reflect directly their variable "individual cognitive models" of the plant world, at least so far as these models are taxonomically structured and linguistically coded.

Individualized plant folk taxonomic models could be constructed which differ in their internal complexity and size for my ten informants, as is indicated in Table 2. The size of an individual's taxonomy is simply derived as in the table by subtracting the number of plant names which that person regards as synonyms for other plant names from his total lexicon, leaving the number of discrete named plant classes which he considers to exist.

Such a simple computation procedure cannot be used, however, to determine the size of a "Shared Folk Taxonomy" of plants. Among the 970 names in the "Shared Plant Name Lexicon" (see above), thirty-three may be considered "semantically ambiguous" in that, while all ten informants recognized the terms as legitimate plant names, they disagreed as to the taxonomic statuses of the plant classes so labeled. For example, all ten knew the name, *suvam''bara*, but for four of the informants (B, C, E, and I), the term labeled a distinctive kind of *sana* ('vine'), while the other six maintained that it was only an alternative name for *kwaa'sapara*, which all agreed was a kind of *sana* (cf. Hays 1974:416, 430-433). What is meant by "shared," then, in Table 2, is that all ten informants agreed as to the existence of 766 mutually exclusive and hierarchically ordered named classes of plants. Given the fact that all individual folk taxonomies are affected by the recognition of additional classes, however, perhaps the designation "Lowest Common Denominator Model" would be more appropriate.

A further problem in describing Ndumba ethnobotany in conventional terms is that it is impossible to construct a "Composite Folk Taxonomy" without entirely disregarding the fact of informants' disagreements. Thus, in Table 2, the size of such an abstraction

Table 2. Informant variability in plant folk taxonomy size.

Informant*	Number of Names Known	Synonyms	Number of Named Taxa
A	1040	205	835
B	1145	260	885
C	1162	279	883
D	1146	273	873
E	1141	257	884
F	1071	246	825
G	1111	263	848
H	1112	261	851
I	1129	271	858
J	1180	283	897
Mean	1123.7	259.8	863.9
Range	1040-1180	205-283	825-897
"Shared"	970	171	766
"Composite"	1247	Indet.	Indet.

*Informants A-E are males, F-J females, in order of ascending age.

must be considered indeterminable except that it would include at least 766 named taxa. The indeterminacy is due to the fact that disagreements regarding taxonomy are true contradictions and thus cannot be reconciled.[6]

It is interesting and important to note that with respect to the *content* of individual folk taxonomic models, variation occurs principally in the "middle" of the hierarchy. That is, all ten individuals' models include five taxa of the rank "life form" (cf. Berlin, et al. 1973) and two taxa of the rank "sub-variety," at, respectively, the highest and lowest taxonomic levels. The variability in taxonomy size is confined almost entirely to the ranks of "genus" and "species," as is shown in Table 3. Thus we might say that the informants do not significantly differ so much in the *structure* of their individual "cognitive maps," but only in their relative elaboration of the contents.

It is, of course, the "content" of plant knowledge, in the further sense of the referential meanings of plant names and the identification of empirical tokens of the folk taxa, which is most relevant to Ndumba as people. This aspect of his view of the plant world is what counts when a given individual wishes to know of which conceptual class a

Table 3. Informant variability in plant folk taxonomy size (by taxonomic rank).

Informant*	Life Form	Genus	Species	Variety	Sub-variety	Total
A	5	430	372	26	2	835
B	5	454	398	26	2	885
C	5	445	401	30	2	883
D	5	434	404	28	2	873
E	5	448	400	29	2	884
F	5	405	389	24	2	825
G	5	418	397	26	2	848
H	5	422	395	27	2	851
I	5	428	397	26	2	858
J	5	445	412	33	2	897
Mean	5	432.9	396.5	27.5	2	863.9
Range	5	405-454	372-412	24-33	2	825-897
"Shared"	5	385	350	24	2	766
"Composite"	5	Indet.	Indet.	Indet.	2	Indet.

*Informants A-E are males, F-J females, in order of ascending age.

particular plant is a member so that he will know what, if anything, to do with it. Thus it becomes important, and of primary significance to the present inquiry, to consider data regarding informants' plant naming responses. Here, as elsewhere, considerable variation and disagreement occurred which would require explicit attention in a description of Ndumba ethnobotany. The more limited goals of this discussion, however, are to indicate broadly the extent of this diversity and to propose a method by which it can be used to expand our understanding of the plant world as Ndumba conceptually order it through the discovery of plant groupings which are not linguistically labeled, i.e., "covert categories."

variable plant naming responses as a guide to covert taxa

One of the most important methodological advances in ethnosystematics research was marked by the paper on "Covert Categories and Folk Taxonomies" by Berlin, Breedlove, and Raven (1968). There they persuasively documented the existence of unlabeled taxa in the Tzeltal folk classification of plants, the incorporation of which subsequently resulted in substantially richer and more complete descriptions than had previously been possible (Berlin, et al. 1974; cf. Hunn 1973, 1975b for Tzeltal folk zoology).

Furthermore, Berlin, et al. supported their documentation with a clear, nonintuitive procedure for discovering covert (i.e., unnamed) categories through informants' performances of slip-sorting tasks in which

> the names of the immediately included taxa of each major class name, written on slips of paper, were presented to informants with instructions to read through the lists and place in separate piles those names which applied to plants that were judged to be similar to one another (1968:293).

This technique, together with observational data and informants' comments on plants in natural contexts, yielded confident identification of at least eighty-eight unnamed Tzeltal plant "complexes" (Berlin, et al. 1974; cf. Hunn 1975b:25 for forty postulated animal "covert complexes").

Despite this important advance in technique, however, no one working outside of the Tzeltal region has yet published extensive data on unlabeled taxa in other ethnobiological systems. Brown's recent criticisms of slip-sorting notwithstanding (1974; cf. Berlin 1974b for rebuttal), it is surely not the case that unnamed groupings of organisms are absent elsewhere. In Ndumba, informants often volunteered statements, as they reportedly do in Tzeltal, that plants A, B, and C "go together" or "are brothers" (cf. Berlin, et al. 1968:298, n4; Hunn 1975b:24), but they lack any inclusive name except at the very highest taxonomic rank of life form (e.g., *sa'tari*, 'trees and shrubs').

My problem and, I suspect, that of many researchers who would like to use the powerful slip-sorting technique lies in its inherent restriction, namely, that informants must be at least semiliterate. In fact, Berlin and his colleagues themselves stated:

> It is assumed, of course, that the informant can read and write his native language with relative ease. Much of the most productive work in ethnoscience depends, in fact, on the use of literate informants (1968:298, n5).

What, then, of those of us whose informants are not literate? Presented as I was in Ndumba with a folk taxon like *sa'tari*, which immediately includes from 208 to 233 named folk generic taxa (the exact number depending on the informant), are we necessarily limited to this degree of complexity in our descriptions, or can internal conceptual subdivisions be reasonably postulated without the use of techniques which require literacy on the part of our informants? Unless the lack of *named* "midlevel

groupings," which "probably represents a feature universal to all folk ethnobiological taxonomies" (Berlin, et al. 1974:36), is to be considered sufficient evidence for the absence of conceptual groupings other than those which are named (with the Tzeltal being an extraordinary or even unique case), less restricted methods for the discovery of covert categories must be devised.

I wish to outline here an approach which appears to offer at least a partial solution to the problem. Briefly put, I suggest that not only the existence but also the partial contents of at least some covert categories can be inferred from patterns of variation in informants' plant naming responses. Only preliminary analyses have been conducted so far on my Ndumba material, but these are sufficient for illustrative purposes.

To determine the referential meanings of plant and animal names, kinship terms, and other vernacular expressions, ethnographers at some point ask informants to perform naming tasks. In the present case, over a period of fourteen months I presented 517 freshly collected plant specimens to my ten informants and asked them, separately, to provide the most specific names they could. Since my primary objective was to ascertain the nature and degree of individual variation in plant knowledge, each informant was kept ignorant of the others' performances (see Hays 1974:179-192 for details on collecting and naming procedures).

Informants frequently differed from each other in their responses, as is illustrated by an example shown in Table 4. Some of the variation can be explained as a function of synonymy, which is a common feature of Ndumba plant and animal nomenclature. In the example, *kwaipa'saasira* is, for all ten informants, an alternative name for *ki'saasa*, as is *qora'faanresa* ('mountain *faa'nresa*') for *faanresa tuana'nraanra* ('true *faanresa*'). Thus, while informants B, D, E, F, I, and J assigned either of two different names to Collection 356, they agreed as to its category membership. In the lower portion of Table 4, then, I have standardized the responses, clarifying in the process at least some of the apparent informant disagreement, in this case reducing the variation from six *linguistically* distinct responses to five *conceptually* distinct responses.

Even adjusting for synonymy, however, leaves considerable variation unaccounted for; in this case there were still five different naming, thus classificatory, responses to the

Table 4. Example of plant naming response variability.

Collection	Plant Name	Informant
356	*faa'nresa*	A
(*Riedelia* sp.)	*ki'ringga*	G
	ki'saasa	B D I
	kwaipa'saasira	EF J
	qora'faanresa	H
	paata'faanresa	C
	(Adjusted for Synonymy)	
	**faanresa*$_2$	H
	**faanresa*$_r$	A
	ki'ringgd	G
	ki'saasa	B DEF IJ
	paata'faanresa	C

*The subscript *2* signifies the "type specific" *faanresa tuana'nraanra* ('true *faanresa*'); subscript *r* signifies the "residual" category within the folk genus *faa'nresa*, i.e., a category which includes all *faa'nresa* which are considered as distinct from any named folk species but which themselves have no distinctive names.

same plant by the ten informants. Indeed, as is shown in Table 5, the majority (73.7 percent) of the plant collections evoked two or more conceptually distinct naming responses (see Hays 1974:435-493 for complete data). Response variability is illustrated further in Table 6, where I present the names applied to all eleven collections of plants of the botanical genus *Riedelia* (in the family Zingiberaceae, or the "ginger" family). How might this variation be explained?

Table 5. Variable frequency of conceptually distinct naming responses.

Number of Nonsynonymous Naming Responses	Number of Plant Collections	Percent of Total
1	136	26.3
2	87	16.8
3	83	16.1
4	88	17.0
5	54	10.4
6	43	8.3
7	18	3.5
8	6	1.2
9	2	0.4
10	0	0.0
Total	517	100.0

A striking feature of the variation in Table 6 provides a clue which leads to a solution in Ndumba folk taxonomics. Inspection of the 110 naming responses to the *Riedelia* collections reveals that amidst the variation there is a discernible pattern, namely, that a limited number of fifteen responses co-occurred in varying combinations, with regard to any one collection or any one informant: *qaa'saura, faahifaan'daura, faanra'vesa, faa'nresa, faanresa*$_2$, *faanresa*$_r$, *fekwa'so'vainranra, kaare'vora, ki'ringga, ki'saasa, mmondira, paata'faanresa, punranra, roro'mmunra*, and *tonggaqa*. If I may be allowed to "climb inside my informants' heads" metaphorically for a moment, it is as if, presented with an example of *Riedelia*, the pertinent question was not, "Which of all possible 1,100 or so plant names applies to this?" but rather, "Which of a small subset of plant names applies to this?" In other words, having decided initially that it was one of the relatively few possible plants, which *of these* was it?

Presumably, folk taxa could readily serve as such subsets, constituting as they do conceptual groupings of plants judged by some criteria to be similar to each other. In Figure 1, I present the immediately relevant portions of a taxonomic model which can be imputed, at least for heuristic purposes, to all ten informants (cf. Hays 1974:392-396). That is, they would all agree with any propositions regarding set contrast and set inclusion implied by the model.

Directing attention to the named taxon, *faa'nresa*, a folk genus within the life form *mauna* ('herbaceous plants'), the variation in responses to seven of the eleven *Riedelia* collections (023, 087, 283, 284, 339, 346, and 356) can be seen as clearly patterned in that at the folk generic level there was *no* informant disagreement; all classified the plants as *faa'nresa* rather than some other folk genus of *mauna*. The disagreements had to do with just which kind of *faa'nresa* was represented in each case. A comparable example from American folk botany might be a situation where some informants called a tree a *white maple*, others a *sugar maple*, still others a *red maple*, all agreeing that it was, in any event, a *maple* and not, say an *oak*.[7]

Table 6. Naming responses to collections of *Riedelia* spp. (adjusted for synonymy).

Collection	Plant Name	Informants
023 (*Riedelia* sp.)	*faa'nresa*	A CD F H
	ki'saasa	B E G I
	mmondira	J
	* * *	
087 (*Riedelia* sp.)	*faa'nresa*	FGHI
	faanresa$_2$	B
	ki'saasa	CDE J
	paata'faanresa	A
	* * *	
088 (*Riedelia* sp.)	*faahifaan'daura*	J
	faa'nresa	H
	kaare'vora	I
	ki'ringga	B
	ki'saasa	A CDEFG
	* * *	
091 (*Riedelia monticola*)	*kaare'vora*	E
	ki'ringga	ABCD FGHI
	tonggaqa	J
	* * *	
283 (*Riedelia* sp.)	*fekwa'so'vainranra*	H J
	ki'ringga	ABCD FG I
	ki'saasa	E
	* * *	
284 (*Riedelia* sp.)	*fekwa'so'vainranra*	BCD
	kaare'vora	E
	ki'ringga	A FGHI
	ki'saasa	J
	* * *	
285 (*Riedelia* cf. *geluensis*)	*qaa'saura*	B
	fekwa'so'vaniranra	F
	ki'ringga	I
	ki'saasa	DE G J
	paata'faanresa	A C
	roro'mmunra	H
	* * *	
291 (*Riedelia hollandiae*)	*faanra'vesa*	B
	fekwa'so'vainranra	A
	ki'ringga	J
	punranra	CD F
	tonggaqa	E GHI
	* * *	
339 (*Riedelia* sp.)	*faanresa*$_r$	E
	fekwa'so'vainranra	B H J
	ki'ringga	A CD FG I
	* * *	
346 (*Riedelia* sp.)	*faanresa*$_r$	B
	fekwa'so'vainranra	J
	kaare'vora	D
	ki'ringga	A C FGH
	ki'saasa	E
	mmondira	I
	* * *	

Table 6 (*cont'd*)

356	*faanresa*$_2$	H
(*Riedelia* sp.)	*faanresa*$_r$	A
	ki'ringga	G
	ki'saasa	B DEF IJ
	paata'faanresa	C

Why informants did not agree in their identifications at the more specific level, which indicates that their "shared" taxa are not identical in their signification, is an important question, but beyond the scope of this paper. The main point for present purposes is that the variable naming responses might lead one to predict, on the basis of these repeated co-occurrences, just such a conceptual grouping as is in fact represented by the folk generic taxon labeled *faa'nresa*. Conversely, knowledge of the taxa included in *faa'nresa* could lead one to predict that variation in naming responses would follow a pattern imposed by an initial decision that plant *x* was classifiable as *faa'nresa*. Put another way, if one informant classified a given plant as *faanresa tuana'nraanra*, then another informant (or the same informant on another occasion) might be expected either to give it the same name or *fekwa'so'vainranra, kaare'vora*, or one of the others from the same set.

This argument is similar to that of Frank Cancian's (1963), in which he showed that informants' variable placements—or "informant errors" as he called them—of individuals

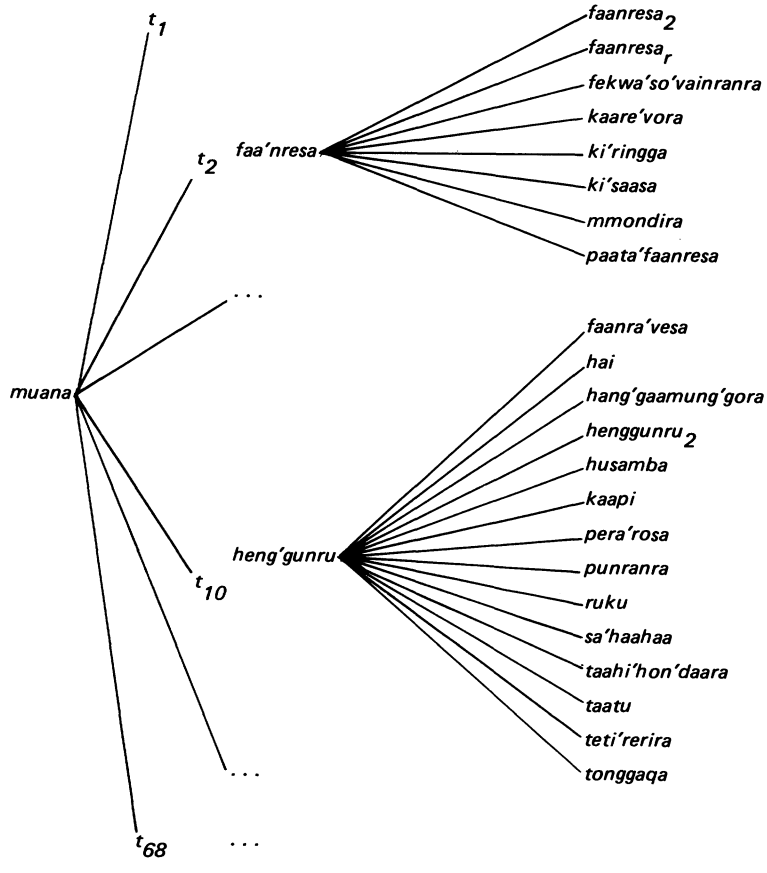


Figure 1. Portion of "shared folk taxonomy."

in the Zinacantan cargo system did not indicate random guesses. Rather, they were patterned in a way that closely resembled the actual or "correct" positions of the individuals in that system. The kinds of errors made were constrained, just as in our case an "erroneous" identification of a certain kind of *faa'nresa* would still be made along a limited set of alternative possibilities (cf. Sankoff 1971 for a similar analysis of "wrong" assignments of Buang individuals and land plots to descent groups).

There remain four collections of *Riedelia* in which the naming response variation cannot be accounted for so simply; these four cases, however, provide good examples for the argument I propose for the discovery of covert categories. In Collection 088, all names but one label various folk species of *faa'nresa*; the exception is *faahifaan'daura*, which all informants agreed was a folk genus of *sa'tari* ('trees and shrubs'). In Collection 285, again there is only one non-*faa'nresa* name, *roro'mmunra*, a name which was known by only three informants (H, I, and J) and considered by them to label a folk genus of *mauna*; the other name which appears in this response set, *qaa'saura*, was a kind of *faa'nresa* for all informants except A, who did not know the name. In these two cases, then, there was informant disagreement at a higher level of classification than previously, namely, at the folk generic rank. It should be noted, however, that in these two cases the problematic names were given by single informants and may not support the argument below as strongly as do the final two cases.

In Collections 091 and 291, again there was disagreement at the level of folk genera. In these instances, however, we can see from Figure 1 that when informants chose to identify the plants as something other than *faa'nresa*, they chose from a comparable subset within *mauna*, namely, from the folk genus called *heng'gunru* (specifically choosing *faanra'vesa*, *punranra*, or *tonggaqa*).

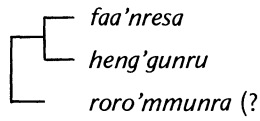
Converting all 110 naming responses to taxonomic assignments at the same rank, that of the folk genus, we find, then, that only four named classes of plants (out of at least 766 possibilities if random guessing were involved; cf. Table 2 above) are involved, a considerable reduction from the earlier apparent diversity.

Briefly summarizing the eleven sets of naming responses to collections of *Riedelia* spp., we find that in seven of the sets the co-occurring names form a grouping of eight which precisely matches the group of taxa which are included in the folk genus *faa'nresa*. Thus the variation reflects informant disagreement at one level, that of the folk specific rank, but agreement at the more inclusive folk generic rank. Converting the naming responses in the other four sets to their appropriate folk generic names, we find four co-occurring names: *faahifaan'daura*, *faa'nresa*, *heng'gunru*, and *roro'mmunra*. This grouping, however, does not appear in the "shared" folk taxonomic model; in fact, one of the names, *faahifaan'daura*, labels a taxon which is included in a different life form taxon (*sa'tari*) than are the other three (all being folk genera within *mauna*). Thus, while some plant name co-occurrences are understandable with reference to the folk taxonomic system, the others seem problematic.

All that may be required to account for these cases, however, is to postulate a conceptual grouping of these four plant folk taxa, albeit one that is not linguistically labeled and thus is not a part of the folk taxonomic model so far constructed. In other words, we could propose a covert taxon, consisting of (at least) four folk genera; or, given the "crossing of life form lines" in the case of *faahifaan'daura* (a genuine "informant error"?), we might more cautiously propose a covert taxon which includes (at least) *faa'nresa*, *heng'gunru*, and *roro'mmunra*. To be even more conservative, we might wish to delete or otherwise indicate uncertainty regarding *roro'mmunra*, since it only co-occurred as a naming response once with *faa'nresa* and never with *heng'gunru*, while *faa'nresa* and

heng'gunru co-occurred in six different naming response sets (including four collections of plants other than *Riedelia* spp.).

Using dendritic diagrams to indicate the variable closeness of the relationship postulated (cf. Berlin, et al. 1974:157), we may thus propose a "*faa'nresa* complex" consisting of



This proposed method of inferring covert categories on the basis of repeated co-occurrences of nonsynonymous plant names may be illustrated perhaps more clearly by briefly examining an additional example. I have chosen the five sets of naming responses to my collections of *Saurauia* spp. (a genus of tropical and subtropical trees and shrubs, several species of which are common in Ndumba territory) since they evoked naming responses which designate folk taxa of only one rank (the folk generic) and thus are somewhat "neater" than those in the previous example.[8]

In Table 7 it can be seen that among forty-nine responses (one informant was absent from one of the naming sessions), again there was variation, but again it involved only a small number (four) of plant names: *fo'vasara*, *hori'ori*, *tondaam'bu*, and *tu'raatura*. This time, however, none of the variation can be accounted for by synonymy; informants insisted that the four names label different trees and could not be used interchangeably.

Table 7. Naming responses to collections of *Saurauia* spp.

Collection	Plant Name	Informants
125 (*Saurauia* sp.)	*hori'ori*	ABCDEFGHIJ
	* * *	
294 (*Saurauia* cf. *conferta*)	*hori'ori*	J
	tondaam'bu	ABCDEFGHI
	* * *	
313 (*Saurauia* sp.)	*tondaam'bu*	D
	tu'raatura	ABC EFGH-J
	* * *	
439 (*Saurauia* sp.)	*hori'ori*	B E G J
	tondaam'bu	CD F I
	tu'raatura	A H
	* * *	
502 (*Saurauia* sp.)	*fo'vasara*	ABCDEF HIJ
	tu'raatura	G

Moreover, the relevant portion of the "shared" folk taxonomic model provided in Figure 2 shows that there is no named taxon comparable to *faa'nresa* which includes the four genera in question. Only at the very highest named taxonomic rank (the life form *sa'tari*) are all four included in a named taxon, as are 194 other folk genera (cf. Hays 1974:401-408). Unlike the case of *faa'nresa*, knowledge of the folk taxa included in *sa'tari* would not lead one to predict that these four particular names would repeatedly co-occur in informants' plant identifications since they form no subset—at least no *named* subset—of *sa'tari*.

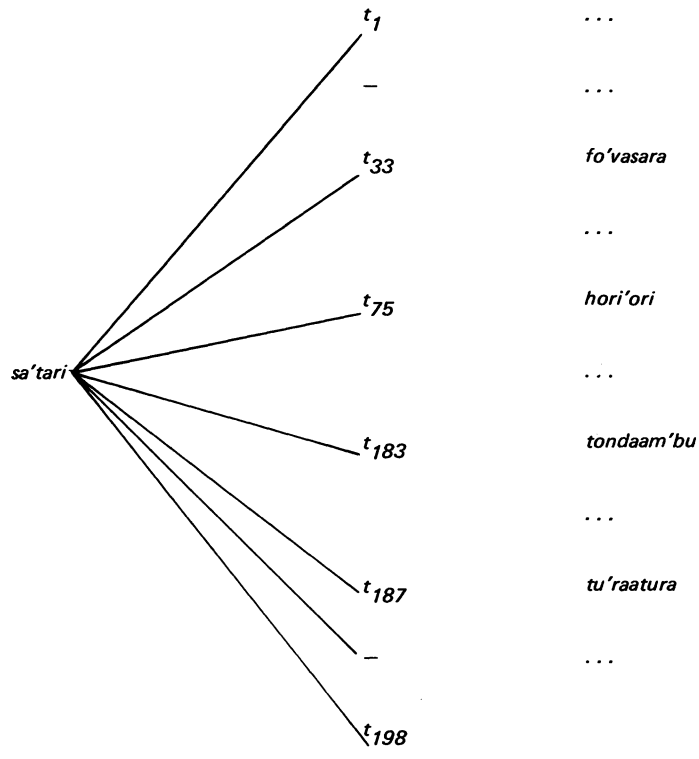


Figure 2. Portion of "shared folk taxonomy."

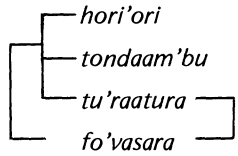
Again it seems reasonable to postulate that *fo'vasara* and the other folk genera do constitute a legitimate conceptual grouping that does not happen to be named. If we propose a covert catetory within *sa'tari* at the suprageneric rank which includes these four named taxa, the variable naming responses to the *Saurauia* collections are understandable in the same way as were the responses to the *Riedelia* spp.

Again we could refine our hypothesized grouping by assigning varying degrees of confidence to different combinations of the four taxa. Examining all 517 sets of naming responses we find variable frequency of occurrence of the six mutually exclusive pairs of names which can be formed from the four names, as is shown in Table 8. There it can be seen that while all four names never co-occurred in a single set, at least three of the paired occurences were not isolated instances, and one can imagine that some sort of "chaining" effect links these four taxa together in a way which could not be predicted solely on the

Table 8. Frequency of plant name pair occurrences (partial list).

Plant Name Pair	Number of Occurrences
fo'vasara – hori'ori	0
fo'vasara – tondaam'bu	0
fo'vasara–tu'raatura	2
hori'ori–tondaam'bu	2
hori'ori–tu'raatura	1
tondaam'bu–tu'raatura	2

basis of knowing that they were four of 198 taxa which are included in a single superordinate taxon, *sa'tari* (see Hays 1974:151-152 and Hunn 1973:115-116 for discussions of "chaining"). Thus we might propose a "*hori'ori* complex" as follows:



The general logic of the method I am proposing should by now be clear, irrespective of any ultimate validity regarding the two illustrative examples. Assuming that my informants perceive their world and conceptualize it according to similar, though not identical, information-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, whether by several informants when presented with a particular plant to identify or by the same informant when presented with the "same" (or a very closely related) plant on different occasions. 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 or complex.

I have not so far performed comprehensive analyses of my field materials along these lines, and an attempt to provide a full treatment of Ndumba covert categories is, in any case, beyond the scope of this paper.[9] However, some preliminary partial explorations may be usefully reported to demonstrate further some of the possibilities of the proposed method.

Of the 517 plant collections made, 136 (26.3 percent) evoked only a single naming response from my ten informants (cf. Table 5 above). Excluding phonological variants, 652 lexically distinct expressions occurred among a total of 5,104 responses (the sixty-six missing responses reflecting informants' absences from naming sessions). Of these 652 expressions, fifty were later identified as descriptive phrases, leaving 602 plant names which occurred, ninety-eight of which were reported synonyms. Thus the 517 plants evoked a total of 504 conceptually distinct naming responses, i.e., names which designated mutually exclusive plant folk taxa.

Confining our attention to the 381 plants which evoked two or more conceptually distinct responses, 105 of these response sets involved informant disagreement of two types which are not of concern here: (1) those which included only a single folk generic name and a life form name (e.g., *faa'nresa* and *mauna*), and (2) those which included only folk specific and/or folk varietal names (e.g., *ki'ringga* and *ki'saasa*). Thus we are left with 276 naming response sets which included two or more folk generic names, once folk specific names are converted to their appropriate folk generics.

Inspecting these response sets, all discrete *pairs* of names were recorded and the number of sets in which they occurred as pairs, disregarding triads and other combinations of names for present purposes. A total of 163 pairs of names were found to occur in two or more sets; e.g., the pair *faa'nresa-kwaza'kwaza* occurred twice,

faa'nresa-heng'gunru six times.[10] Table 9 provides a breakdown of the relative frequency of occurrence of name pairs; e.g., 106 pairs occurred only twice, twenty-five pairs occurred three times.

Table 9. Relative frequency of plant name pair occurrences.

Frequency of Occurrence	Number of Name Pairs
2	106
3	25
4	10
5	8
6	6
7	3
8	3
9	1
10	0
11	0
12	0
13	0
14	0
15	1
Total	163

Basing our degree of confidence on the frequency of occurrence of a pair of names we might propose that the folk genera named *ho'tera* and *kwaza'kwaza* constitute a covert folk category, or at least are two members of such a category, since my informants considered fifteen plant collections as tokens of either one or the other. The single instance of a pair of plant names (*hai* and *kaam'bi*) which occurred nine times provides a second likely covert category, proposed with only slightly less confidence. Thus we have a "*ho'tera* complex" and a "*hai* complex":

ho'tera
kwaza'kwaza

hai
kaam'bi

In principle we could proceed in this way and ultimately propose as many as 163 (at least partial) covert categories or complexes. Of course, while only pairs of names have been considered above, we could hypothesize larger groupings through the merging of name pairs which share common members. For example, the names *kim'buenranra* and *naam'bufua'raara* co-occurred in seven response sets, *kim'buenranra* and *simmaa'nru* in five sets, and *naam'bufua'raara* and *simmaa'nru* in five. Thus we might arrive at a "*kim'buenranra* complex" consisting of (at least) three folk genera:

kim'buenranra
naam'bufua'raara
simmaa'nru

conclusion

While the logic underlying the method I have outlined seems defensible, additional evidence for the hypothesized covert categories (complexes) would be useful and perhaps necessary in assessing its validity. I have earlier mentioned the fact that informants sometimes volunteered statements to the effect that certain named plant classes "are

brothers" or otherwise discussed plants with me in such ways that I have no reason to doubt that unnamed groupings in fact exist.

Various kinds of supplemental evidence may be cited, e.g., with regard to the tentative "*ho'tera* complex" proposed above. Nearly every plant identified as *ho'tera* or *kwaza'kwaza* was a member of the botanical family Orchidaceae; conversely, nearly every orchid collected was considered to represent either one or the other folk genus. Thus, as in the cases of the botanical genera, *Riedelia* and *Saurauia*, used in earlier illustrative discussions, an empirical basis can be seen for a joining of the two folk genera based on perceivable morphological characteristics.[11]

The folk taxonomic treatment of the category named *naa'roruqauqa* is also illuminating. The name occurred as a response to fifteen different plant collections, all of which were orchids (Hays 1974:530). For Informants A, C, D, E, F, G, I, and J, *naa'roruqauqa* is a folk species of *ho'tera* while for Informants B and H it is a species of *kwaza'kwaza* (Hays 1974:431). When I happened to ask Informant A how, without reference to particular individuals, people could disagree about *ho'tera* and *kwaza'kwaza*, he responded, "*qio 'mia 'fotiziovaqa 'hiva 'moqanrasina*," i.e., 'They are nearly the same, but different.'

Thus in this case, and doubtless others as well, evidence may be found to test the validity of the covert categories tentatively proposed by the method I have described. Additional relevant data may be obtained, although they are not complete enough for Ndumba at present, even when the conventional slip-sorting task cannot be adequately administered.[12] On the whole, *if the results are viewed as suggestive rather than final*, I am confident that the method can be a tool of general utility, compensating in some cases for the inability to employ other techniques, supplementing those where that is possible. Surely no single procedure can be relied upon completely, whether the one described above or some other, in the very difficult task of inferring cognitive structures and phenomena by necessarily indirect means. The method proposed must pass tests of validity and adequacy which have only been partly considered here.

One important implication of the above attempt concerns the importance, only recently receiving proper consideration, of sensitivity and explicit attention to the undeniable fact of "intra-cultural" variation. Cultural transmission, in Ndumba as everywhere, is too contingent and imprecise to result in a "shared culture" in any simple sense. This is not to say, however, that "shared" and "composite" models of culture are invalid when their limitations are recognized. Indeed, both kinds of model have been employed in constructing the argument here, and the covert categories toward which I have been working could, given the nature of the data used in their elucidation, only be considered as parts of a composite model. What I am stressing is that ethnographers have for too long considered informants' disagreements and variable behavior as a source of frustration, inevitable but regrettable, in their search for "authoritative" informants who will reveal *the* culture.

The method I have proposed seizes upon, indeed it depends on, the fact of variation. Viewing my informants' statements and performances as representations of unique "cognitive maps" which nevertheless follow patterns which allow Ndumba society to persist, I have provided an example of how by "looking at tendencies which appear in the grouping of these representations. . .we can make certain inferences about the ways in which the individual models underlying these representations tend to differ, and, perhaps even more importantly, the ways in which they are the same" (Sankoff 1971:406).

In such ways as that offered here, "informant error, which is usually a hindrance to the ethnographer, becomes an invaluable aid" (Cancian 1963:1073). It becomes an

invaluable aid with respect to the particular problem at hand, although others can doubtless improve on the method itself. Such improvements will benefit us all in understanding the nature of folk taxonomic systems, and in understanding the nature of "errors," whether those made by our informants or those made by ourselves.

notes

[1]The method proposed here was first outlined in a paper read in the symposium, Folk Systems of Biological Classification, at the 72nd Annual Meeting of the American Anthropological Association, New Orleans, 1973. I am indebted to my wife, Patricia, Gene Hunn, and Shelly Rosaldo for their helpful comments on that paper.

[2]The field research from July 1971 to October 1972, reported here, was supported by a National Institutes of Health Pre-Doctoral Fellowship; this support is gratefully acknowledged.

[3]All figures given here are based on analyses and some additional data which were not included in my doctoral dissertation (Hays 1974). The earlier reported figures are superseded by these.

[4]The Ndumba unnamed grouping of organisms which I here refer to as "plants" is very similar to the Western category. It includes five life forms: *mauna* ('herbaceous plants'), *muso* ('grasses, sedges and rushes'), *sana* ('vines'), *sa'tari* ('trees and shrubs'), and *foringa* ('lichens and mosses'); most fungi are excluded.

[5]Invaluable assistance in constructing eliciting frames and solving innumerable linguistic and logistics problems was generously given by Alex and Lois Vincent, a Summer Institute of Linguistics translation team resident in the Tairora region for more than ten years. They can never be thanked sufficiently.

[6]One solution, of course, would be to regard some informants' opinions on such matters as "authoritative" and choose these, but this rather Orwellian approach to the notion of "culture-bearers" is contrary to the meaning of "composite" and would further obscure the significance, as well as the fact, of diversity.

[7]The pattern would be even clearer if the binomial forms of plant names were shown here, e.g., *ki'saasa 'faanresa*. Binomialization is culturally permissible for nearly all Ndumba plant names but is uncommon except when used for emphasis; in a few cases (e.g., *qora'faanresa* and "type specifics") it is obligatory.

[8]The two illustrative examples employ naming sets for collections of closely related plants from the standpoint of Western botany. The Western groupings represented by the *Riedelia* and *Saurauia* genera do not precisely match Ndumba groupings, either overt or covert, but it is clear that the similarities are sufficient to warrant further exploration of the possibility that there exists a "culture-free" basis for taxonomic groupings. The matter is too important to deal with adequately here, but Berlin (1974a) and Hunn (1975a) have recently offered excellent discussions of the issue.

[9]Indeed, such an attempt would require more complete data than I currently possess, especially considering the relatively small number of plant collections made from a biota of staggering complexity and profusion. However, given the fact that I collected a virtually random sample of plants from each major and minor vegetation community, I am confident that my total collections are a reasonably representative sample of the flora, at least in terms of Western botany.

[10]To say that a pair of names occurred in a given response set does not imply that no other names occurred in that set; this was true in ninety (32.6 percent) of the 276 sets.

[11]Brown (1974) has recently suggested that putative covert categories, as in the Tzeltal case, really represent groupings based on functional similarities, i.e., similarities in the uses of the plants, rather than taxonomic (by which he means morphological) relationships. Berlin (1974b) strongly doubts this for the Tzeltal, and Ndumba categories, whether overt or covert, do not usually consist of plant classes which are functionally the same, with cultivated plant groupings being major exceptions.

[12]In fact, during the course of the field research Informant A became sufficiently literate to perform some slip-sorting tasks. However, the results of his performances are inadequate in three ways to fully test the validity of the categories yielded by the proposed method. First, with regard to many of the suggested categories his personal knowledge of plants was insufficiently complete, because he has the smallest plant name lexicon and the second smallest folk taxonomy of all of my informants (cf. Tables 1 and 2). Second, on numerous occasions he offered two or more alternative sortings of the slips, each based on a different morphological feature of the plants in question; his sortings, then, could not be considered sufficiently stable to serve as a standard with which the proposed groupings could be compared. Finally, the categories produced by my method can, because of the way in which they were derived, only be imputed to a "composite model" of the Ndumba plant world. As such, they cannot be expected, or assumed, to match the contents of an individual's model, a point which is clear from the earlier discussion (especially that concerning the data presented in Tables 1 and 2).

A comparison of the proposed categories with Informant A's slip-sort groupings will, however, be extremely useful in suggesting points for investigation in future field research.

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