

# **Mushrooms in Forests and Woodlands**

## **Resource Management, Values and Local Livelihoods**

*Edited by*

*Anthony B. Cunningham and Xuefei Yang*

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# **A Primer on Ethnobiological Methods for Ethnomycological Research: Studying Folk Biological Classification Systems**

*Eglée L. Zent and Stanford Zent*

## **INTRODUCTION**

Ethnomycology is part of a broader discipline, ethnobiology, which is dedicated to the study of the dynamic relationships among people, biota and environments. Yet the distinctive local knowledge systems, practices and uses of the fungi kingdom by human populations to date make up a tiny portion of the total subject matter of ethnobiological research performed worldwide. Fungi are fascinating bioforms that provoke diverse, and sometimes starkly opposed, reactions among different peoples. Viewpoints oscillate between use and avoidance, food and poison, mundane and ritual, divine and demonic, beautiful and hideous creatures. Considering the extreme variation in the types of material and in the symbolic interactions between human cultural groups and fungal taxa, it would seem that this subject offers a potentially rich and largely untapped opportunity for future scientific investigation. Furthermore, the proliferation of well-designed, in-depth studies of human–fungi relationships could make a substantial contribution, at both empirical and theoretical levels, to the continuing development of ethnobiology as a whole. It is suggested here that many field methods currently used in ethnobiology are relevant for ethnomycological research and the realization of this potential application could have an invigorating effect on the development of the subfield.

Ethnobiology may well be regarded as an interdisciplinary field, the unique development of which has been shaped by a creative mix of philosophies of knowledge, theoretical positions and research strategies borrowed from different scientific disciplines. The list of affiliated disciplines that have directly influenced lines of ethnobiological research includes cultural anthropology, archaeology, linguistics, cognitive psychology, geography, systematics, population biology, ecology, conservation biology, pharmacology, nutrition, economics and ethics. Therefore, becoming familiar with the basic concepts and methods of these disciplines is an important ingredient in preparation and planning for ethnobiological research. The proper selection of a specific methodological package depends upon individual research aims and priorities,

whether cognitive, economic, religious, aesthetic, practice-oriented or otherwise. In this and the following chapter (Chapter 4) we suggest a broad variety of field methods derived mainly from ethnobiology and its affiliated disciplines, most of which have had little impact on ethnomycological research to date. One of our objectives is to stimulate prospective ethnomycological researchers to try out some of the methods described here in their future investigations of human–fungi interactions.

This chapter focuses on cognitive techniques for studying folk biological classification systems. Many of the methods discussed here were developed as part of the ethnoscientific approach to cultural description and were modified over the years to fit the circumstances of ethnobiological research. As a way of practising ethnography, ethnoscience puts an emphasis on the study of a given society's folk classifications – the particular ways of classifying its material and social universe – with the goal of representing accurately the native's point of view (Sturtevant, 1964). A hallmark of the ethnoscientific method is the use of explicit, systematic and replicable techniques for data collection and analysis (Metzger and Williams, 1966). While local language and terminological systems are treated as a primary source of data, this method also encompasses the documentation of physical objects and people's activities to the extent they shed light on classificatory behaviour (Kay, 1970; see also this chapter, section 'Two modes of inquiry: verbal and behavioural'). According to Warren (1997), the most recent phase of ethnoscience involves the study of indigenous knowledge systems, in particular the careful documentation of community-based classifications of natural resources and associated management practices, in support of facilitating sustainable approaches to development. In the following sections, we describe a number of concepts and procedures that have been developed to record and interpret different aspects of folk biological classification systems, including: (a) the local nomenclature; (b) the perceptual recognition of named entities; (c) the taxonomic classification of perceptually-distinguished groups of natural organisms; and (d) alternative forms of categorization. Before turning to specific methods, however, we discuss several general considerations about conducting fieldwork with people from another culture in general and ethnobiological research in particular.

## **GENERAL CONSIDERATIONS OF A RESEARCH PROJECT**

### **Concept and design**

Before starting the research project, the researcher(s) must secure the free and informed consent of the people with whom the study will be carried out, as well as any legal permits required at local, provincial, national and international levels. The agreements made with the community can be accomplished in different ways, such as through consultation with community representatives (e.g. leaders) or public assemblies, written or oral – in line with local customs and protocols (Alexiades, 1996; Cunningham, 1996; Laird, 2002; Bannister and Barrett, 2004; Berlin and Berlin, 2004). Likewise, before initiating any systematic data collection it is a good idea to get to

know some members of the community (Martin, 1995:103). Social contact and friendly dialogue are foundations for building a compatible long-term relationship. Ideally, local people should be consulted in regards to the concept and design of the research project, and encouraged to take an active part in data collection, processing and analysis. If any scientific or popular intellectual product, such as a written publication or audiovisual recording, arises, then proper credit or authorship must be given to the local participants. If the project is potentially capable of generating any kind of material benefits (e.g. royalties), the local community/ies, organizations and/or key informants must be included as beneficiaries in accordance with the wishes of the affected members.

## Understanding contexts

Field research with human subjects has been characterized as a scientific activity that embraces two fundamental intellectual pursuits, the *sophy* and the *logos*. The first, *sophos*, ‘discovers wisdom of human life, while the second, *logos* is aimed at logical structuring of knowledge’ (Tinyakova, 2007:601). We qualify ethnographic fieldwork as an integrative endeavour that comprises a family of methods for relating scientific knowledge and extra-scientific forms of experience and practice. The so-called holistic approach to culture refers precisely to the investigation and integration of the different parts that make up the whole (Pelto and Pelto, 1978).

A holistic approach to analysing the interactions between people and fungi should begin with an understanding of the interwoven contexts. These multiple contexts can be grouped in two macro-levels:

### *Study site*

Investigate as completely as possible the biocultural setting where the interactions take place. This includes:

- the biophysical habitat (climate, seasons, natural disasters, elevation, topography, geological substrate, soil classes, vegetation and fauna);
- the people (population size and distribution, language(s), ethnic affiliation(s), history of human occupation, migrations, settlement pattern, productive activities, trade, dietary habits, health situation, political system, socioeconomic composition, kinship and marriage, land tenure, magico-religious beliefs, ritual practices, moral dimensions);
- the human impact on the area (transportation infrastructure, man-made disasters, colonization, development projects, anthropogenic modification of habitat features, and conservation policies – such as the size and types of protected areas).

### *Research project*

Understanding the multiple contexts should proceed in parallel with the data collection in the field. Contextualizing the research settings and dynamics is an ongoing and to some extent an endless task. Be aware of the particular position, background, motive

and bias of the research team and how such ‘cultural filters’ can influence the research results. Factors such as nationality, gender, education, local language proficiency, age, political views, familiarity with the locality, etc. on the part of the data collector(s) may affect significantly the quantity and quality of the information provided by local people. Of particular importance in this regard is the academic training and experience of the researcher(s). One of the keys to success in ethnobiological research is being able to build transdisciplinary bridges in theory, methodology and epistemology. Thus collaboration with specialists outside one’s primary field or team projects may be necessary.

In brief, contextualization is essential to adequately comprehend and interpret the complex interactions between humans and fungi from different perspectives: both synchronic (studies at one particular time, without considering the background history) and diachronic (studies over longer time periods).

## **TWO MODES OF INQUIRY: VERBAL AND BEHAVIOURAL**

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The interactions between people and members of the fungi kingdom can be understood through two kinds of data: verbal and behavioural. Words and actions (what people say and what people do) are different things and they imply the use of different methods. On one hand, vernacular vocabulary and verbal statements made by local people in the community being studied constitute the main data source for discovery of the emic (i.e. insider’s) point of view. This data is elicited by means of interviews and casual conversations, followed by careful translation or semantic analysis. On the other hand, people’s physical behaviours and movements, as well as the material effects and products of their activities, can be observed and recorded directly by the researcher. To the extent that such behaviours and objects are classified and interpreted according to the researcher’s conceptual system, they provide the primary data used to construct an etic (i.e. outsider’s) perspective. It is important to emphasize that these two levels of information are not opposed but rather complementary and therefore both kinds are crucial for grasping the full range of contacts with mushrooms. Eliciting verbal data is an indispensable method for tapping a large portion of local cognitions, perceptions, values, beliefs and attitudes. Such information is also crucial for the researcher who is initially unfamiliar with the local environment and the intricacies and motives of people’s behaviour.

The recording of behavioural data is important because some aspects of knowledge are encoded behaviourally instead of linguistically and therefore learned through visual observation rather than verbal communication (e.g. practical skills). Furthermore ‘a great deal of research has shown that about a third to a half of everything informants report about their behaviour is untrue’ (Bernard, 1995:114). Verbal data can enhance comprehension of behavioural data and vice versa. The classic anthropological approach to fieldwork, which rests on the combined use of key informant interviewing and participant observation, sets the precedent for this integrated style of data collection (Pelto and Pelto, 1978). A good example of the creative combination of interview and observational methods in ethnomycological research is provided by Vasco-Palacios et al



**Figure 3.1** *Ethnomycological knowledge can be surveyed among people of different ages and genders: A Joti boy displaying fresh mushroom in the Tricholomataceae, Agaricales, Jkayo Ijkuana, Amazonas, Venezuela*

Photograph: Stanford Zent



(2008). The researchers combined collection of specimens and intensive interviews of 29 elders wise in local mycology among three Amazonian groups (Andokes, Muinanes and Uitotos). The results were then contrasted with those obtained through random interviews with 97 people of different ages and genders (Figure 3.1). The results show a remarkable level and range of ethnomycological knowledge, including biological (substrates, habitats, associations, morphology), ecological (species associations such as coleoptera–plant–fungi, insects that eat fungi) and eco-cosmological (essential and spiritual notions of mushrooms with other bio-forms) information.

A diverse range of field and analytical methods which can be used to produce different kinds of ethnobiological data and information (verbal and behavioural, emic and etic, qualitative and quantitative) are described in this chapter as well as the following one (Chapter 4). The appropriateness of each method depends on the nature of the phenomena being studied. For instance, the documentation of highly specialized ethnomedicinal knowledge may be handled best by extended, open-ended interviews with a few expert healers in which the focus is on capturing qualitative details, whereas the topic of consumption patterns of seasonally available wild mushroom species will probably require the application of a structured dietary recall questionnaire administered to a sample of households over an annual cycle and then the results submitted to statistical analysis. Beyond trying to find the best approach for tackling the research problem at hand, the choice of method will have to be adjusted to a number of other factors, such as spatial scale and temporal duration of the study, social complexity of the target study population, number of researchers and their expertise, logistics of work and travel in the study area, and budgetary constraints.

The remaining part of this chapter is devoted to a discussion of specific methods that are relevant for exploring the cognitive dimensions of peoples' relationship to fungi, including the local naming systems, identification of real world natural organisms, folk taxonomies and several others.

## **METHODS FOR STUDYING COGNITION**

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The verbal interview is usually the core technique, but it is not the only one used to reveal how local people categorize and classify mushrooms and fungi. One of the primary tasks to undertake in any ethnobiological investigation is to determine the cognitive position of the biotic group in the conceptual universe of the people being studied: where does this group stand in relation to other groups of natural organisms recognized by the local people? (See Figure 3.2.)

The first question is whether there exists a segregated semantic domain, labelled or not, which includes all and only the bioforms belonging to the fungi kingdom. In other words, do fungi constitute a unique beginner category in the sense given by Brent Berlin (Berlin et al, 1973; see definition below)? To make this determination, one has to discover the inventory of biota that from the local point of view are recognized and grouped together as a natural class, and chart their relationships to one another. Next, one has to delineate the relationships of the class as a whole and/or the constituent class members individually to other biological groupings (such as plants or animals). In short, the proper demarcation of the domain will depend on mapping both the internal



**Figure 3.2** *Mushrooms and indigenous people’s conceptual universe: The authors conducting a detailed interview with Ijtō about ñamuliye yakino (the first mushroom that sprouted in the leg of the first woman-tree) and its role as entity in the myth of human creation (anthropogony). Kayamá, Venezuela, October 2005.*

Photograph: Yheicar Bernal

conceptual configuration as well as the external perceptual and cognitive boundaries from a local cultural perspective.

The taxonomic status of fungi as a separate ethnobiological domain, or unique beginner, is hinted at but nevertheless ambiguous in several folk classifications, and therefore the question of this status has drawn the attention of different researchers. Among the Gbēē Zapotec (Mexico), the category of mushroom can be considered ‘as either an exceptionally large, heterogeneous folk generic taxon or a small life form’ (Hunn, 2008:94), although after a linguistic analysis it is also conceivable to treat the mushroom category in Zapotec ‘as an unaffiliated life form within a covert “superkingdom” of living things’ (ibid, 95). Among the Ka’apor (Brazil) fungi cannot be easily classified as to life form and its affiliation with the plant domain ‘remains unclear’ (Balée 1994). A similar case of classificatory ambivalence appears among the Jotī (Venezuela). Some people consider mushrooms to be a separate life form but included within the plant kingdom, while most informants see them as separate from plants altogether (Zent et al, 2004). Similarly, based on linguistic and ecological data (mushrooms are highly seasonal, short-lived, fleeting, etc.), the Tzeltal Maya (Mexico)

consider macro-fungi as a 'single, coherent domain that is separate and different from the domains of plants and animals' (Lampman, 2007:14–15). The Tzeltal category refers exclusively to species that are recognized as fungi in the Western scientific system (Shepard et al, 2008:450). Even in places where mushrooms are not very abundant or significant, in an ecological or in a cultural sense, such as the Nualulu of Seram (Indonesia), the use of a single term seems to support the reality of mushroom as a separate kingdom (Ellen, 2008:489).

At least three criteria can be used in the selection of informants: (1) community members who are exceptionally friendly, well-known or cooperative and therefore are highly trusted by the researcher to provide good reliable information; (2) community members who are recognized by their peers as being experts or having special knowledge of the domain being studied; and (3) a sample of different persons drawn from the study population in order to provide a more rounded view of the group as a whole. If the latter strategy is adopted, some care should be taken to select a representative sample (e.g. using random, systematic or stratified sampling). If the community is not too large, Bernard (1995) recommends a sample size of about 20 per cent of the total population. Keep in mind that a thorough population census and socioeconomic survey of all houses in the study community should be conducted, or previous censuses updated, prior to drawing the sample. If considerable socioeconomic variation is found, the sample should probably be stratified according to these variables.

According to Hunn (1975), the pre-scientific human apprehension of biodiversity in nature involves three primary cognitive processes or phases: nomenclature (linguistic labelling of classes and objects), identification (perceptual recognition of individuals, groups and key characters) and classification (conceptual categorization of groups of natural organisms and the organization of categories into taxonomic systems). Thus the understanding of how a local group conceptualizes fungi implies recording the different names assigned to different species of fungi or their fruiting bodies (mushrooms), as well as locating and collecting specimens that go with names. It is also important to explore the semantic contents of the inventory of terms that are included within the domain as well as the logical relationships (e.g. inclusion/contrast, focality/peripherality, transitive/nontransitive) among the different named and unnamed classes. An additional phase involves finding out the cultural and ecological significance and use value of the different recognized classes.

Specific methods pertinent to each of these facets are described and justified below.

## Nomenclature

A good place to begin is by eliciting the lexemes (i.e. the fundamental unit of the lexicon of a language) that refer to the different segregates (i.e. terminologically-distinguished objects) comprising the domain of mushrooms as well as associated words or linguistic forms used to indicate their anatomical parts, growth habits, habitats and significances. Probably the fastest way to record the names is *free listing*, which consists of asking individuals to name all the kinds of *X* that they can recall. The question may be phrased in specific terms, such as 'Please name all the red/round/tree-sprouting/edible/medicinal/etc. mushrooms that you know?' Individual lists can then be merged to produce a composite list. This collection of names provides the researcher with a

handy checklist for purposes of organizing collection efforts and also conveys a rough idea of the size and complexity of the domain in terms of the number of taxa.

A second step is collecting secondary terms that denominate or hint at the taxonomic categories at lower and higher inclusive ranks. These data are usually recorded through structured interviews or controlled question-answer substitution frames. The structured interview format involves the same set of questions or response stimuli being administered to every informant in the sample and may take the form of a written questionnaire, for literate populations, or an oral interview schedule, for preliterate populations. The substitution frame involves formulating a standard query and plugging in different previously named taxa (e.g. 'What is the name of one/another kind of \_\_\_\_\_?'). Another query technique entails ostension (i.e. pointing out). For example, showing the informant a real specimen or pictorial representation and asking him or her 'What is this?' or 'How do you call it?'. Related questions could be: 'What other (related) kinds of it are there?'; 'Is there just one kind?'; or 'Does that name refer to something else or is it just a name?'. The formal interview procedures mentioned here are designed to control the linguistic context that is presented to the informant, using language that is appropriate and easy to understand. The objective is to ensure equal semantic values from source to receptor and thus stimulate consistent and comparable responses across different informants and different questions. The resulting list of terms elicited from a particular frame should be mutually exclusive, which is to say they form a contrast set. This data collection format has been referred to as 'white-room' to indicate that the context is homogenized and controlled. Besides controlling the linguistic context, the method also calls for the elimination of extraneous cultural noise and distracting influences, and is best administered to individuals or small focus groups. Some authors have argued that the concept of data elicitation frames should be broadened to include the wider social and behavioural contexts, facetiously called 'grass hut' ethnography, which involves carrying out conversational exchanges in more naturalistic and culturally realistic situations (cf. Frake, 1977).

Besides the structured interview, semi-structured and unstructured formats can also be used to collect terminological data. The semi-structured interview follows an interview guide, that is, a list of questions and topics to be covered, but actual administration of the interview is more flexible, allowing the respondent more freedom to answer in their own words and permitting the interviewer to follow up interesting lines of inquiry with spontaneous questions. The main advantage of this approach is that it can arise in potentially useful information that the informants consider worth mentioning but which was completely unanticipated by the researcher. The disadvantage is that the process of searching, extracting and analysing pertinent information from the response data is more complicated and time-consuming. Unstructured interviews and informal conversations may be invaluable to clarify gaps in the data, ambiguous categories, synonyms and polysemic terms (i.e. terms that have multiple meanings), non-transitive classes, focal vs. peripheral members or rare segregates, etc.

The names (lexemes) for ethnobiological taxa correspond to two basic types that are distinguished by linguistic, taxonomic and semantic properties: primary names and secondary names. The former can be either simple (mono-lexemic) or complex (two or more words or morphemes) and usually refer to taxa at the folk generic and life form ranks. The latter are always complex and invariably refer to sub-generic taxa. Complex primary names can be semantically productive or unproductive. Productive

forms can be analysed (i.e. they make reference to some perceptual or functional attribute of the group of organisms) with the superordinate taxon as one of the lexemic constituents. Unproductive forms do not include the superordinate taxon and thus are usually arbitrary and cannot be analysed. Secondary names also include some mention of the superordinate category, in this case the folk generic, and thus may provide an easy lexical cue for determining membership in this class. The Jotí generic term for mushroom is *yakino* and some productive examples point to size (*jani yakino*, ‘small mushroom’), colour (*kyabo yakino*, ‘white mushroom’), texture (*jwaiño yakino*, ‘soft mushroom’), animal associations (*uli jkwayo yakino*, ‘spider monkey [*Ateles belzebuth*] fungus’), plant associations (*jkaile yakino*, ‘tree [*Micropholis melinoniana* Pierre] fungus’), or spirit associations (*awëla yakino*, ‘phantom fungus’).

## Identification

The main goal of this phase is to determine which real-world entities or attributes substantiate and structure the individual categorical constructs as well as the relationships among them. Berlin (1992) notes that the perceptual salience of plants and animals (we could perhaps add fungi here although he does not mention them) is determined by multiple attributes such as size, colouration, position, frequency of observation, cultural importance, biotaxonomic distance and morphological aberrancy.

The first step is to identify as completely as possible the biological genera and species that correspond to each named segregate. Scientific systematic biology constitutes the universal reference (both as a name and an object) or metalanguage in terms of which perceptible organisms and characters can be described and understood. The most reliable way of identifying the biosystematic content of folk biological taxa is by collecting voucher specimens (along with the local names) and then sending them to a specialist for taxonomic determination (see Chapter 2).

Another step involves specifying the perceptually salient phenotypic traits – morphological, behavioural and others – intrinsic to the organisms classified and which define membership in a particular class. There are two main category types that can be distinguished on the basis of perceptual processes: deductive (or monothetic), i.e. defined by abstract (widely applicable) features; and inductive (or polythetic), consisting of many concrete features which are perceived as a unitary configuration (also known as a ‘gestalt image’). The former have been described as artificial and special-purpose classifications, imposed by practical considerations such as cultural uses, while the latter are considered to be natural and general-purpose concepts, based on the recognition of real perceptual gaps in nature (which in turn reflect phylogenetic relationships) (Hunn, 1982; Berlin, 1992). The task of the researcher during data analysis is to specify the necessary and sufficient features of class membership (e.g. colour, size, texture) in the first case and the relationships of similarity/difference (i.e. focal/peripheral members) in the second case.

Previously collected specimens or pictures (such as photographs or drawings) can be used as visual prompts for determining named or covert class membership and perceptual salience criteria (Berlin et al, 1981; Boster, 1987a). However, the appropriateness of such materials should first be tested because some groups or individuals may not be familiar with such media (Ross, 2002; Cruz García, 2006; Monteiro et al, 2006) or

because some people may use other perceptual cues (colour, substrate, habitat, smell, taste) to identify the species (Jernigan 2006). Thus we recommend that the researcher adopt the ‘walk in the woods’ interview technique for eliciting mushroom names and distinguishing key characters, at least during the early phase of fieldwork. This method provides a more realistic and appropriate context for ethnobiological interviews as it features living individuals in their natural habitat (Zent, 2009:24). After the researcher has a basic grasp of the perceptual contours of the domain and its inhabitants, he or she can try out more controlled and experimental queries for exploring less obvious features (see Classification below).

## Classification

According to the universalist theory of ethnobiological classification advanced by Berlin (1992), the semantic domains of living entities (plants, animals and mushrooms) are usually, if not universally, organized in the human mind as a taxonomy, which is to say a hierarchy of sets. However, the depth and elaboration of the hierarchy varies between different groups of people or between classes of organisms.

The objective of taxonomic analysis is to map the taxonomic structure. This is understood as encompassing two fundamental components: a finite set of categories or taxa that make up the entire domain; and a relational structure defined by the properties of progressive set inclusion (i.e. a set of contrasting taxa are included within a higher-level taxon which also belongs to a set of contrasting taxa which in turn are included within a still higher taxon, until reaching a single taxon which includes every other member of the entire domain) and partition (i.e. division of a set into subsets that places every member in exactly one subset) (Kay, 1971). Queries about domain organization are thus largely concerned with exploring the vertical relationships of inclusion or the horizontal relationships of contrast among different pairs or subsets out of the inventory of segregate categories. Direct forms of questioning about these might include the frames ‘What is a kind of X?’ and ‘What is X a kind of?’ respectively. Frake (1964) cautions that questions must be directed both upward and downward the taxonomic ladder in order to achieve classificatory precision.

Berlin (1976; 1992) argues further that the hierarchical structure of classification points to the existence of qualitatively separate ethnobiological ranks, which can be distinguished on the basis of nomenclatural, psychological, biological and taxonomic criteria. The theory stipulates that all systems of folk biological classification throughout the world display a minimum of three and a maximum of six such ranks. The ‘universal’ ethnobiological ranks are described as follows:

- 1 Unique beginner – the domain-defining or all-inclusive taxon, usually unnamed – in which case indicated by indirect linguistic and behavioural markers – or labelled by a single lexeme, corresponding to the kingdom level in western biosystematics.
- 2 Life form – preceded immediately by the unique beginner, includes a small number (one to ten) of very distinctive morphotypes based on the correlation of morphological features (size, shape, substance) and ecological adaptation (e.g. tree, vine, herb, fish, bird, snake, possibly mushroom?), usually broadly polytypic and containing the majority of lesser inclusive taxa, named by a single lexeme.

- 3 Intermediate – taxonomically fall between life forms and generics, group small numbers of generic taxa due to their perceived affinity, relatively rare and when found most commonly are not labelled overtly.
- 4 Generic – most (but not all) of these taxa are preceded immediately by life form taxa, the rank with by far the largest number of taxa, considered to be the backbone or nucleus of the entire classification system, the first segregates learned by children; perceived as a gestalt image, named by one or two words that are either productive or unproductive.
- 5 Specific – included within generic taxa, few in number, segregated by contrast sets defined by a few characters (e.g. colour, size, microhabitats), named by binomial expressions.
- 6 Varietal – lowest ranking and hence terminal category where found, rare or non-existent in foraging societies, more common in domesticated species, few in number, always part of a contrast set.

This taxonomic scheme corresponds to a general-purpose type of classification in the sense of being polythetic, which is to say its members possess many attributes in common, mainly morphological and behavioural attributes, as well as natural, meaning that it (somewhat) accurately represents phylogenetic diversity and relationships that actually exist in nature, hence it is valid in a variety of contexts. Other researchers criticize the natural taxonomic model of ethnobiological classification in general and the concept of rank in particular, and instead highlight the importance of other types of structural arrangements, such as fuzzy sets, coordination, cross-cutting associations, non-transitivity, residual categories, part-whole relationships, special-purpose classifications, and indexing of categorical meaning within social contexts (Ellen, 1975, 1986; Hunn, 1976, 1982; Randall, 1976; Maranhão, 1977; Hunn and French, 1984; Randall and Hunn, 1984). While we are not advocating one or the other theoretical position, the ethnomycological researcher should be aware that there may be different options for analysing the semantic content of categories as well as the structural relationships between them within a folk biological domain.

In this sense, it should also be kept in mind that certain methods are better suited for investigating different semantic-structural arrangements. For example, the basic elicitation frame involving the successive application of the query 'What are the names of all the kinds of X in Y?' is inherently designed to generate folk taxonomies of the hierarchical kind because it specifically refers to inclusive and contrastive relations while excluding other types of information (cf. Hunn, 1982). By contrast, special purpose classifications, such as utilitarian, ecological or gendered distinctions, may require additional lines of questioning or even participant observation to decipher properly (see next subsection below). Although such categories can be investigated by inserting the term referring to the target semantic feature into the same question frame mentioned above (e.g. 'edible/cultivated/female X') it is also important to limit such questioning to culturally valid categories. In this regard, Frake (1964) proposes a method of linked queries, in which the output responses of a question frame are used as input for new queries. The application of this method is demonstrated by presenting the case of the manufacture of beer by yeast spice (a fungi-activated process) among the Subanun of the Philippines. The cultural significance of plants as yeast spice ingredient is revealed by compiling categorical lists and tracing the inter-linkages among the botanical species selected for this purpose, the major plant types (i.e. life forms) in which these fall, the

parts which are used, the habitats where the source plants grow, and the gastronomic properties (e.g. flavour) of the different species. Once all the relevant contrast sets are completed and the inter-linkages established, one can proceed with the componential analysis of the segregate set, which involves specifying all of the criterial attributes (i.e. distinctive features of meaning) for each and every segregate.

Besides direct verbal elicitation, there are several controlled experimental techniques, sometimes called cognitive exercises or games, which can be used to probe the underlying, often unconscious, perceptual or cognitive structure and content of selected cultural domains. These include: ranking exercises (Likert scale), paired comparisons, triad tests and pile sorts (Bernard, 1995:237–255; Martin, 1995:117–135). The informant is asked to arrange categories along a scale (ranking), compare categories according to a given criterion (paired comparison) or organize categories into groups (triad tests, pile sorts) respectively. In some cases (e.g. triad tests), the informant is asked to explain the reasons for his or her choices. Pile sorts have been widely used to explore the non-obvious patterns of taxonomic knowledge of natural organisms, such as covert categories, and the intercultural correspondence of taxonomic knowledge (Berlin, et al 1968; Hays, 1976; Boster et al, 1986). These analytical tools are especially useful for exploring the internal structure of categories, such as absolute vs. graded class membership, identification of prototypical vs. marginal members of the class, relative salience of certain attributes and less vs. more valued taxa.

### **Utilitarian, ecological, spiritual and other cultural significances**

As suggested in the preceding section, the ethnomycologist should probably anticipate that the people he or she works with will discriminate the fungal domain not only on the basis of morphological and behavioural attributes but also according to specialized cultural criteria, such as utility, habitat type and magico-religious significance, among others (cf. Shepard et al, 2008). For example, one of the key characteristics employed to partition the fungal domain across a wide range of cultures is the dichotomous feature of edible/inedible. A good example in the English language is the distinction between ‘mushroom’ and ‘toadstool’ (Shepard et al, 2008:454; see also Box 3.1).

### **Expanding Frame Analysis**

In order to achieve a rounded understanding of this sort of special-purpose categorization, it may be necessary to augment the narrowly-focused, controlled elicitation procedures mentioned in the previous sections with more open-ended and flexible approaches to data collection. Possible options include: informal or spontaneous interviewing about fungi-related topics; participant observation of people’s activities dealing with mushrooms; and even the study of other cultural behaviours and expressions that directly or indirectly might reveal insights into the semantic values attached to this biotaxonomic group and its members. In effect, we are suggesting attention to Frake’s (1977) call for expanding frame analysis to encompass the wider social context that makes interpretation more meaningful and accurate. The complexity and variability of this context may well dictate methodological versatility and triangulation.



### BOX 3.1 INDIGENOUS KNOWLEDGE AND USE OF FUNGI IN AUSTRALIA

*Arpad Kalotas*

Aboriginal people of Australia have a detailed knowledge of fungi, their uses and ecological relationships. Though the ethnomycological record is limited, many fungi are recorded as used for food, medicine and other purposes (Kalotas, 1996). Fungi are also incorporated into traditional beliefs and mythologies. In the late 19th century, for example, Spencer and Gillen (1899) recorded that 'Falling stars appear to be associated with the idea of evil magic in many tribes. The Arunta believe that mushrooms and toadstools are fallen stars, and look upon them as being endowed with *arungquiltha* (evil magic) and therefore will not eat them.' However, as I have suggested elsewhere (Kalotas, 1996), this belief does not apply to all fungi, for a number are eaten by Aboriginal people in Central Australia. Fungi are also the subject of contemporary Aboriginal art (Trappe et al, 2008).

Fungi used as food included species from a range of families and biogeographical regions:

- The Native Bread, the large sclerotium of *Laccocephalum mylittae*, is known from the temperate forests of southeastern and southwestern Australia. Aboriginal people could detect the presence of this vegetative mass that matures underground by the swelling of the ground (as the sclerotium grows) and the smell given off as it matures. Recent collections from Western Australia indicate that fire appears to play a part in stimulating the development of the sclerotium (Robinson, 2009).
- Species of edible large puffballs (*Pisolithus* spp) occur across the continent.
- Several truffle species are found in the arid zone of central Australia (Trappe et al, 2008). The truffles used as food by Aboriginal people predominantly occur in the arid zone. A recent revision of Australian species (ibid, 2008) indicates that: 'Seven truffle species (three of which are new to science) belonging to six genera (one being new to science) have been discovered' and continues:

*Desert truffles of the Australian Outback, once a cherished food resource for diverse Aboriginal ethnic groups, currently have little or no value for contemporary Aboriginal communities either as a gathered food or as a saleable or even tradable commodity (Liddell, pers. observation). Likewise, no attempts have been made to commercially market Australian desert truffles in contrast to their African and Middle Eastern counterparts.*

Interestingly, some other food species used by Australian Indigenous peoples include species that are the same or closely related to those recorded as food in other cultures. The Beech Orange (*Cyttaria gunnii*), which only grows on the Myrtle (*Nothofagus cunninghamii*), was used for food in Tasmania. Other species of *Cyttaria* (also associated with *Nothofagus* spp) are known as food in Chile and in recent times have been sold in local markets there.

The fruiting body of Beefsteak Fungus (*Fistulina hepatica*, which is believed to have been used as a food source in south-western Australia) and various species of large puffballs (*Pisolithus* spp) are known as a food species in America and Europe.

Fungi also play a part in traditional medicine. The Orange Shelf Fungus (*Pycnoporus coccineus*) was used as a disinfectant for children with sore lips and mouths, or thrush of the mouth, and the woody Hoof Fungi (*Phellinus* spp) were used in northern Australia for varying ailments including sores, coughs and fevers.

Miscellaneous uses of fungi include providing tinder and carrying fire, as is the case with the White Punk (*Laetiporus portentosus*). This is not restricted to Australia, with records of other indigenous peoples using related fungi for the same use, such as the Tinder Fungus (*Fomes fomentarius*) used in Europe (Peintner et al, 1998). Some species such as the mature Stalked Puffball (*Podaxis pistillaris*) which produces a purplish-black spore mass, were used as decorative body paint, and by old men for cosmetic purposes, to darken grey hairs.

In addition to traditional Aboriginal uses of fungi, the ethnomycological record contains a rich assemblage of Indigenous names and beliefs, including those associated with the dreamtime and the exploits of ancestral beings. There is potential to continue the documentation of traditional use of fungi and to gain valuable ecological insights. Indigenous communities, and particularly Aboriginal language centres, are best placed to record this knowledge and undertake salvage ethnomycology. Trappe et al (2008) state in relation to truffles (although this can be applied to all useful species):

*Traditional knowledge is increasingly endangered as the elders succumb one by one. A multidisciplinary collaboration between mycologists, ecologists, ethnobotanists, anthropologists, and linguists is urgently needed to document these remarkable truffles and their traditional place in the lives of Aboriginal peoples.*

Several specific methodological proposals for expanding the cultural and ecological scope of ethnobiological descriptions have been elaborated and will be mentioned briefly here.

Hunn's (1982) concept of *activity signature* is designed to systematically describe the practical significance of each taxonomic distinction from the native point of view. The method involves recording the total inventory of culturally valid affirmative or imperative sentences in which the taxon occurs as the object. The resulting series of statements amount to the taxon's activity signature, which can be considered 'recipes or instructions for action' within the life of the cultural group. This kind of practical classification can be used to discriminate the list of recorded taxa in terms of the sum total of how, when, where and who uses them. The activity signature method is conceptually consistent with Alcorn's (1995) thesis that ethno-ecological research should take the form of text analysis. She contends that efforts must be made to look into the interrelationships of biota and people 'embedded in dynamic ecosystems of natural and social context' (Alcorn, 1995:24). Given that such interrelationships are produced not just by immanent attributes of the species but also by the particular physical, ecological, social and historical milieus in which they are situated, the researcher must strive to elucidate the species' 'text' where the interactions are 'played out' (ibid).

A similarly holistic approach is found in Ellen's (1986) concept of *prehension*, referring to those processes which through various cultural and other constraints give rise to particular classifications, designations and representations of the species within unique ecological, social and cultural contexts. He advocates that an experientially realistic understanding of classificatory behaviour must begin by observing people assigning items to categories and using names in natural ethnographic settings. In this sense, knowledge and know-how are not independent; rather knowledge is socially distributed in terms of the know-how it may encode and also in terms of the value placed upon it.

A couple of examples of ethnomycological research that have used a multi-pronged approach to data collection can be mentioned here. Pieroni et al (2005) conducted individual and focus group interviews as well as specimen collections to record the edible wild mushrooms in Southern Italy. They found that mushrooms make up a prominent component of the local cuisine. Thirteen different species are gathered by men on a seasonal basis and are eaten either roasted or raw. Beyond their nutritional and gastronomic importance, the activities surrounding the procurement and consumption of this food type help to reinforce kinship and social networks (Pieroni et al, 2005:263). Aaron Lampman (2004, 2007) made use of specimen collections, semi-structured interviews and pile sort exercises (in which mounted photographs of the most frequently gathered species were used as stimuli) to elicit folk names, taxonomic categories and cultural uses of mushrooms in two municipalities of Tzeltal Maya in Chiapas, Mexico. The researcher recorded over 30 species of wild edible mushrooms gathered seasonally by Mayan families and some species used as medicine (2007:12). The data record shows that the Tzeltal possess a sophisticated understanding of 'mushroom ecology, substrate preferences, microhabitat tendencies, seasonality, edibility, and medical applications' (Lampman, 2007:14).

One of the most common and appropriate situations for collecting cultural information about folk taxa is precisely when making specimen collections. Two basic approaches have been described: (a) the artefact/interview, which consists of queries about what species a particular cultural artefact or product (e.g. edible dish, medicinal concoction, ornament) is made from, followed by collection of them; and (b) the inventory/interview, which involves the active collection of specimens in the field and the simultaneous or subsequent queries about the pertinent cultural information (Boom, 1989:81). It is a good idea to prepare a data sheet that should be filled out for each specimen or folk species collected. Besides the basic information such as date, location, habitat, collector's or informant's name and local name of the folk taxon, the following data should be recorded: phenology, spatial or habitat distribution, interactions with other species, life expectancy, seasonality, management techniques, specific uses or treatments, parts used, potential for domestication, salient attributes (odors, colours, shapes, etc.), physiological or psychological effects, rare uses and ideological notions.

Another constructive method for recording ethnomycological data is the life history interview, which involves asking an informant to narrate the key events in their life from early childhood to the present. In this case, the researcher prompts the subject to recall and recount their experiences and memories involving fungi, for example whether they collected and ate them when they were children and if they still do so. Since many mushroom species or genera produce strong psychobiological effects if consumed or even touched, it is not surprising to find their incorporation in myths, stories, ritual performances or magico-religious beliefs.



**Figure 3.3** *Joti children painting the arms of one of the authors (S. Zent) for a ritual celebration*

The admixture used to paint contains certain culturally meaningful mushrooms. Kayamá, Venezuela, December 2005.

Photograph: Egleé Zent

### BOX 3.2 THE HUNTING MAGIC OF THE SPIDER MONKEY MUSHROOM

*Eglée Zent*

A melodious cry broke the stillness of the night. From a neighbouring shelter, Jkwiaun ('Piping Guan's wife') answered the singing of her sister, Bölöaun ('Partridge's wife'), with her own alluring harmony. Their duet divulged the day's hunting plans to the game animals' guardian spirits. Towering trees swayed like restless guards keeping watch around the tiny encampment of three hasty lean-tos which housed twelve people. The intermingling of songs still embraced the hunters like the pre-dawn dampness that clung to their bodies as they slipped out of the camp. In a fleeting movement, the lead hunter veered briefly to snatch a soggy mushroom from a nearby log, stuffed it into his nostril and then sped off down the trail once again. A second man followed him into the forest after rubbing his nose with the same mushroom. A barrage of shooting darts was announced with the 'pop, pop, pop' of the blowgun some twenty minutes later. After a brief but frenetic chase, the fresh corpse of a spider monkey fell from the canopy just when the first daylight was breaking. An hour later, another prey of the same species crashed to the ground. At mid-morning, we headed back to the campsite with enough meat for two to three days. The snuff substance had been extracted from *ulijkwayoyakino*, a powerful mushroom named for the spider monkey (*Atelesbelzebuth*) and considered to be connected metaphysically to its guardian spirit. The Joti believe that the act of inhaling the fungal essence is instrumental for securing the successful capture of this game species.

Accordingly, these venues offer possible fields of discourse for understanding the cultural significance of mushrooms in a particular group. It is not uncommon to find more than one version of the myths and legends and therefore it is advisable to record the text from more than one informant. Sometimes brief encounters with subtle ecological behaviours are more effective than words at opening up expansive doors for understanding people's eco-cosmological universe (see Box 3.2).

## CONCLUSION

Mushrooms, like people, are cosmopolitan. In many places all over the world, during different historical periods, encounters with fungi have evoked a strong reaction in humans, ranging from fear to adoration. Rarely is the response one of indifference. In recognition of the conspicuous presence and significance of fungi among diverse cultural groups, we urge that ethnobiologists consider the need to expand their studies of this relationship. Mycophilic cultures have contributed to the increase of scientific knowledge on fungi precisely in areas where inventories of this biological group are

poor (Fidalgo and Prance, 1976; Fidalgo and Hirata, 1979). Although there are certainly systematic and valuable studies in mycology (Alexopolus et al, 1996), some biologists believe that less than five per cent of the total estimated number of fungal species (~1.5 million) worldwide have been identified so far (Læssøe, 1998:6). The notion that there are species presently unknown to global science but recognized and used by folk people is more than a remote possibility, as some previous ethnographic field surveys indicate (Prance, 1984), and should prompt in-depth research that pays attention to both verbal and behavioural expressions of the relationship between people and fungi. We stress the benefits of a comprehensive approach to studying ethnobiological cognition, starting with description and explanation of the basic processes of nomenclature, identification and classification, but also potentially encompassing other cultural significances such as utilitarian, ecological and spiritual values. In a similar vein, we recommend that methods and epistemologies should be integrative in outlook, both qualitative (such as those described in this chapter) and quantitative (such as those described in Chapter 4).

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