Ethnography and Experiments:
Cultural Models and Expertise effects elicited with experimental research techniques.

Norbert Ross
Vanderbilt University
Douglas L. Medin
Northwestern University
Evanston, IL

Please address all correspondence to: Norbert Ross
Department of Anthropology
Vanderbilt University
VU Station B #356050
2301 Vanderbilt Place, Nashville, TN 37235-7703
norbert.o.ross@vanderbilt.Edu

Abstract
This paper reports the results of two independent studies dealing with saliency effects within the domain of folkbiological knowledge. In Study 1 we present data from a free listing task that explored tree name generation among Tzotzil Maya of Zinacantán (Chiapas). Study 2 compares Menominee Native Americans with Majority Culture (non-professional) fish experts in central Wisconsin. Both studies explore patterns of informant agreement/disagreement, looking at the accessibility of certain kinds of biological knowledge, both within and across cultural groups. We show that both differences in levels of expertise / practice as well as habitual patterns of knowledge organization (spontaneous categorization) can lead to significant differences in the salience or accessibility of certain types of knowledge.

Introduction

This paper presents two experimental studies exploring the organization and accessibility of aspects of biological knowledge, both within and across cultures. The first study uses free-listing combined with an analysis of participant agreement, informed by ethnographic / historical research. In this scenario, we trace cultural change, indexed by changes in specific practices (gender related), relating it to changes in the spontaneous accessibility of names of natural kinds (in this case, trees) among men and women in the Tzotzil community of Zinacantán, Chiapas. While free listing tasks have a long history in Anthropology (see Weller & Romney 1988), rarely have they been used in combination with the Cultural Consensus Model and an analysis of participant agreement / disagreement. It is this specific combination that makes them an extremely valuable research tool. In the second study we describe a set of experimental tasks that are interrelated to make a similar argument; here, however, we relate differences in the accessibility of knowledge to differences in knowledge organization. In both studies we apply the Cultural Consensus method to formally justify to looking at group pattern. We also look at residual differences and patterns of disagreement to test hypotheses generated from the ethnographic context. The experimental tasks used in the second study not only allow us to analyze consensus but also to base our argument on cross-task analysis.

On a theoretical level we argue that knowledge organization depends on at least two factors: the relative expertise of the individual (see Boster and Johnson 1989) and the

conceptual structure – habits of the mind – provided by a culture. By "habits of the mind" we mean ease of access to certain aspects of knowledge, that are "good to think with," e.g. the first things that come to mind when dealing with a specific domain.

Differences in the organization and accessibility of knowledge may derive from different sources. First, members of different cultures might engage in different activities (agriculture, hunting and gathering versus becoming a Ph.D.) and may have different levels of expertise in specific domains. Such differences seem to drive the findings in the López et al. study (1997), in which the authors compare Michigan students with Itza' Maya farmers with respect to their folkbiological classification and reasoning. Although both groups were familiar with the mammals used in the study, there is little doubt that the Itza' were more expert. Even when domain knowledge is equated across groups, however, different goals, occupations and activities may produce distinct *types of expertise*. Medin et al (1997) showed that different kinds of tree experts in the Chicago area differed significantly in the ways they categorize trees. The differences seemed to be reflecting different goals the participants brought to the task rather than differences in base knowledge per se. The studies reported here extend our understanding of knowledge organization and accessibility in two ways. The first study shows how activities may affect knowledge accessibility, and the second makes the methodological point that.the pacing of a task can be a useful tool for verifying differences in knowledge organization.

Study 1: Gender, expertise and saliency of trees among Tzotzil Maya

The first study looks at Tzotzil Maya of the Highland of Chiapas. A freelisting task was applied to explore the idea that different activities by men and women of this particular community lead to differences in the salience or accessibility of knowledge.. Specifically we argue that processes of social change are associated with the accessibility of tree names being greater for women than for men. Free-listing techniques are a standard technique in the social sciences (see Weller & Romney 1988). However it is the combination of free listing with the Cultural Consensus Analysis (Romney et al. 1986) that allows a novel exploration of patterns of residual agreement in order to address an array of different questions – including the ones asked in this study.

The Tzotzil Maya community of Zinacantán is located in the Highlands of Chiapas Zinacantan about 10 km from San Cristóbal de Las Casas, the center of tourism

and economic activity in the wider area. Zinacantán has managed to preserve much of its cultural distinctiveness. Tzotzil Maya is still spoken in the streets, and children grow up learning Spanish only as a second language. Women dress in the traditional *huipil*, a blouse identifying the person as a member of the community. For a large part the traditional religious system is still in place and functioning well (see Cancian 1965). Yet, despite these features, the community has experienced many changes over the last 50 years. Its location, close to the city of San Cristóbal de Las Casas, has led many individuals away from working the *Milpa*, the traditional agricultural field comprised of corn, squash, and beans. Closeness to a major highway has been associated with many individuals shifting their attention toward (a) cash-cropping corn in the lowlands (Breedlove & Laughlin 1993), (b) the production and sale of cut flowers (Ross 1994a & 1995), and (c) non-agricultural occupations (bus- and taxi-drivers, trading, service-men in San Cristóbal de Las Casas etc.). In addition, out migration to oil fields provided additional household income, until the oil crisis hit Mexico in the late 1970s. But opportunities are only one side of the story; needs are the other. Population increases have been associated with deforestation and increasing pressure on agricultural lands. The INEGI census of 2000 reports approximately 30,000 inhabitants for the municipality, corresponding to an annual increase of 2.9% over the previous decade. This number compares to an average annual increase of 1.5% (including the peak 4.0% for the state capital Tuxtla Gutierrez) across the different municipalities in Chiapas (INEGI 2000).

These changes have led to a decreasing exposure of Zinacantán men to their natural environment. Land has become an increasingly scarce resource and individuals have had to replace agricultural work and hunting (currently only one adult person in the main village engages in hunting) with other occupations. Furthermore, wood suitable for construction is no longer available (see Ross 1994b for an account of a similar situation in the neighboring community of San Andrés Larraínzar).

The externally-driven need for new construction materials for houses and the emergence of new opportunities for cash income have had a bigger effect on men than women. Traditionally, men and women in Zinacantán engage in different activities. Women take care of the household, occasionally accompanying their husbands to the field or leaving the compound to gather firewood or wild vegetables. Household activities

might include the tending a small fruit and vegetable garden, and caring for the domestic animals (chicken, pigs etc). These tasks have remained essentially the same over the past decade.

One of the questions we asked in an ongoing research project is how these changes affected folkbiological knowledge among Tzotzil Maya adults within this community. On the basis of the recent changes in the community we hypothesized that 1. men and women would show clear differences with respect to the accessibility of knowledge concerning trees, e.g. women should report more species than men and these differences should be concentrated in those species relevant to women's activities. 2. women should show no age related differences in accessibility, as women's involvement with the natural environment has basically stayed the same. 3. but changes in activities for men should lead older men to recall more names than younger men. In short, we expected a gender by age interaction in the accessibility if tree names.

A series of tasks was applied to test these and other hypotheses of within-cultural differences. In this paper we report only the results of one task, the generation (freelisting) of tree-species (see Weller & Romney 1988; Ross in press, for a description of the task). Because of its simplicity, this task is often ignored as a serious research instrument. However, it is exactly this simplicity that makes it a powerful tool. Many ethnographers have employed this tool (informally) in their research, especially when developing knowledge in certain domains. We suggest that much can be gained if we apply this task as a formal tool.

Altogether we interviewed 130 individuals, 90 women and 40 men, each of whom was asked to generate lists of the different plant life-forms (tree, *te'*, vine. *ak'*, grass, *jobel*). As in the case of other Maya languages, Tzotzil Maya does not have a word for the folk kingdom "plants." Instead, plants are marked in conversation through the use of classifiers. Here, we only present data on the generation of trees-species, *te'*. Each person was asked to generate all the trees he/she knows. After he/she stopped generating more items, informants were asked once more to try to come up with more species. This approach allows us to look at the number of items produced by each informant as a meaningful unit of exploration. In addition, after the list of trees was completed, each

individual was asked to describe the use(s) of each tree. The entire interview took about 15 minutes.

Participants were randomly chosen within the *jteklum*, the center town of Zinacantán, and two hamlets (one adjacent to the center village, the other approximately 30 minutes driving distance away). Selection was based only on the willingness of a person to participate in the study and the apparent adulthood of an individual; no individual refused to participate. On average, informants were 40 years old and no gender differences in age or area of residence (hamlet versus center) were observed. Informants were randomly assigned to three interviewers, two male and one female. No interviewer effect was found and nor did it matter whether or not the gender of the interviewer and the interviewee matched. Interviews were conducted in the homes of the participants in Tzotzil Maya and each informant was reimbursed for his/her participation.

Measure of Agreement To assess responding within and across groups we applied the Cultural Consensus Model (CCM), as developed by Romney et al. (1986) (see also Atran et al., 1999; Weller, 1987 for examples). The CCM is a factor-analytic method for computing levels of agreement and disagreement in the structure and distribution of information within and across populations. The model assumes widely-shared information is reflected in a high concordance, or "cultural consensus," among individuals. We used a principal-components analysis to determine if a single underlying model held for all informants from a given population: a strong group consensus exists if (1) the ratio of the latent root of the first to the second factor is high, (2) the first eigenvalue accounts for a large portion of the variance and (3) all individual first factor scores are positive and relatively high. If this is the case, then the structure of the agreement can be largely explained by a single factor solution, the “consensual model.” In this case, first factor scores represent the agreement of an individual with this consensual model.

The CCM is also useful for analyzing within and across group differences. These differences can be explored by (1) comparing first and second factor scores of each individual and (2) analyzing patterns of residual agreement. Residual agreement is calculated by subtracting predicted agreement (equal to the product of first factor scores) from observed agreement (Boster, 1986; Coley, 1995; Lopez, et al 1997). To the extent

that within group residual agreement is larger than across group residual agreement, there is evidence of reliable group differences. Once we formally establish the existence of group agreement and systematic differences, we can explore the differences with respect to individual responses.

The CCM analysis was based on an inter-informant agreement matrix. Informant agreement was calculated as the percentage of agreed upon items over all generated items across the 130 informants. In total 71 identifiable species of the category *te'* were reported. While 18 species were reported by only one individual, the top three species were reported by over 100 informants (*tulan*, Quercus spec., *toj*, Pinus spec., and *on te'* spec., Ericacea). In this specific analysis agreement was assumed when two individuals either mentioned the same item or when they did **not** mention a specific item.

A high consensus was found across the 130 informants (ratio 1^{st} / 2^{nd} factor eigenvalue: 6.0; variance explained by first factor: 45.6 percent; average first factor score (all positive): 0.66). Two factors account for such a high consensus: 1. Name generation tasks target the most salient species hence we should expect high agreement on the salient items. 2. Agreement was calculated both, as two individuals reporting a species or **not** reporting a species. If we only take positive matches into account, agreement drops dramatically. However, the problem with looking only at positive matches is that individuals were not forced to come up with a fixed number of items, complicating our calculations of agreement. Finally, there is a logical argument to be made against looking only at positive matches. Two people not mentioning a species (not reporting it) agree in that for both individuals this specific species is not salient (in the context of the interview). Finally, while consensus is increased with such an approach, we maintain a high resolution with respect to patterns of agreement, by exploring patterns of residual agreement.

Despite the relatively strong consensus, we find significant gender differences. Women generate significantly more trees than men (9.7 items compared to 8.5 items; $F=7.99$; $Mse=41.1$; $p=0.005$). Furthermore, we find a marginally-significant correlation between age and the number of trees generated by men ($r=0.22$; $p=0.08$); no such trend was found among the women ($r=-0.07$). Both findings are in the predicted direction and are further supported by the analysis of residual agreement. We find systematic residual

agreement, in that men agree more with each other than they do with women (F=5.88; Mse=0.10; p=0.018). Women, too, seem to show their own within-group residual agreement, but it is not significantly greater than their average agreement with men (F = 1.74). In this particular context the difference in residual agreement is driven by the fact that women are more likely to mention certain plants than men. Men, however, reach a higher consensus on the basis of items that were **not** mentioned (agreeing on non-generated items**)**.

The gender differences in tree name generation are concentrated in a few relevant species. Women are more likely to report *batz'i te'* ($X^2(1) = 7.28$; $p<0.007$); *isbon* ($X^2(1) = 5.32$; $p<0.021$), and somewhat more likely to report *ajte* ($X^2(1) = 3.6$; $p<0.058$), *pomos* ($X^2(1) = 3.18$; $p<0.07$), and *ch'ix* ($X^2(1) = 3.0$; $p<0.08$). (Analyses are two factor Chi-squares with gender and reported/not reported as variables).

Batz'i te', translated the "true, genuine tree," refers to the black oak (Quercus crassifolia). It is a dominant species in the pine-oak forests of the Chiapas Highlands. Traditionally the trunks were used for roof rods, tamale platforms, and bean-poles. At times it is used for corral posts, but it tends to rot quickly as it has no heartwood. It is most highly valued as firewood. It is also used as payment for ritual functionaries (see Breedlove & Laughlin 1993:185&186). Batz'i te' was mentioned by 90 informants. Of these 90 informants, 79 individuals (62 women) specified that the major use for this tree was for firewood. Twenty individuals (13 women) reported its use as a construction material (both for houses but also for corral fences which now are mostly made by women!), seven reported the use of this wood for the production of charcoal, while church adornment and medicinal use each was reported by 2 individuals. With the exception of house construction, all of these are common activities for the women of Zinacantán. Interestingly, a Chi-square analysis (two factors) shows that men are more likely (marginally significant) than women to report construction as one use of this tree ($x^2(1) = 2.7$; $p<0.09$).

Isbon (Cornus excelsa) refers to the common creek dogwood. It occurs along streams in the Highlands often extending to temperate areas. The trunk has a variety of secular and ceremonial uses, including things like handlebars for tools, drumsticks, corral posts, and walking sticks for authorities. Within ceremonial contexts dogwood also

provides the frame for flower arches. The name of the tree (bon = dye or paint) may come from a historical use of the plant as a fixative for black dye and wool (de Leon & Goicoechea 1797, cited in Breedlove & Laughlin 1993:162). Again, its most common contemporary use is as firewood. This can be seen in the fact that out of 17 individuals who reported this tree, 12 mentioned firewood as its major use. Interestingly, fourindividuals reported the use as a dye in the weaving process, indicating that the use of this tree as a coloring agent might not be purely historical. Again, the reported uses of this specific tree are related to female activities; predictably, only one man reported this tree.

Ajte', "reed tree" (Casimiroa edulis) refers to the white sapote. It is generally protected by Zinacantecos and often serves as shade tree in the coffee plantations. Although it grows wild, Zinacantecos often plant this tree. The wood can be used for log chairs and also for fences and bridges. The fruits are edible, although Zinacantecos often describe it as bad tasting, and more appropriate for the *Chamulas*, members of a neighboring Tzotzil community to whom such fruits are often sold. Seeds serve a medicinal purpose (Breedlove & Laughlin 1993:172). Only 8 individuals reported this tree species, all women. Out of these informants 5 mentioned food and 1 mentioned firewood as the major uses of this tree. The tree was described both as growing in the wild and planted.

Three different species of *pomos* are identified among the Tzotzil Maya: *Ik'al pomos* (Ceanothus coeruleus); *sakil pomos* (Gymnopodium floribundum var. antigonoides) and *tzajal pomos* (Holodiscus argebtus). The name identification indicates that color is one of the distinctive markers (*ikal* = black, *sakil* = white and *tzajal* = red). Plants are often used for living fences and the wood sometimes serves as a handle for tools. Again, firewood is a very frequent use for this tree. The trunk of *sakil pomos* is used by the women to make loom bars for weaving. As such it has replaced bamboo, which is nearly extinct around the community (Breedlove & Laughlin 1993). In total, 31 individuals (6 men) mentioned this species. Of those, 27 reported the use of this tree as firewood. One woman mentioned medicinal use and two women reported the use of this tree as a construction material.

Ch'ix (Cirsium spec.). Zinacantecos distinguish three different species of ch'ix by name: *Lo'balal ch'ix* (Cirsium horridulum), *tomal ch'ix*, and *sakil ch'ix*. The latter two refer to three different species (C. mexicanum; C. nigriceps and C. subcoriaceum). *Lo'balal ch'ix* is a medicinal plant whose boiled roots are used to reduce stomach pain. The underground part of the stalk can serve as emergency food during famines. The boiled young stalks of both *tomal ch'ix* and *sakil ch'ix* serves as a food source (Breedlove & Laughlin 1993:222). In total 18 individuals reported this tree (two men). Again, the overwhelming majority (12) reported firewood as the major use of this plant. Other reported uses are construction (4), food (2) and church ornament (2). Only one of the two men reported a use of this tree. He described both the value of *ch'ix* as firewood and construction material.

Summary Both the pattern of informant agreement as well as the number of species generated indicate that tree-species are indeed more salient for the women than for the men of Zinacantán. Women generate more species than men, and only for men do we find a correlation between age and the number of species reported. Older men tend to report more species than younger men. While this could be the result of a general learning curve (more experience with age), it is important that no such an effect is observed for the women. However, if age-based experience is all there is we should expect a general effect (across gender). The fact that we find do not find such a trend for the women is in line with the hypotheses that recent changes have affected men and their relation with their natural environment more than women, whose work sphere has basically remained the same. Older men are less likely to take on new jobs outside of agricultural work, and if they do, are much more likely to have had an agricultural occupation previously. Older men probably benefit from the fact that they experienced "better times," when land was not as scarce and when trees and forests were still abundant in the area.

These differences were confirmed with the help of the consensus analysis and respective analyses of residual agreement. Overall a clear consensus emerged, which should not be surprising given the overall plant knowledge people in this community have (see Breedlove & Laughlin 1993), but it was also coupled with clear gender

differences in patterns of residual agreement. Several species were identified that drive these differences, and an analysis of their use clearly marks them as being within the realm of traditional female occupations.

All in all, this pattern is consistent with our hypotheses about the consequences of recent changes in the social and physical environment of the community. New employment opportunities (and low prices for agricultural products), coupled with dramatic land-shortage and deforestation, have led men to seek other types of employment, decreasing their exposure to nature. Although Zinacantán men still have an extraordinary knowledge of plants, the cultural importance of this knowledge seems to be receding. Anecdotal evidence is the fact that two men but no woman mentioned *manzaniya* within this task. It is telling that *manzaniya* (Chamomilla recutita) is not a tree, but the little herb from which Chamomile tea is made!

In sum, it appears differences in activities drive gender differences with respect to saliency of certain plants among the Tzotzil Maya of Zinacantán. The data are based on a simple but formal task, the generation of names of trees. It is the simplicity of this task, coupled with targeted analyses that make this task so powerful. However, without the ethnographic knowledge of the area (as well as the specific knowledge of the stimuli materials, i.e. the plants) the meaning of these results would remain largely obscure. It is here that a combination of methods and disciplines can make a big difference: Rather than working in the vacuum of the psychology laboratory, with undergraduate students and meaningless stimuli, it is the work with "real people" in "real life situations" using "real stimuli" that will provide important data, both for processes in high-level cognition and cultural studies. We turn now to our second example, cultural differences among fishing experts in central Wisconsin. The combination of culture and expertise allows one to ask questions about the role of the structure of nature and experience versus the role of cultural models in structuring experience.

Study 2: Culture and folkbiological knowledge organization

The view that the structure of nature and goal-related activities drives conceptual structure leaves little if any room for culture to influence folkbiology. On the other hand, one might argue events in nature are complex and subject to construal. It may be that

framework theories serve to guide the interpretation of experience (Keil, 1995; Keil, Levin, Richman and Gutheil, 1999) and highlight or grant access to certain features over others. Culture may act as a framework theory, either in the form of so-called "skeletal principles" (e.g. nature seeks a balance; every fish has a role to play, etc) or in the form of more concrete stories and examples that might serve to guide reasoning by analogy (e.g. knowledge about cowbirds tricking other birds into caring for their young may lead one to be alert for the possibility that some species of fish might spawn on the bed of another species of fish with the same goal in mind). In short, culture may produce different "habits of the mind" that have consequences for people's conceptualization of nature. This raises the possibility that shared activities and decades of experience may be insufficient to produce convergence in conceptual behaviors. On this view, we would predict certain levels of agreement (due to shared experience) with underlying differences in the ways culture shapes the interpretation of experience and attention to various aspects of nature.

Again, we see two possibilities for how culture may affect conceptual organization. One is that it may lead to different knowledge bases, and the other is that it may lead to differences in the *salience or accessibility* of different types of knowledge (e.g. Hong, Morris, Chiu and Martinez, 2000). It is the latter idea that we pursue in the following study.

Menominee Native American Folkecology

In this study we compare Menominee Native Americans with Majority Culture people from the same area. This comparative approach, while not favored in anthropology, has a distinct advantage in testing the above ideas concerning knowledge organization. To foreshadow the results, experts of the two cultures differ with respect to accessibility effects that seem to be driven by the way these two groups organize their knowledge. Our findings indicate that these differences are not based on differences in the knowledge base, i.e. the individual expertise.

The Menominee are Algonquin speakers and form part of what is known as *Northern Woodland Culture*. Historically, Menominee lands were too far north for reliable corn cultivation. Therefore, the Menominee provided for themselves through a combination of hunting, fishing, and gathering (particularly wild rice, which was a staple

of their diet; Menominee means “wild rice people”). Menominee territory was reduced in treaty after treaty following the invasion of white armies and settlers. A final treaty signed in 1865 declared 235,000 acres of land the home of the Menominee. This is only a small fraction of the approximately 10 million acres they once controlled.

Despite economic incentives to the contrary, the Menominee have preserved diversity and habitat types of their forest, which is managed by a tribal enterprise. Overall, sustainable coexistence with nature is a strong value among the members of this population (Hall & Pecore, 1995). The reservation has a number of lakes, ponds, creeks and rivers. One of the major rivers is the Wolf River. Harboring one of the most sacred areas, Keshena Falls, the Wolf River runs through the reservation into Shawano and continues as far south as Lake Winnebago.

The tribe sets its own fishing regulations, which allow spear-fishing of some game fish (in contrast to Wisconsin state law which generally prohibits spear-fishing; nonetheless, only a minority of Menominee fishermen spear-fish). Notably, tribal fishing regulations prohibit the “wanton destruction” of any fish. For Menominee, a strong cultural value is respect for nature and the belief that one should only take what is needed from the environment. Recent surveys reveal that the fish population on the reservation shows above average health, and abundance (Schmidt, 1995).

Currently approximately 4-5000 Menominee live on tribal lands in three small communities. The 2000 census indicated that the mean family income was about $27,000 compared with $38,000 in adjacent Shawano County. Over 60% of Menominee adults have at least a high school education and 15% have had some college. Outdoor activities are very important and special attention is paid to both hunting and fishing, the latter being done in a variety of ways (fly-fishing, casting, ice-fishing etc.), over the whole year.

Majority Culture

Just south of the reservation is Shawano County, the other focal area for our study. The major sources of income in the town of Shawano are light manufacturing, small-scale farming, and tourist recreation, mainly in the form for hunting, fishing, boating, jet-skiing and snow-mobiling. Shawano Lake is a major attraction and there are

also several smaller lakes in the county. The Wolf River runs through Shawano County and is connected by a channel to Shawano Lake.

Outdoor recreation is very important to Shawano residents and many of them have been fishing since the time they were young children. Several fishing clubs (e.g. a "Muskie Club") provide a social dimension to fishing. These clubs also raise money to stock lakes and rivers with desirable fish and encourage the practice of "catch and release" (for example the Muskie Club rules are such that your club membership will be terminated if you cause the death of a single muskie). There are usually several local fishing contests each year, open to Shawano residents, tourists and professional fishermen. Considerable sums of money go to winners; for example, one of our informants had recently won $25,000 in a muskie contest. (There are some small-scale fishing contests on one of the reservation lakes but the prizes are tiny by comparison and it is more a local, social event than a contest per se).

Comparison of Populations It is important to bear in mind that many of the above generalizations are associated with considerable variability. For example, a number of Menominee -- about half of our sample of experts -- do not approve of spear-fishing walleyes (a game fish prized for its meat) because spearing is typically done in the spring when fish are spawning and they believe that it might hurt the fish population. The response by spear-fishers is that they ignore the larger females in favor of spearing the males. Conversely, a fair number of majority culture fishermen oppose fishing contests, citing high death rates from catch and release and expressing concerns about moving individual fish from their natural home range.

In general, Menominee pay more attention to fishing as a food source than their majority culture counterparts, since fishing for food is a higher priority goal for the Menominee in our sample. Generally, we found that majority culture informants focus relatively more on fishing for sport than on fishing for food.

Differences in goals may lead to some (minor) differences in experience with particular species. For example, the muskie is the largest game fish found in this area and, for majority culture informants, there is prestige associated with catching (and releasing) them - the bigger, the better. Majority culture fishermen are more likely to target muskie than are the Menominee (there are fewer muskie in the reservation lakes than in Shawano

Lake). Majority culture fishermen also target two other gamefish as “large and prestigious.” These are the northern pike, belonging to the same genus as the muskie, and the walleye. Larger northerns and walleyes are typically released, but majority culture fishermen may eat walleyes and smaller northerns. Menominee fishermen also eat smallmouth and largemouth bass, northerns, and walleyes, and both groups eat panfish (e.g. bluegills, sunfish, crappies, perch).

Menominee are somewhat more likely to target trout than are majority culture informants. Trout are very good to eat, according to both groups of informants, and trout streams are abundant on the reservation. When we asked 14 Menominee and 14 majority culture fish experts to rank order the importance of 15 species of fish to themselves, we found that trout (brook trout and brown trout) were ranked reliably higher by Menominee fishermen and that muskie was ranked reliably higher by majority culture fish experts. In another task we asked 13 Menominee and 15 majority culture fish experts to generate names of local fish spontaneously (freelisting). Majority culture fishermen were reliably more likely than Menominee to mention northern, muskie and walleye in their first five names while Menominee were reliably more likely to mention either “trout” or specific trout (e.g. brown, brook, rainbow).

Although the two groups have somewhat different specific goals, they share the general goal of catching fish and conserving fish as a resource. Furthermore, both groups target essentially the same set of fish (including trout and muskie, notwithstanding the differences in emphasis noted above) using the same set of methods. This common goal and common practices, coupled with their very extensive fishing experience, should lead one to expect a convergence of the two groups with respect to their knowledge of fish.

At a finer level of detail, one might expect that goals and associated activities could lead to some modest group differences. The goal of catching fish can be broken down into finer goals of catching a trophy-sized fish for catch and release (or for mounting) versus catching fish for food. We see two possibilities for how these more subtle differences may affect knowledge and conceptual organization. One is that catch and release allows fewer opportunities to observe what a fish has been eating than catching and cleaning fish. However, it is unlikely that this reduces knowledge of fish-fish interactions in that experts who practice catch and release with (large) northern and

walleyes will nonetheless have caught and cleaned several hundreds if not thousands of walleyes and northerns.

The second possibility is that differences in species of fish targeted leads to differences in knowledge. For example, we might expect majority culture experts to know relatively more about the large species of gamefish (northern, muskie, walleye) and Menominee experts to know relatively more about trout. This possibility is more plausible than the first one. Note, however, that differential experience with particular species would be unlikely to lead to overall differences in conceptual organization.

These possibilities are, of course, not mutually exclusive. In the present project we aim to see if culture influences conceptual organization in a manner that cannot be accounted for in terms of habitual goals and activities. The CCM was again used to measure agreement between informants and to test for systematic group differences. In our study we expected an overall consensus but perhaps also reliable group differences, which could then be evaluated for whether they are due to group differences in goals and activities or to culturally developed "habits of the mind."

Participants were nominated (non-professional) fish experts of both communities. Expertise was further controlled through a familiarity task, including 44 fish-species that naturally occur in the area. No participant had received any formal training about fishing or fish-species and no differences in educational levels were observed. The two groups did not differ in age, years of experience fishing (median = 40 years) or expertise.

First we asked individuals to spontaneously sort 44 local species of fish into groups, sub-groups and supergroups based on the question "put the fish together that go together." This creates a hierarchical taxonomy for each informant, which helps address the problem of different criteria for lumping a splitting which is especially salient when only a single sorting is used. The data for each informant consist of a fish by fish distance matrix and agreement across informants is based on the correlation of their fish-fish distances (See Lopez, et al, 1997 for a justification for this use of the cultural consensus model).

Results. The 15 Menominee and 15 Majority Culture experts showed an overall consensus (ratio of first eigenvalue to second = 7.6 to 1, 57% of variance accounted for by the first factor, average first factor score = .75) but also reliable between group

differences. Our analyses of residual agreement revealed that Menominee hold a model beyond the consensual model they share with the majority Culture experts. This is not true for the Majority Culture experts. Multi-dimensional scaling (MDS) yielded a two-dimensional solution for majority fish experts. Characteristic adult size correlated with one of these dimensions and desirability with the other. MDS yielded three dimensions for Menominee experts with the first dimension correlating with fish habitat and the other two dimensions correlating with size and desirability. This pattern was further confirmed by the justifications individuals gave for their sorts.

Ecology task. A subset of 21 fish species was selected to probe directly for ecological relations. All possible pairs (210) were presented to 15 Majority Culture and 15 Menominee fish experts and in each case the question was of the form “Does fish A affect fish B and/or does B affect A?” In case of an affirmative response the individual was asked to elaborate on the kind of relation. Again, we find clear cross-group consensus (ratio of first to second eigenvalue = 4.2:1, 30% of variance accounted for, average first factor score = .52) coupled with reliable between group differences (Medin, Ross et al. 2002, Medin et al, in press). For all relations reported by 70% or more of informants from one group we find: (a) 85% are reported by both groups, (b) 14% are reported by Menominee but not majority culture experts, and (c) 1% are reported by majority culture but not Menominee fishermen. This resembles our previous findings in that Menominee show responses not shared by majority culture people, but not vice versa. This pattern is caused by two main factors: (1) Menominee responses refer to the whole life-cycle of fish whereas majority culture experts mainly answer in terms of adult fish. For example, Menominee might describe a fish eating the fries of another species, a response rarely given by Majority Culture experts; (2) Menominee do not describe the interaction between bait fish and predators, if both are not naturally found in the same waters. In contrast, Majority Culture experts tend to over-generalize predator-bait relations. These results suggest that majority culture experts organize their ecological knowledge around goals that target adult fish. This interpretation is further reinforced by the results from spontaneous sorting.

Ecological sorting. Given the overall expertise of individuals involved in the study we hypothesize that these differences are not differences in levels of expertise (base

knowledge), but rather in knowledge organization. When we asked members of both groups to sort ecologically ("put the fish together that are found together") we found an overall consensus (ratio of first to second eigenvalue = 9.5, 72% of variance accounted for by first factor, average first factor score = .85) and no reliable between group differences (5). This indicates that in previous cases where Majority Culture experts over-generalized across habitats, a relation (bait to game fish) is not based on the lack of ecological knowledge.

Ecological probes at a slower pace. To further probe the nature of the group differences we conducted a second fish-fish interaction study (n = 14 per group) with fewer items and at a slower pace. Our idea was that effects of differences in knowledge organization would disappear under the unspeeded probe condition. The design replicated task one and almost all participants did both tasks. (The interval between the speeded and unspeeded tasks was between one and two years.) This time we asked only about 34 fish-fish interactions (rather than the 210 of the first task). Our expectation was that the between group differences would disappear, with the main effect of majority culture experts responding like Menominee. This was in fact the case. Using performance on these 34 pairs from the speeded task as a baseline, for the slow task majority culture experts report reliably more relations (means of 29.3 versus 17.0, $t=2.79$, $df = 27$, $p< 01$), including more relations involving spawn ($t= 2.61$, $p <.05$) and more reciprocal relations ($t = 2.60$, $p < .05$). Menominee experts showed no reliable changes. This indicates that the cultural differences are in "habits of mind," the organization of knowledge, rather than knowledge *per se*. In short, conclusions about group differences and similarities are sensitive to the pace of the task. Differences in knowledge organization are most apparent under speeded conditions.

General Discussion.

In both studies we made extensive use of the Cultural Consensus Model (Romney et al. 1986), not so much as a basis for a theory of culture (see Garro, 2000 for a critique, see also Ross in press), but as a tool to detect patterns of agreement / disagreement among informants. In both cases the experimental approach not only allowed us to use this formal tool to explore patterns of agreement, but also we were able to probe some of these differences in enough detail to understand their specific nature.

Two types of differences were explored: (1) Activity-related differences in saliency, e.g. access to species among Tzotzil Maya, and (2) differences in the organization of knowledge and resulting differences in the saliency of certain kinds of knowledge among Menominee Native Americans and Majority Culture fish experts. The results are very important both for theories of cognition and for our understanding of cultural processes. It is hard to imagine how one could obtain these results without the use of formal methods of data gathering and analyses. At the same time, detailed ethnographic knowledge was needed not only to form relevant hypotheses and to make reasonable decision about the informant pool, but also in order to interpret the results. This is the strength of coupling two distinct but complementary fields of research, anthropology and cognitive psychology. It is here that our research goes beyond previous approaches in culture and cognition in showing that disciplinary differences in methodology should not lead us to believe that these different methods cannot be used together; in fact, each method displays it full strength only in combination with the other. In our opinion, this kind of research, using strategies from both the cognitive sciences and anthropology will allow anthropology to find its way back where it belongs, into the center of social science research.

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