Triad Tasks, a Multipurpose Tool to Elicit Similarity Judgments: The Case of Tzotzil Maya Plant Taxonomy

NORBERT ROSS
TOMÁS BARRIENTOS
ALBERTO ESQUIT-CHOY
Vanderbilt University

The universality of multipurpose taxonomies has been widely established in folk biology. However, recent studies with nonprofessional fish experts in the United States as well as with tree experts in the Chicago area suggest that different goals can affect category organization of natural kinds. This article reports the results of a triad task study exploring specific aspects of the multipurpose plant taxonomy among the Tzotzil Maya of Zinacantán in the Highlands of Chiapas. Despite previously encountered differences with respect to saliency, no corresponding differences with respect to conceptual organization could be detected. A balanced incomplete block design was applied. Resolution was enhanced by allowing participants to judge the three items as either "too similar" or "too different" in addition to single out one item as different. Analyses explore (1) the pattern of informant agreement (as a precondition for), (2) the content of existing models, and (3) the saliency of responses.

Keywords: *categorization; ethnobotany; triad task; consensus analysis*

Research by Atran (1998) and Berlin (1992) established the universality of multipurpose taxonomies. However, recent studies with nonprofessional fish experts in the United States (Medin et al. 2002, forthcoming) as well as with tree experts in the Chicago area (Medin et al. 1997) suggest that different goals can affect category organization of natural kinds.

This article links the latter type of research to the question of cultural change and data from a larger research project exploring effects of changes in socioeconomic activities on aspects of folk-biological knowledge (see Ross and Medin 2005; Atran, Medin, and Ross 2004). The research explores the

This research was supported by a grant from the National Science Foundation (BCS 0216762) to Norbert Ross. We thank the people of Zinacantán for their collaboration. The research could have been conducted without us but not without them.

Field Methods, Vol. 17, No. 3, August 2005 269–282
DOI: 10.1177/1525822X05277861

content of cultural models and patterns of informant agreement, tying those patterns systematically to the social processes. Specifically, we test whether encountered gender and age differences in saliency of plant species (Ross 2005; Ross and Medin 2005) would carry over to differences in the organization of the respective knowledge. We define saliency as the "accessibility of information" measured within a freelisting task (see Ross 2004, 2005; Ross and Medin 2005).

Previous research in Zinacantán indicated that due to recent changes in the socioeconomic setting of the community, women are in closer contact with the environment (seeking firewood, tending to small animals and gardens) than are men, who often abandoned the subsistence-oriented agriculture looking for outside employment. Not surprisingly, we found that the saliency of trees is higher for women than for men. In addition, we found an age effect among men (older men reporting many more trees than younger men) but not for women, indicating that the encountered effect is indeed related to an ongoing cultural change with respect to saliency of tree species (Ross 2005). This approach relates the study to previous research by Wolff, Medin, and Pankratz (1999), which explores the decrease of saliency of folk-biological knowledge in England based on entries in the *Oxford English Dictionary*, and Ross (2001, 2002), who analyzed the loss of folk-biological knowledge across two generations of Lacandon Maya of Chiapas. (See Atran, Medin, and Ross 2004 on the devolution of knowledge.)

The described changes and differences pose a challenge to traditional synthetic accounts of cultural knowledge: Whose knowledge is reported?

In most descriptions of folk-knowledge systems, it is not clear whether the reported knowledge is held by every individual or even by any single individual in a community. Most often, neither is the case; instead, the data represent an artificial collage of knowledge bits reported by individuals and put together by the author in a systemic fashion. Such an approach might show the detailed knowledge available in a community, but it ignores questions of how knowledge is distributed and what kind of knowledge is shared and by whom. It is these kinds of questions, however, that allow us to link cognitive processes with social processes.

Linking different tasks within one study is a powerful tool for social science analyses. However, the tasks must allow us to analyze both content and patterns of agreement for direct comparison of responses. Given the field setting, we also needed short and simple tasks (applicable with nonliterate individuals) that would not depend on sophisticated equipment (e.g., the experiments run on computers in the psychology lab). The triad task provides such a tool. It is simple to administer (paper and pencil) and puts little demand on the informants. Furthermore, it does not presuppose any organization of the data (as card sorting usually does). Finally, it allows for a straightforward analysis of informant agreement, an essential tool for systematic anthropological research.

RESEARCH BACKGROUND AND STUDY DESIGN

Zinacantán is probably one of the most studied communities in Mexico, possibly in the world (Vogt 1994). While this might cause many anthropologists to shy away from studying such a place, it is exactly the richness of information available that attracted us to it. Much is known about the community with respect to cultural, political, and economic processes (Cancian 1965, 1992; Collier 1975, 1999; Ross 1994), and there is considerable knowledge about folk-biological knowledge in the community (Breedlove and Laughlin 1993). So why bother? This project set out to actively build on these existing foundations to deepen rather than widen our knowledge in the regional area, the specific domain (folk biology), and in the field of cultural change.

The Tzotzil Maya community of Zinacantán is located in the highlands of Chiapas, about ten kilometers from San Cristóbal de Las Casas, the major urban center of the area. Zinacantán has managed to preserve much of its cultural distinctiveness yet has experienced many changes over the past fifty years (Cancian 1992; Collier 1999; Ross 2005; Ross and Medin 2005). A mixture of pressures and opportunities has led many individuals away from working the traditional agricultural field, shifting them toward (1) cash-cropping corn in the lowlands (Breedlove and Laughlin 1993), (2) the production and sale of cut flowers (Ross 1994), and (3) nonagricultural occupations (bus and taxi driving, regional trade, service jobs in San Cristóbal de Las Casas, etc.). These changes estranged Zinacantán men from their natural environment but had less effect on the women. Traditionally, men and women 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 tending to a small fruit and vegetable garden, caring for the domestic animals (chicken, pigs, etc.), and gathering wild herbs. These tasks have remained essentially the same over the past decades.

For this specific study, we selected the sixteen most salient items from four different life forms: trees (*te'*), bushes/herbs (*tz'ilel*), grasses (*jobel*), and vines (*ak'*). Tzotzil does not have a word for the plant kingdom. For each life form, we asked a set of one hundred participants to list all the species they could think of. Informants were randomly selected. The most salient species

TABLE 1
Species Used in This Study

Folk Species	*Life Form*	*Scientific Name*
Batz'ite'	Tree	*Quercus grassifolia*
Chikinib	Tree	*Quercus* sp.
Onte'	Tree	*Arbutus xalapensis*
Sipres	Tree	*Cupressus benthamii*
Toj	Tree	*Pinus* sp.
Tulan	Tree	*Quercus* sp.
Hinojo	Herbs/bushes	*Foeniculum vilgare*
Maravilla	Herbs/bushes	*Calendula* sp.
Pak'chak	Herbs/bushes	*Malva* sp.
Pem kulum'	Herbs/bushes	*Verbena* sp.
Saju'	Herbs/bushes	*Simsia* sp.
Ana jobel	Grass	*Muhlenbergia macroura*
Ne chuch' jobel	Grass	*Piptochaetium virescens*
Yisibe	Grass	*Cyprus* sp.
Chix ak'	Vine	*Celtis iguanaea*
Pik'ok	Vine	*Ipomoea* sp.

were used for this task to ensure that participants would actually know the plants. This does not guarantee a common conceptual organization (see Medin et al. forthcoming). In contrast, many participants not knowing certain plants would weaken our analyses of participant agreement. On average, participants reported more trees and bushes than grasses and vines. This is reflected in our species list. Numbers reflect the ratio of number of species generated per life form.

Table 1 presents the species used in this study. Each species was represented by a name card (written in Tzotzil Maya).

THE TRIAD TASK

In previous studies, two different tasks have been used by researchers to elicit categories of items: card/pile sorts (Freeman et al. 1982) and triad tasks (see Romney and D'Andrade 1964). Card sorts have the advantage of allowing the researcher to administer a larger number of items in the task. Still, this comes at a cost. First, in the usual form, card sorting presupposes a taxonomical order, in which an item belongs in only one category (Weller and Romney 1988; see Medin et al. forthcoming for an alternative approach). Second, in the unrestricted form, participants might differ widely in the number of categories produced (the “splitter/lumper problem”). This makes it impossible to analyze interinformant agreement in a straightforward manner. Finally, in card sorting, we lose some control about the reasoning individuals use in their decisions (see Ross 2004 for a discussion of the respective analyses of informant agreement).

In comparison, in a triad task, participants are asked to judge similarity between three items (which one is different, which two items are most similar). With sixteen items and a Lambda 2 design (see below), this leads to eighty triads for which judgments are elicited. Previous work (Ross 2001) showed that this task can be administered to illiterate individuals with name cards (as a mnemonic device). This allows the exploration of abstract concepts, preventing participants from becoming distracted by the pictures. Triads were set up in the balanced incomplete block design with Lambda 2 (Burton and Nerlove 1976). This means that each pair of species is compared exactly twice (otherwise there would be 560 trials to this task!). Obviously, these comparisons are highly context dependent. Compare the following two triads with respect to the elicited similarity of bear and horse:

Bear, Horse, Donkey
Bear, Horse, Eagle

The problem is somewhat leveled by the fact that each pair of items is compared against two different third items. Furthermore, the similarity between two items is calculated as their shared similarity to other items (see Burton and Nerlove 1976). Another way of ameliorating these low-lambda effects is by using a between-subject design, in which different sets of participants become different sets of trials, which allows an overall higher Lambda design. However, there is a huge drawback for such a procedure, as we lose not only considerable statistical power but also the ability to conduct an analysis of informant agreement (beyond the subsets). For this reason, applying a between-subject design was not an option for this research. Furthermore, such aggregation of data across informants is formally not justified without a prior cultural consensus model (CCM) analysis, showing that the informants agree among one another. For this reason, we decided to use a within-subject design for our study. However, to ameliorate the described problem, we used an additional precaution and introduced the following procedure: Whenever an informant was not sure about a response, the triad was delayed until the end of the task. If the informant (when asked again) still could not provide a response, he or she was then asked if the items are too similar or too different to make a judgment (this became the coded response).

STUDY POPULATION

Fifty-one individuals were interviewed, fifteen men and thirty-six women. Again, the individuals were randomly chosen, and half of the subjects were part of the initial sample of one hundred participants. The second interview took place approximately two months after the first. The average age across both sexes was 40.7 years, with no gender difference in age (40.2 years for men and 43.1 years for men). As in the initial study (Ross 2005), fluency in Spanish correlated negatively with exposure to the forest (i.e., the more fluent a person is in Spanish, the less time he or she spends in the forest; $r = -.526$, $p = .02$). Again, as in the previous task, we find that speaking Spanish is also (marginally significant) related to holding/having held an inauguration ceremony for the house ($F = 3.54$, mean squared error [MSE] = 0.373, $p = .07$). The latter, however, is unrelated to age. As in the original sample, women are less likely to speak Spanish and more likely to visit the forest (see Ross 2005).

DATA ANALYSIS: MEASURING AGREEMENT

To assess agreement within and across groups, we applied a method based on the CCM, as developed by Romney, Weller, and Batchelder (1986; for applications, see Atran et al. 1999 and La Torre Cuadros and Ross 2003). Principle component factor analysis was used to compute levels of agreement and disagreement in the structure and distribution of information within and across populations. Widely shared information is reflected in a high concordance, or "cultural consensus," among individuals. Principal-components analysis is used to determine if a single underlying model holds 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 explained by a single factor solution, the consensual model. First-factor scores represent the agreement of an individual with this consensual model. Based on the individual consensus parameters, one can analyze patterns of residual agreement. Residual agreement is calculated by subtracting predicted agreement (equal to the product of first-factor scores) from the observed agreement (Boster 1986; Coley 1995; López et al. 1997). To the extent that within-group residual agreement is larger than across-group residual agreement, one has evidence of reliable group differences.

For each trial, individuals could either pick one item as "different" (codes 1–3) or describe the items as "too different" (code 0) or "too similar" (code 4) to determine similarities. Participant agreement was calculated based on matched responses across all eighty trials (agreement = matched responses/80). These calculations present us with the observed agreement matrix (between participants). Compared to previous studies using the triad task, we did not force individuals to pick out one of the three items as different. Instead, we allowed individuals to select the response "too similar"/"too different" when the decision was not obvious. For this reason, we decided not to adjust for guessing. The observed agreement matrix was subjected to a principal component factor analysis to conduct the CCM. We found a strong consensus (ratio first/second factor eigenvalue 5.5; first factor accounts for 67.7% of variance, all loadings on the first factor are positive and high, average = 0.82).

This indicates that overall, participants strongly agreed with one another with respect to the categorization of the sixteen plants. This should not be surprising, given that plant taxonomies have been shown to be extremely similar even across cultures. In addition, in this particular study, we were dealing with the most salient plants of Zinacantán across different life forms.

Given the hypotheses, we were particularly interested in the possibility of finding gender or age differences (among the men).

ANALYSIS OF SUBGROUPS

As a first step, we explored the distribution of second-factor loadings. Systematic differences of second-factor loadings indicate group differences (beyond the consensus). We tested for both gender and age (by gender and combined). Using the mean split to select for the age groups, we detected no differences on the first or second factor. No systematic group differences of age or gender could be detected. However, existing submodels might be located across factors. Therefore, we conducted a detailed analysis of residual agreement.

Residual Agreement

Residual agreement describes the agreement that is left when we subtract predicted agreement from observed agreement. Predicted agreement is the agreement that one can expect based on each participant's agreement with the consensual model (first-factor score). It is calculated as the product of the first-factor scores of two participants (see Ross 2004 for a description of these procedures). The residual agreement describes agreement that goes beyond the consensus (i.e., what goes beyond everyone's knowledge). In such a scenario, systematic patterns in standardized residual agreement are the expression of existing submodels (e.g., subgroups of participants, who share more than the common model). If within-group residual agreement is significantly higher than between-group agreement, we have evidence of systematic differences in residual agreement. Note that this method is intended to test an existing theory about group differences. Given previous findings, we hypothesized that we would find both gender- and age-related group differences (the latter among men only). Again, we used the mean age split to test for age differences among men.

Results are not shown as none of the statistical tests approaches even marginal significance. This suggests that no systematic differences exist and that the described social changes affected saliency of tree species but not the overall categorization of plant species. As mentioned before, this result is not surprising. The established consensus provides us with the formal justification to aggregate our data across all informants without masking important information.

In further analyses, we explored other indicators that might account for some differences among the informants. While exposure to the forest is negatively correlated with the ability to speak Spanish, it does not predict either first- or second-factor scores. The only reliable predictor of a person's first- and second-factor score is whether he or she holds or has held a ceremony for a newly built house (first factor: $F = 12.1$, MSE = 0.014, $p = .002$; second factor: $F = 5.53$, MSE = 0.712, $p = .028$). Individuals who would not hold a ceremony for a newly built house show a higher first-factor score than do individuals who would hold a ceremony. While the willingness of holding a ceremony for a newly built house seems to be an index of being involved in the traditional customs, it is not clear what this relation actually describes, as holding such a ceremony is not related to age and only marginally related to the Spanish fluency of a person (individuals not conducting a ceremony report higher Spanish-speaking abilities; average: 0.41 vs. 0.11, $F = 3.5$, MSE = 3.73, $p = .07$). More research will be necessary to explore and explain these findings.

CONTENT ANALYSIS

The triad task allows for two basic content analyses. First, we can look at the individual trials and compare informant agreement across trials (for which trials do we find the highest agreement?). This approach enables us to answer some questions with respect to saliency effects (i.e., trials that have a culturally well-defined response). For example, in Western societies, it is much easier to pick the different item for the triad *horse*, *donkey*, and *robin* than for the triad *horse*, *goldfish*, and *robin*. Analyzing the agreement pattern across trials presents us with some ideas about the organization of knowledge. The second type of analysis includes aggregating individual responses and plotting similarities between the items. Note that due to the existence of a strong consensus and the lack of submodels, we are formally allowed to aggregate the data according to the response given by the majority of participants. Remaining disagreement is random (with respect to the research question) and can be treated as noise.

AGREEMENT BY TRIAL

Five different codes were used in this task: 0 (items very different), 1, 2, 3 (items selected as different), and 4 (items very similar). We should expect response patterns to be spread out between trials for which participants agree on a specific item, trials for which participants agree that items are either too similar or too different, and trials for which one group of participants selects an item and another declares the items in the trial as too similar or two different. It is unlikely, however, that substantial numbers of participants select (two or three) different items within one trial as the different one.

Of the eighty trials, we found ten trials for which a large majority of individuals agreed on one item as different from the other two (agreement >80%). As predicted, in all but two cases, the remaining informants chose either “too different” or “too similar” as their response (see Table 2).

If we look at the composition of these triads with respect to life forms, it becomes clear that in all the cases, two items belong to one life form and the third to another. In all of these cases, the plant from the different life form was chosen as different. (Trials are sorted according to level of agreement.)

For thirty-two trials, the majority of the participants (>80%) responded that the plants in the trial were “too different” to make a specific selection. With four exceptions, all these trials pitted plants from three different life forms against each other. The four exceptions have in common that they always pit two members of the category *ts’ilel* against a member of another life form. Ts’ilel (herbs/bushes) is arguably the life form that includes the highest variation with respect to size of the plants. Still, for three of these trials, between 12% and 17% of the participants chose life form as the basis for distinction. This analysis demonstrates the importance of life forms as categories for the Tzotzil Maya plant taxonomy. Given these results, we should

TABLE 2
High-Agreement Trials

Ana jobel/grass	Ne’ chuch’ jobel/grass	Onte’/tree
Toj/tree	Sipres/tree	Inojo/bush
Ch’ix ak’/vine	Ana jobel/grass	Ne’ chuch’ jobel/grass
Tulan/tree	Batz’ite’/tree	Pak’chak/bush
Batz’ite’/tree	Chikinib/tree	Pem kulum’/bush
Ne’ chuch’ jobel/grass	Tulan/tree	Batz’ite’/tree
Ana jobel/grass	Tulan/tree	Chikinib/tree
Ch’ix ak’/vine	Tulan/tree	Chikinib/tree
Pik’ok/vine	Ch’ix ak’/vine	Batz’ite’/tree
Pik’ok/vine	Ch’ix ak’/vine	Yisibe/grass

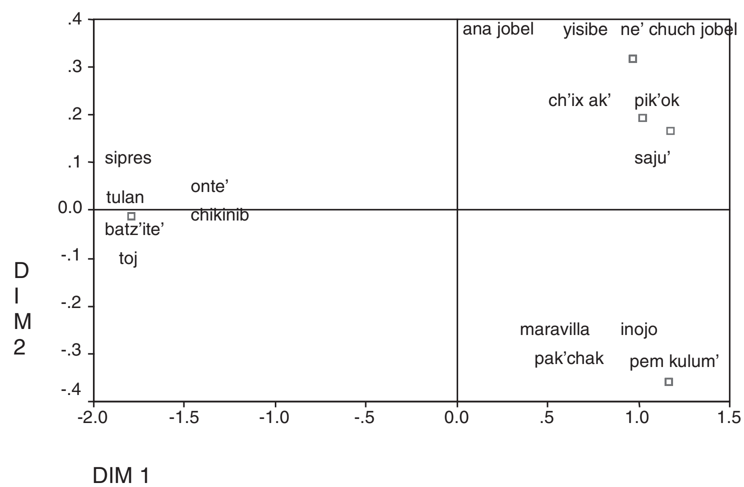
expect life forms to be salient in the calculated similarity between the individual plants (for the aggregated responses). We turn now to this kind of content analysis.

CALCULATION OF SIMILARITIES

For each trial, we aggregated all individuals’ responses and converted the percentage into a modal response. Compared to conventional aggregation techniques, this approach allows for a clearer, albeit somewhat simplified, picture of the structure of our data, excluding existing noise in the data. Formally, this aggregation is justified by the existing consensus and the lack of relevant residual differences. Based on the eighty trials, a plant-by-plant similarity matrix was generated. As each pair of plants appeared exactly twice during the trials, the entry for two plants was either 0 (plants were described as different in both trials), 0.5 (plants were described as similar in one trial and different in the other), or 1 (plants were described as similar in both trials). Coding 0 (all plants different) and coding 4 (all plants similar) were entered accordingly. The resulting matrix was used to calculate the interspecies similarity of each pair of plants comparing the similarity scores of two species across all other plants. The resulting matrix was used as the input for the multidimensional scaling (MDS). Figure 1 shows the MDS of calculated plant similarities.

In general, the analysis confirms the different life forms described in the study. With the exception of herbs/bushes, each life form is represented by exactly one point reflecting the fact that members of each life form are perceived as extremely similar. Dimension 1 clearly separates trees from grasses, vines, and herbs/bushes. This indicates a large perceptual distance

FIGURE 1
Multidimensional Scaling (MDS) of Plant Similarities



between trees and the other plant life forms. Grasses, vines, and herbs/bushes are separated in dimension 2. Two things are noteworthy: In general, vines are perceived as closer to grasses than are herbs/bushes. Within the life form of herbs/bushes, *saju'* is clearly seen as different from the others. It is this difference that explains the exceptions noted in the above-described Agreement × Trial analyses. Saju' is a coarse, rank, weedy herb very different looking than the other members of the ts'ilel group. The finding with respect to saju' triggers the question whether the perceived similarity of saju' with vines is based only on the set of plants included in this study or whether this is a general feature of saju' (and maybe other species). If the latter is the case, it would be interesting to see whether the named category, ts'ilel, or the perceived similarities (MDS) carry greater inferential strength (see Ross 2004). Only if the former were the case could we argue that ts'ilel indeed represents a cognitive category for the Zinacantecos. This, however, is outside the scope of the present article.

CONCLUSION

In this article, we describe a triad task with balanced incomplete block design to elicit perceived similarities between plant species of four life forms. As a novelty, the task allowed informants to judge three plants as being either too different or too similar; it also allowed them to single out a specific plant as being different. This helped mediate the problem of an incomplete triad design, in which similarity judgments depend on the context in which two items are compared to one another. Compared to other formats (in which sets of individuals are given different trials), this format ameliorates (to some extent) the low-lambda effect without trading in the ability of analyzing participant agreement. The latter is important to justify the aggregation of data across a group, a fact often neglected in between-subject designs.

We found a strong consensus across all participants, indicating a clear cultural model with respect to plant similarities. Furthermore, we probed for patterns of residual agreement/disagreement. Such an analysis has to be done against the background of a clear theory of group differences. In this case, the ethnographic data and previous research suggested the possibility of gender and age differences. Neither of them, however, was detected in our analysis of residual agreement. Failing to detect differences always remains somewhat inconclusive, as it might be only a consequence of the applied research methods or the selected items. For example, in our case, it seems that the saliency of the included categories (grass, shrub/herb, vine, tree) might have overshadowed potential differences among informants. In addition, described cultural changes are rather recent and might not yet have affected the organization of knowledge. Future research comparing (1) different life forms and (2) elements within life forms will help elaborate on these issues. Overall, analyses revealed that members of Zinacantán have a clear model of life forms guiding their similarity judgments of plants.

REFERENCES

Atran, S. 1998. Folkbiology and the anthropology of science: Cognitive universals and cultural particulars. *Behavioral Brain Sciences* 21 (4): 547–609.

Atran, S., D. Medin, and N. Ross. 2004. Evolution and devolution of knowledge: A tale of two biologies. *Journal of the Royal Anthropological Society* 10 (2): 395–420.

Atran, S., D. Medin, N. Ross, E. Lynch, J. Coley, E. U. Ek', and V. Vapnarsky. 1999. Folkecology and commons management in the Maya Lowlands. *Proceedings of the National Academy of Sciences of the United States of America* 96:7598–603.

Berlin, B. 1992. *Ethnobiological classification.* Princeton, NJ: Princeton University Press.

Boster, J. 1986. Exchange varieties and information between Aguaruna manioc cultivators. *American Anthropologist* 88 (2): 428–36.

Breedlove, D., and R. Laughlin. 1993. *The flowering of man: A Tzotzil botany of Zinacantán.* Washington, DC: Smithsonian Institute Press.

Burton, M., and S. Nerlove. 1976. Balanced designs for triad tests: Two examples from English. *Social Science Research* 5:247–67.

Cancian, F. 1965. *Economics and prestige in a Maya community: A study of the religious Cargo system in Zinacantán, Chiapas, Mexico.* Stanford, CA: Stanford University Press.

———. 1992. *The decline of community in Zinacantán: Economy, public life and social stratification, 1960-1987.* Stanford, CA: Stanford University Press.

Coley, J. 1995. Emerging differentiation of folkbiology and folkpsychology: Attributions of biological and psychological properties to living things. *Child Development* 66:1856–74.

Collier, G. 1975. *Field of the Tzotzil: The ecological basis of tradition in highland Chiapas*. Austin: University of Texas Press.

———. 1999. *Basta! Land & the Zapatista rebellion in Chiapas*. Rev. ed. Chicago: University of Chicago Press.

Freeman, L., A. K. Romney, J. Ferreira-Pinto, R. E. Klein, and T. Smith. 1982. Guatemalan and U.S. concepts of success and failure. *Human Organization* 40 (2): 140–45.

La Torre Cuadros, M., and N. Ross. 2003. Secondary biodiversity: Local perceptions of forest habitats among the Maya of Solferino, Quintana Roo, Mexico. *Journal of Ethnobiology* 23 (2): 287–308.

López, A., S. Atran, J. D. Coley, D. L. Medin, and E. E. Smith. 1997. The tree of life: Universal and cultural features of folkbiological taxonomies and inductions. *Cognitive Psychology* 32:251–95.

Medin, D., E. Lynch, J. D. Coley, and S. Atran. 1997. Categorization and reasoning among tree experts: Do all roads lead to Rome? *Cognitive Psychology* 32:49–96.

Medin, D., N. Ross, S. Atran, R. C. Burnett, and S. V. Blok. 2002. Categorization and reasoning in relation to culture and expertise. *Psychology of Learning and Motivation* Vol. 41, ed. B. H. Ross, 1–41. New York: Academic Press.

———. Forthcoming. The role of culture in the folkbiology of freshwater fish. *Cognition*.

Romney, A. K., and R. D'Andrade. 1964. Cognitive aspects of English kinterms. *American Anthropologist* 68:146–70.

Romney, A. K., S. C. Weller, and W. H. Batchelder. 1986. Culture as consensus: A theory of culture and informant accuracy. *American Anthropologist* 88:313–38.

Ross, N. 1994. Die Entwicklung der Blumenindustrie in Zinacantán. *Zeitschrift für Ethnologie* 119:59–73.

———. 2001. *Bilder vom Regenwald: Mentale Modelle, Kulturwandel und Umweltverhalten bei den Lakandonen in Mexiko.* Münster, Germany: Lit Verlag.

———. 2002. Cognitive aspects of intergenerational change: Mental models, cultural change and environmental behavior among the Lacandon Maya of southern Mexico. *Human Organization* 61:125–38.

———. 2004. *Culture and cognition: Some implications for theory and method.* Thousand Oaks, CA: Sage.

———. (2005). "We are all flowering": A cultural account of the naming of plants among the Tzotzil Maya. In *Categorization inside and outside the laboratory: Essays in honor of Douglas Medin*, ed. W. Ahn, R. Goldstone, B. Love, A. Markman, and P. Wolff, 15–27. Washington, DC: American Psychological Association.

Ross, N., and D. Medin. 2005. Ethnography and experiments: Cultural models and expertise effects elicited with experimental research techniques. *Field Methods* 17 (2): 131–49.

Vogt, E. Z. 1994. *Fieldwork among the Maya: Reflections on the Harvard Chiapas Project*. Albuquerque: University of New Mexico Press.

Weller, S. C., and A. K. Romney. 1988. *Systematic data collection*. Newbury Park, CA: Sage.

Wolff, P., D. Medin, and C. Pankratz. 1999. Evolution and devolution of folkbiological knowledge. *Cognition* 73:177–204.

NORBERT ROSS is an assistant professor in anthropology and psychology at Vanderbilt University. His research interests are focused on issues of culture and cognition. Specifically, he works on the emergence of cultural processes and their relation to cognitive processes. Most of the research takes place in the Highlands of Chiapas. Recent publications include Culture and Cognition: Implications for Theory and Method *(Sage, 2004).*

TOMÁS BARRIENTOS is a Ph.D. candidate at Vanderbilt University. He is also currently a professor at the Universidad Del Valle de Guatemala and codirector of the Cancuen Archaeological Project. He is interested in Maya archaeology with parallel social development and ecotourism projects. He has done archaeological work in the Maya lowlands, highlands, and the Pacific Coast of Guatemala. Recent publications include "Los proyectos de arqueología y desarrollo comunitario en Cancuén: Metas, resultados, y desafíos en 2003" (with Arthur Demarest, XVII Simposio de Investigaciones Arqueológicas en Guatemala*, Museo Nacional de Arqueología y Etnología, 2003) and "Climate and Technological Innovation at Kaminaljuyu, Guatemala" (with Marion Popenoe de Hatch et al.,* Ancient Mesoamerica*, 2002).*

ALBERTO ESQUIT-CHOY is a Ph.D. student in cultural anthropology in the Department of Anthropology at Vanderbilt University.