reliance on the less well tested concepts of sexual selection, differential parental investment, or female dependency. The use of these concepts in past explanations supposes that the attractiveness of the female breast gave rise to their selection and we are forced to assume, therefore, that a human emotion not clearly understood today was operating in the evolutionary past. This assumption is one that appears to be impossible to substantiate and wrought with too many problems at present to be used to draw conclusions.

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Exchange of Varieties and Information Between Aguaruna Manioc Cultivators

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Cognitive anthropologists view culture as an information pool that emerges when members of a community attempt to make sense of the world and each other (D'Andrade 1981; Goodenough 1957; Roberts 1964; Wallace 1961). Because individuals construct their concepts of the world from their own experiences, their understandings vary from one another depending on the characteristics of the individuals (Boster 1985a; Garro 1986; Kempton 1981), the nature of the domain learned (Boster, Berlin, and O'Neill 1986; Hays 1976), and the social situations in which learning takes place (Mathews 1983; Sankoff 1971). Culture is thus a partially shared understanding of the world. In deriving the characteristics of the cultural whole from the purposive action of individuals, this concept of culture directs the attention of the ethnographer to the pattern of interinformant variation and the question of how people learn their culture.

Recent years have seen considerable progress in our understanding of intracultural variation (Boster 1985a; Boster, Berlin, and O'Neill 1986; Burton and Kirk 1979; Foster 1979; Furbee and Benfer 1983; Gal 1973; Gardner 1976; Garro 1983, 1986; Hays 1976; Kempton 1981; Mathews 1983; Nerlove and Walters 1977; Pelto and Pelto 1975; Romney, Weller, and Batchelder 1986; Romney and Weller 1984; Sankoff 1971; Weller 1983, 1984a, 1984b). Taken as a whole, this body of research demonstrates that an examination of the pattern of informant disagreement can provide a valuable insight into what culture is. One of the more important findings of recent research is that consensus reflects knowledge; approach to the consensus depends on motivation, ability, and opportunities to learn (Boster 1985a; Romney and Weller 1984; Romney, Weller, and Batchelder 1986; Weller 1984b; cf. Roberts 1964).

In this article, I explore implications of this finding by examining the social correlates of the pattern of agreement between Aguaruna Jivaro in their identification of manioc variables. The Aguaruna are a group of swidden manioc horticulturalists living in the humid tropical forest on the rim of the Amazon basin in northern Peru. Manioc (*Manihot esculenta* Crantz), a perennial shrub with starchy roots, provides most of the calories in the diet (Berlin and Berlin 1978). The roots are prepared for consumption by boiling, roasting, and fermenting. Background information on Aguaruna folk biological classification, nutrition, and subsistence is provided by Berlin (1976) and Berlin and Berlin (1978), while Boster (1983, 1984a, 1984b, 1985b) provides information on various aspects of gardening practices, manioc selection, and garden compositions. Harner's ethnography of the Ecuadorian Jivaro (1972) is an excellent general description of a closely related group.

My earlier analysis of variation in Aguaruna manioc identification (Boster 1980, 1985a) showed that there is a single shared cultural model of Aguaruna manioc identification and that deviations from the shared model are patterned according to the sexual division of labor, individual expertise, and membership in kin and residential groups. In other words, the female gardeners know more about manioc than the male hunters, older traditional women know more about manioc than younger, school-educated women, and closely related women agree with each other more than they do with unrelated women. Thus, the patterns of agreement between informants on the identity of manioc varieties reflect the pattern of transmission of cultural knowledge.

I am concerned here with the relationship between the pattern of the transmission of knowledge about manioc and the pattern of exchange of the manioc varieties themselves. Three types of links between people are compared: agreement in manioc identification, exchange of manioc varieties, and kinship. There are good reasons to expect strong congruence among these three social links. For informants to agree in the identification of something, they must recognize it as a member of the same distinct category and must label the category with the same name. Since names of categories of manioc plants (i.e., varieties) are for the most part arbitrary, sharing of a category label depends on social contact: people learn the culturally appropriate names of manioc varieties from other people. Close kin, especially mothers and sisters, are probably the most important sources of this information. To a lesser degree, unrelated women who exchange varieties also can be expected to converse about the names and characteristics of manioc varieties. Exchange of manioc varieties in Aguaruna society seems to have more social than economic importance, comparable to the exchange of recipes in our society; the gift of a planting stem costs the donor very little and is rarely directly reciprocated. Although individuals learn the names of the varieties from other people, I believe the categories of plants that those names label are constructed largely by the individual herself. Direct experience of the plants is probably more important than social contact for learning to identify manioc varieties. Exchange of manioc varieties could be expected to increase agreement in manioc identification primarily because it allows shared experience of the physical plants. Although close kin are much more likely to exchange varieties than unrelated women, most of the exchanging pairs of women are unrelated because such a small proportion of the women are closely related. Thus, the kinship network partially, but not completely, channels the flow of goods and information between people in this community.

To reiterate, for a woman to agree with others in manioc identification she must learn the names of the varieties from other people and learn the distinguishing characteristics of the varieties through direct experience of the plants. Other kinds of intellectual sharing are probably not so dependent on shared experience of some physical reality. For example, Frake (1961) observed that the Subanun "learn to diagnose diseases through verbal description of their significant attributes" rather than through direct experience with particular cases of illness. He goes on to argue that there is greater interinformant variability in the assignment of a particular illness to a disease category than there is in the verbal criteria defining the categories. In contrast, the Aguaruna learn manioc varieties by looking at them, not by describing the varieties in the abstract, and they are more variable in their descriptions of the perceptual attributes of the varieties, in proportion to the number of possible alternate designations, than they are in the identification of the varieties. This dependence of agreement on shared experience of the physical tokens makes manioc identification an appropriate place to study the relationship between intellectual and material exchange.

Methods of Data Collection

The degree to which informants shared knowledge of manioc was determined through analyzing the results of manioc identification experiments. Two experimental manioc gardens were planted, the first with 61 different varieties of manioc, the second with 6 examples of each of the 15 most common varieties. Informants were guided through the gardens and asked to identify each plant by native name. A total of 58 women identified the plants in the first "hard" garden, whereas 43 women identified the plants in the second "easy" garden. The amount of agreement between pairs of informants has been measured by computing the *proportion of agreement,* the number of times the pair of informants agree on the identity of a plant in the identification task divided by the total number of plants.

To determine the flow of varieties through the community and the culturally important properties of the manioc varieties, a standard interview was administered to a total of 70 Aguaruna women from Huampami, the principal field site, and neighboring communities. This sample included most of the adult women from these communities. Among the many questions posed by the interview, informants were asked who had given them each of their varieties. The responses to this question allowed the determination of the number of varieties exchanged by all pairs of informants. It would have been preferable to have been able to directly observe the exchange of manioc varieties rather than rely on informant report; the measure of exchange used here is perhaps better interpreted as "perceived" exchange rather than actual exchange (cf. Bernard et al. 1984).

Kin relationships between women were determined by asking each informant in the identification task and the interview to list her husband and her parents. After a list of informants was compiled, I worked with Aguaruna assistants to discover the mother, sisters, mother-in-law, sisters-in-law, and co-wives (if any) of every informant in the sample.

The analysis presented here is limited to a subsample of 31 informants who participated in both manioc identification experiments and the interview.

The Relationship of Material and Intellectual Exchange

An insight into the relationship between exchange, kinship, and agreement is gained by splitting agreement into two components: one reflecting the agreement due to shared knowledge of the general cultural system and the other reflecting deviations of pairs of informants from the consensus. These components can then be compared with the measures of exchange and kinship.

The first step is to calculate the component of agreement due to consensus. This was accomplished using Romney, Weller, and Batchelder's model of culture as consensus (1986). Their key idea is that the agreement between informants is a function of the extent to which each knows the culturally defined "truth." The application of their formal model requires that three conditions be met: that informants share a common culture, that their answers are given independently, and that the competence of the informants is constant over all questions (Romney, Weller, and Batchelder 1986). Aguaruna manioc identification satisfies the first and second conditions, but probably not the third condition. However, Romney, Weller, and Batchelder argue that the model is robust even under mild violations of this third assumption.

Minimum residual factor analysis of the agreement matrix can be used to check whether these three conditions for application of the consensus model have been met (Romney, Weller, and Batchelder 1986). If the conditions are satisfied, there should be a single factor solution such that the first latent root (the largest eigenvalue) should be large in comparison to all other latent roots. The patterns of agreement in the two manioc identification experiments do meet this criterion; the first latent roots, 6.7 in the hard task and 20.9 in the easy task, are more than 2 and 10 times larger than the next largest latent roots, 3.2 and 1.7, respectively. However, it should be noted that the results of the easy manioc identification experiment more clearly meet this criterion than do the results of the hard manioc identification experiment.

The component of the agreement between informants due to their shared knowledge of the cultural "truth" (Romney, Weller, and Batchelder 1986) can be estimated using this minimum residual factor solution. The *expected agreement* between a pair of informants is equal to the product of their scores on the first factor.

The second step in the analysis is to calculate the component of agreement due to systematic deviations from consensus. The largest contribution to this pattern is made by pairs of informants who agree with each other more than would be expected on the basis of their approach to the general consensus. The pattern of deviations from the consensus was derived using a procedure developed by Hubert and Golledge (1981) and introduced to the anthropological literature by Nakao and Romney (1984). First, the expected agreement between informants was computed for both the hard and the easy identification tasks. Next, the raw agreement and the expected agreement matrices were standardized by subtracting the mean of the elements from each element and dividing by the standard deviation. The standardized expected agreement between informants was then subtracted from the standardized raw agreement to yield a matrix reflecting the pattern in which pairs of informants deviated from their expected agreement. The result of this subtraction will be called *residual agreement*. In a similar fashion, the matrix of kin relationships between informants (coded 3 = consanguine, 2 = affine, 1 = same community, 0 = no relation) was standardized and subtracted from the standardized presence/absence exchange matrix to yield a matrix that reflects the pattern in which exchange deviates from the kin relationships between informants. The result of this subtraction will be called *residual exchange*.

The final step in the analysis is to compare the six matrices of relationship with each other. These six matrices are raw agreement, expected agreement (approach to the consensus), residual agreement (deviations from the consensus), exchange, kinship, and residual exchange. Matrices were compared using Hubert and Schultz's (1976) Quadratic Assignment Program (QAP). The results of this comparison are presented in Table 1, which compares two sets of six symmetric matrices of relationships among a constant set of 31 informants who participated in all tasks (N = 465 pairs). The upper triangle contains the results of the easy manioc identification task and the lower triangle contains the results of the hard manioc identification task. The QAP z score between the row and column matrices is the upper number in each cell, while the Pearson correlation between corresponding off-diagonal elements in the pair of matrices is the lower figure in each cell. Monte Carlo simulation, as described by Hubert and Schultz (1976), was used to gauge the extent to which the pairs of matrices were more similar or different than would be expected by chance. Matrices that were more similar than randomly permuted pairs in more than 995 or less than 5 of 1,000 trials are starred. This corresponds to a two-tailed probability of .01.

If the pattern of agreement were completely described by Romney, Weller, and Batchelder's (1986) cultural consensus model, the raw agreement and expected agreement would be strongly associated, while raw agreement and residual agreement would be unassociated. This means that once the pattern in the raw agreement due to expected agreement is removed, there would be no significant portion of the original pattern of agreement left; systematic deviations from the cultural consensus would be negligible.

This description aptly fits the pattern of results of the easy manioc identification task, shown in the upper right triangle of Table 1. The association of raw agreement and expected agreement is quite high (z = 5.6, p < .01) whereas there is

Table 1
Association between agreement, exchange, and kinship.

	Raw agreement	Expected agreement	Residual agreement	Exchange	Kinship	Residual exchange
Raw agreement		5.59*	3.22	1.77	2.18	−.34
		.98	.10	.13	.16	−.03
Expected agreement	5.72*		−3.36	1.65	1.75	−.07
	.84		−.10	.12	.13	−.01
Residual agreement	5.14*	−4.79		.66	3.17	−2.27
	.28	−.28		.03	.14	−.10
Exchange	3.78*	2.68*	1.83		7.64*	10.85*
	.25	.20	.09		.38	.55
Kinship	2.97*	.03	7.14*	7.64*		−10.87*
	.19	.00	.34	.38		−.55
Residual exchange	.71	2.26	−4.74*	10.85*	−10.87*	
	.05	.18	−.23	.55	−.55	

little association between raw agreement and residual agreement ($z = 3.2$, $p > .01$).

The pattern of results of the hard identification task is quite different, as shown in the lower left triangular portion of Table 1. Once again, expected agreement is strongly associated with raw agreement ($z = 5.7$, $p < .01$), but in this case raw agreement is also significantly associated with residual agreement ($z = 5.1$, $p < .01$). In other words, a significant portion of the pattern of agreement between informants in the hard identification task consists in deviations from the cultural consensus.

These two components of agreement in the hard identification task appear to have different relationships to exchange and kinship. Exchange is strongly associated only with the component reflecting the cultural consensus ($z = 3.8$; $p < .01$), while kinship is significantly associated only with the component reflecting deviation from the consensus ($z = 7.1$, $p < .01$). This contrast is further supported by the weak positive association of expected agreement with residual exchange ($z = 2.3$, $p > .01$ but $p < .05$) and the significant negative association of residual agreement with residual exchange ($z = -4.7$, $p < .01$). This indicates that the component of agreement reflecting the cultural consensus is more strongly associated with exchange than with kinship, while the component reflecting deviation from consensus is more strongly associated with kinship than with exchange.

To summarize, the pattern of agreement in the easy manioc identification task is adequately captured by a single factor reflecting the approach or departure of informants from the cultural consensus. In the hard task, there appear to be two components: the largest reflects informants' shared knowledge of the cultural consensus, and a smaller component reflects deviations from the consensus. The two parts of the pattern of agreement are associated with different kinds of social relations: deviations from the consensus are associated with close kin ties, whereas approach to the general consensus is associated with exchange of cultivars with people outside an individual's kin group.

Conclusions

I interpret these results as follows. As I argued in earlier works (Boster 1980, 1985a), there is a general cultural system of Aguaruna manioc identification. Individuals vary in their knowledge of this system. An individual's learning of the system depends on her motivation, ability, and opportunities to learn. In the easy manioc identification task, virtually all women have had the opportunity to learn to identify the varieties, since the varieties are the most common in the area and are not restricted to one kin group or another. Thus, almost all of the pattern of agreement between informants is determined by their overall knowledge of the cultural system; the results of the easy manioc identification task fit Romney, Weller, and Batchelder's (1986) cultural consensus model quite well. The varieties used as stimuli in the hard manioc identification experiment are much less evenly distributed through the community. The results of this experiment suggest that the relative success of informants was much more dependent on their opportunities to study the physical plants. Most women exchange manioc varieties with their close kin, but a lesser number exchange with other women throughout the community as well. These well-connected individuals in the manioc exchange network have a better understanding of the general cultural system than other women. Apparently, exchange with others in the community outside immediate kin ties allows one to learn the cultural consensus, hence the association of expected agreement with exchange. Here, exchange knits a society together not by creating economic interdependence but by fostering cultural consensus! Deviations of pairs of informants from the cultural consensus can be interpreted as resulting from the restriction of a variety or a variety name to a particular kin group, hence the association of residual agreement with kinship.

This work demonstrates the power of

the insight that approach to the consensus reflects an individual's knowledge of the cultural system (Boster 1985a; Romney and Weller 1984; Weller 1984b), particularly as this insight has been formalized by Romney, Weller, and Batchelder (1986). But it also demonstrates that there is more to culture than consensus, that in some situations the deviations from the cultural consensus may constitute a significant portion of the pattern of agreement between individuals. In one such situation, the identification of rare manioc varieties by the Aguaruna Jivaro, the exchange of manioc varieties outside of kin relationships is associated with a general understanding of the cultural system of manioc identification, whereas communication of varieties and information along kin lines appears responsible for cases in which informants agreed more with each other than would be predicted by their general knowledge. Apparently, informants' opportunities to learn to identify the varieties are constrained by the sparse distribution of the actual plants. This is interpreted as a consequence of the interdependence of intellectual and material exchange; in this case, cultural sharing depends on a shared experience of the physical world.

This interpretation comes out of a more general set of expectations concerning the cognitive and social correlates of agreement in different cultural domains. The way in which members of a community learn about a cultural domain is expected to be the most important determinate of the relationship between agreement and other variables. In turn, the nature of the domain is likely to strongly influence how people learn it. Categories in domains of concrete natural objects (e.g., Aguaruna manioc varieties and many other natural kinds) are likely to be learned primarily through the direct examination of instances and are likely to be recognized on the basis of family resemblances to prototypical members of the category (cf. Rosch and Mervis 1976). Categories in abstract[1] domains (e.g., gods, social relations, Subanun disease concepts, cf. Frake 1961) are likely to be learned primarily from other people's verbal descriptions and to be defined on the basis of the presence of a set of verbalizable attributes. In concrete domains, one would expect greater variability in attribute description than in identification, whereas in abstract domains, one would expect greater variability in identification than in attribute description (cf. Frake 1961). Additionally, in concrete domains, the pattern of agreement between individuals should more strongly reflect the distribution of instances of the categories, whereas in abstract domains, learned through verbal communication, the pattern of agreement between individuals should more strongly reflect the social network. Further research is required to test these expectations.

Notes

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[1]"Concrete" and "abstract" label extremes on a continuum of domains that vary in the degree to which it is possible to point at instances of categories. One can point to concrete natural objects such as trees and manioc plants in a way one cannot point to more abstract entities as diseases, gods, or social relations.

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