Measuring Culture as Shared Knowledge: Do Data Collection Formats Matter? Cultural Knowledge of Plant Uses among Tsimane' Amerindians, Bolivia

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In this article, the authors contribute to the empirical study of culture as shared knowledge by exploring correlations of individual responses to different questionnaires of the same tasks and correlation of individual responses to different tasks. They collected data on ethnobotanical knowledge from 149 adult Tsimane'

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Amerindians in Bolivia. The authors used a cultural consensus model to calculate individual scores of cultural knowledge for each questionnaire, correlating individual scores using pooled samples and various subsamples. Results from multiple-choice questionnaires show high reliability. A comparison of competency scores from the paired-comparison and the average of the three multiple-choice questionnaires showed a positive correlation (r = .46), although it was lower than when comparing multiple-choice to each other. Competency on the triad questionnaire did not correlate with information from any of the other questionnaires. The evidence presented suggests that cultural competence may be consistent across questionnaires of the same task but not necessarily across different tasks in the same domain.

Keywords: *folk knowledge; consensus analysis; multiple choice; paired comparison; triad questionnaire; Tsimane'; Bolivia*

From the past century, anthropologists have grown more and more inclined to define culture as knowledge shared by a group (Kroeber and Kluckholm 1952; D'Andrade 1995; Romney 1999). Cognitive anthropologists have made headway providing an operational definition of shared knowledge and methods for quantifying it. In the mid-1980s, cognitive anthropologists developed the theory of cultural consensus (Romney and Weller 1984; Romney, Weller, and Batchelder 1986). They defined knowledge as agreement among informants and presented a method to analyze people's responses to structured questions to estimate shared knowledge. Given appropriate data, one can estimate the amount of knowledge each respondent has about a cultural domain; the estimate depends on the pattern of agreement among all pairs of respondents. The correlation in responses between any pair of informants reflects the extent to which each answer correlates with some truth. Agreement reflects knowledge (Romney and Weller 1984).

Cultural consensus theory rests on three assumptions. First, there is a culturally correct answer for every question. Whatever the cultural reality, it is the same for all informants and is defined as the answer given by most people. Second, each informant responds to the task independently of other informants. The level of agreement between informants reflects their joint agreement with the cultural consensus. Third, the probability that an informant will answer correctly a question in a domain of knowledge reflects the informant's competence in the domain (Romney, Weller, and Batchelder 1986). Competence refers to the proportion of correct answers given by the informant. Information for consensus analysis comes from responses by informants to systematic interview questions. The informant-by-informant matrix of agreement between informants across questions is factor analyzed to summarize the patterns of agreement between informants. If the information gathered meets the assumptions of the model, the matrix of informants' interagreement will contain only one major factor, indicating there is enough agreement on what everyone considers correct (Romney, Weller, and Batchelder 1986).

Researchers have developed different methods to collect information for doing consensus analysis. For example, Garro (1986, 1988) used true-false questions to examine variation and consensus in knowledge about high blood pressure in an Ojibwa Indian community in Manitoba, Canada. Boster (1986) asked informants in the Peruvian Amazon to identify manioc varieties in two experimental gardens. He calculated the amount of agreement between pairs of informants by computing the number of times the pairs of informants agree in the task divided by the total number of plants. To assess the links between behavior and cognitive patterns, Atran and his colleagues (2002:426) asked Itza', Q'eqchi, and Ladino informants in Guatemala, "Which kinds of plants and animals are most necessary for the forest to live?" From the list, they compiled the names of twenty-eight plants and twenty-nine animals. Participants were then shown pictures of each of the twenty-eight animals and asked whether each plant helped or hurt the animal. Zent (2001) used structured interviews to examine the impact of socioeconomic and demographic variables on knowledge of tree names among Piaroa Amerindians of Venezuela.

Consensus analysis has been frequently used to estimate agreement in different cultural domains but less frequently to estimate the amount of overlap in the information collected with different tasks (Boster 1985). Researchers have examined whether different methods for eliciting information about shared knowledge produce similar results. For example, Boster, Johnson, and Weller (1987) found a moderately high ($r = .47$) correlation in competency scores from pile sort and triad data. Brewer (1995) found moderately strong correlations ($r = .44$–$.68$) between the length of the free list and competence in hard tasks (matching) that required reasonable variation in informant knowledge. Furlow (2003) found a significant correlation between the length of the free list and competence on tasks in the same domain; correlations ranged between .11 and .54. All the studies focus on estimating how the same individual at the same time responded to different tasks.

Following this line of research, in this study, we tested the same informants during five consecutive quarters. Informants included 149 Tsimane' Amerindian adults (fifteen years of age and older) in two villages of lowland Bolivia. We tested informants for their cultural knowledge of wild flora. We gave informants five different questionnaires, one each quarter, which represented three different tasks. We tested informants three times using three different multiple-choice questionnaires (dichotomous task), once using a paired-comparison questionnaire (ordering task), and once using a triadic questionnaire (similarity task). We analyzed informants's reliability across different questionnaires of the same task by comparing results from the three multiple-choice questionnaires. Then, we analyzed informants's consistency across tasks to assess if indices of cultural knowledge were task specific or if they were generalized across tasks.

THE TSIMANE'

The Tsimane' are a foraging horticulturalist group of Amerindians in the Bolivian rain forest. Their Tsimane' territory spreads from the foothills of the Andes to the edges of the Moxos savanna in the Amazonian lowlands of Bolivia. The latest census of Bolivia puts the Tsimane' population at approximately eight thousand.

Tsimane' remained relatively isolated until the middle of the twentieth century (Chicchón 1992; Daillant 1994). In the 1950s, evangelical missionaries arrived in the Tsimane' area, and since then, they have contributed to the creation of schools and health outposts for the Tsimane'. Missionaries have also influenced Tsimane' settlement patterns, pushing and luring them to live in larger villages with schools. In the 1970s, the opening of roads in the area induced a wave of highland colonists and loggers to move into the Tsimane' territory; encroachers became both a source of conflict and of employment for the Tsimane'.

Tsimane' depend on forest goods and shifting cultivation for subsistence. Their lifestyle varies widely, depending on the amount of exposure to markets (Godoy 2001). Some Tsimane' are seminomadic, live in small villages without schools, are monolingual in Tsimane', and rely on shifting cultivation, hunting, fishing, and plant foraging. Others Tsimane' live close to towns, live in large villages with schools, and are bilingual in Tsimane' and Spanish. Tsimane' with closer links to the market complement horticulture and foraging with earnings from the sale of forest and farm goods and from wage labor in logging camps and ranches (Reyes-García 2001).

METHOD

Fieldwork took place in two Tsimane' villages during eighteen months (May 1999 to November 2000) and was done by five researchers (Reyes-García, Byron, Vadez, Apaza, and Perez) who lived continuously in the two villages during the entire period of research. During the first quarter, we tested methods for collecting information, and during each of the subsequent five quarters, we tested all adults in the two villages with a different questionnaire. During any one quarter, we gave the same questionnaires to all informants.

Setting

We chose two Tsimane' villages comparable in socioeconomic, demographic, and ecological characteristics. Both villages had similar population size and sources of income. The first village, Yaranda (n = 22 households), was about 50 km in a straight line from the closest market town, San Borja (population ~16,000), or three days upriver in a canoe without a motor. The second village, San Antonio (n = 27 households), was about 10 km from San Borja, or about three hours walking during the dry season. San Antonio was richer and more integrated to the market economy than was Yaranda (Godoy et al. 2002). Ecologically, both villages are comparable. They are both in the same river basin and have similar patterns of rainfall and temperature. Although Yaranda was at a higher altitude and closer to the forest and San Antonio was in a gallery forest closer to the savanna, most of the plant species were found in both sites.

Sample

The total sample for the study included 149 Tsimane' adults, defined as people older than fifteen years. Forty-two percent of the sample were from the more isolated village of Yaranda, and 58% were from the more integrated village of San Antonio. The sample was almost evenly split between men (51%) and women (49%). From the total sample, 57% of the people were thirty years of age or younger. Only 25% of the sample were fluent in Spanish. About half the sample (48%) did not have any education; 29% had some schooling but had not completed primary school (grades 1–5). Only 23% of the sample had completed primary schooling. Two households in the remote village of Yaranda (9%) and three households in the more accessible village of San Antonio (11%) refused to take part in the study. From the total sample of participants who took part in the study, 68 answered five questionnaires, 40 answered four questionnaires, 11 answered three questionnaires, and 30 answered two or fewer questionnaires.

Free Listing of Useful Plants

During the first quarter of data collection, we used free listing (Weller 1998) to generate a comprehensive list of useful plants known by the Tsimane' in the two villages. Fifty informants from the two villages were asked to name all useful plants. We asked each informant, "Can you tell me the names of all the useful plants you know?" Once informants stopped naming, we tried to prompt them to list more plants by asking, "Do you know any other plant that can be used as firewood?" Once they said they didn't know any more plants that could be used for firewood, we asked the same question for medicine, dye, construction, canoe building, and tools. Ninety-two plants were mentioned by at least two informants, one from each village. We used the list of ninety-two Tsimane' plant names to develop the data collection methods described below. Informants who supplied information for free listing were included in the study.

Multiple-Choice Questionnaires

We constructed three different multiple-choice questionnaires on specific uses of plants. We asked informants whether plants could be used for any of the following: house building, firewood, food, medicine, canoe, or tools. For each plant, informants could choose none, one, or more potential uses. For example, we asked, "Can you tell me if X [name of plant] can be used as firewood?" (yes/no), "to build a house?" (yes/no), "to eat?" (yes/no), "to cure?" (yes/no), "to make a canoe?" (yes/no), and "to make a tool?" (yes/no). After presenting participants with the six choices, we asked the same questions for the next plant in the list. In each questionnaire, we offered informants the same choices when answering questions about the uses of plants. We collected information in the form of a matrix with the names of the plants on the x-axis and the possible uses on the y-axis. We coded affirmative answers as 1 and negative answers as 0. The first and second questionnaires included forty-six plants each. The lists of plants on the two questionnaires were exclusive; between the two questionnaires, they covered all ninety-two useful plants listed by informants in free listing. The third questionnaire consisted of twenty-one plants chosen at random from the list. Thus, each informant was asked 276 (46×6) dichotomous questions for questionnaires 1 and 2 and 126 (21×6) dichotomous questions for the third multiple-choice questionnaire.

Paired-Comparison Questionnaire

We also collected ordered data on usefulness. We applied a paired-comparison questionnaire in which we asked informants to "select the most useful plant of the pair." The questionnaire included sixty-six questions in which the names of twelve plants randomly selected from the list of ninety-two Tsimane' useful plants were compared. We did not show informants pictures or drawings of plants nor did we offer other visual or tactile cues when asking questions.

Triad Questionnaire

We applied a triadic questionnaire using pictures to collect similarity data with specific reference to usefulness. The questionnaire was constructed using a balanced incomplete block design (Burton and Nerlove 1976) with fifteen plants (the twelve used in the paired comparison plus three other selected at random from the list of useful plants). The questionnaire had seventy triplets in which each pair of plants appeared twice (lambda two design). Each question consisted of three pictures of plants, from which we asked informants, "Can you tell me which of those plants has a much different use from the other two?" For example, if only two of the plants were suitable for firewood, the informant was expected to select the one that could not be used for firewood. If the informant did not recognize the plant from the picture, the informant was given the Tsimane' and/or Spanish name of the plant.

ANALYSIS

We used data collected through multiple-choice questionnaires to measure informants' similarities in responses to different questionnaires of the same task. Responses consisted of 1 (the plant can be used for that purpose) and 0 (the plant cannot be used for that purpose). On the first multiple-choice questionnaire, we found 11% of the data missing (informants responded "I don't know"); on the second questionnaire, we found 8% missing; and on the third questionnaire, we found 6% of the data missing. Since different informants typically tend to be unfamiliar with the same terms, missing data will tend to bias the pairwise agreement coefficients among informants. To avoid the bias, we replaced all missing values by randomly assigning 0 or 1 values based on the mean proportion of 0 or 1 responses in the questionnaire. The data were then treated as true/false and analyzed using the cultural consensus model (Romney, Weller, and Batchelder 1986).

Analysis for the first multiple-choice questionnaire was based on the 97 informants by 276 yes/no responses, for the second questionnaire on 109 informants by the 276 questions, and for the third questionnaire on 106 informants by 126 responses. To analyze multiple-choice data, we used both the matching and the covariance methods. The matching method is sensitive to response bias when measuring similarity among respondents. The covariance method is insensitive to response bias but is sensitive to the proportion of 1s and 0s (Batchelder and Romney 1988; Weller and Mann 1997). Bias can inflate the knowledge scores using either method. For the covariance method, we calculated the probability of any cell having a positive response by adding the total number of positive (1) cells and then dividing that number by the total number of cells in the questionnaire. The a priori probability of a cell containing a positive answer was 28%. Scores obtained by the matching and covariance methods showed a strong positive correlation for the three multiple-choice questionnaires ($r = .92$ for the first multiple-choice, $r = .76$ for the second, and $r = .87$ for the third; p .001 in all three cases, not shown), indicating that both methods produced the same distribution of knowledge. Since the two methods produced similar results, we arbitrarily decided to use scores obtained through the covariance method.

We used a paired-comparison questionnaire to collect ordered data. Data collected with paired comparisons were first transformed into a single ranking of the plants according to their usefulness. The analysis consisted in counting the number of times an individual selected a plant from a pair as being "more useful." Then, for each individual, we added the number of times each item got selected in all the pairs, which gave us the rank order of the plants according to their usefulness. We analyzed the ranked data from paired comparisons using the informal consensus model, which consists of a principal components analysis of subjects (Romney, Batchelder, and Weller 1987).

We used a triadic questionnaire to collect similarity data. Every time an informant chose a plant as "most different," the other two plants in the triad received a point of similarity. We tabulated the similarity data for each informant and then used the informal consensus model, as for the ordered data, to compare the similarity matrices between informants.

RESULTS

Reliability in Three Different Multiple-Choice Questionnaires

For each of the three multiple-choice questionnaires, we calculated the cultural consensus of the group and the individual cultural competence of each individual (Romney, Weller and Batchelder 1986). Answers to the three multiple-choice questionnaires fit the cultural consensus model. In the three multiple-choice questionnaires, the first to the second eigenvalue showed a good fit to a single factor; the first eigenvalue was about ten times higher than the second (see Table 1). Individual cultural competence scores showed similar mean values for the three multiple-choice questionnaires, which varied between 0.75 and 0.84 on a 0 to 1 scale, with a standard deviation between 0.15 and 0.20 in the different questionnaires. The coefficient of variation

TABLE 1
Cultural Consensus and Competence for Three Multiple-Choice Questionnaires

	Cultural Consensus		*Cultural Competence*					
Test	*Ratio of First to Second Eigenvalue*	*% Distribution across Choices (0/1)*	*Observations*	M	SD	*Minimum*	*Maximum*	*CV*
Multiple-choice 1	9.85	28.4 = 1	97	0.75	0.20	0.06	1	0.27
Multiple-choice 2	9.99	27.7 = 1	109	0.83	0.15	0.46	1	0.18
Multiple-choice 3	15.45	28.4 = 1	106	0.84	0.16	0.39	1	0.19

NOTE: CV = coefficient of variation.

(standard deviation/mean) of the three multiple-choice questionnaires ranged from .27 (in the first questionnaire) to .18 (in the second questionnaire).

To estimate the reliability between the three multiple-choice questionnaires, we ran a series of pairwise correlations of individual competence for the three multiple-choice questionnaires. First, we used the pooled sample, and then we used different subsamples. We explore heterogeneity in the sample because it is possible that correlation among questionnaires is higher for different subsamples. In particular, we explore how scores obtained on the three multiple-choice questionnaires correlate among women versus men, people in the more isolated village of Yaranda versus people in the more accessible village of San Antonio, people younger than thirty years of age versus people older than thirty years of age, and people who spoke Spanish versus people who were monolingual in Tsimane'. For the analysis, we use scores from the previously described consensus analyses.

When comparing the pooled samples of the three multiple-choice questionnaires, we find a strong positive and significant correlation among individual cultural competence scores (see Table 2). In Table 2, we show pairwise correlation coefficients between the three multiple-choice questionnaires. In Table 2 and in all subsequent tables, we estimate correlation coefficients with Sidak corrections for multiple comparison fallacies to reduce the probability of producing a Type I error. The correlation coefficient between the first and the second multiple-choice questionnaire was .72, the correlation coefficient between the first and the third multiple-choice questionnaire was .68, and the correlation coefficient between the second and the third multiple-choice questionnaire was .85. All results were statistically significant at the 99% confidence level or higher.

Results are similar when doing the analysis by gender, age, and ability to speak Spanish. We found that competence scores from the three multiple-choice questionnaires showed a strong positive and significant correlation for both men and women. For men, the correlation coefficient between the first and the second multiple-choice questionnaire was .71, the correlation coefficient between the first and the third was .74, and the correlation coefficient between the second and the third was .81 (p .0001 in all three correlations). For women, the correlation coefficient between the first and the second multiple-choice questionnaires was .71, the correlation coefficient between the first and the third was .63, and the correlation coefficient between the second and the third was .88. All results were statistically significant at the 99% confidence level or higher.

Competence on the three multiple-choice questionnaires within each of the two age groups (older and younger than thirty years of age) showed a pos-

TABLE 2
Pairwise Partial Correlation Coefficients[a] for Three Multiple-Choice Questionnaires: Pooled and Subsamples

	Multiple-Choice 1	*Multiple-Choice 2*
Pooled sample		
Multiple-choice 2	0.72 (84)***	
Multiple-choice 3	0.68 (83)***	0.85 (96)***
Gender		
Multiple-choice 2		
Men	0.71 (42)***	
Women	0.71 (42)***	
Multiple-choice 3		
Men	0.74 (43)***	0.81 (46)***
Women	0.63 (40)***	0.88 (50)***
Age (old = 30 years, young = ≤30 years)		
Multiple-choice 2		
Young	0.67 (33)***	
Old	0.73 (51)***	
Multiple-choice 3		
Young	0.55 (33)***	0.82 (46)***
Old	0.76 (47)***	0.88 (50)***
Ability to speak Spanish (yes = able; no = unable)		
Multiple-choice 2		
Yes	0.63 (21)***	
No	0.70 (63)***	
Multiple-choice 3		
Yes	0.73 (21)***	0.78 (24)***
No	0.64 (62)***	0.85 (72)***
Village of residency (Yaranda = traditional; San Antonio = modern)		
Multiple-choice 2		
Yaranda	0.34 (38)	
San Antonio	0.26 (46)	
Multiple-choice 3		
Yaranda	0.40 (41)**	0.34 (45)*
San Antonio	0.22 (43)	0.50 (51)***

NOTE: Number of observations in parentheses.
a. Šidák correction for multiple comparisons used.
**p* .1. ***p* .05. ****p* .01.

itive and strong correlation. Correlation coefficients were slightly lower for people younger than thirty years of age than for people older than thirty years of age. For younger people, the correlation coefficient between the first and the second multiple-choice questionnaire was .67, the correlation between the first and the third was .55, and the correlation coefficient between the second and the third multiple-choice questionnaire was .82 (*p* .0001 in all three correlations). For older people, the correlation coefficient between the first and the second multiple-choice task was .73, the correlation coefficient between the first and the third was .76, and the correlation coefficient between the second and the third multiple-choice task was .88 (*p* .0001 in all the three correlations).

Competence on multiple-choice questionnaires for informants who spoke Spanish and for informants who did not speak Spanish also correlated positively and significantly with one another. Correlation coefficients were higher among monolingual Tsimane' speakers than among those who could speak Spanish. For monolingual Tsimane' speakers, the correlation coefficient between the first and the second multiple-choice questionnaire was .70, between the first and the third was .64, and between the second and the third multiple-choice questionnaire was .85 (*p* .0001 in all the three correlations). For bilingual speakers, the correlation coefficient between scores of the first and the second multiple choice was .63, the correlation coefficient between the first and the third multiple choice was .73, and the correlation coefficient between the second and the third multiple choice was .78 (*p* .0001 in all the three correlations).

Competence scores from informants living in each village differed from the pattern found in the pooled sample and in the other subsamples. For informants in the village of San Antonio, only the second multiple-choice questionnaire showed a positive and significant correlation to the third multiple-choice questionnaire (*r* = .50, *p* .001), whereas for informants in Yaranda, the third multiple-choice questionnaire correlated significantly with the first (*r* = .40, *p* .03) and the second (*r* = .34, *p* .06), although in both cases, the correlation coefficient was low for reliability. To decide whether the level of group knowledge differed between the two villages, we ran a series of two-sample *t*-tests with equal variance (see Table 3). Regardless of the multiple-choice questionnaire used, people from the more isolated village of Yaranda showed higher cultural competence than did people from San Antonio. On average, people from Yaranda agreed about 25% more among themselves than people from San Antonio did. People in the village of Yaranda had mean overall scores between 0.91 (*SD* = 0.11) and 0.97 (*SD* = 0.04), whereas people from San Antonio had mean overall scores that ranged from 0.61 (*SD* = 0.16) to 0.71 (*SD* = 0.10). Results of *t*-tests of comparisons of means were statistically significant at the 99% confidence level (*p* .001) for the three multiple-choice questionnaires. We tested for the equality of variance on knowledge scores in the three multiple-choice questionnaires between people from Yaranda and people from San Antonio and found that the differences were statistically significant at the 99% confidence level ($p \leq .01$).

TABLE 3

Comparison of Mean and Variance of Ethnobotanical Cultural Competence in Three Multiple-Choice Questionnaires (from 1 to 0)

	Yaranda			*San Antonio*				
	M	*SD*	*Observations*	*M*	*SD*	*Observations*	t-*Test of Comparisons of Means* (p)	*Test for Equality of Variance* (p)
Multiple-Choice 1	0.91	0.11	47	0.61	0.16	57	.00	.01
Multiple-Choice 2	0.97	0.05	51	0.71	0.10	64	.00	.00
Multiple-Choice 3	0.97	0.04	54	0.71	0.12	58	.00	.00

Consistency across Tasks

We did a similar analysis using knowledge data collected through three different tasks: multiple choice, paired comparison, and triad questionnaires. We used the competence scores from the multiple-choice questionnaires as an example of a dichotomous task on the uses of plants. To obtain a single individual cultural competence score for multiple-choice questionnaires, we calculated the average individual score from each of the three multiple-choice questionnaires. We used the paired-comparison questionnaire to generate cultural competence scores on an ordered task, and we used the triadic questionnaire to generate cultural competence scores on a similarity task.

For the paired-comparison and the triad questionnaires, we calculated the cultural consensus of the group and the cultural competence of each individual. Answers to the paired-comparison questionnaire fit the cultural consensus model, although the ratio of the first to the second eigenvalue in the paired-comparison questionnaire ($M = 3.63$) was lower than the average ratio of the first to the second eigenvalue of the average for the three multiple-choice questionnaires ($M = 11.76$) (see Table 4). The triad questionnaire did not fit the consensus model; the ratio of the first to the second eigenvalue was 1.58. In addition, results from the triad questionnaire produced a first factor loading with sixteen negative values ($n = 106$), indicating a lack of fit for the whole group. We did further analysis (not shown) and calculated cultural consensus based on answers to the triad questionnaire for different subsamples of the population (men vs. women, old vs. young, Spanish speakers vs. Tsimane' monolingual) and found that for all the groups, there was a lack of fit in the model.

The mean cultural competence of the paired-comparison questionnaire was lower than the mean cultural competence of the three multiple-choice questionnaires ($M = 0.70$, $SD = 0.19$, $n = 124$, for paired-comparison; $M = 0.81$, $SD = 0.16$, $n = 122$, for multiple choice). In contrast, the mean score of cultural competence for the triad questionnaire ($M = 0.20$, $SD = 0.19$, $n = 106$) was about 75% less than the mean cultural competence score in other tasks (range = 0.70–0.81). Besides differing in their mean values, the three different tasks also differed in variation around the mean. The coefficient of variation of the three multiple-choice questionnaires was .20, the coefficient of variation of the paired-comparison questionnaire was .27, and the coefficient of variation of triad questionnaires was .95.

One explanation for the lower scores in some of the tasks is that some tasks were harder than others. But even then, scores in all tasks should have correlated with each other. In Table 5, we present the results of pairwise correlations of individual competence using different tasks. Results from paired

TABLE 4

Cultural Consensus and Competence for Three Knowledge Tasks (Multiple Choice, Paired Comparison, and Triad)

	Cultural Consensus		*Cultural Competence*					
Test	*Ratio of First to Second Eigenvalue*	*% Distribution across Choices (0/1)*	*Observations*	M	SD	*Minimum*	*Maximum*	*CV*
Average multiple choice	11.76	28.2 = 1	122	0.81	0.16	0.06	1	0.20
Paired comparison	3.63	37.1 = 1	124	0.70	0.19	0.02	0.98	0.27
Triad	1.58	34.9 = 1, 32.7 = 2	106	0.20	0.19	?0.28	0.56	0.95

NOTE: CV = coefficient of variation.

TABLE 5
Pairwise Partial Correlation Coefficients[a] for Three Knowledge Tasks: Pooled and Subsamples

	Average Multiple Choice	*Paired Comparison*
Pooled sample		
Paired comparison	0.46 (112)***	
Triad	0.13 (98)	0.10 (95)
Gender		
Paired comparison		
Men	0.51 (54)***	
Women	0.45 (58)***	
Triad		
Men	0.13 (48)	0.05 (45)
Women	0.15 (50)	0.16 (50)
Age (old = 30 years; young = ≤30 years)		
Paired comparison		
Young	0.43 (56)***	
Old	0.56 (56)***	
Triad		
Young	0.001 (50)	0.23 (46)
Old	0.20 (48)	0.05 (49)
Ability to speak Spanish (yes = able; no = unable)		
Paired comparison		
Yes	0.40 (25)	
No	0.43 (87)***	
Triad		
Yes	–0.03 (20)	0.36 (18)
No	0.15 (78)	–0.001 (77)
Village of residency (Yaranda = traditional; San Antonio = modern)		
Paired comparison		
Yaranda	–0.11 (55)	
San Antonio	0.14 (57)	
Triad		
Yaranda	–0.04 (48)	0.24 (46)
San Antonio	–0.21 (50)	–0.14 (49)

NOTE: Number of observations in parentheses.
*p .1. **p .05. ***p .01.

comparisons show a positive and statistically significant correlation with the average for the multiple-choice questionnaires ($r = .46, p$ .001). The correlation coefficient between the triad questionnaire and the average competence from multiple-choice questionnaires was .11 (p .49), and the correlation coefficient between the triad and the paired-comparison questionnaires was .10 (p .72).

We next explored heterogeneity in the sample by running correlations between the different subsamples. When doing the analysis of cultural competence for each gender separately, we found that results from both men's and women's answers to paired comparisons showed a positive and statistically significant correlation with multiple-choice tasks, although the correlation for men was slightly higher ($r = .51$, p .001) than the correlation for women ($r = .45$, p .001). Last, answers by either gender to the triad questionnaire did not correlate with answers to the multiple-choice task (r .20), nor did they correlate with answers to the paired-comparison task (r .16). For older and younger informants separately, competence using the paired-comparison task correlated positively and significantly with competence using the multiple-choice task, although the correlation was about 15% higher for people older than thirty years of age ($r = .56$, p .001) than for people younger than thirty years of age ($r = .43$, p .001). In no case did we find that competence in the triad task correlated with competence in other tasks. For informants who spoke Spanish well, the correlation coefficient between answers to paired-comparison and to multiple-choice tasks was close to being statistically significant at the 90% confidence level ($r = .40$, $p = .13$). The correlation coefficient of answers to paired-comparison and to multiple-choice tasks from informants who did not speak Spanish was similar ($r = .43$, p .001). In either group, competence scores from the triad task did not correlate with competence scores from other tasks.

Last, we compare competence scores between informants from the more isolated village of Yaranda with informants from the more accessible and modern village of San Antonio. Neither in San Antonio nor in Yaranda did we find that competence in the paired-comparison task correlated significantly with the average cultural competence in the three multiple-choice tasks or with the triad tasks. Cultural competence from triad questionnaires from informants in San Antonio or in Yaranda did not correlate with measures of cultural competence from any of the other tasks.

DISCUSSION AND CONCLUSIONS

In this article, we have addressed two methodological issues in cultural consensus. First, we wanted to test the reliability of various questionnaires of the same task. To do that, we compared scores of cultural competence in ethnobotanical knowledge of three different multiple-choice questionnaires. Second, we wanted to find out whether scores in cultural competence varied across tasks. To do that, we compared scores of cultural competence from multiple-choice, paired-comparison, and triad tasks.

We found that responses to the three multiple-choice questionnaires correlated with each other, both when comparing informants in the pooled sample and when comparing informants within subsamples. The high correlation in responses to questions from the multiple-choice questionnaire is a classic example of the parallel-test assessment of reliability of tests (Nunnally 1967). Our results buttress the reliability of scores of cultural knowledge from multiple-choice questionnaires. The only exception was the lack of statistically significant correlation between multiple-choice questionnaires in each of the two villages separately. Knowledge scores were uniformly higher in the village of Yaranda but were more varied in the more integrated village of San Antonio. Results from *t*-tests suggest that people from the village of Yaranda had overall higher cultural competence scores than people from the village of San Antonio. The lack of correlation between answers from people in the same village reflects clustering and truncation in responses, not lack of reliability.

Answers to the paired-comparison task correlated with answers to the multiple-choice task when using the pooled sample and when using various subsamples (except village of residency). The correlation coefficients were lower than when comparing the different multiple-choice questionnaires between each other. The lower correlation coefficient of the paired-comparison versus the multiple-choice tasks suggests that the paired-comparison task may have been harder than the multiple-choice task. Multiple-choice tasks allowed informants to select more than one use for each plant. Multiple-choice questionnaires did not require comparative tasks since informants were asked to evaluate each plant by itself and to point at all of its possible uses. The paired-comparison task was harder because it required informants to compare two plants and to choose the most useful of the pair.

Results from the triad questionnaire differ. Responses to the triad task did not fit the cultural consensus model. In addition, scores from the triad task did not correlate with results from any of the other tasks, irrespective of whether we did the analysis for the pooled sample or for subsamples. This is a very unusual result, given that people of various groups and subgroups and across national and linguistic boundaries do similarity tasks in the same way (S. Weller, personal communication). A possible explanation may have to do with the characteristics of the sample and with the way we asked the question. The triad task may have been a more difficult task than indicating all possible uses of a plant (multiple choice) or than comparing two plants (paired comparison). In the triad questionnaire, we asked informants to choose the plant that had a much different use from the other two. The task was even harder because we indicated a specific dimension, usefulness. During fieldwork, we found that some Tsimane' found it hard to understand the task and may have given random answers. Furthermore, unlike multiple-choice and paired-comparison tasks, the triad was applied with the help of visual aids. Since many Tsimane' do not know how to identify objects through pictures, the use of pictures may have hindered rather than helped with identification.

In sum, the evidence presented suggests that multiple-choice questionnaires are reliable in their measurement of cultural knowledge but that cultural knowledge is task specific.

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