Successive Free Listing: Using Multiple Free Lists to Generate Explanatory Models

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Successive free listing is a data collection technique that links multiple free lists together in a single interview. The technique can be incorporated into naturally occurring conversations and is readily understood by informants. It also generates more information about the similarity between items than do standard free-listing tasks and allows investigators to better describe intracultural variation among informants. Data from Yoder's ethnomedical study of childhood diarrhea in Zaire are used to demonstrate how the technique works and how the data can be analyzed. The authors warn that successive free listing is not a substitute for more formal frame substitute techniques, and investigators may wish to use the technique early in the research process to systematically explore and describe the multiple relationships between items in a domain.

Free listing is a common elicitation technique in the social sciences (Weller and Romney 1988; Bernard 1994; Borgatti 1999). Researchers use free lists to identify items in a cultural domain and to calculate each item's relative psychological or cultural salience (i.e., prominence, importance, familiarity, or representativeness). Other researchers use free lists to measure cognitive characteristics of informants, including their knowledge of a domain and their categorization patterns (Gatewood 1983; Brewer 1995; Robbins and Nolan 1997).

In this article, we show how multiple free lists can be linked together in a single interview. In the spirit of successive pilesorts (Boster 1994), we refer to this type of data collection as a *successive free list*. We use data from Yoder's (1995) published ethnomedical study of childhood diarrhea in Zaire to dem-

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onstrate how the technique works. We argue that successive free listing is a natural data collection technique that is readily understood by informants. The procedure also generates more information about the similarity between items than does standard free listing and allows the investigators to better describe intracultural variation among informants.

STANDARD FREE LISTS

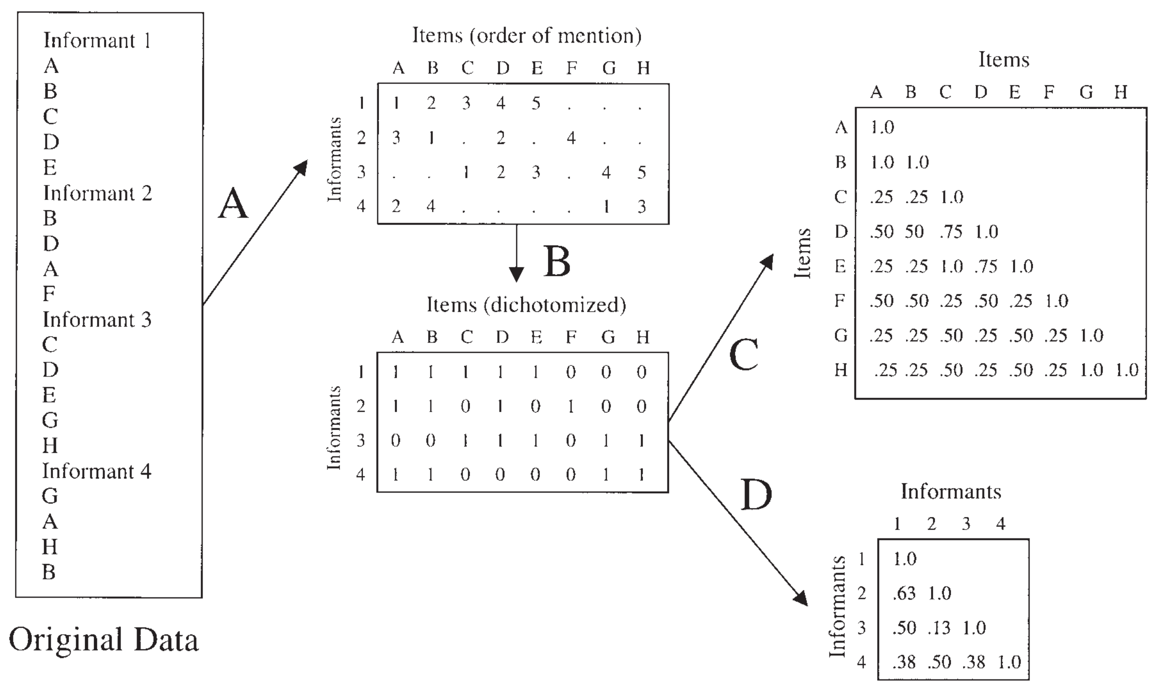
Researchers typically identify items in a cultural domain by asking informants to "list all the kinds of X that you can think of." Step A in Figure 1 shows how such lists are easily converted into informant-by-item matrices. The cells of the matrix are filled with the rank order in which each informant mentioned each item. These data are often dichotomized to ones and zeros to represent whether an informant mentioned an item or not (step B in Figure 1).

Informant-by-item matrices allow researchers to make statements about the items in the domain or the informant's knowledge of the domain. Most researchers first perform a univariate analysis of the items by calculating each item's frequency of occurrence. Items that occur more often are assumed to be more salient in the domain. Additional measures of item salience can also be calculated by considering the order of an item's occurrence in individual lists and the frequency of an item's occurrence across all lists (Smith 1993; Robbins and Nolan 1997; Smith and Borgatti 1998).

An informant's knowledge of a domain can be calculated by simply totaling the number of items mentioned or by using more sophisticated techniques that assign more weight to certain items than others. For example, consensus analysis calculates a measure of knowledge by first identifying those informants who agree most with everyone else and weighting their answers more than informants who are more idiosyncratic (for reviews of consensus analysis, see Romney, Weller, and Batchelder 1986; Romney 1999).

The similarity between items and between informants can also be calculated from the informant-by-item matrix. To do so, however, investigators must make some crude assumptions. First, they must assume that contiguous items are more similar than are items that occur far apart (Henley 1969). Second, items that are mentioned by the same informants are assumed to be more similar than are items that are mentioned by different informants. Granting these assumptions, researchers can calculate the similarity between any pair of items by correlating the corresponding columns of data in the informant-by-item matrix. Doing this for all possible pairs of items produces an item-by-item similarity matrix (step C in Figure 1). The same techniques can be used to create an informant-by-informant similarity matrix (step D in Figure 1).

FIGURE 1
Matrices Created from Standard Free Lists



Such similarity matrices can be analyzed with multidimensional scaling and cluster analysis (Chick and Roberts 1987). For example, Borgatti (1999) showed how such an analysis of the item-by-item matrix can identify core and periphery items in a domain. Johnson (1990) suggested that an analysis of the informant-by-informant matrix will help investigators identify key and idiosyncratic informants.

Standard free-list data are limited in that they produce only a two-mode, informant-by-item matrix. Relationships between items or people are based solely on the similarity of the content and organization of informants' lists. Investigators are left to generalize about the rules informants use to order or categorize listed items.

SUCCESSIVE FREE LISTS

Successive free lists overcome this limitation by linking multiple lists together.[1] The technique uses standard free-list results as cues for additional sets of free lists. The researcher begins by asking informants to list all the items they know in a particular domain. Once the list has been completed, the researcher uses each item mentioned as a prompt for an additional set (or sets) of free lists. For example, Trotter (1981:108–9) asked 378 Mexican American informants to list all the home remedies they knew. For each home remedy, interviewers asked informants to list the types of illnesses treated by the remedy, a description of the method of preparation, and a case description of a known use of the remedy. In all, Trotter collected 1,235 descriptions (what he calls "cases") of home remedies.

Successive free lists have been used in a number of other ethnomedical studies. Crandon-Malamud (1991) used a technique similar to Trotter's. While living in a small Bolivian town, Crandon-Malamud identified 110 local illness terms through semistructured interviews with informants. She then asked 38 residents to list the symptoms, etiology, and cures for each illness. Ryan, Martínez, and Pelto (1996) showed thirty mothers from rural Mexico twenty short video clips of children with acute respiratory illnesses. For each clip, the researchers asked mothers to diagnose what illness the child had, list the signs of the illness, name its potential causes, and explain how they would treat it. Ryan and colleagues found that the technique elicited more terms than did standard free-list techniques and that the task was intuitively simple for informants.

Successive free lists have also been used in ethnobotanic studies. For instance, Nolan and Robbins (1999) asked fourteen Ozark folk plant experts to list all the native medicinal species they knew. For each plant, the researchers asked about its use, which parts were used, and how it was prepared. Experts listed thirty-nine plants and over 200 applications. Ethnobotanical methods manuals allude to a successive free-listing technique but don't spell out the steps in detail (e.g., Martin 1995:214; Cotton 1996).

By far the largest successive free listing we found is an ethnomedical study conducted by Berlin and Berlin (1996) among the highland Maya in Mexico. The Berlins' research team asked 351 local informants (including 161 healers) to help identify and locate plants that had medicinal properties. The experts named approximately 1,650 species of plants from 750 genera and 150 families. From this list of plants, Berlin and Berlin selected 204 of the most commonly mentioned species and pressed them into a "Traveling Herbarium." They then showed the pressed plants to 126 knowledgeable informants (63 males and 63 females from fourteen municipalities). They asked each informant "to name each specimen, specify the health conditions it was used to treat, indicate any other plant species mixed with it in the preparation of the herbal remedy, and note why the particular species was thought to have the power to cure" (pp. 81–82).

Berlin and Berlin's (1996) analysis was extensive (almost 350 pages) and provides a detailed description of ethnobotanical remedies for three groups of gastrointestinal illnesses: diarrheas, abdominal pains, and worms. Most of the analysis, however, is limited to univariate and bivariate relationships. Ryan (1998) suggested that these data could be analyzed further by examining the multivariate relationships between signs and symptoms, illness types, and treatments; and how these relationships vary across physical, biological, epidemiological, and linguistic landscapes. We believe that the techniques described below will be particularly helpful.

EXAMPLE

To illustrate the potential of successive free lists, we reanalyzed Yoder's (1995) data on Lubumbashi mothers' classification of childhood diarrhea. Yoder and his colleague Jean Bihini conducted interviews with thirty-nine small groups of Lubumbashi mothers to discuss their knowledge of childhood illnesses. Yoder first asked them to identify the childhood illnesses they knew, asking the question in a variety of ways (which illnesses affect children here, which illnesses affect children in their first two years, etc.). For the first five or six groups, Yoder focused on getting an extensive list of illnesses that affected children, gradually building up a list of symptoms and treatments associated with many of them. Working from the symptoms given by the mothers, Yoder eventually identified six illnesses related to diarrhea in the biomedical sense. These included *kuhara*, *kilonda ntumbo*, *lukunga*, *kasumbi*, *buse*, and *kantembele*.

Next, Yoder asked more groups of mothers about these illnesses specifically. These interviews were neither focus groups nor standard free-list interviews, but rather natural, open-ended conversations. Yoder built on the answers given by the mothers and was careful not to provide any information that might bias their responses.

The results of Yoder's group interviews are published in an appendix to the article "Examining Ethnomedical Diagnosis and Treatment Choices for Diarrheal Disorders in Lubumbashi Swahili" (1995:233–45). We have reproduced some of these data in Table 1. The table shows descriptions for three illnesses taken from three of the group interviews. Each row in the table represents one group's description of a particular illness.

ANALYSIS

As Yoder (1995) notes, the data in his appendix (our Table 1) can be read vertically and horizontally. A horizontal reading shows the signs and symptoms, causes, and treatments that a single group associated with each illness. A vertical reading provides a measure of how groups provided similar responses when queried about signs and symptoms, causes, and treatments.

In our reanalysis, we converted Yoder's (1995) qualitative data into several matrices. The trick was to treat each column of data as if it were a separate free list and each description as if it were a single informant. In Yoder's case, 24 groups gave complete descriptions of kuhara, 21 described kilonda ntumbo, 25 described lukunga, 20 described kasumbi, 11 described kantembele, and 5 described buse. In all, there were 106 descriptions or "informants" and three free lists (signs and symptoms, causes, and treatments).

Figure 2 outlines the general steps in this process. The data to the left of the figure include five descriptions and two lists (signs and symptoms and treatments) taken from Table 1. The first description is of kuhara. Mothers in group 1 associated the illness with frequent stools, vomiting, fever, and no appetite. They recommended treating the illness with sugar-salt solutions (SSS), rice water, and juice. The fourth description is also of kuhara, but comes from mothers in group 2. They associated kuhara with frequent and watery stools, weakness, and thirst. These mothers recommended going to the health center, or treating the illness with SSS, terramyacin, rice water, or juice.

(text continues on p. 92)

TABLE 1
Illness Descriptions from Three Groups of Mothers

Group ID	*Illness*	*Sign and Symptom*	*Cause*	*Treatment*
1	Kuhara	Frequent stools, vomiting, fever, no appetite	Teething, poorly prepared bottle, intestinal worms, diarrhea from walking, eating dirt (ground), lukunga	SSS, rice water, carrot juice, guava juice
2	Kuhara	Frequent stools, watery stools, general weakness, intense thirst	Bad food, teething, intestinal worms, bottle-feeding, eating dirt (ground)	Go to health center, SSS and ORS, terramyacin, rice water, carrot juice
3	Kuhara	Very frequent stools, no appetite, listlessness, crying, thirsty	Unboiled water, bad food, poorly prepared milk, eating many different kinds of food, intestinal worms	Rice water, SSS
1	Kilonda ntumbo	Fever, stools with undigested food, watery stools, very frequent stools	Food that is too sweet, fruit that is not ripe	Put Vicks on anus; put banana leaves and palm oil on anus
2	Kilonda ntumbo	Rash on buttocks, very frequent stools, anus becomes enlarged	Eating foods that are too sweet, e.g., porridge, sweetened drinks, tea	Put Vicks on anus; suppository of tomato leaves
3	Kilonda ntumbo	Rash on buttocks, frequent stools, anus becomes enlarged, stools with undigested matter, stools containing fibrous matter	Food that is too sweet, suckers (candy), mangos that are not ripe	Put Vicks on anus; sit in basin of water containing mango bark
1	Lukunga	Very frequent stools, clacking of the tongue, vomiting, sunken fontanelle, spots/bumps on palate	If a mother eats fish called *kabambale* or *mulonge*, she may give birth to a child with lukunga	Any plant picked up at a crossroads can be burned and mixed with palm oil and local salt and applied to palate

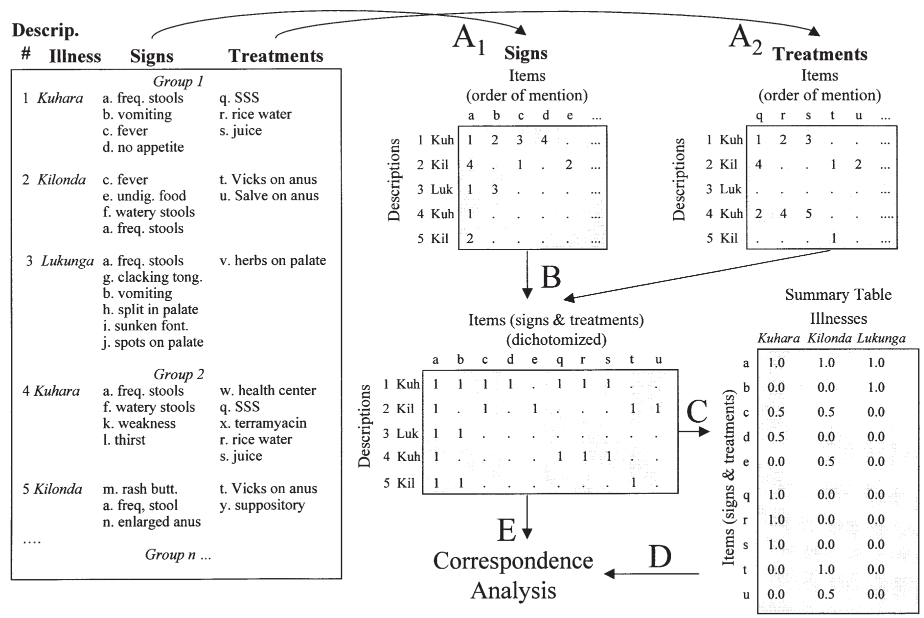
(continued)

TABLE 1 Continued

Group ID	*Illness*	*Sign and Symptom*	*Cause*	*Treatment*
2	Lukunga	Frequent stools, clacking of the tongue, split in the palate, sunken fontanelle, green stools	A child can be born with it, bottle-feeding a child	Burn the head of mulonge fish and mix with palm oil and local salt to apply to palate; apply a mixture of burned banana bark, palm oil, and local salt to palate
3	Lukunga	Clacking of the tongue, intense thirst, sunken fontanelle, spots/bumps on palate	Sorcery	Burn some trash from the market, mix with palm oil and local salt to apply to palate

SOURCE: Adapted from Yoder (1995:233–45).
NOTE: SSS = sugar-salt solutions; ORS = oral rehydration solutions.

FIGURE 2
Matrices Created from Successive Free Lists



NOTE: Example data taken from Table 1. SSS = sugar-salt solutions.

To convert the textual data into matrices, we first typed each column (list) into a separate text file. We then used ANTHROPAC's (Borgatti 1992) free-list procedure to identify the unique items in each list.[2] In the process, ANTHROPAC automatically converted each free list into a description-by-item matrix (steps A1 and A2 in Figure 2).[3] The numbers in the cell indicate the order in which each item was encountered in the original description. For example, the second row of the description-by-sign/symptom matrix indicates that frequent stools (a) was encountered fourth, fever (c) first, and undigested food (e) second. Vomiting (b), fever (c), and no appetite (d) were not found in the second description.

In all, we found 123 unique signs and symptoms, 142 causes, and 191 treatments. To simplify each list, we combined similar items into categories. For example, we lumped causes associated with drinking poorly prepared milk, bottle-feeding, and no breast feeding under the category "bottle-feeding." We performed similar procedures on the signs and symptoms and treatments. For instance, we categorized all the different concoctions that were applied to the palate and fontanelle as one kind of treatment and all the different teas created with leaves as another kind of treatment.

After lumping similar items together, we counted the number of times that our reduced set of signs and symptoms, causes, or treatments was mentioned. To eliminate idiosyncratic items, we adopted a simple inclusion criterion: An item had to be used by more than 20% of the groups to describe at least one of the six illness categories. We identified twenty-seven key items for signs and symptoms, fifteen for causes, and eighteen for treatments—sixty items in all. Finally, we merged the three matrices into a single description-by-item matrix, with 106 descriptions and sixty items (step B in Figure 2).[4] In the process, we dichotomized the matrix to indicate which items were mentioned in each description and which were not.

The simplest way to analyze this matrix is to calculate the frequency and percentage of groups that spontaneously mentioned each of the sixty items (step C in Figure 2). For example, the first row of the summary table in Figure 2 indicates fever (a) was mentioned in all descriptions of kuhara and lukunga and in 50% of the descriptions of kilonda. The data from the entire study are summarized in Table 2. The table reduces Yoder's (1995) original data to 360 cells and allows us to compare the six illnesses across the sixty items (or features). Such large summary tables are commonly found in ethnomedical and ethnobotanical studies, usually in appendixes (e.g., Finkler 1985; Hatfield 1994; Gardner 1995; Figueiredo, Hermógenes, and Begossi 1997; Nazarea

(text continues on p. 96)

TABLE 2

Frequency and Percentage of Mentioning Signs and Symptoms, Causes, and Treatments from Thirty-Nine Discussion Groups

	Kuhara (n = 24)		*Kilonda Ntumbo* (n = 21)		*Lukunga* (n = 25)		*Kasumbi* (n = 20)		*Buse* (n = 5)		*Kantembele* (n = 11)		*Total* (n = 106)	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*
Signs and symptoms														
Watery stool	19	79.2	2	9.5	18	72.0	3	15.0	1	20.0	0	0.0	43	40.6
Frequent stools	10	41.7	16	76.2	2	8.0	11	55.0	1	20.0	0	0.0	40	37.7
Loss of appetite	12	50.0	9	42.9	2	8.0	3	15.0	4	80.0	3	27.3	33	31.1
Weakness	20	83.3	1	4.8	1	4.0	0	0.0	4	80.0	0	0.0	26	24.5
Sunken fontanelle	1	4.2	0	0.0	24	96.0	0	0.0	0	0.0	0	0.0	25	23.6
Tongue clacking	0	0.0	0	0.0	24	96.0	0	0.0	0	0.0	0	0.0	24	22.6
Rash on buttocks	1	4.2	10	47.6	0	0.0	12	60.0	0	0.0	0	0.0	23	21.7
Fever	9	37.5	8	38.1	0	0.0	1	5.0	2	40.0	2	18.2	22	20.8
Very frequent stools	9	37.5	3	14.3	2	8.0	6	30.0	1	20.0	0	0.0	21	19.8
Fibrous matter in stools	3	12.5	16	76.2	0	0.0	1	5.0	0	0.0	0	0.0	20	18.9
Crying	3	12.5	0	0.0	1	4.0	9	45.0	2	40.0	4	36.4	19	17.9
Red groin	0	0.0	0	0.0	0	0.0	16	80.0	0	0.0	0	0.0	16	15.1
Vomiting	3	12.5	0	0.0	12	48.0	0	0.0	0	0.0	0	0.0	15	14.2
Thirst and dehydration	12	50.0	0	0.0	3	12.0	0	0.0	0	0.0	0	0.0	15	14.2
Bloody stools	0	0.0	13	61.9	0	0.0	0	0.0	0	0.0	0	0.0	13	12.3
High fever	2	8.3	1	4.8	0	0.0	0	0.0	0	0.0	8	72.7	11	10.4
Red mouth	0	0.0	1	4.8	1	4.0	0	0.0	0	0.0	9	81.8	11	10.4
Bumps and spots on palate	0	0.0	0	0.0	11	44.0	0	0.0	0	0.0	0	0.0	11	10.4
Diarrhea	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	90.9	10	9.4

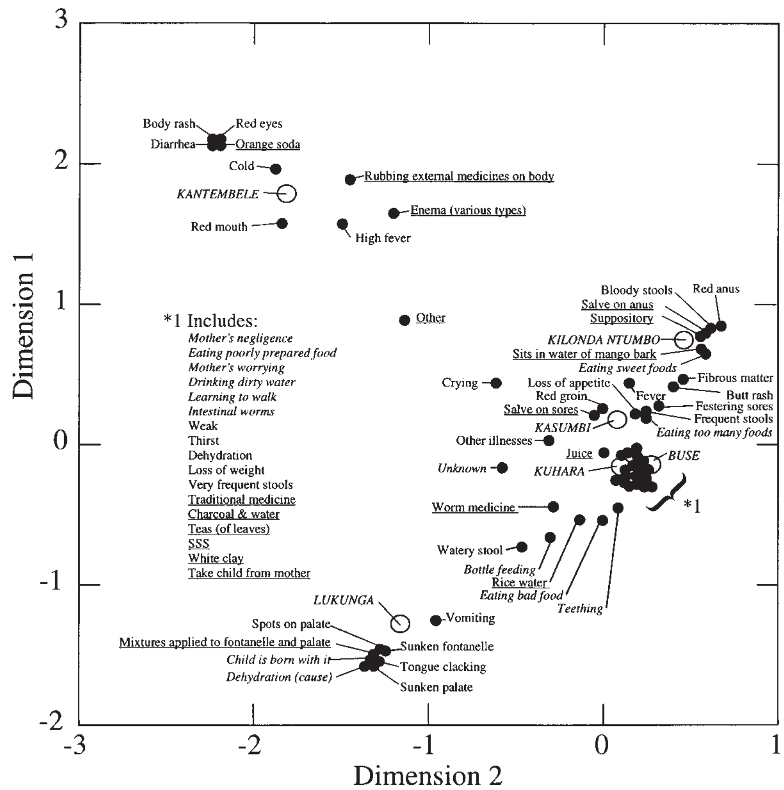
(continued)

TABLE 2 Continued

	Kuhara (n = *24*)		*Kilonda Ntumbo* (n = *21*)		*Lukunga* (n = *25*)		*Kasumbi* (n = *20*)		*Buse* (n = *5*)		*Kantembele* (n = *11*)		*Total* (n = *106*)	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*	*Freq.*	*%*
Red eyes	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	90.9	10	9.4
Cold	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	8	72.7	9	8.5
Loss of weight	2	8.3	0	0.0	2	8.0	2	10.0	2	40.0	0	0.0	8	7.5
Dehydration	7	29.2	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	8	7.5
Red anus	0	0.0	7	33.3	0	0.0	1	5.0	0	0.0	0	0.0	8	7.5
Sunken palate	0	0.0	0	0.0	8	32.0	0	0.0	0	0.0	0	0.0	8	7.5
Festering sores	0	0.0	0	0.0	0	0.0	6	30.0	0	0.0	0	0.0	6	5.7
Body rash	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	36.4	4	3.8
Causes														
Bottle-feeding	15	62.5	0	0.0	7	28.0	0	0.0	1	20.0	0	0.0	23	21.7
Intestinal worms	21	87.5	1	4.8	0	0.0	0	0.0	0	0.0	0	0.0	22	20.8
Eating foods that are too sweet	1	4.2	19	90.5	0	0.0	0	0.0	0	0.0	0	0.0	20	18.9
Eating too many kinds of food	6	25.0	13	61.9	0	0.0	0	0.0	0	0.0	0	0.0	19	17.9
Unknown	0	0.0	0	0.0	6	24.0	12	60.0	0	0.0	1	9.1	19	17.9
Teething	17	70.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	17	16.0
Other illnesses	7	29.2	0	0.0	2	8.0	6	30.0	0	0.0	2	18.2	17	16.0
Mother's negligence	8	33.3	0	0.0	0	0.0	4	20.0	4	80.0	0	0.0	16	15.1
Mother's worrying	12	50.0	0	0.0	0	0.0	0	0.0	3	60.0	0	0.0	15	14.2
Eating bad food	13	54.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	13	12.3
Drinking dirty water	11	45.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	11	10.4
Child is born with it	0	0.0	0	0.0	11	44.0	0	0.0	0	0.0	0	0.0	11	10.4

Learning to walk	8	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	7.5
Eating poorly prepared food	6	25.0	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	7	6.6
Dehydration	0	0.0	0	0.0	7	28.0	0	0.0	0	0.0	0	0.0	7	6.6
Treatments														
Local salt and palm oil	0	0.0	0	0.0	25	100.0	0	0.0	0	0.0	0	0.0	25	23.6
Sugar and salt solution (SSS)	20	83.3	0	0.0	3	12.0	1	5.0	0	0.0	0	0.0	24	22.6
Rice water	22	91.7	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	23	21.7
Sit in mango bark water	1	4.2	17	81.0	0	0.0	1	5.0	0	0.0	0	0.0	19	17.9
Suppositories	1	4.2	17	81.0	0	0.0	0	0.0	0	0.0	0	0.0	18	17.0
Salve on sores	0	0.0	0	0.0	0	0.0	17	85.0	0	0.0	0	0.0	17	16.0
Salve on anus	1	4.2	13	61.9	0	0.0	1	5.0	0	0.0	0	0.0	15	14.2
Enemas (of various types)	1	4.2	4	19.0	0	0.0	0	0.0	0	0.0	10	90.9	15	14.2
Juice	12	50.0	0	0.0	0	0.0	0	0.0	0	0.0	1	9.1	13	12.3
Teas (of leaves)	10	41.7	1	4.8	0	0.0	1	5.0	0	0.0	0	0.0	12	11.3
Traditional medicine	2	8.3	0	0.0	0	0.0	4	20.0	5	100.0	0	0.0	11	10.4
Charcoal powder in water	10	41.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	9.4
Other	1	4.2	1	4.8	1	4.0	2	10.0	0	0.0	4	36.4	9	8.5
White clay	8	33.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	7.5
Orange soda	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	7	63.6	7	6.6
Worm medicine	6	25.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	5.7
Take the child from its parents	1	4.2	0	0.0	0	0.0	0	0.0	3	60.0	0	0.0	4	3.8
Rub external medicine on body	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	3	27.3	4	3.8

FIGURE 3
Correspondence Analysis of Signs and Symptoms, Causes, and Treatments by Six Illnesses



NOTE: SSS = sugar-salt solutions.

1998). These tables can be further subdivided to focus on more specific comparisons. For example, Yoder (1995:218) compared the most frequently mentioned symptoms for kuhara, kilonda ntumbo, and lukunga.

Large summary tables such as Table 2, however, make it difficult to compare illnesses at the aggregate level. For instance, we would be hard pressed to answer the question: "Is kuhara more similar to kilonda ntumbo or more similar to lukunga?" based on our reading of Table 2. The problem can be solved by using correspondence analysis (step D in Figure 2).

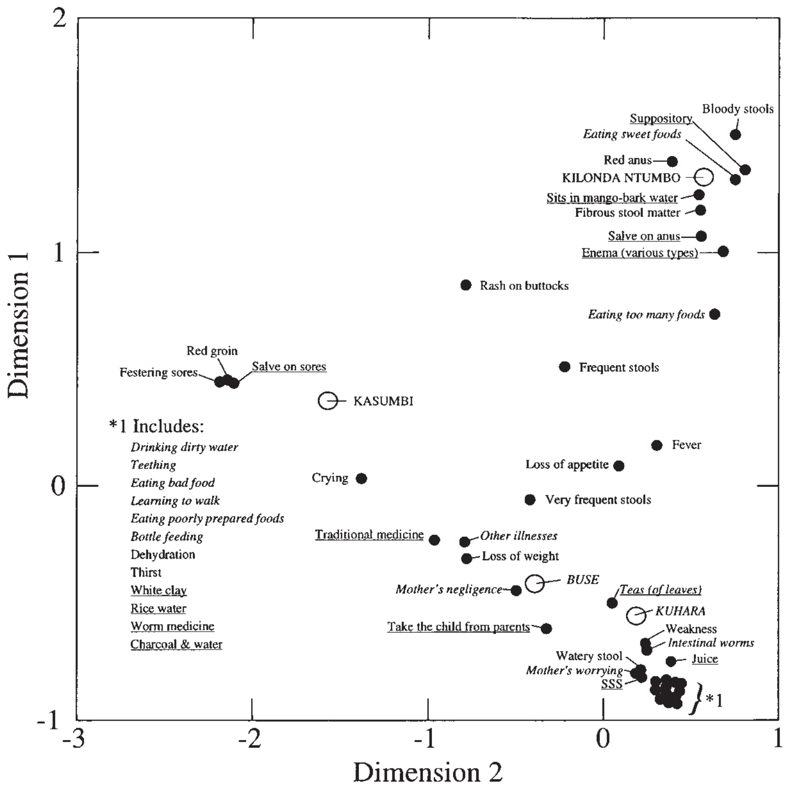
Correspondence analysis is a practical technique for exploring and describing tables of categorical data (Greenacre 1984; Weller and Romney 1990; Greenacre and Blasius 1994; for an exceptionally clear description of the technique, see Watts 1997). The technique scales the rows and columns of a table into the same multidimensional space. It can be used on both large and small samples and is relatively insensitive to cells with low or no cases. Figure 3 shows the results of a correspondence analysis of Table 2. The relative distance between items in the graph represents the relative associations between the rows and columns in Table 2.

The graphic representation suggests that kantembele and lukunga are distinct from the other four illnesses, which tend to cluster together at the right-hand side of the figure. Kantembele is strongly associated with body rash, diarrhea, red eyes and mouth, high fever, and having a cold. The illness is treated with orange soda, enemas of various types, and external medicines that are rubbed on the body. On the other hand, lukunga is associated with sunken fontanelle, sunken and spotted palate, tongue clacking, and vomiting. Yoder's (1995) groups of mothers believed that the illness could be caused by dehydration or that some children could be born with it. The illness is best cured by applying mixtures of salt and palm oil to the fontanelle and palate. These strong associations can be checked against the original data in Table 2.

The dense clustering of the remaining signs and symptoms, causes, and treatments around the other four illnesses makes it difficult to determine how they differ from one another. One solution would be to run a correspondence analysis using only the data for kilonda ntumbo, kasumbi, kuhara, and buse. To do this, we eliminated the kantembele and lukunga columns in Table 2. We applied our original inclusion criteria (for a feature to be included, it had to be used by more than 20% of the groups to describe at least one of the illness categories), which eliminated eighteen additional features. Figure 4 shows the resulting correspondence analysis. Clearly, of the four remaining illnesses, kilonda ntumbo is the most different, followed by kasumbi. Buse and kuhara remain almost indistinguishable—in terms of the signs and symptoms, causes, and treatments that distinguish them.

Figures 3 and 4 tell us how similar the illnesses are to one another but fail to demonstrate the boundaries of each illness and the degree to which illnesses overlap each other. The problem lies not in correspondence analysis but in the use of the summary data of Table 2. By aggregating the data across the descriptions, we had lost the intracultural variation among informants (in Yoder's [1995] case, groups of mothers). It is the variation among informants that defines the boundaries of abstract constructs (Ryan 1999).

FIGURE 4
Correspondence Analysis of Signs and Symptoms, Causes, and Treatments by Four Illnesses



NOTE: SSS = sugar-salt solutions.

To examine the extent to which the six illness categories overlap based on their signs and symptoms, we performed a correspondence analysis on the description-by-sign matrix, with 106 descriptions and twenty-seven signs (step E in Figure 2).[5] The analysis plots each of the 106 descriptions in the same space as the twenty-seven signs. Figure 5 shows the results. We have labeled the 106 descriptions with symbols to represent the six illnesses. The interdispersion of the symbols shows where one illness overlaps with another. We can also use the coordinates of the descriptions to calculate 95%

confidence intervals for each illness category.[6] The size of the ellipses indicates the amount of intergroup agreement. The smaller the ellipse, the more agreement there is about an illness's features (in this case, signs and symptoms).

Based on the twenty-seven most common signs and symptoms, kantembele is quite distinct from the other illnesses, and lukunga only slightly overlaps with kuhara and buse. There is, however, quite a strong overlap between kilonda ntumbo and kasumbi, suggesting that groups of mothers are not in agreement on how to distinguish between these illnesses. The confidence interval around buse is relatively large because only four groups described the signs and symptoms associated with the illness.

To identify which illness categories overlapped based on their recommended treatments, we ran a correspondence analysis on the description-by-treatment matrix, with 106 descriptions and eighteen treatments. Figure 6 displays the results. Clearly, lukunga is treated differently from the other five illnesses. Checking the data in Table 2, we find that all groups agreed that the illness should be treated by applying a local salt and palm oil mixture to the palate and fontanelle. Furthermore, this particular treatment is not associated with any other illness category.

Figure 6 also supports Yoder's (1995) contention that illness labels are strongly associated with specific treatments. With the exception of buse, which is treated in a manner similar to kasumbi, the illness categories denote specific treatment recommendations. We see far less overlap among illness categories when descriptions are scaled based on treatments in Figure 6 than when they are scaled based on signs and symptoms in Figure 5. It is interesting to note that whereas kilonda ntumbo and kasumbi were hard to distinguish based on signs and symptoms in Figure 5, they are treated as distinct illnesses in Figure 6. This appears to be a clear case of mothers' treatment behaviors being more strongly associated with the diagnostic category assigned to the illness rather than the signs and symptoms observed.

Finally, Figure 7 shows what happens when we combine signs and symptoms and treatments in the same matrix (step E in Figure 2). Lukunga and kantembele are seen as distinct illnesses, with their own sets of signs and symptoms and corresponding treatments. Kuhara is relatively distinct, but overlaps slightly with kasumbi. Kilonda ntumbo and kasumbi share the most overlap, although for some groups they were very distinct. Buse overlaps with kasumbi, kuhara, and kilonda ntumbo probably because of its small sample size.

(text continues on p. 103)

FIGURE 5
Correspondence Analysis of Signs and Symptoms by Illness with 95% Confidence Intervals

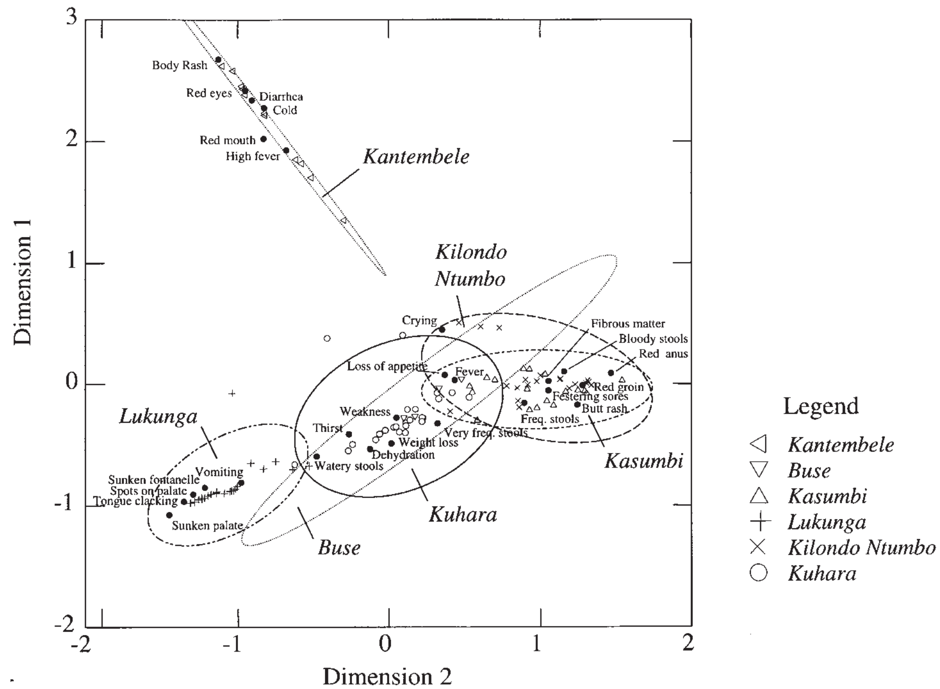
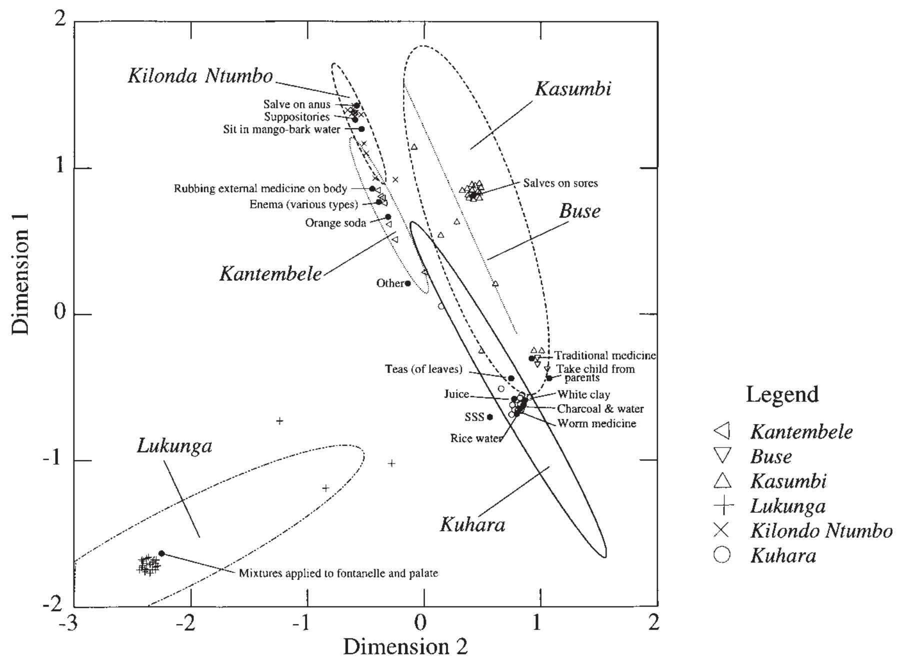
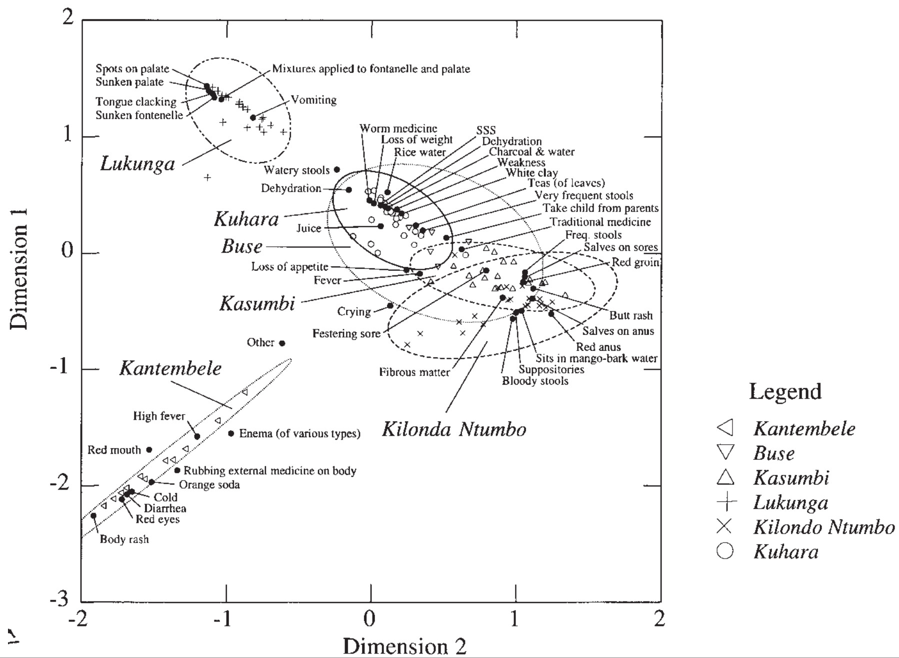


FIGURE 6
Correspondence Analysis of Treatment by Illness with 95% Confidence Intervals



NOTE: SSS = sugar-salt solutions.

FIGURE 7
Correspondence Analysis of Signs and Symptoms and Treatment by Illness with 95% Confidence Intervals



NOTE: SSS = sugar-salt solutions.

DISCUSSION

Yoder (1995) examined the central characteristics associated with each of the six types of diarrhea. He concluded that illness diagnosis was based largely on observed symptoms and that choice of treatments varied according to ethnomedical diagnosis.[7] Our analysis expanded on Yoder's original work. First, we converted Yoder's tables of textual data into aggregate illness-by-item matrices. We then used correspondence analysis on these matrices to assess the similarity between illnesses. For example, Figure 3 shows us how distinct kantembele and lukunga are from the other illnesses, and Figure 4 shows us how kilonda ntumbo and kasumbi are different from kuhara and buse.

Next, we examined the degree to which groups agreed with each other about illness signs and symptoms and treatments. We used the agreement between the groups as a proxy for drawing boundaries for six abstract illnesses. When all illnesses are displayed together, as in Figures 5–7, we can discover which illness boundaries overlap. For example, Figure 5 shows that kantembele and lukunga are readily distinguishable by their signs and symptoms, whereas kilonda ntumbo and kasumbi are less clearly delineated. The overlap between kilonda ntumbo and kasumbi shows that there is some disagreement between groups in terms of illness diagnosis. The fact that there is so little overlap in Figure 6 between kilonda ntumbo and kasumbi[8] strongly supports Yoder's claim that ethnomedical diagnoses influence treatment choices.

As a data collection technique, successive free listing is not new. Researchers from a variety of fields—most notably ethnomedicine and ethnobotany—have developed and used the procedure independently. Like standard free lists, successive free lists are easy to administer and can be applied to literate and nonliterate informants. Successive free listing offers an advantage over standard free listing in that it provides a systematic way of collecting additional data on each of the original items mentioned by informants. This extra information allows researchers to understand more fully the multiple relationships between the items in the original list.

The data generated from successive free listing are similar to those generated by more formal frame substitution methods (for overviews of these techniques, see Weller and Romney 1988; Bernard 1994). Both techniques ultimately produce item-by-feature matrices. The techniques differ, however, in the role that investigators play in determining which items and which features are ultimately included in these matrices. In the case of frame substitution, investigators select a finite list of items and features *before* querying informants about the relationships. (Typically, investigators base their decisions on prior ethnographic studies.) In the case of successive free listing, investigators make choices about which items and features to include *after* they have collected data from informants.

Is one technique a substitute for the other? We suggest not. During early stages of a research project, investigators may wish to use successive free lists to systematically explore and describe the multiple relationships between items in a domain. At later stages, investigators may wish to use the formalism of frame substitution techniques to test more specific hypotheses.

In addition to showing how successive free lists can be used to generate rich relational data, we present three techniques for analyzing such data sets. Typically, successive free lists have been summarized in item-by-feature tables similar to our Table 2. These tables tend to be expansive and are usually difficult to interpret. For such complex tables, we show that correspondence analysis can be a helpful tool for graphically displaying aggregate patterns among items and features. We suggest, however, that the real power of successive free lists lies in their ability to capture intracultural variation from open-ended questions. By treating each description as if it were a separate item, we can construct a description-by-feature matrix. We can then use correspondence analysis on this matrix to display not only the central features of abstract items and constructs but also their boundaries and overlaps.

The power of combining qualitative and quantitative techniques is best seen in hindsight. We started with qualitative descriptions similar to those displayed in Table 1. We concluded with the rather complex, but highly interpretable, graphics in Figures 5–7. Our analysis is in no way a substitute for the detailed, ethnographic analysis originally done by Yoder (1995). Instead, it is simply an extension of a rich database that a researcher had the foresight to publish.

NOTES

1. See Frake (1964) for an early formulation of linked lists.

2. ANTHROPAC 4.95X reads a file of informants' free lists and converts it into an informant-by-item matrix.

3. Note that in step A1, items are kinds of signs and symptoms. In step A2, however, items are kinds of treatments.

4. We used ANTHROPAC's merge function to create the master matrix. We used ANTHROPAC's row labels to keep track of which descriptions (rows) were associated with each illness.

5. We have deviated slightly from conventions suggested by Weller and Romney (1990:70–84), who recommend "doubling" matrices of dichotomous data. In our case, we found that the doubling process had little effect on where the signs and symptoms and illness descrip-

tions were located on the first and second dimensions (r = .92 for dimension 1 and r = .89 for dimension 2). Adding extra columns simply cluttered the final display and made interpretation more difficult. We thank Susan Weller for pointing out this discrepancy.

6. We used several software programs to produce Figure 5. First, we created the description-by-sign matrix, with 106 descriptions and twenty-seven signs, in ANTHROPAC and ran correspondence analysis on it. We exported the resulting coordinate file and read the file into an Excel spreadsheet. In the spreadsheet, we added a variable called "group" and categorized each description as belonging to one of the six illness categories. We saved the file (in Excel 4.0 format) and imported it into Systat. We used Systat's graphical functions to plot the coordinates and calculate 95% confidence intervals for the six illnesses. We exported the resulting graphic (in .wmf format) and imported it into PowerPoint, where we made the final cosmetic changes. We followed similar steps to create Figures 6 and 7.

7. Yoder (1995) also concluded that etiology did not play a major role in illness classification. Due to space limitations, we do not examine Yoder's conclusion here.

8. Such ambivalent diagnostic categories would allow a mother who had a child with frequent or bloody stools, festering sores, and a red groin to make a preliminary diagnosis and treat the child with appropriate remedies, and, if these failed, rediagnose the child and try another set of treatments.

REFERENCES

Berlin, E. A., and B. Berlin. 1996. *Medical ethnobiology of the Highland Mayan of Chiapas, Mexico: The gastrointestinal diseases*. Princeton, NJ: Princeton University Press.

Bernard, H. R. 1994. *Research methods in anthropology: Qualitative and quantitative approaches*. 2d ed. Thousand Oaks, CA: Sage.

Borgatti, S. P. 1992. *ANTHROPAC 4.0*. Natick, MA: Analytic Technologies.

———. 1999. Elicitation techniques for cultural domain analysis. In *The ethnographer's toolkit*, vol. 3, edited by J. Schensul, M. LeCompte, S. Borgatti, and B. Nastasi, 115–51. Walnut Creek, CA: AltaMira.

Boster, J. 1994. The successive pile sort. *Cultural Anthropology Methods Journal* 6 (2): 11–12.

Brewer, D. 1995. Cognitive indicators of knowledge in semantic domains. *Journal of Quantitative Anthropology* 5:107–28.

Chick, G. E., and J. M. Roberts. 1987. Lafte craft: A study in "part" appreciation. *Human Organization* 46:305–17.

Cotton, C. M. 1996. *Ethnobotany*. New York: John Wiley & Sons.

Crandon-Malamud, L. 1991. *From the fat of our souls: Social change, political process, and medical pluralism in Bolivia*. Berkeley: University of California Press.

Figueiredo, G. M., F.L.-F. Hermógenes, and A. Begossi. 1997. Ethnobotany of Atlantic forest coastal communities: II. Diversity of plant uses at Sepetia Bay (SE Brazil). *Human Ecology* 25:353–60.

Finkler, K. 1985. *Spiritualist healers in Mexico: Successes and failures of alternative therapeutics*. New York: Praeger.

Frake, C. O. 1964. Notes on queries in anthropology. *American Anthropologist* 66 (3): 132–45.

Gardner, P. 1995. Illness and response among south Indian foragers. *Medical Anthropology* 16:119–39.

Gatewood, J. B. 1983. Loose talk: Linguistic competence and recognition ability. *American Anthropologist* 85:378–86.

Greenacre, M. 1984. *Theory and application of correspondence analysis*. London: Harcourt Brace.

Greenacre, M., and J. Blasius. 1994. *Correspondence analysis in the social sciences*. London: Harcourt Brace.

Hatfield, G. 1994. *Country remedies: Traditional East Anglian plant remedies in the twentieth century*. Woodbridge: Boydell Press.

Henley, N. M. 1969. A psychological study of the semantics of animal terms. *Journal of Verbal Learning and Verbal Behavior* 8:176–84.

Johnson, J. C. 1990. *Selecting ethnographic informants*. Newbury Park, CA: Sage.

Martin, G. J. 1995. *Ethnobotany: A methods manual*. London: Chapman and Hall.

Nazarea, V. D. 1998. *Cultural memory and biodiversity*. Tucson: University of Arizona Press.

Nolan, J. M., and M. C. Robbins. 1999. Cultural conservation of medicinal plant use in the Ozarks. *Human Organization* 58 (1): 67–72.

Robbins, M. C., and J. M. Nolan. 1997. A measure of dichotomous category bias in free-listing tasks. *Cultural Anthropology Methods Journal* 9 (3): 8–12.

Romney, A. K. 1999. Culture consensus as a statistical model. *Current Anthropology* 40 (suppl.): 103–15.

Romney, A. K., S. C. Weller, and W. Batchelder. 1986. Culture as consensus: A theory of culture and informant accuracy. *American Anthropologist* 88:313–39.

Ryan, G. 1998. Review of "Medical ethnobiology of the Highland Maya of Chiapas, Mexico: The gastrointestinal diseases," by Elois Ann Berlin and Brent Berlin. *American Journal of Human Biology* 10:271–73.

———. 1999. Measuring the typicality of text: Using multiple coders for more than just reliability and validity checks. *Human Organization* 58 (3): 313-22.

Ryan, G., H. Martínez, and G. Pelto. 1996. Methodological issues for eliciting local signs/symptoms/illness terms associated with acute respiratory illnesses. *Archives of Medical Research* 27:359–65.

Smith, J. J. 1993. Using ANTHROPAC 3.5 and a spreadsheet to compute a free-list salience index. *Cultural Anthropology Methods Journal* 5 (3): 1–3.

Smith, J. J., and S. P. Borgatti. 1998. Salience counts—and so does accuracy: Correcting and updating a measure for free-list-item salience. *Journal of Linguistic Anthropology* 7:208–9.

Trotter, R. T. 1981. Remedios caseros: Mexican-American home remedies and community health problems. *Social Science and Medicine* 15B:107–14.

Watts, D. D. 1997. Correspondence analysis—A graphical technique for examining categorical data. *Nursing Research* 46:235–39.

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

———. 1990. *Metric scaling: Correspondence analysis*. Newbury Park, CA: Sage.

Yoder, P. S. 1995. Examining ethnomedical diagnoses and treatment choices for diarrheal disorders in Lubumbashi Swahili. *Medical Anthropology* 16:211–48.

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