



Cognitive Structure and Informant Accuracy

Linton C. Freeman; A. Kimball Romney; Sue C. Freeman

American Anthropologist, New Series, Vol. 89, No. 2 (Jun., 1987), 310-325.

Stable URL:

<http://links.jstor.org/sici?sici=0002-7294%28198706%292%3A89%3A2%3C310%3ACSAIA%3E2.0.CO%3B2-7>

American Anthropologist is currently published by American Anthropological Association.

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/anthro.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact jstor-info@umich.edu.

LINTON C. FREEMAN
A. KIMBALL ROMNEY
SUE C. FREEMAN
University of California, Irvine

Cognitive Structure and Informant Accuracy

The problem of informant accuracy is examined in light of principles of memory organization from cognitive psychology. These principles turn out to be powerful, not only in explaining overall patterns of informant error, but in predicting details about the types of errors made. Predictions are made in terms both of different kinds of informants and different kinds of objects. All the predictions are strongly supported by the data. Finally, in the light of these results, two strategies are developed. The "best" informants, it seems, can be used to reveal long-range stable patterns of events, and the "worst" informants can be used to reveal the details of a particular event of special interest.

THIS ARTICLE, ON INFORMANT ACCURACY, IS FOCUSED on the relationship between what people do and their recollections of those doings. The approach stems from earlier work by Bernard, Killworth, and Sailer (Killworth and Bernard 1976, 1979; Bernard and Killworth, 1977; Bernard, Killworth and Sailer 1980, 1981, 1982) on the accuracy of people's reports about their social interaction.

These studies by Bernard, Killworth, and Sailer (BKS) all focus on the comparison between a social event—the interaction among a set of people—and the recall of details of that event by the people involved. Although the several BKS studies vary over a range of kinds of interaction and question forms, they all come to the same result: there is little agreement between what people say and what they do. Informants, it seems, are typically unable to report accurately on the others with whom they have interacted. They make two kinds of errors: (1) they *forget* some of those others and (2) they generate *false recalls* by claiming to have interacted with others with whom they have not. In summarizing their own work, BKS (writing with Kronenfeld 1985) have suggested that these inaccuracies are so common that about half of what informants tell us is wrong in some way.

This result raises an issue of considerable importance. Much social science data have been and continue to be generated by questioning informants. Ethnographers, for example, typically draw on informants in their field research. And survey methods are at the core of most sociological research. Both produce data based on reports by informants about experiences they have had. Moreover, as BKS have stressed, these informant reports are often used as if they embodied accurate accounts of events that actually took place. Thus, with the BKS evidence that information based on what people say is only half true, many of the generalizations of the social sciences become questionable.

In an earlier report, two of the present authors (Freeman and Romney 1987) indicated that this issue may not be as significant as it appears at first to be. Following Hammer (1980), we argued that social scientists have no special interest in exact records of unique social events. Rather, the main concern of social science is in relatively long-term, more or less stable *patterns* of repeated events. From this perspective, the question is not whether

LINTON C. FREEMAN is Professor of Sociology, School of Social Sciences, University of California, Irvine, CA 92717. A. KIMBALL ROMNEY is Professor of Anthropology, School of Social Sciences, University of California, Irvine. SUE C. FREEMAN has just received her Ph.D. in Social Science, School of Social Sciences, University of California, Irvine.

data based on informants' reports correspond to data based on records of observations of those events. The real question is how well data gathered by either of these procedures correspond to long-range patterns of social structure.

In our previous study, therefore, we focused on a series of colloquia and recorded who was present for a short (unfortunately, too short) series of sessions. We took this pattern as our index of the long-range structure of attendance. Then we recorded who attended a particular designated target session, and, after a delay, we asked those present to recall who else had been there.

The relation between a one-time sample observation and the long-term pattern is quite straightforward. The single observation should be an unbiased estimator of the long-term pattern, but it is subject to sampling error. It can be completely accurate only if there is *no* variance in the long-term pattern. But if anyone attends only part of the time, a one-time sample must provide a less than perfect index of the long-term pattern.

The relation between the recall responses and the long-term pattern is by no means so simple or well understood. Our informants were asked to recall who was present on a particular occasion. As an index of the actual behavior on that occasion, the informants' reports turned out, like those of BKS before us, to be full of errors. People were forgotten and others were falsely recalled.

The errors introduced by both forgetting and false recall, however, were not random; they were systematically biased. The people forgotten by an informant were those who attended infrequently, and the people falsely recalled were those who were frequent attenders. The bias, then, worked in the direction of consistency with the long-term patterns. And for that data set, the biases were consistent enough that the informants' responses provided a better index of the long-term pattern than that provided by the one-shot observation. If those results hold up, recall responses should provide the better index whenever there is a significant amount of variance in the long-term structure.

This result may give some comfort to ethnographers and those engaged in survey research, but it still leaves some serious questions. First, it was based on a preliminary study that needs to be expanded—particularly in the area of measurement of long-term patterns—before we can have any confidence in its findings. And second, it leaves unsolved the problem of explaining how it is that informants come to bias their responses in the direction of long-term patterns.

The present study is intended to address these questions. First of all, it is a replication of the earlier study, but one that involves better data-gathering procedures. In particular, we have recorded social acts over an entire school term to provide a better index of the social structure being examined. And second, in this expanded study, we will try to confront the problem of explaining the observed pattern of response bias. Because the bias seems to us to lie somewhere in the cognitive processes of our informants—somewhere in memory, between perception and recall—we will turn to the cognitive literature on memory for help in untangling this phenomenon. In so doing, we hope to explain our earlier findings about biases and to provide hypotheses to guide our current research.

We will begin, then, by describing our new data and outlining their properties in terms of the question of accuracy. Next, we will turn to the cognitive literature on memory. From that literature, we will try to uncover some cognitive principles that might help us to understand how informants come to bias their responses to be consistent with the long-term patterns of interaction. We will then examine the degree to which the hypotheses generated by those cognitive principles are supported by our data. And finally, we will explore the problem of how best to use data generated by informants to reconstruct either particular events or long-term patterns.

The Data Set

Data were collected in the context of an ongoing colloquium series organized by the Mathematical Social Science Group at the University of California at Irvine. Those who

attend are primarily faculty and graduate students from the Mathematical Social Science Program itself, but faculty and students from other programs and from other universities are often present. The setting is a large lounge in which participants sit around more or less in a circle, so everyone is visible to everyone else.

Attendance patterns were recorded for nine consecutive sessions—an entire term—the spring quarter of 1985. Two observers unobtrusively drew maps that recorded the names and seating patterns of all participants as well as their arrival and departure times. The maps were compared to ensure their reliability and the results were filed away.

These attendance records were used to generate two data sets. First, they were simply cumulated into counts of individual attendance. The result is a vector that records the relatively long-term pattern of social participation—the *social structure* of the group. Second, the record of the ninth and final session was pulled out and designated as the specific *target event* about which the informants would be questioned. Informant data were collected five days after the final—the target—colloquium session. Sixteen persons who had attended two or more sessions but missed the target session were included, along with the 17 who were present at the target session. In all, then, 33 persons were interviewed. All cooperated; there were no refusals.

Interviews were conducted by computer. Each began with a description of the target session including the day, date, location, speaker's name, and the title of his talk. Each subject was asked whether he or she had attended that target session. If a subject recalled having attended, he or she was asked to try to list the names of all the others who were present or, failing that, to present detailed descriptions of those whose names could not be recalled. The computer recorded each keystroke along with a log of the time at which the key was stroked. Thus, the data include not only a record of each subject's recall of others who attended, but details of the order and timing of responses. This constitutes the *recall* data set for the present study.

Thus, these data sets resemble those collected by BKS in that comparative data are generated based on (1) observation of a target event and on (2) recall of that event by participating persons. But, as in our own earlier study (Freeman and Romney 1987), we also generated data of a third sort—what we are calling social structure—to capture long-term participation patterns. The focus of the present research is on interrelations among these several kinds of data.

A First Look at the Data

Overall, both participation rates and session attendance display considerable variability. In all, 65 different persons attended one or more sessions. Some participants attended all nine sessions, while others came only once. Particular sessions attracted anything from 13 to 38 participants. Seventeen attended the target session.

The structure of participation in this group is straightforward. For these colloquium participants, individual attendance rates capture the entire group structure. Indeed, the correlation between the co-attendance rate of pairs of people and the product of their two individual attendance rates is .96. Thus, the data on co-attendance exhibit a simple center-periphery form, without subgroups, cliques, or clusters and differentiated only by varying individual attendance rates.

The recall results match those of BKS quite closely. There were no errors due to people's forgetting that they attended the target session, and no one who was absent falsely claimed to have been there. But, if recall were perfect, each of the 17 informants who attended would have recalled each of the 16 others who also were present. Collectively, then, they would have reported 272 others as present. But 115 of these opportunities were missed; people simply forgot others who co-attended the target session with them. Moreover, on 26 occasions, names of others who did not attend the target session were included in the reports as false recalls. This ratio of 141 errors out of 272 opportunities (52%) is quite close to the BKS estimate that about half of what informants report is incorrect in some way.

The results here also match those of our own earlier study. Again, it turns out that the informants' reports provide a better predictor of long-term patterns than that provided by observing who attended the target session. The correlation between attendance frequency at the nine sessions and presence or absence at the target session is .72. That between attendance frequency and number of times named by informants is .85.

So again, we have data that display a great deal of inconsistency between a target event and informant's recall of that event. Moreover, as in our earlier study, we have evidence that the reports of our informants provide a better index of the long-term pattern than does a prediction based on direct observation of the target event. Now we will turn to the cognitive literature to seek an explanation of these findings.

Cognitive Organization and Memory

Contemporary cognitive psychology provides no general overall theory of the storage and retrieval of experience. In the words of Garner, "psychologists have come to accept the idea that how humans (or other organisms) process information is not a very simple question; certainly it is not a question of seeking an invariant law about human behavior" (1978:131). Instead, research findings seem to suggest that people perceive, process, and retrieve information about their experiences in a wide range of differing manners. Overall, as both Simon and Newell (1971) and Anderson and Bower (1973) have indicated, all that can be said is that humans seem to change memory storage and retrieval strategies to suit the differing demands of different tasks.

Nonetheless, a set of fairly general principles is beginning to emerge from the wide-ranging collection of experiments having to do with memory. These principles are presented at a rather high level of generality and they do not yield precise predictions about the details of any particular experiment. But they do summarize the main tendencies of a great deal of memory research. Here we shall set some of these generalizations down and try to tease out from them some ideas that might cast some light on our work on informant accuracy. We will set down five principles that are practically universal in the memory literature. Together these principles form the core for a proto-theory of human memory. They describe an assumed cognitive process that is consistent with the experimental results in memory research.

1. *Human memory is organized.* People are not passive recording devices like cameras or tape recorders. They are active organizers of information, and they construct mental structures that impose regular patterns on that information. J. M. Mandler suggests that from the viewpoint of an individual, "repeated experience of similar events and situations generates mental structures that represent them" (1979:260).

2. *The organization embodied in a mental structure is revealed in free recall.* When an individual is asked to recall a story, a picture, a word list, or any event at all, the parts or elements of that event tend to be reorganized in the individual's report. Elements that are grouped together in recall report are assumed to be linked somehow in that individual's mental structure.

This point is illustrated in an experiment by Katz (1976). Subjects were presented with a randomly ordered series of animal names. But when they were asked to recall those names, the subjects did not retrieve the original order. Instead they grouped the house pets together in their recall, and the farm animals, the jungle beasts, and so on. Thus, a categorical form of organization was imposed on the information somewhere between the presentation of the list and its recall. This is evidence that the subjects organized their new experience in terms of a preexisting mental structure.

There is extensive evidence of this sort (Pellegrino and Ingram 1979; Friendly 1979). Once a person has established a structure to organize a class of experiences, any new experience is automatically perceived and processed—reorganized perhaps—in terms of expectations imposed by that structure.

3. *The organization of memory is based on experience.* Individuals perceive regular patterns in the world and these patterns are important to them. Rosch describes the kind of regularity people see:

the material objects of the world are perceived to possess . . . high correlational structure. That is, given a knower who perceives the complex attributes of feathers, fur, and wings, it is an empirical fact provided by the perceived world that wings co-occur with feathers more than with fur. [1978:29]

Then, given such regularities in the world, J. M. Mandler suggests that "The mind creates order and structure out of welter of stimulation, seeks for, and finds regularities and comes to expect them in the future" (1979:260). Perception of regularities, then, is the basis for the construction of mental structures.

But individuals vary in experience. They differ, that is, in terms of their exposure to, and knowledge about, the regularities exhibited in and among the elements found in a class of events. Low-knowledge individuals have seen only a few regularities. They are able, therefore, to develop only rather simple mental structures about the events they experience. But high-knowledge individuals have seen more. Their greater experience is embodied in more elaborate structures that contain more information about regularities among the elements.

4. *The tendency of a person to recall an element that occurred in an event depends on two factors: (a) the amount of elaboration of the person's mental structure, and (b) the degree to which the element is typical in events of the kind being examined.* When a person tries to recall elements in a particular event, the amount of information remembered will be determined by the degree to which that person has a well-developed structure for representing events of that kind. Voss has summarized research on the impact of experience on the development of structure and consequently on memory:

When the memory structure is relatively undeveloped, that is, in the case of a low knowledge individual, only a small amount of input information may be mapped onto the existing structure, and thus the amount stored is relatively small. To store additional information would require the construction of a representation of the information not mapped onto the memory structure, and this process is apparently difficult. [1979:385]

Thus, the degree of development of a mental structure is the principal factor in determining the amount remembered. To the extent that a person has an established mental structure for a class of events, that person will have the apparatus for recalling the elements or details of particular events in that class. Research reports by G. Mandler (1967); Tulving (1962); J. M. Mandler (1979); Spilich et al. (1979); Thorndyke (1977); Bower et al. (1969); and Broadbent, Cooper, and Broadbent (1978) all provide evidence for the impact of cognitive structuring on recall.

The degree of development of a mental structure determines not only the amount remembered, but what is remembered. The likelihood that a particular element in an event will be recalled is determined by the degree to which it is typical in events of that class. One important kind of pattern that people incorporate into their mental structures is the regularity of occurrence of an element in a context. Elements that occur regularly are seen as typical; they are embedded into the mental structure as expectations. The more regular the occurrence of the element, the greater the expectation, so the incorporation of elements into mental structures is hierarchical. And this hierarchy is reflected in recall. More typical elements—those with higher expectations—are more likely to be recalled (see Rosch 1978 and J. M. Mandler 1979 for two quite different views, both of which support this generalization).

5. *The tendency of a person to falsely recall an element that did not actually occur in an event depends on two factors: (a) the amount of elaboration of the person's mental structure, and (b) the degree to which the element is typical in events of the kind being examined.* Though elaborate mental structures aid in recall, they are not without a cost in accuracy. What seems to occur is that with increased experience on the part of observers and increased structure or regularity

of the elements in the events they experience, there comes an increased tendency for *default processing* of those elements. As J. M. Mandler puts it, "We often do not—in fact, cannot—attend to all of the details of familiar experiences; they are often filled in by the schema itself rather than by actual perception" (1979:270). Thus, people with well-developed mental structures will process incoming information on the "normal" or typical elements of an event only shallowly; they will "see" whatever they *expect* to see and their actual memory of such elements will be poor.

In such cases, requests for retrieval cannot be met by any genuine recall of those elements. Instead, attempts at recall will result in a constructive process that taps into the general structure rather than the specific memory. The expectations contained in the structure are *instantiated* (Bobrow and Norman 1975; Bransford and Franks 1971) and, if the structure and the event do not match exactly, false recalls will be produced. But, to the degree that the "normal" elements in an event are statistically typical, use of the model embedded in the cognitive structure as a substitute for actual perception and recall will introduce very few errors.

This, in brief, is the substance of the organizational view of human memory. It is particularized in the literature in a great many different kinds of experiments. Detailed models for various forms of mental structures are proposed, and laboratory experiments are designed to determine whether one or another model is appropriate for understanding a particular kind of material to be memorized. For our purposes such details are unnecessary. We have attempted simply to extract the main ideas and the empirical generalizations upon which there seems to be a fairly general consensus. We will now examine these ideas to see if they can illuminate the results of our preliminary data analysis and suggest any hypotheses for further analysis.

Implications of Cognitive Organization for Accuracy

Preliminary analysis uncovered three noteworthy patterns in our data: (1) many people who attended the designated session of the colloquium were forgotten, (2) some who were absent were falsely recalled, and (3) the overall tendency of informants who made these errors was to bias their recall in the direction of the long-term attendance patterns. The job here is to see if we can use the ideas from the cognitive literature to develop a story about how these results might plausibly have occurred.

The fact that there were quite a few false recalls suggests that at least some of our informants had relatively highly developed mental structures that they used in answering the question "Who was there?" This means that they had a high degree of knowledge about the other people involved. The great number of others who were forgotten, on the other hand, suggests that some informants lacked such developed mental structures. They had little knowledge about the others.

That these colloquium participants differed in their knowledge bases about each other makes sense in light of ethnographic information about the people involved. Some pairs are colleagues of 20 years standing; other pairs have never met outside of the context of the colloquium itself. Overall, these people differ in their time in, and involvement with, the program of which the colloquium was a part. It seems reasonable to guess that persons who are deeply embedded in this broader program structure would be generally well informed about a range of behavior of their colleagues. To index knowledge base, then, we need a measure of program involvement.

Measuring involvement in this case turns out to be fairly easy since the group itself has set up an informal procedure by which (very scarce) office space is assigned. Faculty and students who are regularly involved in program concerns, those who teach courses or engage in research projects that are explicitly focused on areas of interest to the program, all seem to end up in a cluster of offices on one floor of the Social Science Building. Outsiders, including new graduate students and faculty who are only marginally involved in the program, are housed elsewhere. This arrangement is both a signal of group accep-

tance and an opportunity for the selected persons to share in the give and take of daily program-oriented activities. Those who are settled in the office complex are in some sense "in-group" members who are de facto involved in all the daily activities of the inner circle.

It is reasonable to assume that these in-group people would have maximal experience with the group as a whole. Thus, they would have ample opportunity to develop cognitive structures that embrace the whole range of group activities, including the colloquium. So, in the light of this reasoning, we partitioned our informants into those who had an office in the group space and those who did not. This was our index of experience.

Those informants with experience—those having well-developed mental structures—should have forgotten fewer others who did attend the target session and they should have falsely recalled more of those who did not attend. This would account for the false recalls seen in the data. Moreover, the informants with less experience—those who were unable to develop mental structures—should be responsible for most of the occasions in which those who were present were forgotten.

We can reason similarly with respect to the targets of recall. People who attended frequently are likely to have been seen as typical. These are the people who should have been expected to attend in the minds of the more-experienced informants. Such frequent attenders, then, would be the ones falsely recalled if they missed the target session. Infrequent attenders, on the other hand, are less likely to have earned their way into the expectations of the informants. In that case, even if they were present at the target session, infrequent attenders are less likely to be recalled. Thus, both false recalls and forgets strain in the direction of long-term attendance patterns. This combination of errors accounts for the observation that the informants were biased in the direction of the long-term pattern.

It is possible, then, to develop a plausible explanation for the overall results of the current research on the basis of ideas suggested by the memory literature. This explanation, however, depends on our making a number of assumptions about details of relationships embodied in the data. Two of these involve the assumed relationship between in-group membership and recall. Two more concern the relationship between attendance and being recalled. And the last centers on the relationship between in-group membership and the order of recall of elements.

1. To the degree that our informants are in the in-group of the program, they are experienced and have developed internal mental structures to represent that experience. Consequently, they will generate more false recalls about which others attended a particular session.

2. To the degree that our informants are in the in-group of the program, they are experienced and have developed internal mental structures to represent that experience. Consequently, they will forget fewer others who attended a particular session.

3. To the degree that people have attended the colloquium series regularly, they will be seen as typical elements in that setting and consequently, if they were present at the target session, will be less likely to be forgotten by the informants.

4. To the degree that people have attended the colloquium series regularly, they will be seen as typical elements in that setting and consequently, if they were absent at the target session, they will be more likely to be falsely recalled by the informants.

5. To the degree that our informants are in the in-group of the program, they are experienced and have developed internal mental structures to represent that experience. Consequently, they will display an organization reflecting that structure in the order of the items they remember.

These assumptions all follow from the literature on memory. They must be true if the explanation presented above is true. Here, they will be cast as hypotheses to guide the detailed analysis of our data. If they are not supported by the data the whole explanation must be rejected.

Testing the Hypotheses

According to the first hypothesis outlined above, informants with more experience should generate more false recalls than informants with less experience. They should be the ones who tend to “remember” the attendance of others who were not actually present at the target session. Since we are assuming that experience is embodied in in-group membership, we ran our data on the number of false recalls against the in-group/out-group partition. Eight in-group informants produced 22 false recalls, yielding an average of 2.8 false recalls per informant. But 9 out-group informants produced only 4 false recalls or .4 per informant. These results are strongly supportive of the hypothesis. Informants in the in-group generated seven times as many false recalls on average than did those in the out-group.

The second hypothesis suggests that more experienced informants should forget fewer others who did attend the target session. And, indeed, the in-group informants failed to name 42 others who were present (4.7 per informant), while out-group informants omitted 73 names (8.1 per informant). Again, it is apparent that it is the in-group informants who display the effects of mental structuring. Indeed, out-group informants forgot nearly twice as many others as did in-group informants.

Now let us examine the targets of recall—the people specified in hypotheses 3 and 4. In principle, any person at all could have been recalled as having attended the designated session by one or more of our informants. But in fact, no informant recalled having seen anyone who had not been present at one or more of the previous sessions. Moreover, our informants falsely recalled others according to the attendance frequencies of those others. The six others who had been present at more than half of the colloquium sessions but missed the target session were falsely recalled as having been present by 13 informants (yielding an average of 2.1 false recalls per target). The 9 who had attended more than one but less than half the sessions were recalled by 10 informants (with an average of 1.1 false recalls per target). And the 33 who had attended only one earlier session were falsely recalled by only 2 informants (with an average of only .06 false recalls per target).

Similar confirmation of the hypothesis was obtained with respect to those who attended the target session but were forgotten. The four people who attended the target session and had been present at all the previous sessions were omitted from the informants' lists only 6 times (with an average of 1.5 omissions per target). Nine who had attended more than 4 previous sessions (but not all of them) were forgotten 66 times (7.3 per target). And 4 who had attended from 1 to 4 earlier sessions were forgotten 43 times (10.7 per target). Thus, potential targets of recall are indeed more likely to be forgotten if they are infrequent attenders.

The fifth hypothesis specifies that in-group informants should display more organization in the lists of targets they remember than out-group informants. In order to address this question, we need to examine the proximities among the names in the lists generated by our informants. The memory literature indicates that elements that are close together in a free recall list are connected somehow in the mental structures of the people who generated the lists. So we can examine the lists produced by our informants and see whether they group the names of the others they recall in any patterned way.

We calculated the average time taken by each informant to generate his or her entire recall list. Then the time of recall of each name on an informant's list was expressed as z score based on that informant's mean and standard deviation. These z scores were used to calculate a matrix of the temporal “distances” between each pair of names generated by that informant. Finally, we determined the average distance between each pair of names for all the informants in the in-group. These informants generated 17 names—8 in the in-group and 9 in the out-group. Similar calculations for names generated by out-group informants produced 15 names—7 in the in-group and 8 in the out-group.

A multidimensional scaling plot of the distances between the names produced by in-group informants is shown in Figure 1. Attendance frequencies and group memberships

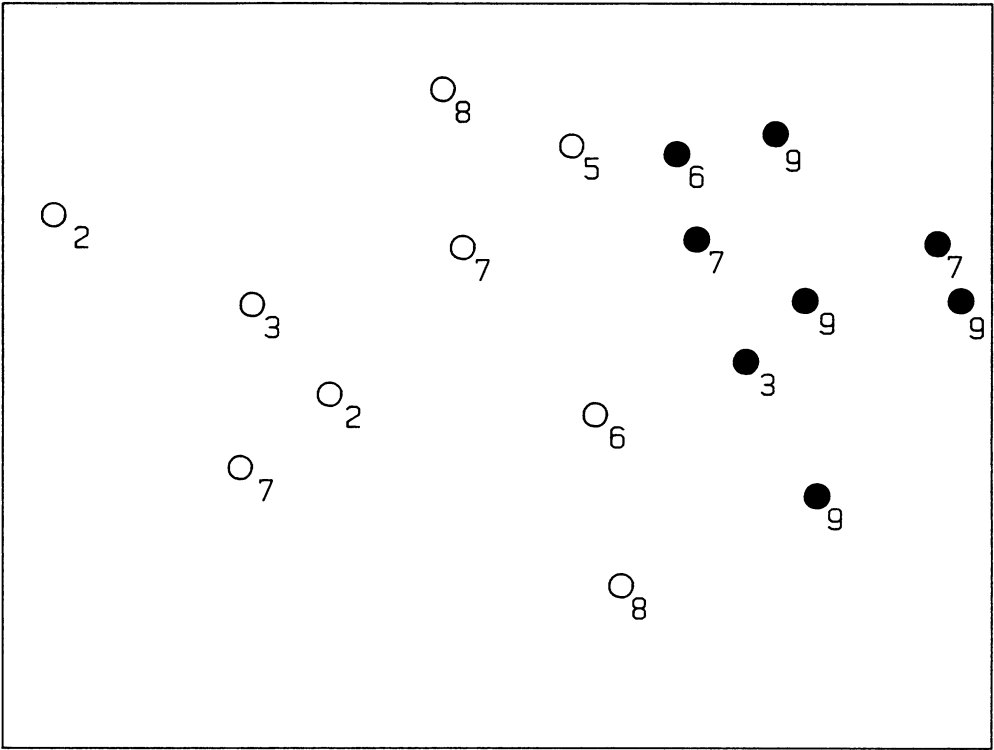


Figure 1

Average proximities among names generated by in-group informants (black circles are in-group targets; numbers are attendance frequencies).

of the targets are overlaid. It is immediately clear that these high-knowledge informants were not grouping names according to the target's attendance frequencies. High and low frequencies are spread out over the plot with no patterning. But since all targets that were in the in-group are all segregated in the right half of the plot, it is apparent that targets are patterned according to group membership. It would seem, then, that in-group informants do have organized mental structures and that they are organized according to an in-group/out-group model.

Figure 2 shows the same data for out-group informants. In this case there is no patterning based either on attendance or on in-group membership. The targets are simply scattered around the space.

Like all the others, these results are strikingly consistent with those suggested in the cognitive literature. Our high-knowledge informants show what seems to be a clear pattern of mental organization based on the in-group/out-group distinction. Our low-knowledge informants display no pattern at all. All in all, then, it would seem that the notions of cognitive structuring provide a key to understanding the kinds of biases that intrude when people are asked to recall the details of a particular social event.

Implications for the Problem of Accuracy

An examination of the implications of these results for the general problem of accuracy is appropriate at this point. Our findings support those of BKS that people's recall of the details of a particular event is poor. But we have shown that these recall responses are biased toward the long-term patterns of such events. For researchers interested in uncov-

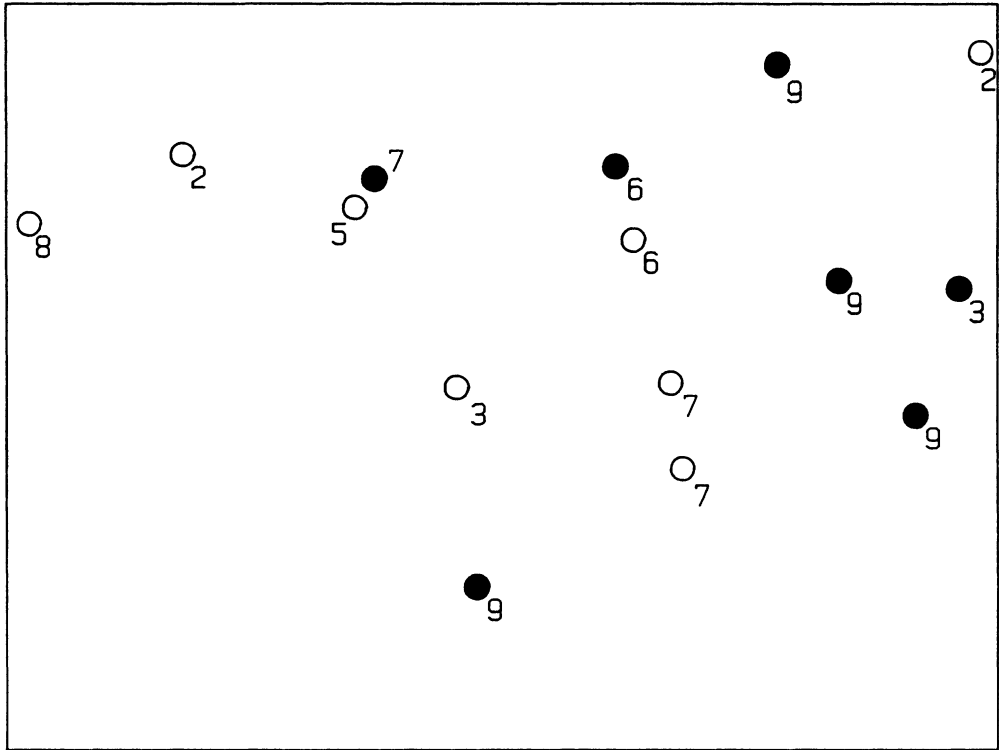


Figure 2

Average proximities among names generated by out-group informants (black circles are in-group targets; numbers are attendance frequencies).

ering such long-term patterns, our results can be seen as encouraging since informant bias is working toward rather than against the norms.

But, based on the insights provided by the memory literature, we can go a step further and suggest a way to reconstruct either long-range patterns or event details from data provided by informants. Consider the implications of the existence of both high- and low-knowledge informants. High-knowledge informants forget very little, but they create “errors” in the recall of a particular event by reporting typical elements that did not actually occur in that case. Since their errors tend toward the long-term pattern, their collective judgment about a particular event should provide the best possible index of that pattern. If what you want is information on long-term patterns, you can do no better than to pool the wisdom of these high-knowledge informants.

Let us order our informants from most to least productive—from the one who recalled the most targets to the one who recalled the fewest. Our results show that those near the top of the list are the ones with the well-developed mental structures. They have internalized the most information on patterning in the data, and they should, therefore, contribute most to our knowledge about the long-term pattern.

We propose, then, to use a sort of “top-down” look at our informants. We will begin with the most productive informant. We will calculate how effective he or she is in naming the others who were most active, those who were fairly active, and those who were relatively inactive as colloquium participants. We will also determine the correlation between the information provided by that informant and overall participation rates. Then we add in the second most productive informant and pool the information provided by both. We will examine how well the pair of informants is at finding the top, middle, and bottom of

the distribution of participation rates. And we can tally their nominations and see whether their combined data have a higher correlation with actual overall attendance rates. Then we can add a third informant, and so on, accumulating results as we proceed. This procedure should enhance the ability of informant data to approximate the data on actual long-term attendance.

Results of using this procedure for the 10 most productive informants in the present case are shown in Table 1. This table is read down from the top. The first column shows the number of names that each informant recalled. The second accumulates the number of targets in the top 10 in attendance (those who were present at 7 or more sessions), picked up by this procedure. The third column does the same for the top 22 (those attending 3 or more sessions). And the fourth column accumulates the number of targets in the bottom 43 (who attended 1 or 2 times). Finally, the last column gives the correlation between the number of times each target is named, working down the list, and that target's attendance rate.

Note that by the time we work down to the third informant we have identified all of the top 10 most active participants. And by the fourth informant we have located 20 of the top 22. At the same time, we are picking up a few relatively inactive participants, but not very many. The important information is in the column of correlations. The correlations grow as we add informants. By the time we work down to the seventh informant our correlation is as high as the .85 we got when we used the responses of all 17 informants. When we build up to 10 informants the correlation increases slightly. If we kept on adding informants the number would gradually shrink back to .85. That would occur because the bottom informants simply report the facts about who actually attended, and thereby bend the estimates away from the long-term patterns and back in the direction of the one-time colloquium session.

If we do these same kinds of operations bottom-up, from the least productive informants to the most, our results should be quite different. Each low-knowledge informant should remember relatively little about the event. But, since they don't have developed mental structures, those with low knowledge should not be able to make anything up. Then too, without developed structures to bias their recall, each of them should remember elements of the event more or less at random. Therefore, though each one of them provides meager information, together they should give a pretty good overall picture of attendance at the actual event.

So again, we arranged our informants—this time from low to high. Table 2 shows the nine least productive informants. Data are recorded that will let us evaluate how good they are in providing information about who attended the target session. The first column

Table 1
Accuracy of the 10 best informants in reporting regular patterns of attendance.

Informant rank	No. of names	Cum. no. in top 10	Cum. no. in top 22	Cum. no. in bot. 43	Correl. with attend.
Top	17	9	14	3	.62
Second	17	9	17	4	.70
Third	16	10	18	4	.76
Fourth	15	10	20	4	.80
Fifth	15	10	20	4	.82
Sixth	14	10	20	4	.82
Seventh	14	10	20	4	.85
Eighth	12	10	20	4	.85
Ninth	11	10	20	4	.86
Tenth	11	10	21	4	.88

Table 2
Accuracy of the nine worst informants in reporting attendance at the target session.

Informant rank	No. of names	Cum. no. named	Cum. no. false recalls	Proportion error
Bottom	6	6	0	.65
Second	7	9	0	.47
Third	8	11	0	.35
Fourth	8	14	0	.18
Fifth	9	16	0	.06
Sixth	10	17	1	.05
Seventh	10	17	4	.19
Eighth	11	17	5	.23
Ninth	11	17	6	.26

lists the number of names generated by each informant. Working down from the top, the second column accumulates the number of targets who were correctly identified as present by the informants down to that stage. The third column accumulates the number of false recalls. And the last column is a simple proportion of the number of errors of either type present at that stage to the total number of names recalled.

Note that errors descend until we have five informants. The number who were present and recalled by at least one informant grows up to that point, and the generation of false recalls does not start until the sixth informant is included. At that stage everyone who attended had been recalled, and we are just beginning to see false recalls. Using this procedure, we are able to reconstruct attendance patterns with only 5% errors. This is quite a bit better than the 50% reported by BKS.

The trouble with this approach, of course, is that it does not provide a rule for stopping. If we had data only from informants we would not know how many informants to include to try to reconstruct actual attendance. If we stop too soon some people who attended will be omitted. If we stop too late some absentees will be included. Nevertheless, this procedure does capture an important insight about data of this kind. And it does point in the direction of an answer to the accuracy problem. The rule is simple: if you want information on long-term patterns, ask your most productive informants—those who produce the longest lists. But if you want to reconstruct an actual event, ask your least productive ones—those with the shortest lists.

Summary and Conclusions

In this article we have used some ideas from cognitive information processing to address the problem of informant accuracy. We began with a problem generated by a practice that is common in social science—using informants' reports as a proxy for data based on observing an event. Our data involved an attempt to reconstruct the participants at a social event (that we had observed) from the reports of informants about who was there. It turned out that when informants who were present at a social event were asked to recall the others involved, their responses were incorrect about as often as they were correct. Informants forgot some others who were present, and they falsely recalled some of those who were not.

The interesting part, to us, was that our informants' incorrect answers were strongly biased in the direction of the long-term patterns of attendance at social events like the one being studied. It seemed that although we asked the question "Who was there?" the question our informants actually answered was more like "In a typical setting like the one we're referring to, who is likely to be there?" To us, the problem seemed cognitive. Somewhere between experience and recall our informants were somehow warping the

information about the event. So we turned to the cognitive literature on memory to seek an explanation of the process involved.

The memory literature contained a set of ideas and experimental results that turned out to be useful in this case. They provided an explanation of our results in the form of a proto-theory of memory and recall. Persons were assumed, through experience, to develop mental structures that reflect the regularities of their experience. These structures provide a means for the recall of more detail than is possible without them. But at the same time, they intrude on perception and recall in such a way that experiences are shaped by expectations as they are stored in memory. What is recalled, then, is what is typical—whether it happened or not. In the present instance, our informants leaned toward the long-term patterns because those patterns were what they expected to see.

Not only did these ideas provide an explanation of the broad results of our preliminary analysis, they implied a set of specific hypotheses that called for further, more detailed analyses. These hypotheses all involved proposed relationships between memory and the experience of the informants as well as the degree to which each of the others that they were trying to recall was typical in the setting. All of the hypotheses were strongly supported by the data.

The kinds of cognitive processes uncovered in this research are consistent also with the results of earlier research. For example, D'Andrade (1974, 1976) reported that informants do not remember a detailed inventory of cultural facts or social events. Instead, they are more likely to recall the system of rules that generates the events. This is exactly the sort of generalizing process uncovered in the present article.

In another series of reports, D'Andrade and Shweder (D'Andrade 1965, 1973, 1974; Shweder 1975, 1977, 1980; Shweder and D'Andrade 1979, 1980) found that their informants systematically distorted information in assessing personality traits. Even though the systematic distortion hypothesis deals with the memory of personality syndromes and the present research deals with the memory of social events, there are close parallels. Just as Bernard, Killworth, and Sailer worry over their informants' inability to report accurately on social interaction, D'Andrade and Shweder take the view "that one cannot trust evidence of personality syndromes derived from memory-based assessment procedures" (Shweder 1980:66).

A robust finding from research on the systematic distortion hypothesis is that "what correlates with what in memory-based ratings tells us more about preexisting ideas of what is like what than about what correlated with what in actual behavior" (Shweder 1980:68). Our finding that informants, when asked to remember who attended a specific colloquium, gave answers distorted in the direction of the average attendance at colloquia is very similar. Our view is that both findings result from the same cognitive principles that were outlined here. In both cases memory bias is in the direction of some kind of norm. The exact degree of parallelism between these two results deserves much more detailed research.

Another line of work that parallels our attempts to find the "best" informants can be found in recent research in cultural consensus theory (Romeny and Weller 1984; Batchelder and Romney 1986, 1987; Romney, Weller, and Batchelder 1986; Romney, Batchelder, and Weller 1987; Weller 1987). Romney, Batchelder, and Weller provide a method for estimating both the accuracy of each informant and the correct answer to each of a series of questions at the same time. That model, however, cannot be used for data of the sort gathered in the present study. Here, informants were asked to generate free recall lists, while the consensus model requires asking specific questions in some simple format, i.e., true-false, multiple choice, fill-in-the-blank, matching, or ranking.

Indeed, the aims of consensus theory and those of understanding memory bias as developed in this paper are quite different, though complementary. Here we used free listing specifically because it gave the informants the opportunity to reveal biases in their cognitive structuring. And the results suggest that their social perceptions are subject to predictable distortions. But consensus theory was designed to measure informants' knowl-

edge of items in a context that is relatively free from such systematic bias. Much future research will be required to discover the settings in which each of these different approaches is appropriate. The findings and conclusions of both kinds of research must be replicated before we can be confident of our understanding.

Finally, the results presented here suggest the importance of breaking through disciplinary boundaries in seeking answers to a research problem. We began with a methodological problem from sociology and anthropology. As long as we looked at the problem in the context of those fields, we were limited in terms of what we could come up with. But as soon as we turned to the cognitive literature, we found a rich source of intuitive ideas and hypotheses to guide our research. We were helped by a foray into the territory occupied by a sister discipline.

And, at the same time, we can offer our colleagues in psychology something in return. We have taken their work out of the laboratory and shown that their ideas and generalizations have applicability far beyond that narrow confine.

Acknowledgments. This research was supported by the National Science Foundation under Grant No. SES 84-8410209. The authors are indebted to David Morgan and Robert Z. Smith for their many helpful suggestions in planning this project.

References Cited

- Anderson, J. R., and G. H. Bower
1973 *Human Associative Memory*. Washington, DC: V. H. Winston.
- Batchelder, W. H., and A. K. Romney
1986 The Statistical Analysis of a General Condorcet Model for Dichotomous Choice Situations. *In* *Information Pooling and Group Decision Making*. B. Grofman and G. Owen, eds. Pp. 103-112. Berkeley, CA: JAI Press.
- 1987 Test Theory Without an Answer Key. *Psychometrika*. (In press.)
- Bernard, H. R., and P. D. Killworth
1977 Informant Accuracy in Social Network Data, II. *Human Communication Research* 4:3-18.
- Bernard, H. R., P. D. Killworth, and L. Sailer
1980 Informant Accuracy in Social Network Data, IV: A Comparison of Clique-Level Structure in Behavioral and Cognitive Data. *Social Networks* 2:191-218.
- 1981 A Review of Informant Accuracy in Social Network Data. *In* *Modelle für Ausbreitungsprozesse in Sozialen Strukturen*. H. J. Hummell and W. Sodeur, eds. Pp. 153-186. Duisberg: Sozialwissenschaftlichen Kooperative.
- 1982 Informant Accuracy in Social Network Data, V: An Experimental Attempt to Predict Actual Communication from Recall Data. *Social Science Research* 11:30-66.
- Bernard, H. R., P. D. Killworth, D. Kronenfeld, and L. Sailer
1985 On the Validity of Retrospective Data: The Problem of Informant Accuracy. *Annual Reviews in Anthropology*. Palo Alto: Stanford University Press.
- Bobrow, D. G., and D. A. Norman
1975 Some Principles of Memory Schemata. *In* *Representation and Understanding: Studies in Cognitive Science*. D. G. Bobrow and A. M. Collins, eds. Pp. 131-149. New York: Academic Press.
- Bower, G. H., M. C. Clark, A. M. Lesgold, and D. Wizenz
1969 Hierarchical Retrieval Schemes in Recall of Categorized Word Lists. *Journal of Verbal Learning and Verbal Behavior* 8:323-343.
- Bransford, J. D., and J. J. Franks
1971 The Abstraction of Linguistic Ideas. *Cognitive Psychology* 2:331-350.
- Broadbent, D. E., P. J. Cooper, and M. H. P. Broadbent
1978 A Comparison of Hierarchical and Matrix Retrieval Schemes in Recall. *Journal of Experimental Psychology: Human Learning and Memory* 4:486-497.
- D'Andrade, R.
1965 Trait Psychology and Componential Analysis. *American Anthropologist* 67:215-228.
1973 Cultural Constructions of Reality. *In* *Cultural Illness and Health*. L. Nader and T. W. Maretzki, eds. Pp. 115-127. Washington, DC: American Anthropological Association.

- 1974 Memory and the Assessment of Behavior. *In* Social Measurement. T. Blalock, ed. Pp. 139–187. Chicago: Aldine-Atherton.
- 1976 A Propositional Analysis of U.S. American Beliefs about Illness. *In* Meaning in Anthropology. K. Basso and H. Selby, eds. Pp. 155–180. Albuquerque: University of New Mexico Press.
- Freeman, L. C., and A. K. Romney
1987 Words, Deeds and Social Structure: A Preliminary Study of the Reliability of Informants. *Human Organization*. (In press.)
- Friendly, M.
1979 Methods for Finding Graphic Representations of Associative Memory Structures. *In* Memory Organization and Structure. C. Richard Puff, ed. Pp. 85–129. New York: Academic Press.
- Garner, W. R.
1978 Aspects of a Stimulus: Features, Dimensions, and Configurations. *In* Cognition and Categorization. Elinor Rosch and Barbara B. Lloyd, eds. Pp. 99–133. New York: John Wiley and Sons.
- Hammer, M.
1980 Reply to Killworth and Bernard. *Connections* 3:14–15.
- Katz, W. A.
1976 The Single Structure Hypothesis: A Comparison of Organizational Structures Derived from Semantic and Episodic Memory. Unpublished M. A. thesis, York University.
- Killworth, P. D., and H. R. Bernard
1976 Informant Accuracy in Social Network Data. *Human Organization* 35:269–286.
1979 Informant Accuracy in Social Network Data, III: A Comparison of Triadic Structures in Behavior and Cognitive Data. *Social Networks* 2:19–46.
- Mandler, G.
1967 Organization and Memory. *In* The Psychology of Learning and Motivation, Vol. 1. K. W. Spence and J. T. Spence, eds. Pp. 328–371. New York: Academic Press.
- Mandler, J. M.
1979 Categorical and Schematic Organization in Memory. *In* Memory Organization and Structure. C. Richard Puff, ed. Pp. 259–299. New York: Academic Press.
- Pellegrino, J. W., and A. L. Ingram
1979 Processes, Products and Measures of Memory Organization. *In* Memory Organization and Structure. C. Richard Puff, ed. Pp. 21–49. New York: Academic Press.
- Romney, A. K., and S. C. Weller
1984 Predicting Informant Accuracy from Patterns of Recall among Individuals. *Social Networks* 4:59–77.
- Romney, A. K., S. C. Weller, and W. H. Batchelder
1986 Culture as Consensus: A Theory of Culture and Informant Accuracy. *American Anthropologist* 88(2):313–338.
- Romney, A. K., W. H. Batchelder, and S. C. Weller
1987 Recent Applications of Cultural Consensus Theory. (Under review.)
- Rosch, E.
1978 Principles of Categorization. *In* Cognition and Categorization. Elinor Rosch and Barbara B. Lloyd, eds. Pp. 27–48. New York: John Wiley and Sons.
- Shweder, R. A.
1975 How Relevant Is an Individual Difference Theory of Personality? *Journal of Personality* 43:455–484.
1977 Likeness and Likelihood in Everyday Thought: Magical Thinking in Judgments about Personality. *Current Anthropology* 18:637–648.
1980 Fact and Artifact in Trait Perception: The Systematic Distortion Hypothesis. *Progress in Experimental Personality Research* 11:65–100.
- Shweder, R. A., and R. G. D'Andrade
1979 Accurate Reflection or Systematic Distortion? A Reply to Block, Weiss and Thorne. *Journal of Personality and Social Psychology* 37:1075–1084.
1980 The Systematic Distortion Hypothesis. *In* Fallible Judgment in Behavioral Research. *New Directions for Methodology of Social and Behavioral Science*, No. 4. R. A. Shweder, ed. Pp. 37–58. San Francisco: Jossey-Bass.

Simon, H. A., and A. Newell

1971 Human Problem Solving: The State of the Art in 1970. *American Psychologist* 26:145–159.

Spilich, G. J., G. T. Vesonder, H. Chiesi, and J. F. Voss

1979 Text Processing of Domain-Related Information for Individuals with High and Low Domain Knowledge. *Journal of Verbal Learning and Verbal Behavior* 18:275–290.

Thorndyke, P. W.

1977 Cognitive Structures in Comprehension and Memory of Narrative Discourse. *Cognitive Psychology* 9:77–110.

Tulving, E.

1962 Subjective Organization in Free Recall of “Unrelated Words.” *Psychological Review* 69:344–354.

Voss, J. F.

1979 Organization, Structure, and Memory: Three Perspectives. *In* *Memory Organization and Structure*. C. Richard Puff, ed. Pp. 375–400. New York: Academic Press.

Weller, S. C.

1987 Shared Knowledge, Intracultural Variation, and Knowledge Aggregation. (Under review.)