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In an effort to improve recall accuracy and/or provide data which would be fine enough to show why people are inaccurate about their communications, we performed an experiment. This experiment produced a set of small-group network data which others may be interested in using. In this brief note we describe the data, and report on the gross results of some analysis. The forms of analysis are reported elsewhere, and the results confirm our earlier experiments on recall accuracy. Therefore, we do not report details, only conclusions.

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A Note on Some Very Rich Network Data

We have some rather nice small-group network data which others may be interested in using. The data are time series in a college fraternity of: affective relations (i.e. how much i likes j); cognitive interactions (i.e. how much i says he talks to j); and behavior (how much i did talk to j) for all dyads in a closed group of size 58.

Affect was collected on a scale of 1 (least like) to 11 (most like), and cognition on a scale of 1 (don't talk with) to 5 (talk with a great deal). Behavior was measured by an observer passing through the fraternity every 15 minutes for 21 hours a day, over a period of 5 days, at the end of which the affective and cognitive data were collected. Thus behavioral data exists on a 15-minute time scale, though for most purposes we concatenated it over the 5 day period. This entire procedure was repeated three times, separated by about 6 weeks in each case.

We are interested in offering these data to anyone interested in analyzing them. These data constitute a replication of the Newcomb experiment done 25 years ago on time series data for affective ties in a college fraternity. What we have done so far is as follows.

We checked the dyadic behavior-cognition accuracy as in Bernard and Killworth (1977). The results are (not surprisingly) no better than previous findings. As usual, nobody knew who they talked to with any degree of reliability. We even told the informants that we expected them to get more accurate each time. There was no significant improvement in their accuracy over time (indeed, it was remarkably constant). Attempts to predict behavior from cognition (what one hopes one is doing by measuring cognition) is not helped at all by including affect. In other words, how much i talks to j, as predicted by how much i thinks he talked to j, is not better predicted if one substitutes or includes knowledge of how much i likes j.

The triadic structure (Killworth and Bernard, 1978) was rich at all three times, for both behavior and cognition, and similar in all cases. As before, this was produced by different triads in behavior and cognition.

We've looked at the microstructure problem, too. If X(i,j) is affect (rescaled from -1 to +1) and Y(i,j) is behavioral interaction (as a percentage of a 21-hour day) between i and j, then can one predict the change in X or Y from time 1 to time 2, etc.? Not surprisingly, the time scale is long enough that the optimal guess of X or Y at time (n+1) is X or Y at time n. However, the change in X or Y is what one really wants. Various models have appeared, specifically by Hunter (1974) and by us (Killworth and Bernard (1976). Such models do, indeed, predict dX/dt or dY/dt from a variety of combinations of X or Y at time n. We tried over 30 of these combinations in a large correlative fishing expedition. Some (like X at time n) were highly plausible; some (like sum over k of X(k,j)) are reasonably plausible; some (like sum over k of Y(i,k)X(i,k)X(k,j)) are rather dubious and relate to a specific model only. So they all went in...

The best fit, alas, accounts for only 28% of the variance for X, and rather less for Y, and used unconscionably large numbers of independent variables. We don't think 28% is very good -- being wrong 72% of the time with the richest network data extant does tend to indicate that we're missing something somewhere!

Finally, we played what we think is a totally new game for network studies. One of the most important questions about a time-dependent process is the time scales involved in that process. As far as group microstructure is concerned, there are the time scale(s) for affect and cognition (both slow from our data, i.e. larger than six weeks), and the moment-to-moment changes of behavior (i stops talking to j and goes for a walk, or starts to talk to k, or whatever). What is this time scale -- if it's uniquely defined?

To find out, we went through the 15-minute reports to produce, for a pair of people in a fraternity, a string of 1's and 0's corresponding to the 15-minute periods in the first week when that pair were, or were not, in communication. Then this (hardly continuous!) time series was Fourier analyzed and auto-correlated. (Note to the non-physicists: analysis of a section of a continuous process requires some special manipulations. Just running a correlation at various lags, as one might be tempted to do, gives a very biased answer. A great many strange and counterintuitive operations involving aliasing, windowing, prewhitening, etc., must be done to get the right answer; cf. Jenkins and Watts, 1968.)

We used three pairs of people: a pair who talked a lot; medium; and a little. The time lag over which the auto-correlations hit zero (i.e. the "short" time scales for each pair) were 98, 68, and 51 minutes, respectively. What a surprise! The less you talk with someone, the shorter is the time scale for which you talk with him -- though it isn't proportional, at least.

More interesting are the power spectra. They're rough, of course, because of the dichotomous data that went in. But there is a peak at a period of order ten hours in all three spectra, which is not exactly predictable a priori. (N.B. The "day" is 21 hours, so there is a three-hour gap removed from each record each day. This obviously messes up the power spectra a bit, so that the ten hour figure should be treated with caution. Is it significant that this is roughly half the 21-hour day?). We would appreciate it if anyone who would have predicted the ten hour peak before reading this note would tell us what it means. There's obviously a signal there, even if it's a dubious one.

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