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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A STUDY OF SOME FACTORS THAT AFFECT PATTERNS OF COMMUNICATION IN A NATURAL GROUP

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

KATHRYN BAUER EWBANK

Norman, Oklahoma

1972

A STUDY OF SOME FACTORS THAT AFFECT PATTERNS

OF COMMUNICATION IN A NATURAL GROUP

APPROVED BY

DISSERTATION COMMITTEE

ACKNOWLEDGMENTS

Most importantly, the writer acknowledges and expresses her appreciation to student and faculty participants in the Institute, who consented to the observations upon which this study is based. The writer also thanks Dr. Karl H. Vesper, who directed the Institute, and arranged for National Science Foundation support under grant GY 2910.

In addition, the writer recognizes her debt to Dr. Roger E. Nebergall, who provided support and guidance from the beginning of this study, and to Dr. William Horosz, Dr. Edmund C. Nuttall, Dr. William R. Hood, and Dr. H. Wayland Cummings, who served on her committee and offered comments and suggestions, each according to his individual interest and point of view.

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OVERVIEW

This study is exploratory in purpose. It seeks first to answer the question, Will the regularities in kinds and amounts of interaction and communication which have been reported for small groups, occur in a large, natural group under formal leadership? To this end it will report the interaction and communication patterns which emerged in a large, natural group and compare them to the patterns reported in previous research on small groups. This study seeks in addition to examine the effects of changes in seating arrangement and in assigned task, and of clique formation on interaction and communication patterns.

The data were obtained at a Summer Institute on Case Methods in Engineering which was sponsored by the National Science Foundation. The Institute was held at Stanford University during August and September, 1967. Subjects were sixteen senior undergraduate and first year graduate students, who were formally enrolled in ME 198, Mechanical Engineering Problems, plus the professor(s) who conducted the seminars.

Thus the object of study was a seventeen-member group, although different professors conducted the various sessions.

The data consist of tape recordings and observers' logs of the seminar meetings, plus students' responses to sociometric questionnaires administered after the last meeting. Observations and conclusions are based upon detailed analysis of data from twelve of the sessions, selected on the basis of relevance to expected differences in interaction and communication patterns.

The research questions and the standards for studying them derive in large part from the work of R. F. Bales and his associates. In particular, this study considers questions such as these.

Questions concerning System Effects

1. Would a large, natural group under formal leadership conform to the interaction profile reported for small, initially leaderless, laboratory groups?
2. Would a who-to-whom matrix for a large, natural group under formal leadership show the pattern of rank orders found in small, laboratory groups?
3. Would a large, natural group under formal leadership conform to the phase movements, both within meetings and between meetings, reported for small laboratory groups and for small natural groups?

Questions concerning Intermediate Processes

4. Would changes in the assigned seats of members of a large, natural group affect interaction patterns within the group?
5. Would interaction patterns within a large, natural group change if members were assigned to teams and required to create and present team solutions?

Questions concerning Individual Responses

6. Would communication patterns as reflected in the matrix show an accelerated tendency toward centralization in a large, natural group under formal leadership?

   Or would cliques form in a large, natural group, which might be expected to result in radically different communication patterns?
7. Would a "dual" leadership pattern in which different members serve in task and social-emotional areas emerge in a large, natural group under formal leadership?

   Or would a "unidimensional" pattern of leadership emerge?

The applicability and significance of much earlier work will be considerably enlarged if this study demonstrates emergence of similar patterns in a large, natural group: First, because much of the previous research involved small, ad hoc, laboratory groups engaged in a standardized task. And second, because recent, controlled comparisons point to

important, systematic differences in the behavior of laboratory groups and "real" groups.

Chapter I will review the literature which provided a foundation for the present study.

Chapter II will describe in detail the methods used to collect and prepare the data.

Chapter III will present and discuss the obtained data with regard to System Effects. Comparisons with findings reported in earlier studies will be made wherever appropriate.

Chapter IV will present and discuss the obtained data with regard to Intermediate Processes. Observations from different sessions will be compared wherever appropriate.

Chapter V will present and discuss the obtained data with regard to Individual Responses. Again, data for different students, or categories of students, will be compared wherever appropriate.

Chapter VI will consider the implications of this research in context of present understandings and future needs.

CHAPTER I

THE PROBLEM

Background

Social scientists never doubted that groups--family groups, age groups, work groups, for example--constitute an essential element in primitive societies. But when they first turned their attention to modern, technologically advanced societies, they tended to think of masses of isolated individuals, massive bureaucracies, mass media, etc. The roots of this bias lie deep in the past.

> The great stream of sociological thought in the nineteenth century tended on the whole to flow around and past the primary group. The main theme of nineteenth-century sociology, developing as it did from the philosophy of history, was the emergence and operation of the large-scale society, the "great society," "bourgeois" society. In their perception . . . sociologists saw modern society as impersonal, co-ordinated by actions based on expediental calculations, and highly individualistic. In those spheres in which behavior was still co-ordinated by authority and not by considerations of individual private advantage, traditional authority was seen to be giving place to rational-legal (bureaucratic) authority. The persistence of traditionally regulated informal and intimate relations was regarded as an archaism inherited from an older rural society or from a small-town handicraft society. These relations were

> not thought to possess any significant function in the operation of the "great society."[1]

Despite the insights of Simmel in Germany and Cooley (who coined the term 'primary group') in the United States, this point of view dominated theoretical models and research designs until the late 1930's and early 1940's.

In 1955 Katz and Lazarsfeld described the pattern of events that led social scientists to the "rediscovery" of interpersonal relations and small groups. In each case researchers began their work with expectations that did not include interpersonal relations as a relevant dimension, and in each case variables they regarded as relevant failed to explain the observed behavior. "In the case of the factory, physical and economic variables clearly were not the whole story; in the army discipline and the ideals of the war could not fully account for combat motivation; in the city, social mobility seemed to be something more than mere economic advancement; and in mass communications, direct exposure to the media could not fully account for the observed differences in changing voting intentions."[2] Thus forced to review their

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[1] E. A. Shils, "The Study of the Primary Group," in The Policy Sciences: Recent Developments in Scope and Method, ed. by D. Lerner and H. D. Lasswell (Stanford: Stanford University Press, 1951), p. 44.

[2] E. Katz and P. F. Lazarsfeld, Personal Influence: The Part Played by People in the Flow of Mass Communications (Glencoe: Free Press, 1955), pp. 40-41.

accumulated data and in some cases to interview their subjects again, the investigators discovered a consistent refrain: People.

> Each time attention was redirected, in a similar way, to the possibility that the primary group--interpersonal relations--was relevant. For, obviously, it was not simply the fact that the primary group exists that was discovered, but the fact that it is relevant to an understanding of the workings of each of these areas. Thus, the discovery was not that workers often form friendships in the factory, or that soldiers develop intimate ties to their buddies, or that city dwellers belong to cliques or that radio listeners have families but, rather, the fact that these alliances are relevant (where previously no thought had been given to their relevance) for mass production, combat morale, class status and mobility, and communication behavior.[3]

With this impetus, small groups became an important area of research and literally hundreds of 'small group' studies have been published. Some of the most fruitful of this work was done by Bales and his associates at the Harvard Laboratory of Social Relations. These studies disclosed impressive regularities and unexpected complexities in human social interaction. For his purposes Bales defined a group as "any number of persons engaged in interaction with each other in a single face-to-face meeting or a series of such meetings, in which each member receives some impression or perception of each other member distinct enough so that he can, either at the time or in later questioning, give some reaction

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[3]Katz and Lazarsfeld, Personal Influence, pp. 41-42.

to each of the others as an individual person, even though it be only to recall that the other was present."[4] He also developed and standardized his Interaction Process Analysis (often referred to as IPA) as a method for observing and recording ongoing communication and interaction in groups. At the heart of the system are twelve categories of behavior which are positively defined--there is no "wastebasket" category--and which are intended to be a logically exhaustive list of possible behavior (see page 40) in a group situation.

Using the IPA an observer enters each sentence of running discourse or each meaningful act in the appropriate category by numbers which identify the person who acts and the person(s) to whom the act is directed. Analysis of records from many groups, including play groups, work groups, discussion groups, and therapy groups, but mostly laboratory groups, disclosed certain regularities, or "central tendencies," of group and individual behavior. These regularities appear to stem from the facts that any bit of social behavior is always part of a larger system, and that all groups, whatever their differences in purpose or personnel, face similar fundamental problems.

In all cases a group faces the need to establish and maintain relatively stable and satisfying social-emotional

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[4] R. F. Bales, Interaction Process Analysis: A Method for the Study of Small Groups (Cambridge: Addison-Wesley Press, Inc., 1950), p. 33.

relations among its members. And in most cases a group faces a task that requires its members to reach a common definition of the situation, a standard by which to judge the problem and/or proposed solution(s), and finally a decision or plan of action. Bales labeled a task in which the requirements for orientation, evaluation and control are clearly present "full-fledged," and a task in which any of the requirements is minimized "truncated." The central tendencies apply in particular to groups undertaking full-fledged tasks. The IPA has been used with minor variations by independent researchers to record interaction within family units, therapy groups, and labor-management conferences.[5]

One of the patterns Bales described is the interaction "Profile." This is a tabular or graphic representation of the percentage of total observed interaction that is recorded in each of the twelve categories. Some regularity in the distribution of acts seems intuitively necessary, because "One person acts and another person reacts," constitutes a basic model for social behavior. The process within a group

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[5]Within family units: J. F. O'Rourke, "Field and Laboratory: The Decision-Making Behavior of Family Groups in Two Experimental Conditions," Sociometry, XXVI (1963), 422-435; within therapy groups: G. A. Talland, "Task and Interaction Process: Some Characteristics of Therapeutic Group Discussion," Journal of Abnormal and Social Psychology, L (1955), 105-109; G. Psathas, "Phase Movement and Equilibrium Tendencies in Interaction Process in Psychotherapy Groups," Sociometry, XXIII (1960), 177-194; within labor-management conferences: H. A. Landsberger, "Interaction Process Analysis of the Mediation of Labor-Management Disputes," Journal of Abnormal and Social Psychology, LI (1955), 552-558.

would certainly be self-limiting, and probably self-defeating, if the number of questions raised exceeded the number of answers offered; or if the number of negative acts exceeded the number of positive responses. In a theoretical discussion Bales offered an explanation for the relationship between the amounts and kinds of interaction disclosed in a typical profile.

> The relations between the amounts can be viewed as the final result of a repetitive series of cycles, each of which consists of: (1) an initial disturbance of the system (precipitated by the introduction of a new idea, or opinion, or suggestion into the group) followed by (2) a "dwindling series of feedbacks" and corrections as the disturbance is terminated, equilibrated, or assimilated by other parts or members of the system. Attempted Answers, or as one might call them for the moment, "Initial Acts," acount for a little over half (or 57 percent) of the total activity, with Positive and Negative Reactions and Questions accounting for the other half, roughly.
>
> Looking at the Reaction side alone, and assuming it to be 50 percent of the total, about half the reactions (or 25 percent of the total) are Positive and presumably terminate the disturbance introduced by the initial action. The other half of the time the Reaction fails to terminate the disturbance. Of this non-terminating portion again, about half (or 12 percent of the total) are Negative Reactions, which typically precipitate another Attempted Answer, thus beginning a repetition of the cycle. Of the remaining hypothetical 13 percent or so, about half (or 7 percent) are Questions, which also typically precipitate another Attempted Answer. If about 7 percent of Attempted Answers are in direct response to Questions, these might well be called "Reactions," thus leaving the relation of "Initial Acts" to "Reactions" about 50-50, as assumed above. One might say that quantitatively (as well as qualitatively, by definition) interaction is a process consisting of action followed by reaction. The balance of action

with reaction is one of the equilibrium problems of the system.[6]

This "reactive" quality is also evident in a second analysis, the who-to-whom "Matrix." If group members are ranked according to the total number of acts they initiate, they are also ranked according to the number of acts they address to specific individuals, the number of acts they address to the group as a whole, as well as the number of acts addressed to them by others. In general, each member receives about half as many acts as he initiates. Dependable differences in kinds of behavior occur concomitantly with these quantitative differences in communication activity. The matrix, then, is a description of communication patterns within a group.

Since the matrix is constructed on the basis of initiated activity, from most to least on both axes, as might be expected, cell values decrease across rows and down columns. In other words, "each row and each column presents a rank order which is the same as the basic initiating rank of the members."[7]

A third analysis shows changes in quality of activity through time, which Bales and his co-workers called "Phase

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[6] R. F. Bales, "The Equilibrium Problem in Small Groups," in Working Papers in the Theory of Action, ed. by T. Parsons, R. F. Bales, and E. A. Shils (Glencoe: Free Press, 1953), p. 117.

[7] R. F. Bales, F. L. Strodtbeck, T. M. Mills, and M. E. Roseborough, "Channels of Communication in Small Groups," American Sociological Review, XVI (1959), 463.

Movements." Phase movements occur both within sessions and between sessions in continuing groups. If total activity for each session is divided into three equal time segments and the percentage of each type of behavior in each segment is calculated, systematic changes in activity are disclosed. In task-related communication, there is a shift in relative emphasis from orientation to evaluation to control. In other words, participants first face the question, "What is the problem?" then the question, "How do we feel about it?" and finally the question, "What shall we do about it?" In addition, both positive and negative responses increase through time. Toward the end of the third phase, provided the group has solved both its task and social-emotional problems, positive emotional responses peak as members confirm their agreement and release accumulated tensions. Bales and Strodtback wrote, "We note joking and laughter so frequently at the end of meetings that they might almost be taken as a signal that the group has completed what it considers to be a task effort, and is ready for disbandment or a new problem. This last-minute activity completes the hypothetical cycle of operations."[8]

Regarding between-session phase movements, Heinicke and Bales reported that for the groups they studied single

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[8]R. F. Bales and F. L. Strodtback, "Phases in Group-Problem Solving," Journal of Abnormal and Social Psychology, XLVI (1951), 489.

category trends were not significant, but trends for larger groupings of categories were significant.

> There is a trend toward decreasing rates in the task-oriented categories (giving orientation, giving opinion, and giving suggestion) and a concomitant rise in the social-emotional categories. Negative reactions are low in the first session, show a sharp rise in the second session, and thereafter decrease again. Positive reactions as a whole show a minor rise through the first three sessions, and then a larger rise in the fourth. There are two kinds of trends within the area of positive reactions, however. Overt showing of agreement shows a steady and significant downward trend, which is counteracted by a sharply rising trend of showing solidarity and tension release (largely joking and laughing). In other words there is a marked shift from the more neutral and tentative task-oriented "agreement" to more affectively-charged types of Positive Reactions.
>
> . . . It appears that on the average these groups started in session 1 with a heavier emphasis on task-oriented types of interaction, with inhibition of the more affective types of reaction and with low rates of overt negative reactions. In session 2, however, overt negative reactions show a sharp rise, task-oriented activities begin to decline, and positive reactions, while maintaining their level, show a shift toward greater affect. It appears that session 2 is, on the average, the session of greatest conflict. In sessions 3 and 4 the shift toward greater affect and less emphasis on task-oriented activities continues, but the negative reactions drop and the positive reactions rise. It appears that the groups have gone through some sort of "crisis."[9]

These conclusions were based on pooled observations of laboratory groups at Northwestern and Harvard Universities. The former groups were observed over six meetings. Upon examining these data the authors concluded that stable patterns of

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[9]C. Heinicke and R. F. Bales, "Developmental Trends in the Structure of Small Groups," Sociometry, XVI (1953), 16-17.

interaction had emerged by the fourth meeting, and hence limited observation of the Harvard groups to four meetings.

Differences in quantity and quality of interaction and communication affect the role and status of individual members. Heinicke and Bales reported that if members of laboratory groups are asked at the end of the first meeting to name the person who is best-liked, the person who contributed the best ideas, and the person who most effectively guided the discussion, they are very likely to nominate the most active participant. After the first meeting the likelihood that members will list the most active participant in response to all three questions falls sharply, although "great men" continue to fill all roles in a few groups. More frequently, two complementary roles, performed by two different persons, emerge. The first is the "task specialist," who ranks highest in total activity, as well as in ideas and quidance, but who is not well-liked. He may, in fact, be disliked. The other is the "socio-emotional specialist," who is best-liked, but whose participation is largely supportive. These two interact with each other significantly more than with other group members. In groups with this structure, members typically achieve high consensus in their rankings after the initial meeting, although the degree of consensus may drop after the second meeting, only to recover and stabilize thereafter.

Some groups never achieve stable structure. In these groups the most active participant is neither well-liked nor highly rated on task abilities. The task specialist is less active and not well-liked. The best-liked man is relatively inactive and not highly rated on task abilities. Moreover, nominations for these positions change over time; tension and negative reactions remain at a high level.[10]

In addition, Bales reported that profiles of participants tend to change systematically with their basic initiating rank. High ranking men attempt more answers and address more communication to the group as a whole. On the other hand, low ranking members address more of their acts to specific individuals, ask more questions and display more positive, as well as negative reactions.[11]

In an effort to probe further the finding that the most active member tended to be less well liked, if not disliked, by the others, Bales analyzed data from thirty discussion groups of five men each. He first ranked each man from high to low according to his total activity, and then split participants in each rank into three subgroups according to their "R/I, or Feedback Ratio." Although the total sample showed the expected curvilinear relationship in which the most

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[10] Heinicke and Bales, Sociometry, XVI (1953), 7-38.

[11] Bales, "The Equilibrium Problem," in Working Papers. ed. by Parsons, Bales and Shils, p. 130.

active man is less well liked than the second or third man, the subgroups showed some interesting contrasts.

> But for about one-third of the population there is a positive and linear correlation between how much a man talks and how well he is liked. This is the third, who, in their interaction, receive more in proportion to the amount they initiate, that is, who have a High Feedback Ratio. The falling-off of Liking received among the top ranks in the averages for the total population is attributable especially to the other extreme third of the population, who talk proportionately most above the amount they receive. It is for this third that the "hypothesis of contrariety" . . . tends to hold.[12]

Before these regularities could be accepted as proof of regularities in group processes, it was necessary to show that the behavior of individuals within groups is stable. In considering this question Borgotta and Bales remarked that too much consistency would be as disturbing as too little.

> Researchers working with the observation of groups would be greatly disturbed if they found extremely high reliability of the "test" or consistency of the observed phenomena under conditions which they suppose must vary. This is especially obvious in the analysis of phase changes within a given session, session to session changes, and more generally, in the expectations (or hypotheses) concerning the development of structure in the group over time. On the other hand, if common elements exist in the conditions under which the behavior occurs (i.e., the task, subjects, size of groups, etc.), a certain degree of consistency in the interaction pattern may be expected. It is apparent that in this type of study the term "reliability of the test" becomes inapplicable and the more

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[12] R. F. Bales, "Task Status and Likeability as a Function of Talking and Listening in Decision-Making Groups," in The State of the Social Sciences, ed. by L. D. White (Chicago: University of Chicago Press, 1956), p. 160.

correct identification is the "consistency of the observed phenomena."[13]

Their data on the issue of consistency in individual behavior came from a study in which subjects were first divided into subsamples of nine, and then each subject interacted with all the other eight, two at a time. Each of the resulting four sessions was divided into six time periods, each with an explicit task assigned.

Actual behavior	Get acquainted	6 minutes
Actual behavior	Plan role playing	6 minutes
Role playing behavior	Role play	12 minutes
Actual behavior	Plan role playing	6 minutes
Role playing behavior	Role play	12 minutes
Actual behavior	Relax	6 minutes

Thus the task problem was similar in all meetings, but the social problem was different because different people participated. Interaction was recorded using the IPA.

Borgotta and Bales divided the record into initiated and received role playing behavior and initiated and received actual behavior, and examined stability in two ways. First they compared each subject's scores from the first and third sessions to those from the second and fourth sessions, which masked differences within sessions. Next they compared each subject's scores for one half of each of the four sessions to those for the other half, which masked differences between

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[13]E. F. Borgotta and R. F. Bales, "The Consistency of Subject Behavior and the Reliability of Scoring in Interaction Process Analysis," American Sociological Review, XVIII (1953), 567.

sessions. The resulting total correlations ranged from .33 to .63 under the first method, and from .57 to .81 under the second. As might be expected, individual behavior proved more consistent during interaction with the same people, but both methods point to an underlying stability of performance.

Dinoff, Kew, Rickard and Timmons reported independent confirmation for these conclusions. Their subjects were hospitalized veterans, observed in seven groups which ranged in size from six to eleven members. The groups met from four to nine times, with an average of seven sessions. Some of the groups were assembled for experimental purposes and some for therapeutic purposes. After each meeting each subject was ranked on total frequency of verbal responses, as well as frequency of personal and non-personal references. The coefficients of concordance among rankings were significant in every case. The researchers concluded that "groups of Ss tend to form a hierarchy of verbal responding that persists significantly over a period of time."[14]

Although Bales observed natural groups as well as laboratory groups in developing the IPA, much of his later empirical work is based on observations of five-man laboratory groups solving full-fledged problems. In fact, Bales suggested that the presence of full-fledged problems may be a

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[14] M. Dinoff, J. K. Kew, H. C. Rickard, and E. O. Timmons, "The Stability of Group Verbal Behavior," Psychological Record, XII (1962), 324.

limiting condition on the generality of his results. Yet Philp and Dunphy reported a study that supports Bales' theoretical position under quite different conditions.

Philp and Dunphy's subjects were undergraduates enrolled in an education course at the University of Sydney. They were randomly assigned to eight-member groups. Each group met eight times over a period of ten weeks to investigate and discuss an assigned problem concerning policies for secondary education in Australia. Each group submitted a written report presenting and defending its recommendations. All meetings were observed using the IPA. The major procedural difference between this study and that of Bales and Strodtbeck is the length of the phase unit compared to the length of the problem-solving process. Philp and Dunphy divided each session into four parts, instead of three. More important, since the U. S. groups completed a problem each session, for them "a phase was one third of the total problem-solving process without replication, while for our groups it was one quarter, with each phase replicated eight times."[15]

Analysis of variance showed significant main effects due to categories and sessions, and significant interaction effects due to groups-categories and categories-sessions-phases. In fact, this latter interaction was so strong that

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[15]H. Philp and D. Dunphy, "Developmental Trends in Small Groups," Sociometry, XXII (1959), 165.

it masked phase movements within sessions. In other words, all groups showed a highly significant tendency to use different categories in different phases as the number of sessions increased. Thus, despite differences in the complexity of the problem, in the time devoted to it, in the distribution of information among members, in the importance of the outcome to participants, and in the size of the groups, Philp and Dunphy concluded "that the general theoretical position of Bales is supported by the Sydney research."[16]

Philp and Dunphy used an educational setting to test Bales' formulations. Other researchers used a therapeutic setting. Talland predicted that the central tendencies described for problem-solving groups would not occur in therapy groups, due to differences in the task participants face and in the emotional climate in which they meet.

> They meet in order to discover problems rather than to solve one neatly formulated for their attention; they neither have to reach a solution nor must they finally close a case unresolved at the end of a meeting. Insofar as the psychotherapeutic technique stresses spontaneity, the discussion is allowed a free course, whereas in the laboratory its trend is implicitly determined by the task even in the absence of directive chairmanship. Finally, discussing a hypothetical or didactic case and a transient acquaintance do not lead to deep emotional involvements that occur when patients grapple with their own and each other's personal problems, baring their inmost thoughts and experiences week after week in intimate fellowship.[17]

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[16]Philp and Dunphy, Sociometry, XXII (1959), 173.

[17]G. A. Talland, "Task and Interaction Process: Some Characteristics of Therapeutic Group Discussion," Journal of Abnormal and Social Psychology, L (1955), 105.

Talland observed weekly meetings of four outpatient therapy groups at Maudsley Hospital in London. Each group consisted of four to six members, excluding the therapist. Talland used the IPA, except that he recorded only verbal acts, omitted the categories 'Shows tension release' and 'Shows tension,' and scored antagonistic acts as 'Disagrees.' In addition, he did not record the activity of the therapist. His results confirmed his predictions, and he concluded that therapy groups tend not to progress from orientation through evaluation to control within sessions, and tend to maintain emotional disturbance at a certain level.

Nevertheless, Talland reported the formation of structure in these groups. He asked his subjects to rank their fellow members on five criteria of leadership. As measures of participation he used both interaction recorded under his version of Bales' IPA and interaction coded into a selected list of behaviors believed to be especially important in therapeutic groups. Correlations of subjects' leadership rankings with these measures of participation were positive, and most were significant. In addition, statistical analysis showed that members performed consistently over time. However, Tallant claimed that leadership structure in therapy groups is "unidimensional."

> The therapist, though not a member, is always present and available, and therefore the task would not necessitate role differentiation among the participants, and there is no need of status structuring according to differential

> responsibilities assumed for the group's success. None the less, a hierarchical structure comes into evidence within a few meetings, and is perceived by the participants as well as by the observer. This hierarchy appears to be simple or unitary, in the sense that a member's rank is much the same whichever aspect of his participation in the group is the criterion of his appraisal. If high status is interpreted as effective leadership, for which there is adequate evidence, this combines both the task-oriented and the social-emotional functions of the role. These two areas of leadership functioning, though discernible, do not give rise to two unrelated status hierarchies in therapy groups, neither do they entirely overlap. There is some scope for role specialization, but high status can be achieved only by recognized contributions both to the task and the social-emotional aspects of the group process. Therapy groups are in an extreme position on a continuum, where a complete separation of these two aspects of leadership represents the other pole, for their task is to deal with social-emotional problems, and they demand as much attention to the affective responses the discussion generates as to its content.[18]

Psathas attempted a more comprehensive investigation of equilibrium process in therapy groups. His subjects were outpatients at a New Haven Hospital who met in four-person groups for one year under the same psychotherapist. Psathas used the IPA to observe interaction in nine meetings for each group, selecting equal numbers from early, middle and late periods of the year. Instead of omitting non-verbal acts, Psathas included as many as possible. He also used all twelve of Bales' categories, and recorded the activity of the therapist. Thus his procedures conform closely to those of Bales and his associates.

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[18] G. A. Talland, "Role and Status Structure in Therapy Groups," Journal of Clinical Psychology, XIII (1957), 31.

In contrast to Talland's results, Psathas found within session phase sequences in his therapy groups. He noted that this sequence is not necessarily typical of individual meetings, but emerges from the pooling of observations for many meetings. Again in contrast to Talland's results, Psathas found an equilibrium between actions and reactions that confirmed Bales' formulation.

> Talland noted that the groups he observed were quite different from the theoretical model--only one-fourth of all the interaction could be classified as reactive.
>
> However, interaction profiles which are more similar to those observed by Bales are found for the two groups analyzed here. When the therapist is included in the interaction analysis, half or more of all the acts are reactive and, in turn, at least one-half of these are positive reactions. A higher rate of questions is found in these therapy groups than in laboratory groups, but negative reactions show a much lower rate.
>
> When the therapist is excluded from the analysis, reaction drops below 50 percent of all acts. . . . The major part of this difference is due to the drop in questions asked.[19]

With very minor exceptions, Psathas' analysis of communication patterns using a who-to-whom matrix also replicated Bales' findings.

Size is obviously an important dimension of small groups. In a comparative study of groups of two to seven members, Bales and Borgotta found systematic differences as size increased. In task activity, giving information and

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[19] G. Psathas, "Phase Movement and Equilibrium Tendencies in Interaction Process in Psychotherapy Groups," Sociometry, XXIII (1960), 187-188.

giving suggestions increased, but giving opinions and asking questions decreased. These changes may be due to a reduction in relative time available to each participant: Opinions asked and offered usually lead to suggestions, but if members feel time pressure they may go directly to suggestions. In the social emotion area, showing tension release increased, but showing tension decreased. The former may be an artifact of scoring conventions since general laughter is tallied separately for every member and may disproportionately affect profiles of low-participating members. On the other hand, the gradient of increase is not as steep as would be expected if only this factor pertained. Bales and Borgotta suggested two factors which may operate to minimize tensions--and thus, the need for tension release in larger groups.

> First, in the larger groups the role requirements for task completion and adequate group maintenance may be allocated over a larger range of persons, so that there is more likelihood that the necessary roles will be performed by some persons without difficulty. Second, and this is really the other side of the coin, the larger size group permits relative anonymity for persons who might be prone to show tension if forced into greater involvement.[20]

As group size increased, there was also significantly more variability in individual performance over successive meetings, especially among persons with low rates of interaction.

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[20] R. F. Bales and E. F. Borgotta, "Size of Group as a Factor in the Interaction Profile," in Small Groups: Studies in Social Interaction, ed. by A. P. Hare, E. F. Borgotta, and R. F. Bales (rev. ed.; New York: Alfred A. Knopf, 1966), p. 501.

There was also a marked tendency for communication to centralize and specialize in the larger groups, in that the top ranking man initiates an ever-greater share of activity, addresses more and more of his remarks to the group as a whole, and receives an ever-larger proportion of others' responses. Bales and Borgotta noted an apparent system effect, however, in that there seems to be a ceiling of about fifty percent on the behavior of the most active participant. Even while he initiates more and more of the activity, he must allow feedback--both positive and negative--that approximately equals the amount of his own activity.

Castore measured the extent to which members initiate verbal relationships with each other in different sized groups. He observed inpatient therapy groups ranging in size from five to twenty members. He counted only complete messages unmistakably addressed to another individual. Comparing the number of interpersonal relationships actually established to the number theoretically possible, he found that groups of five and six members used eighty percent of the theoretically available communication channels, but that groups with more than seventeen members utilized less than fifteen percent.[21]

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[21]G. F. Castore, "Number of Verbal Interrelationships as a Determinant of Group Size," Journal of Abnormal and Social Psychology, LXIV (1962), 456-458.

Many investigators mentioned the probability that subgroups or cliques would form in larger assemblages, but few hard data are available. On the basis of members' statements, Hare reported a greater tendency for twelve-member groups, compared to five-member groups, to break into factions.[22] Miller found a significant correlation between number of members (three to ten, twelve, fourteen, sixteen, eighteen, and twenty) and number of times two or three members whispered among themselves.[23]

Communication networks also influence patterns of interaction. Leavitt first demonstrated the effects of artificial restrictions on communication. In a laboratory situation in which subjects could communicate only by written messages in prescribed networks, those in high "centrality" positions in the networks were identified more often as leaders, sent and received more messages, and expressed greater satisfaction than other participants.[24] Steinzor demonstrated that restrictions on communication patterns are implicit in seating arrangements of discussion groups. Over

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[22] A. P. Hare, "A Study of Interaction and Consensus in Different Sized Groups," American Sociological Review, XVII (1952), 261-267.

[23] N. E. Miller, Jr., "The Effect of Group Size on Decision-Making Discussions," Dissertation Abstracts, XII (1952), 229.

[24] H. J. Leavitt, "Some Effects of Certain Communication Patterns on Group Performance," Journal of Abnormal and Social Psychology, XLVI (1951), 38-50.

fifteen sessions he observed two ten-person groups, seated roughly in a circle. Tallies of number of times persons five, four, three, two, and one seat apart responded to verbal action showed that the mean seating distance where interaction was significantly greater than chance was 3.6, while the mean seating distance where interaction was significantly less than chance was 1.2.[25] Extrapolating from these findings regarding centrality and distance, Hare and Bales predicted the pattern of interaction in five-man laboratory groups. Their data confirmed their predictions for task sessions, but in social sessions members tended to turn away from the group and to talk to persons next to them.[26]

Although researchers have long recognized the importance of task in defining the situation in which group members interact, few have attempted to describe tasks in meaningful dimensions. Golembiewski labeled this omission "mountainous."

> Despite the centrality of "task" for leadership study, as well as for small-group analysis so heavily weighted by laboratory experimentation with its inevitable experimental task, there has been no surplus of work on task characteristics. This cannot long be endured. For it seems increasingly clear that task characteristics are

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[25] B. Steinzor, "The Spatial Factor in Face-to-Face Discussion Groups," Journal of Abnormal and Social Psychology, XLV (1950), 552-555.

[26] A. P. Hare and R. F. Bales, "Seating Position and Small Group Interaction," Sociometry, XXVI (1963), 480-486.

> intimately related to the results obtained in experiments, as in producing behavioral change.[27]

Some work has been done toward developing measurable dimensions for tasks since Golembiewski wrote,[28] but most researchers continue to hold this dimension constant by assigning standardized tasks. Bales and his Harvard group chose this course.

Another facet of "groupness" is members' attitude toward group products. Blake and Mouton permitted businessmen attending a human relations workshop to develop autonomous groups through free interaction for three days, then required these groups to compete in solving an assigned problem. All groups received copies of the other groups' solutions for study and evaluation, and in addition heard representatives of the other groups explain and defend these solutions. Despite such ample opportunity to detect common elements in the various solutions, in responding to a questionnaire members claimed that a significantly greater number of common items appeared exclusively in their own group solution.[29] Using

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[27] R. T. Golembiewski, The Small Group: Analysis of Research Concepts and Operations (Chicago: University of Chicago Press, 1962), p. 203.

[28] See e.g., C. G. Morris, "Task Effects on Group Interaction," Journal of Personality and Social Psychology, IV (1966), 545-554.

[29] R. R. Blake and J. S. Mouton, "Comprehension of Points of Commonality in Competing Solutions," Sociometry, XXXV (1962), 56-63.

small laboratory groups under conditions that minimized competition, Ferguson and Kelley also found significant partiality for "own" group solutions.[30]

Another dimension in which groups differ is "realness." In this connection both the adequacy of laboratory studies, and the validity of extrapolating conclusions based on observations of collections of strangers to natural, established groups, have been challenged. With regard to the first, there is evidence that the experimenter affects outcomes selectively,[31] and that subjects--mostly college undergraduates--consciously assume the role of "good subject" and try to respond in ways they think the experimenter desires or approves.[32]

Regarding the second point, there is accumulating evidence that the processes and responses of natural,

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[30] C. K. Ferguson and H. H. Kelley, "Significant Factors in Overevaluation of Own-Group's Products," Journal of Abnormal and Social Psychology, LXIX (1964), 223-228.

[31] See e.g., B. L. Kintz, D. J. Del Prato, D. R. Mettee, C. E. Persons, and R. H. Schappe, "The Experimenter Effect," Psychological Bulletin, LXIII (1965), 223-232; T. M. Mills, "A Sleeper Variable in Small Group Research: The Experimenter," Pacific Sociological Review, V (1962), 21-28; R. Rosenthal, G. W. Persinger, L. Vikan-Kline, and K. L. Fode, "The Effect of Early Data Returns on Data Subsequently Obtained by Outcome-Biased Experimenters," Sociometry, XXVI (1963), 487-498.

[32] See e.g., K. W. Back, T. C. Hood, and M. L. Brehm, "The Subject Role in Small Group Experiments," Social Forces, XLIII (1964), 181-187; H. W. Reicken, "A Program for Research on Experiments in Social Psychology," in Decisions, Values and Groups, ed. by N. F. Washburne (New York: Macmillan Company, 1962), pp. 25-41.

established groups are substantially different from the processes and responses of ad hoc, laboratory groups. A study by Hall and Williams, for example, compared decision-making processes and products of the two kinds of group. All of the businessmen who comprised the natural groups had interacted in excess of fifty hours--from a few weeks to several years; all of the businessmen who comprised the temporary groups were strangers to one another. The experimenters showed a film that portrays deliberations of a jury in a murder trial, as one by one the jurors change their vote from 'guilty' to 'not guilty.' They stopped the film at midpoint and asked the participants to list their individual judgment of the order in which they expected the jurors to change, and then to interact with other members of their group and reach a group judgment. The two sets of judgments provided the data on which Hall and Williams based their conclusions.

Although group judgments for both types of groups were significantly better than the averages for individual members, the mean error score for natural groups was 13.15 and for ad hoc groups, 16.60, a difference significant at the .05 level. The experimenters calculated a "conflict index" based on differences between individual and group judgments, and divided both real and ad hoc groups into high and low conflict groupings. Under high conflict, natural groups improved an average of 11.92 points over mean individual error scores, and under low conflict, 6.87 points. For ad hoc groups average

improvements were 6.58 under high conflict and 7.58 under low conflict. Thus a significant interaction between group type and amount of conflict appeared.

Hall and Williams interpreted emergent solutions as attempts to resolve conflicting or deadlocked opinions. Emergent solutions can be considered creative, if more adequate than the average of individual judgments, compromising if less adequate. High conflict groups produced more emergent solutions than low conflict groups; ad hoc groups produced more emergent solutions than established groups. But under high conflict, emergent solutions of established groups were superior to their mean individual scores by an average of 1.3 points, whereas those of temporary groups were inferior by an average of 1.5 points. These differences produced a significant interaction effect, "suggesting that established groups react to substantive conflict with increased creativity while ad hoc groups resolve their conflicts of opinion via a compromising process."[33] Moreover, emergent solutions of natural groups under both high and low conflict were significantly more accurate than those of the temporary groups. Hall and Williams concluded that the quality of pre-discussion member resources systematically limits production of group decisions

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[33] J. Hall and M. S. Williams, "A Comparison of Decision-Making Performance in Established and Ad Hoc Groups," Journal of Personality and Social Psychology, III (1960), 219.

in ad hoc groups, whereas no such limitation restricts established groups.

This recitation is not, and is not intended to be, an exhaustive review of the small group literature. It is, rather, an explication of the research that provided foundation and direction for this study. Despite the impressive regularities these findings reflect, important questions remain to be answered, especially with regard to the effects of size and "realness" on group processes and products.

CHAPTER II

METHOD

The Research Situation

The data analyzed in this study were obtained at a Summer Institute for Case Studies in Engineering sponsored by the National Science Foundation, and conducted at Stanford University from August 21 through September 12, 1967. The participants were sixteen professors of engineering and sixteen senior or first year graduate students in engineering from schools across the country. The students were recruited by the professors and were formally enrolled in Mechanical Engineering 198, Mechanical Engineering Problems, for three quarter hours credit. Thus the students were a highly-select group, well motivated to take part in class discussions. Professors and students represented most of the areas of engineering specialization.

The cases used at the Institute were written by members of the Stanford faculty and by professors who participated in former Institutes. They describe real problems practicing engineers have faced. Frequently there is a complicating human relations factor, and seldom is there only

one "right" answer. The cases were distributed in advance, in order that students could study the material, consult reference works if necessary, and come prepared to offer and defend a solution. Some of the professors required written assignments to be completed before class; others assigned written work after class discussions. Two sessions were used for written tests over substantive materials from the cases.

Thus the problems entailed the orientation, evaluation and control features of Bales' full-fledged task. However, some of the discussions began with a presentation of solutions, rather than an analysis of the problem. And in no case were class members required to reach a group consensus. Discussion of most, but not all, of the cases was completed in a single class meeting.

Since one or another of the professors conducted each seminar, the meetings more closely resembled therapy groups, which have a formal leader, than laboratory groups, which usually have no assigned leader.

The seminars met in a room in the Business Administration building. Chairs and desks were arranged in ascending, horseshoe-shaped tiers. The professor who conducted the session stood at the open end of the horseshoe at the lowest floor level. The lowest student level contained sixteen chairs. Students occupied seats at this lowest level until the thirteenth session, when they were permitted to select their own places. At that time some of them chose seats at

the closed end of the horseshoe on the second level, rather than seats at the open end on the lowest level.

The observers sat at the highest level, where they could see the participants clearly, but where they were out of the normal field of vision of the participants. In other words, in order to see the observers, students had to look over the heads of other class members. After the first day or two, it was most unusual for a student to look toward the observers during the meetings.

Since the seminars were a credit-bearing course for the students, no experimental procedure which might disrupt normal classroom activity was considered. Therefore, only two manipulations were attempted. In the sixth student session, when it was judged that some communication patterns and expectations regarding amounts of participation might have formed, students were assigned other seats. In reassigning seats, an effort was made to place those students who had been at the ends of the horseshoe in more central positions.

In addition, with the cooperation of two of the professors,[34] for the fifteenth and sixteenth class meetings students were divided into one four-man and four three-man teams, and required to create cooperative solutions to the assigned cases, and to choose spokesmen to present these

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[34]The writer wishes to express her appreciation to Professors George R. Powley and Walter J. Ewbank.

cooperative solutions to the rest of the class. In composing the teams, an effort was made to place the most active participants on one team, and to distribute the least active students among the other teams. However, since no formal counts had been made, this was necessarily a very inexact procedure. In both sessions, as soon as the formal persentations by the spokesmen were completed, discussion again became general.

At later meetings some of the professors changed seat assignments, required group solutions, or introduced role playing into the discussion when it suited their purpose. These variations in normal routine were noted, and will be mentioned in the following account wherever they might have influenced the observed interaction and communication patterns.

The Data

The original data consist of tape recordings and observers' logs for twelve of the thirty-one sessions, and students' responses to sociometric questionnaires administered after the last meeting. Twenty-one of the student meetings were recorded, and the twelve used in this study were chosen for their relevance to the questions mentioned above. For example, under System Effects, the first and second questions refer to summed data, and make no demand as to which meetings are treated. On the other hand, questions regarding phase movements require that early, intermediate and late meetings be compared.

A listing of all student sessions, indicating the relevance of the twelve chosen, as well as any special characteristics, appears as Appendix A.

The observers were instructed to record who spoke to whom for the whole group, and all nonverbal behavior they saw for half the group, without attempting to categorize the interaction in any way. The first three student meetings were used to give the observers practice in recognizing the students and in following the interaction.

When Bales developed the IPA, he recommended that each observer record all behavior, both verbal and nonverbal, by all participants. In this case, the observers were not trained in using the IPA, but even had they been so trained, a division of labor would have been necessary. A seventeen-man group presents 262 possible interacting pairs, plus innumerable possible larger temporary groupings due to area of specialization, position on a disputed point, team assignments, etc. At times the observers lost track, momentarily, of even the verbal communication.

In a methodological note Psathas described two alternative methods for achieving reliable interaction data when the "in-process" system of direct observation and simultaneous scoring is not feasible.[35] Both utilize observers' logs

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[35]G. Psathas, "Alternative Methods for Scoring Interaction Process Analysis," Journal of Social Psychology, LIII (1961), 97-103.

and tape recordings. In the first method the tape is transcribed, and then the typescript and observers' records are combined and categorized. In the other method interaction is categorized directly from tape and logs. The first method was used in this study. Although it required much more time and work for the writer, who performed all the described procedures, it seemed necessary in order to obtain acceptable accuracy and reliability in scoring interaction for so large a group.

In transcribing the tape recordings, each tape was played and replayed as often as necessary to produce an accurate account of the proceedings. Next the nonverbal behavior noted by the observers was interpolated, and a final master protocol of each session typed. Then the propocols were unitized in accordance with Bales' instructions.

> The unit to be scored is the smallest discriminable segment of verbal or nonverbal behavior to which the observer, using the present set of categories after appropriate training, can assign a classification. . . .
>
> Often the unit will be a single simple sentence expressing or conveying a complete simple thought. Usually there will be a subject and predicate, though sometimes one of these elements will only be implied. As an example, if the actor in a conversation says, "What?" the observer translates "What was that?" or "I do not understand you" or "Would you repeat that?", thus filling out both subject and predicate. Complex sentences always involve more than one score. Dependent clauses are separately scored. If a series of predicates are asserted of a single subject, a separate score is given for each additional predicate on the reasoning that each one constitutes a new item of information or opinion. Compound sentences joined by "and," "but," etc., are broken down into their component simple parts, each of which is given a score. As an example of the foregoing

> points, the following sentence would be analyzed into four units: "This problem which we talked about for three hours yesterday/ impresses me as very complicated/ difficult/ and perhaps beyond our power to solve./" (End of units are indicated by the diagonal.)[36]

In addition to the tapes selected to answer the questions raised in this study, two tapes from the remaining nine were chosen at random and transcribed and unitized in the same way. These two tapes were then used for practice in applying IPA categories. The twelve IPA categories are shown below as Figure 1. As mentioned earlier, the categories are intended to be an exhaustive catalog of interactive behavior, but the distinction between orientation and evaluation is sometimes difficult to draw, and an attempt to control a situation can take the form of a question, a statement of fact, or even a joke. After extended practice and study, both tapes were coded twice. Using the Pearson r to measure the interrelation between the codings yielded a value of .99 in both cases.[37]

No attempt was made in this study to establish the validity or the reliability of the IPA as a measuring instrument for social science research. As Bales stated unequivocally in the Preface to Interaction Process Analysis, categorizing ongoing behavior of group participants requires interpretation. It involves "the imputation of meaning, the

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[36] Bales, Interaction Process Analysis, pp. 37-38.

[37] H. M. Walker and J. Lev, Statistical Inference (New York: Holt, Rinehart and Winston, 1953), pp. 230-239.

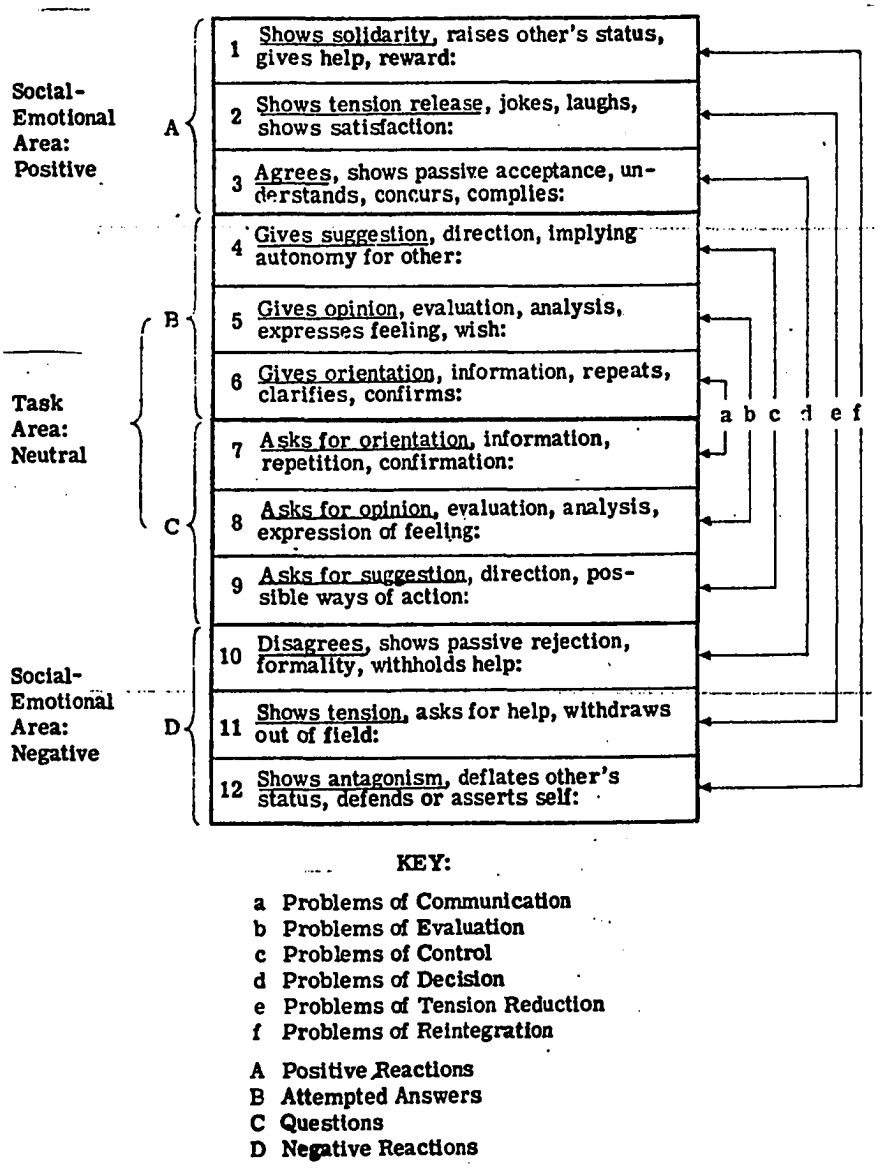

Figure 1. IPA Categories and Their Major Interrelations.[38]

'reading in' of content, the inference that the behavior has function(s), either by intent or by effect."[39] In developing

[38]Bales, Interaction Process Analysis, p. 59.

[39]Bales, Interaction Process Analysis, p. 6.

the IPA and establishing empirical norms for small group behavior, Bales and his coworkers typically used two or more observers, who independently scored the interaction as it occurred. Correlations of the category totals of the observers' records measured the reliability of the instrument. Bales noted that "with competent observers and hard training, correlations between observers ranging from .75 to .95 can be obtained."[40] As an example, he and Heinicke reported correlations ranging from .74 to .90 for the various categories in their study of developmental trends in small groups.[41]

After establishing acceptable reliabilities in scoring the two practice protocols, the unitized protocols for the research sessions were categorized, reading the texts and playing and replaying the tapes in order to take advantage of all available cues. After all twelve protocols were categorized, the scoring was carefully reviewed and edited, and then two of the twelve were selected at random for rescoring. Using the Pearson r to measure the interrelationship between

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[40]R. F. Bales, "Some Uniformities of Behavior in Small Social Systems," in Readings in Social Psychology, ed. by G. E. Swanson, T. M. Newcomb, and E. L. Hartley (rev. ed.; New York: Henry Holt & Company, 1952), p. 150.

[41]Heinicke and Bales, Sociometry, XVI (1953), 7-38.

the two codings for each meeting gave a value of .99 in each case.[42]

As a final step before counting, each protocol was divided into three equal time segments. Then the data were counted, and recorded on separate sheets for each participant for each session, showing to whom he addressed how many of each category of interaction in each time period. From this basic level, the data can be assembled into whatever form is required to consider each research question in turn.

For statistical treatment, when the data are presented as total interaction recorded during a particular session, or total acts initiated by a particular participant, or total communication directed to the professor, they may be considered interval data assigned to nominal categories. Every observed act has equal weight with every other act in the summed data, and it is meaningful to say that one participant initiated twice as much interaction as another, or that five hundred fewer acts were observed in one meeting than in another. In addition, when acceptable reliability in use of the IPA is demonstrated, the same reasoning may be extended to category

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[42]The question of how much of this reliability can be attributed to the writer's remembering previous scorings is not, obviously, answerable. However, Tape #7 (Meeting 16) contains 2555 entries, and Tape #5 (Meeting 14), 2001. In addition, more than half of the interaction was coded in Categories 4, 5, and 6, Attempted Answers. The twelve tapes were scored in chronological order, which means that five other tapes were coded before Tapes #7 and #5 were redone.

totals. Although Bales argued that each of the problems a group faces--communication, evaluation, control, decision, tension reduction, and finally, reintegration--is "nested" into the next,[43] this concept of order has not been empirically demonstrated. Therefore category totals, too, may be treated as interval data divided into nominal categories.

It should be noted that in an exploratory study such as this, no neat, consistent research design or statistical analysis is possible. Sophisticated research methods in which population, sample, controls, hypotheses and statistical analyses are specified in advance become feasible after the question, Is there order in the interaction of a large, natural group under formal leadership? has been answered affirmatively. Accordingly each research question will be considered separately and tested wherever possible with appropriate statistical procedures.

Regarding the sociometric data (see Appendix B), one of the questionnaires required students to rank class members on the quality of their ideas, on their ability to facilitate discussion, and on their overall leadership ability, and also, to rate all class members on a seven-point like-dislike scale. All students completed these forms. The other questionnaire concerned out-of-class activities, and was intended to supplement the like-dislike data for the purpose of identifying

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[43]Bales, Interaction Process Analysis, pp. 60-61.

cliques. However, due to a mix-up in scheduling, students did not have enough time to complete these forms, and the responses may prove to be of little value.

CHAPTER III

SYSTEM EFFECTS

In effect this is a case study of one intact group over a four-week period. Therefore the obtained data are presented, analysed, and compared numerically and graphically with results of previous research. In addition, where relevant, statistical tests for significant differences are reported for their heuristic value.

Interaction Profile

Table 1 in Appendix C presents the observed interaction in each category during twelve meetings of the student seminar, plus totals for each category and percentages based on the totals. In addition, Figure 2 below displays these percentages in graphic form, together with percentages from Bales' model and Talland's study.

Presumably both therapists and professors are formal leaders. Thus the student seminar is more like the groups Talland and Psathas studied than those Bales used in regard to leadership. In size Talland's groups ranged from six to eight members; Psathas' were four-member groups. In large part Bales' normative work on the interaction profile stems

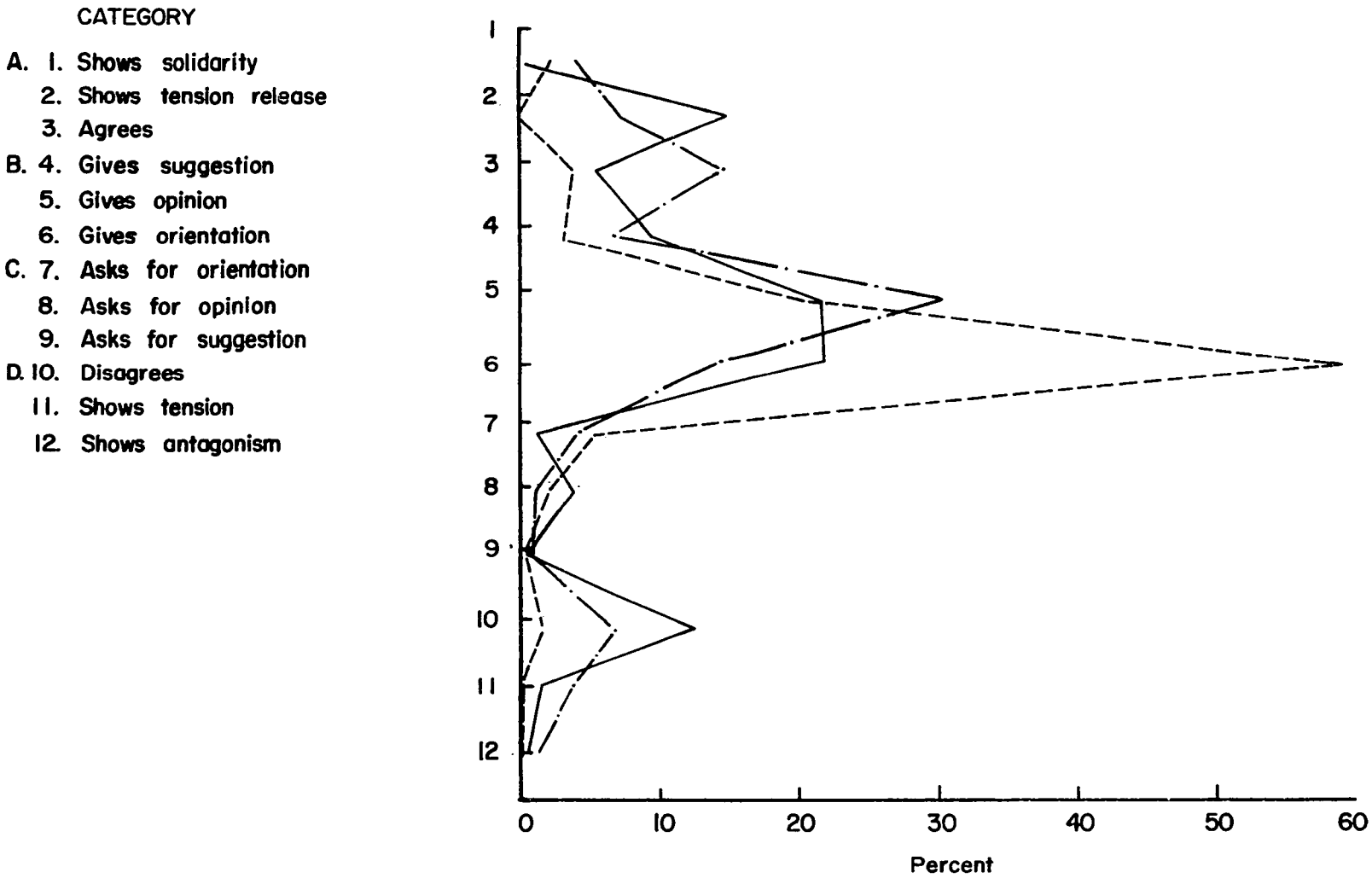

Figure 2. Graphic interaction profiles from twelve meetings of the student seminar (solid lines), from Bales' model (broken lines), and from Talland's study (dashed lines).

from data on groups of five and six members. Apparently there has been no systematic observation over time of groups larger than eight. However, the system effects that constrain communication and interaction in small laboratory and therapy groups might be expected to operate as well in a large, natural group under formal leadership.

The major difference between the interaction profile Talland reported on the one hand, and the profiles Bales and Psathas described and Bales' theoretical equilibrium profile on the other, centers on 'reactive' behavior, that is to say, on (A) Positive reactions, (C) Questions, and (D) Negative reactions. In addition, under IPA procedures a percentage of (B) Attempted answers, equal in amount to (C) Questions, is arbitrarily declared to be reactive. However, Talland's modifications of IPA make his results inconclusive. Thus the interaction profile for this student seminar might be expected to be more like Bales and Psathas' profiles than Talland's.

Table 2 in Appendix C shows interaction profiles, including reactive behavior, from Bales' theoretical model, from Bales' laboratory groups, from Talland's therapy groups, and from twelve meetings of the student seminar. The data shown indicate that in reactive behavior the student seminar is considerably closer to Bales' findings than are Talland's. Figures 3, 4, and 5 below present percentages of observed reactive behavior in each of the twelve meetings, compared to percentages from Bales and Talland. As might be expected,

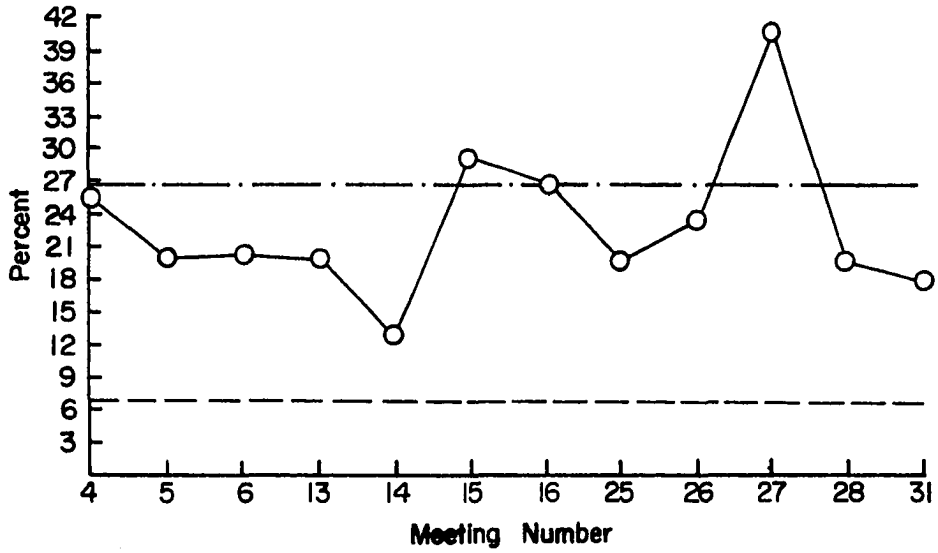

Figure 3. Observed behavior in (A) Positive Reaction for twelve meetings of the student seminar (solid lines). Broken lines shows Bales' theoretical percentage; dashed line, Talland's reported percentage.

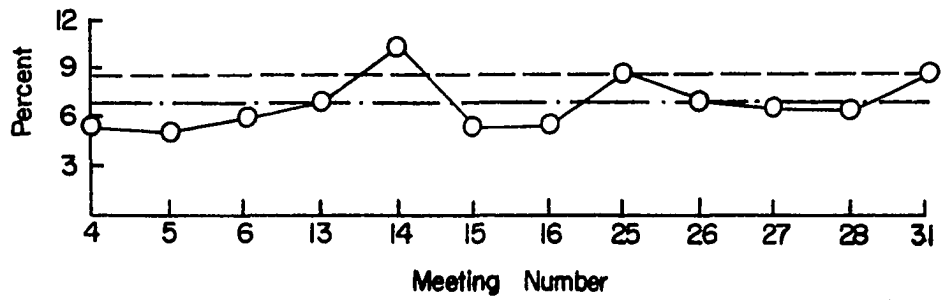

Figure 4. Observed behavior in (C) Questions for twelve meetings of the student seminar (solid lines). Broken line shows Bales' theoretical percentage; dashed line, Talland's reported percentage.

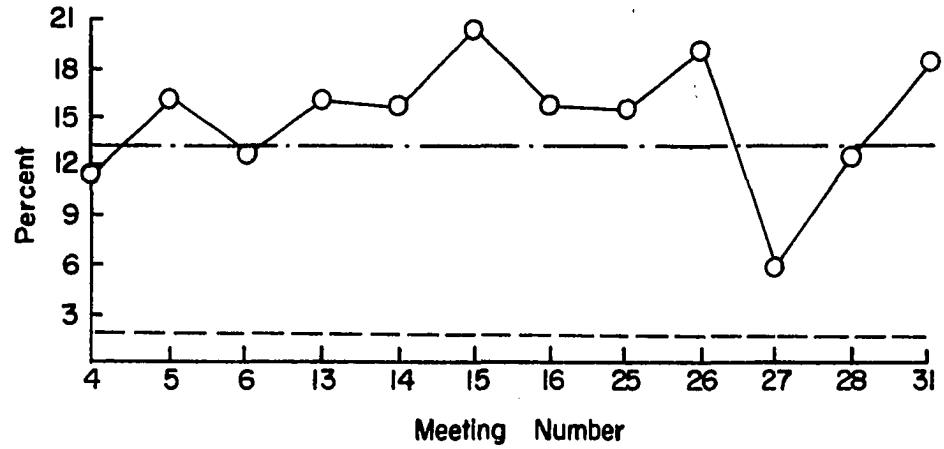

Figure 5. Observed behavior in (D) Negative Reactions for twelve meetings of the student seminar (solid lines). Broken line shows Bales' theoretical percentage; dashed line, Talland's reported percentage.

percentages based upon accumulated totals conceal considerable meeting-by-meeting variation, but all three displays reflect close agreement with Bales' work.

For a final analysis, expected frequencies of reactive behavior were calculated by applying percentages from Bales' model and Talland's report to the total interaction observed in each of the twelve meetings. The absolute differences between these calculated frequencies and the observed frequencies were compared. It was expected that differences between observed frequencies and calculated frequencies based on Bales' model would be smaller than differences between observed frequencies and calculated frequencies based on Talland's work. Table 3 in Appendix C shows the results of these computations. The differences are in the expected direction in thirty-one of the thirty-six comparisons. Using the sign test to determine the probability of this result yields a z of 4.17 ($p < .0003$).[44] Thus data for this large, natural group under formal leadership reflect the expected rough balance between active and reactive behaviors.

Who-to-Whom Matrix

In forming a who-to-whom matrix participants are arranged from highest to lowest according to their total

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[44] S. Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, Inc., 1956), pp. 68-75.

initiated interaction to designate rows--the "who" of the matrix. Then participants are arranged in the same order to designate columns--the "whom" of the matrix. Since the group as a whole can be the target, but not the initiator of communication under the IPA, there is always one more column than row. The appropriate frequencies are then entered in each cell.

To form an aggregate interaction Matrix, data from individual matrices are pooled in accordance with procedures described by Bales and his associates.

> Corresponding cells in each group were combined, that is, cell 1-2 for group 1 was added to cell 1-2 for group 2, group 3, . . . n; cell 1-3 for group 1 was added to cell 1-3 for group 2, . . . n, and so on for all the cells. This addition resulted in a single composite matrix. . . . [45]

Thus the aggregate interaction Matrix preserves ranks--first initiator, second initiator, . . . , lowest initiator, but not identities. In summing the data, subtotals showing total activity addressed to individuals and to the group as a whole are entered, as well as the grand total of interaction initiated, which is, of course, the basis for the original ordering. Totals of the columns show the total communication received by each participant.

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[45] Bales, Strodtbeck, Mills and Roseborough, American Sociological Review, XVI (1951), 462-463.

The aggregate who-to-whom matrix for the twelve student sessions is shown in Table 4 in Appendix C. Participants are identified by number. Students were assigned numbers at the first meeting and the same student was designated by the same number throughout the seminar. The professor who conducted the class was always identified by the number 31. In preparing the matrix, professors were treated as a single participant. There was a student absentee in three of the sessions. Therefore the last column and the last row were omitted from the totals and subtotals shown. Using Kendall's coefficient of concordance to measure the relationship among rankings according to total initiated interaction, interaction addressed to individuals, interaction addressed to the group, and interaction received yields a W of 0.96. Testing the significance of this figure gives a X^2 of 57.6 ($p < .001$).[46]

The aggregate who-to-whom Matrix was developed because in most of the groups Bales and his coworkers studied, each participant appeared only once. However, the same students participated in all of these sessions, and a more important and meaningful question is, Would a who-to-whom matrix that preserved individual identities show the same order among rankings? To investigate this question an individualized summary matrix was constructed. This analysis was confined to nine meetings, since there seemed to be no way to

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[46]Siegel, Nonparametric Statistics, pp. 229-238.

compensate for absentees without distorting the relationships among participants. Again, professors were included as a single participant. The individualized matrix appears as Table 5 in Appendix C. There is a noticeable increase in variability among rankings in this individualized matrix, compared to the aggregate matrix. However, the same statistical procedures yield a W of 0.77, and a X^2 of 49.3 ($p < .001$).

Bales and his group also reported a decrease in magnitude of cell entries across rows and down columns (see page 11). Accordingly, adjacent cell values were compared. For the aggregate matrix, 436 comparisons remain after elimination of ties; of these, 276 show the expected pattern. Using the sign test to determine the probability associated with this figure gives a z of 5.50 ($p < .0003$). For the individualized matrix, 484 comparisons remain after eliminating ties, of which 289 are in the expected direction. The sign test gives a z of 4.23. Although this is a smaller value than that for the aggregate matrix, it, too, is significant ($p < .0003$). Again the data support the premise that there was an underlying order in the interaction among participants in this student seminar.

Phase Movements

With regard to within-session phase movements, the pattern of relative amounts of communication concerning orientation, evaluation, and control, as well as positive and

negative reactions that Bales described (see pages 12-14) is shown in Figure 6 below. Since this pattern has been reported by other investigators (see pages 19-20), the student seminar might also be expected to conform. To test this expectation, interaction during nine meetings--three early, three intermediate, and three late in the course of the Institute--was analyzed. Since the pattern focuses on relative amounts of each class of behavior during each third of a meeting, and since total observed interaction in each third varies considerably, observed frequencies of the five classes of behavior during each period were converted into percentages of total interaction for that period. Tables 6, 7, and 8 in Appendix C display these figures.

	PERIODS		
	1	2	3
Orientation	H	M	L
Evaluation	L	H	M
Control	L	M	H
Positive Reaction	L	M	H
Negative Reaction	L	M	H

Figure 6. Within-Session Phase Movements. H, M, and L Refer to High, Medium and Low Relative Amounts of a Particular Kind of Activity During Periods 1, 2, and 3.

Then for each of the nine meetings, percentages of each class of behavior were compared across time periods and categorized high, medium, or low according to magnitude. In addition, a summary pattern for the combined nine meetings was

calculated and rated. These patterns were compared to the pattern Bales reported.

In determining the significance of the fit between obtained and predicted patterns, Bales and Strodtbeck developed a system for counting the "transpositions" required to convert the obtained pattern into the predicted one. A transposition is defined as an exchange of adjacent values.

> We note that three items may be ordered in six different ways. One of these will be correct and require no transpositions, two will require one transposition, two will require two transpositions, and one will require three transpositions. The probability of a given or cumulative number of transpositions can be computed from the coefficients of the expansion of the following formula:
>
> $$(1 + 2x + 2x^2 + x^3)^k$$
>
> For the case under consideration, k equals 5. . . . One may conclude that if there are three or fewer transpositions, the null hypothesis may be rejected at the .05 level.[47]

Bales and Strodtbeck also measured the significance of the aggregate pattern for all sessions, taken as independent tests, using a combinatorial method developed by Fisher. Individual probabilities are combined under the formula

$$X^2 = (2 \log 1/p_i)$$

where p_i is the probability of the ith case, calculated by the method described above. Significance of the resulting chi square is determined in the conventional manner, using 2n

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[47]Bales and Strodtbeck, Journal of Abnormal and Social Psychology, XLVI (1951), 491.

degrees of freedom.[48] They also presented tables giving probabilities associated with total transpositions for individual sessions, and values for computing chi square for combined sessions.

Figure 7 below shows observed patterns for the nine sessions, as well as the aggregate pattern, plus the number of required transpositions and associated probabilities. Although only two of the nine individual patterns show significant agreement with Bales' pattern, there is a significant overall tendency for the nine sessions to conform to this design. The procedure described by Bales and Strodtbeck yields a X^2 of 35.48 ($p < .01$).

With regard to between-session phase movements, data for the nine meetings of the student seminar are given in Table 9 in Appendix C. For purposes of comparison the study by Heinicke and Bales provides the most complete analysis of between-session trends in that they reported on six consecutive meetings (see page 13). They also concluded that relative amounts of interaction in the various groupings of categories probably remain stable in later sessions. These

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[48] In a footnote Bales and Strodtbeck reported that use of discrete probabilities in a Fisher-type test had been questioned by W. Allen Wallis. But in his paper, "Compounding Probabilities from Independent Significance Tests," Econometrika, X (1942), 229-248, Wallis concluded, "When one or more of the tests is based on a discontinuous distribution, however, Fisher's transformation results in an overevaluation (usually of considerable proportions) of the probability of the product." Thus the Bales and Strodtbeck procedure is conservative, and was used.

Observed Patterns - Early Sessions

Period	Meeting 4			Meeting 5			Meeting 6		
	1	2	3	1	2	3	1	2	3
Orientation	H	L	M*	H	M	L	M	H	L*
Evaluation	L	M	H*	L	H	M	H	M	L**
Control	H	M	L***	M	L	H*	H	M	L**
Positive R	L	H	M*	L	M	H	M	L	H*
Negative R	L	M	H	M	L	H*	L	M	H
Transpositions			6			2			6
Probability			.322			.008			.332

Observed Patterns - Intermediate Sessions

Period	Meeting 13			Meeting 14			Meeting 15		
	1	2	3	1	2	3	1	2	3
Orientation	H	M	L	H	L	M*	M	H	L*
Evaluation	H	M	L**	L	M	H*	L	H	M
Control	M	L	H*	H	M	L***	H	M	L***
Positive R	M	L	H*	L	M	H	M	L	H*
Negative R	L	M	H	M	H	L**	H	L	M**
Transpositions			4			7			7
Probability			.080			.500			.500

Observed Patterns - Late Sessions

Period	Meeting 26			Meeting 27			Meeting 28		
	1	2	3	1	2	3	1	2	3
Orientation	H	M	L	M	H	L*	L	M	H***
Evaluation	H	M	L**	H	M	L**	L	H	M
Control	M	L	H*	L	M	H	L	H	M*
Positive R	L	H	M*	L	M	H	M	L	H*
Negative R	L	M	H	L	M	H	H	L	M**
Transpositions			4			3			7
Probability			.080			.029			.500

Summary Pattern for Nine Meetings

Period	1	2	3
	H	M	L
	M	H	L***
	H	M	L***
	L	M	H
	L	M	H

Figure 7. Within-Session Phase Movements for Early, Intermediate, and Late Meetings. Asterisks Indicate Number of Transpositions Required in Each Case.

findings and conclusions were confirmed by Philp and Dunphy (see pages 19-20).

Although data from the student seminar are seriously defective for studying between-session phase movements in that Meetings 7 through 12 were not observed due to human error, data from the nine sessions were compared graphically to the data obtained by Heinicke at Northwestern University. Figure 8 below displays data concerning task-related communication; Figure 9, positive social-emotional interaction; and Figure 10, negative social emotional interaction. In each case the Heinicke data for six meetings are plotted, and values for the sixth session extended across the figure. Data from the student seminar are plotted in groupings of three, representing meetings early, intermediate and late in the course of the Institute.

Examination of the data shown in Table 9, including average percentages for each of the three groupings, as well as examination of the graphs, suggests some similarity in patterns of interaction and communication. With regard to task-related communication, both Heinicke's groups and the student seminar appear to have become more efficient in the exchange of information, indicated by a decrease in percentage of communication in Category 6, Gives orientation. There seems to be no regularity in the changes in communication rates regarding Category 5, Giving opinion (evaluation) or Category 4, Giving suggestion (control) in the student seminar,

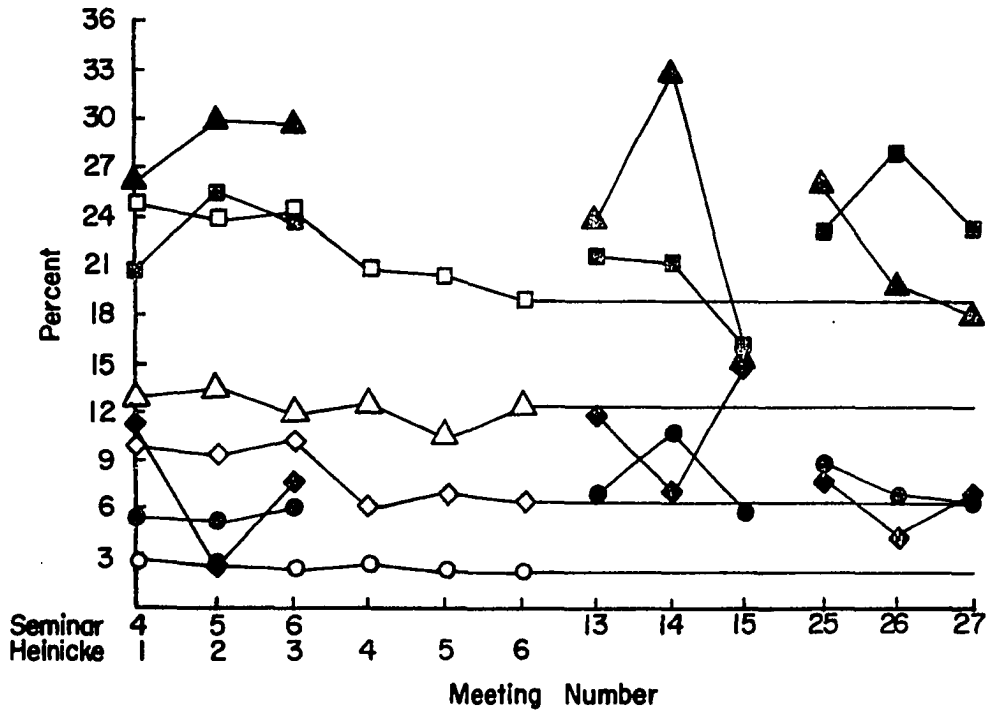

Figure 8. Task-related communication (Category 4, Gives suggestion: ◇ ; Category 5, Gives opinion: □ ; Category 6, Gives orietation: △ ; Categories 7, 8, and 9, Asks questions: ○) for nine meetings of the student seminar (solid symbols) and for six meetings of Heinicke's laboratory groups (open symbols).

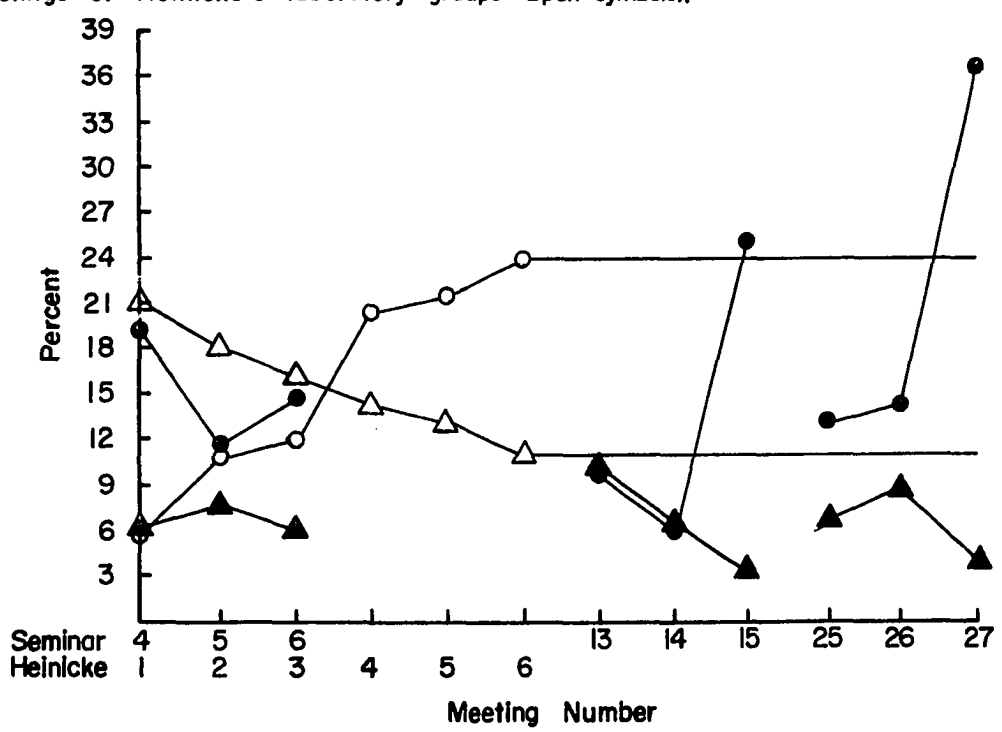

Figure 9. Positive social-emotional interaction (Categories 1 and 2, Shows solidarity and Shows tension-release: ○ ; Category 3, Agrees: △) for nine meetings of the student seminar (solid symbols) and for six meetings of Heinicke's laboratory groups (open symbols).

although communication concerning both declined slightly in the Heinicke groups. Moreover, rates in Categories 7, 8, and 9, Questions, declined steadily in the laboratory groups, but increased in the student seminar.

With regard to social-emotional interaction, like the Northwestern groups, the student seminar showed increases over time in interaction in Categories 1 and 2, Shows solidarity and Shows tension-release. On the other hand, the rate of interaction in Category 3, Agrees, remained constant in the student seminar, but decreased in the laboratory groups.

With regard to negative social-emotional interaction, activity in Categories 11 and 12, Shows tension and Shows antagonism decreased, while activity in Category 10, Disagrees, increased in the student seminar. But in the Northwestern groups, rates of all negative social-emotional interaction decreased over time.

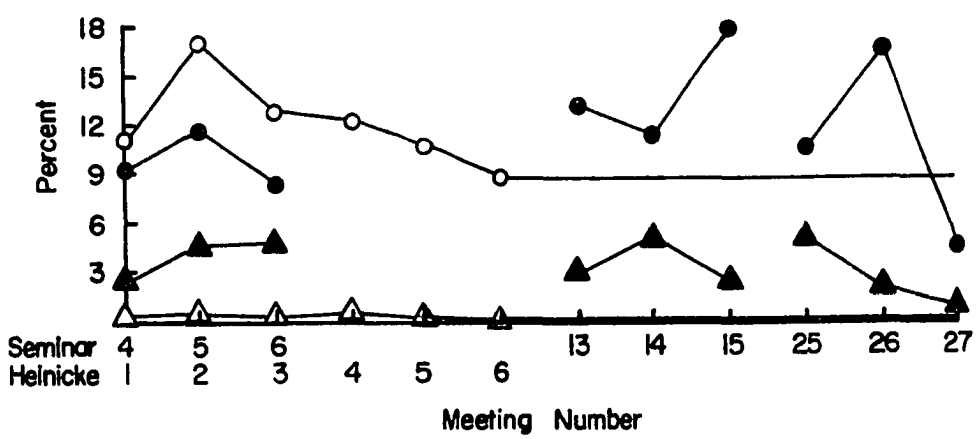

Figure 10. Negative social-emotional interaction (Category 10, Disagrees: O ; Categories 11 and 12, Shows tension and Shows antagonism: △) for nine meetings of the student seminar (solid symbols) and for six meeting of Heinicke's laboratory groups (open symbols).

Discussion

Confirmation of the expectation that the obtained data are closer to Bales' theoretical equilibrium model than to Talland's reported Profile indicates that the basic paradigm for interpersonal behavior--one person acts and another reacts--pertains to this large, natural group. Much of the difference between the observed Profile and Bales' model appears to be a function of size. In fact, some of the differences were reported by Bales and Borgotta (see pages 23-24 above). Thus in task-related communication, both Giving information and Giving suggestions increased, but Giving opinions decreased. And in social-emotional interaction, Showing tension decreased, while Showing tension-release increased markedly. The latter is undoubtedly affected by the IPA scoring convention under which general laughter is tallied separately for every participant, but it also seems to be affected by group size: General laughter reflects much less personal involvement than either Showing solidarity or Showing agreement, both of which decreased.

However, there seems to be a methodological difficulty. In discussing his development of the IPA and the various measures of system effects, Bales explicitly stated his hope that the interaction profile could be used as a diagnostic tool for identifying abnormal--or, at least, atypical--group behavior. On the basis of the differences between the obtained profile for the student seminar and Bales' theoretical profile,

two conclusions seem possible: Either all twelve meetings of this engineering seminar were atypical, or absolute percentages such as those given in Bales' equilibrium model are too rigid to be a practical measure of "normal" interaction. The latter seems to be the more likely explanation.

Perhaps a normal range of values for active and reactive behavior could be established--for example, one standard deviation above and below the mean of pooled observations from many meetings. Table 10 below lists percentages of affective behavior and active and reactive task-related behavior for each of the twelve meetings under study. The mean, standard deviation, and suggested range are also shown. Asterisked entries are outside this range. Plausible, but admittedly conjectural, explanations for most of these extreme values are suggested in the discussion below.

Confirmation of expectations concerning regularities in the aggregate who-to-whom matrix and, more important, regularities in the individualized who-to-whom matrix, again indicates basic order in intragroup relations, as well as considerable consistency in individual behavior.

Phase movements concern relative amounts of particular kinds of interaction in relation to other kinds of interaction, rather than absolute totals, and appear to be much influenced by the business before the group.

Regarding within-session Phase Movements, the critical question seems to be where the discussion begins, rather than

TABLE 10

PERCENTAGES OF REACTIVE AND ACTIVE AFFECTIVE AND TASK-RELATED BEHAVIOR FOR TWELVE SESSIONS OF THE STUDENT SEMINAR, SHOWING MEAN, STANDARD DEVIATION, AND SUGGESTED NORMAL RANGE FOR EACH CLASS OF BEHAVIOR

	AFFECTIVE BEHAVIOR		TASK-RELATED BEHAVIOR		
	Reactive				Active
Meeting	Positive	Negative	Questions	Answers	Answers
4	25.5	11.6	5.3	5.3	52.3
5	19.4	16.5	5.1	5.1	53.8*
6	20.5	12.9	5.9	5.9	54.8*
13	20.1	16.5	6.7	6.7	50.0
14	12.4*	16.2	10.5*	10.5	50.3
15	28.6	20.3	5.4	5.4	40.3*
16	26.7	15.9	5.4	5.4	46.5
25	19.6	15.7	8.7*	8.7	47.3
26	23.0	18.7	6.7	6.7	44.9
27	40.5*	6.1*	6.4	6.4	40.6*
28	19.7	12.6	6.2	6.2	55.3*
31	18.0	18.3	8.6*	8.6	46.5
Mean	22.8	15.1	6.7		48.6
Standard Deviation	6.7	8.1	1.6		4.9
Range	29.5-16.1	23.2-7.0	8.3-5.1		53.5-43.7

*Asterisked entries are outside the suggested range.

what it concerns. To illustrate the point, whether the group task requires construction of a wagon from tinker toys or preparation of a marketing list, participants need to reach consensus regarding the requirements of the problem, criteria for judging success, and a solution that meets these criteria. If the problem were presented after participants had assembled, the discussion might well begin with orientation and move through evaluation to control. On the other hand, if the problem were known and studied beforehand, the interaction might well begin with a discussion of solutions, that is to say, with issues of evaluation and control.

On the basis of this reasoning, the protocols for the twelve meetings were re-examined in order to note the first question the professor asked in opening each discussion. A listing and categorization of the professor's opening question in each session appears in Appendix D. Meetings 4 and 6 began by considering matters of evaluation, and each required six transpositions to reach the predicted pattern. Meetings 15 and 28 began with considerations of control, and each required seven transpositions to reach the predicted pattern. If these four meetings are omitted, calculation yields a X^2 of 28.20, just short of .001 probability.

Regarding between-session phase movements, the data do not conform to the Heinicke and Bales patterns. The margin between positive and negative responses did not increase from the fourth to the sixth meeting. Moreover, the data are

seriously defective for determining when--or if--the conflict Bales observed in his laboratory groups occurred in this student seminar. As mentioned, the first three class meetings were used to train observers, and those immediately following Meetings 4, 5, and 6 were not observed. The data do show the expected non-systematic variation in relative amounts of positive and negative interaction for the remaining sessions.

There seem to be plausible explanations, however, for the unusual patterns of affective communication during Meetings 14 and 27 (see Table 10). The first part of the case considered in Meeting 14 had been discussed the previous day under another professor. The man who conducted Meeting 14 began by asking a low-participating class member increasingly searching questions about the previous day's discussion. The excess of negative over positive acts apparently reflects other students' reaction to what they considered harassment. This interrogation is also reflected in the abnormally high entry under Questions and, of course, under Reactive answers, due to IPA scoring conventions.

The case under discussion in Meeting 27 dealt with a personnel problem, and the student engineers enthusiastically tackled the subtleties of interpersonal relations as a welcome change from problems concerning control circuits or strength of materials. This enthusiasm is reflected in the exceptionally high percentage of positive affect and low percentage of negative affect, and in the low percentage of active task-related behavior as well.

There appears to be no obvious pattern in the variations in amounts of task-related communication during early, intermediate, and late sessions of the seminar, although there is the suggestion of a trend toward more efficient communication regarding the facts of the case. Orientation required more time than evaluation in all three early meetings, and in two of the three intermediate meetings, but in only one of the late meetings. The unusually high percentages of interaction under Active answers shown in Table 10 for Meetings 5 and 6 may be a reflection of this early concentration on orientation.

Meeting 28 also shows an exceptionally high concentration of communication under Active answers. The subject of this discussion was a problem in design, and the professor divided class time roughly into thirds, requiring the students to examine the problem from two different points of view (role playing) and finally, to review the problem and proposed solutions as student engineers. This procedure appeared to yield a thorough understanding of the problem without arousing excessive affective reaction.

These obviously subjective interpretations of unusual patterns of interaction observed in some of the student sessions seem nevertheless relevant in that they point to the kinds of factors that must be identified and measured if reliable prediction of the outcomes of group discussions is to be attained. For example, the data from Meeting 14 emphasize the self-evident--but largely ignored--fact that in a <u>real</u>

group, no discussion can be considered an isolated event: Every discussion is influenced by past interaction and in turn will influence future interaction. The lessons from Meetings 27 and 28 are less clear. At the least, Meeting 27 points to the non-systematic effects of novelty, and Meeting 28, to the advantages of a good discussion plan.

In summary, perhaps it should be stated again that results of statistical procedures are reported in this chapter for their heuristic value in assessing the probability of the relationships, and are not intended to be tests of research hypotheses in the usual sense. This analysis of system effects tends to confirm previous research: Despite the apparent spontaneity of ongoing group discussion, there is impressive regularity and order in such intragroup interaction and communication. On the other hand, it seems increasingly clear that this order is not to be predicted--or explained--on the basis of any single dimension.

CHAPTER IV

INTERMEDIATE PROCESSES

It was argued above (see page 42) that when observations of the student seminar have been reduced to total interaction initiated by various participants, or to total acts tallied in various IPA categories, they are interval data separated into nominal categories. Before expectations regarding intermediate effects were tested, an analysis of the data was undertaken. A histogram of data classified according to initiator was constructed, as well as a smooth curve based on the histogram.[49] Figure 11 below displays the result. As might have been expected, the frequency distribution is unimodal, but skewed in the direction of low participation. However, t and F tests have been shown to be remarkably robust to departures from normality, and therefore were used to measure intermediate effects.[50]

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[49] Q. McNemar, Psychological Statistics (4th ed.; New York: John Wiley and Sons, Inc., 1969), pp. 5-12.

[50] D. W. Norton, "An Empirical Investigation of Some Effects of Non-normality and Heterogeneity on the F-distribution," an unpublished Ph.D. dissertation, reported in E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston: Houghton-Mifflin Company, 1953), pp. 78-86.

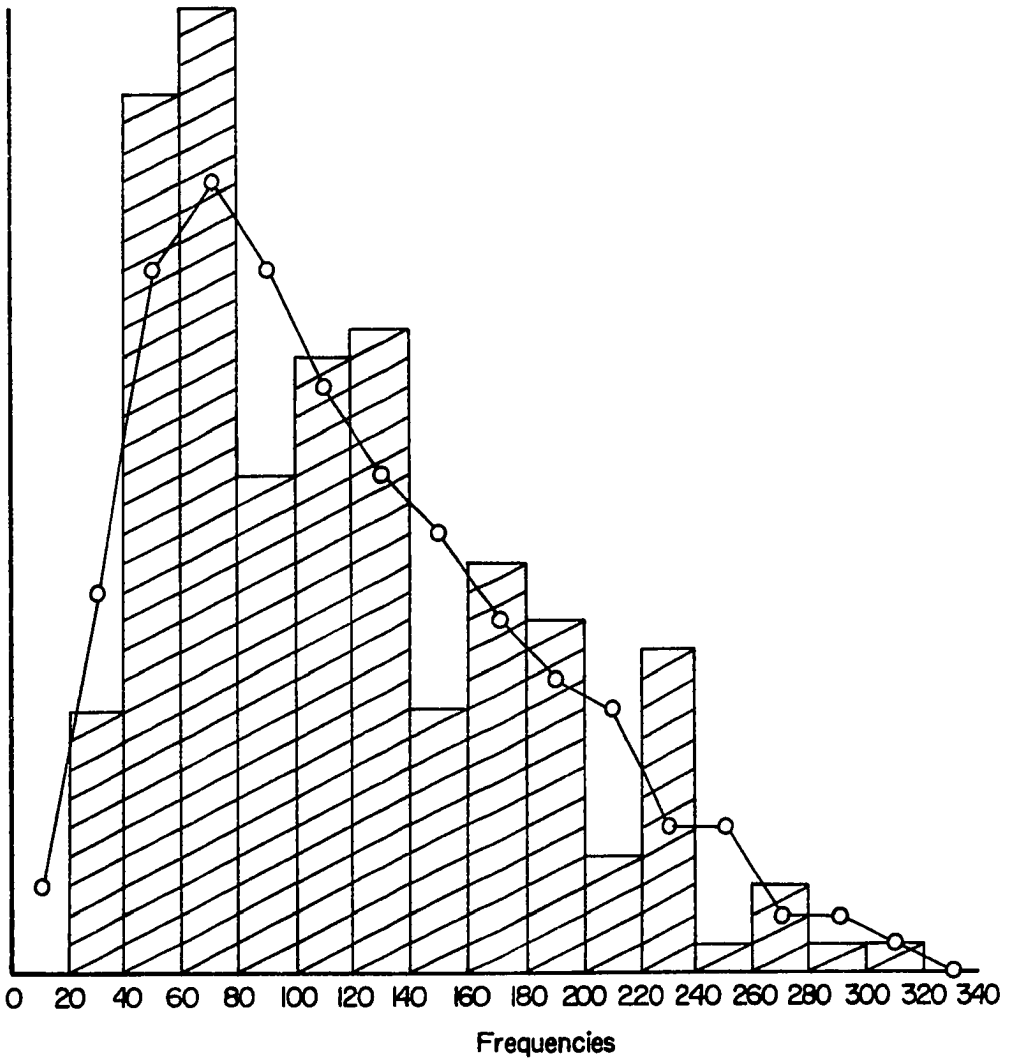

Figure 11. Histogram and frequency curve shows distribution of students' total initiated interaction during twelve meetings of the seminar.

Changes in Seating

The first question in this section concerns possible effects of changes in seat assignments. In view of the work of Borgotta and Bales, and of Dinoff et al., it might be

expected that by the end of the fifth session students had established relatively stable rates of participation. Further, in view of the work of Leavitt, Steinzor, Hare and Bales, it might be expected that changes in assigned seats would affect this participation. Figure 12 below displays the original seating arrangements, and the arrangements made at the beginning of Meeting 6. Three groupings of students result from the changes in seating: Grouping A_1, composed of Students 1, 2, 15, and 16, who were moved to more central positions; Grouping A_2, composed of Students 6, 7, 10, and 11, who were moved to end positions, and Grouping A_3, composed of the remaining eight students, who changed seats but remained in relatively central positions.

To establish a base for assessing the effects of seat changes, the amount of each student's initiated interaction for Meetings 4 and 5 was averaged. Table 11 in Appendix E preserves the groupings described above and shows students' initiated activity for Meetings 4/5 and 6. In addition, students' rankings based on total observed initiated interaction are given in parentheses beside their identifying numbers.

To measure the impact of these changes in seating arrangements,[51] a two factor, Meeting X Seating, repeated

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[51]This was an attempted replication, rather than an original test. See R. Sommer, "Classroom Ecology," Journal of Applied Behavioral Science, III (1967), 498-503.

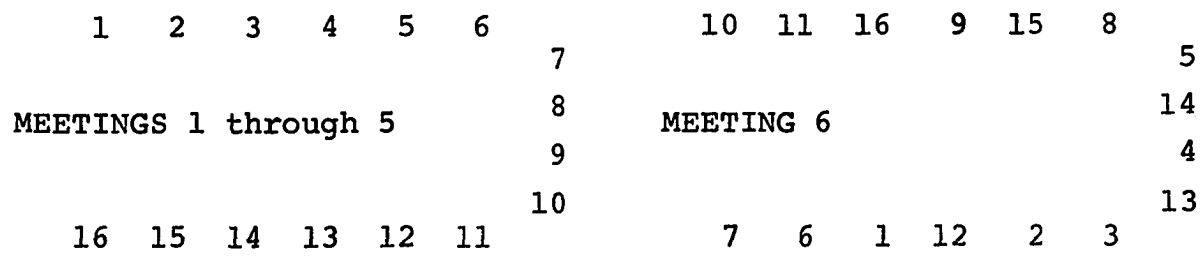

Figure 12. Student Seating Arrangements for Meetings 1 through 5, and for Meeting 6, at Which Seat Assignments Were Changed.

measures analysis of variance was calculated.[52] Table 12 below gives the results. Only the Meeting X Seating interaction reached statistical significance.

TABLE 12

ANALYSIS OF VARIANCE BASED ON TOTAL INITIATED INTERACTION BY STUDENTS IN MEETING 4/5 AND IN MEETING 6, AT WHICH SEATING ARRANGEMENTS WERE CHANGED

Source of Variation	SS	df	MS	F	
Between Subjects	45,833.72	15			
Seating	20.53	2	10.27		
Subjects within groups	45,863.19	13	3,527.94	--	
Within Subjects	11,019.50	16			
Meeting	1,364.23	1	1,364.23	3.94	$p<.10$
Seating x Meeting	5,151.59	2	2,575.80	7.44	$p<.01$
Meeting x Subjects within groups	4,503.68	13	346.44		

[52] B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Company, 1962), pp. 298-307. In his second edition Winer stressed the need to test data for homogeneity of variance when using repeated measures.

Team Assignments

In view of the studies by Blake and Mouton and Ferguson and Kelley, which described significant biases shown by group members toward their "own" group's product, established patterns of communication and interaction might be expected to change if students were assigned to problem-solving teams and asked to create and present cooperative solutions. In other words, students might be expected to feel loyalty or pride in the solution of their own group, and to be motivated to explain and defend it. Accordingly, as mentioned above (see page 36), in preparation for Meetings 15 and 16, students were assigned to teams and required to cooperate in designing equipment to meet the requirements of the cases under study.

At the beginning of Meeting 13, students had been permitted to select their own seats, and they had remained in those seats for Meeting 14. When team assignments were made, new seating arrangements were also made, in order that team members would be together. Figure 13 below shows seating arrangements for Meetings 13 and 14, and for Meetings 15 and 16. Teams are enclosed in boxes.

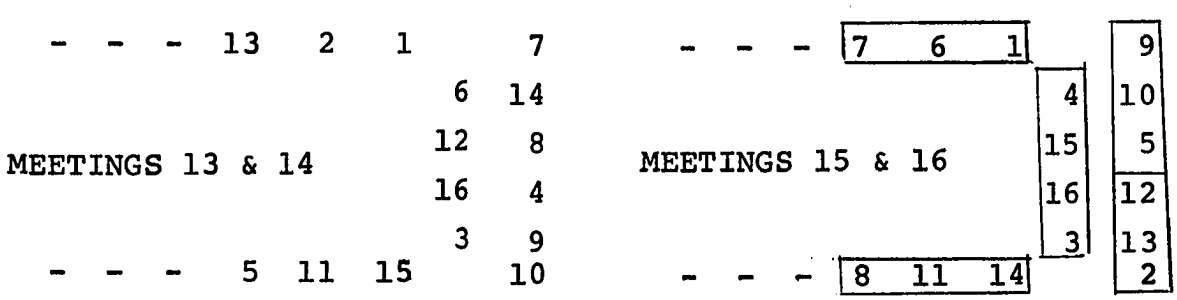

Figure 13. Student Seating Arrangements for Meetings 13 and 14, and Meetings 15 and 16. Teams Are Enclosed in Boxes.

To establish a base for measuring possible effects of these changes on group processes, the amount of each student's initiated interaction for Meetings 13 and 14 was averaged. A student was absent from each of these meetings, and in both cases, an entry was computed by multiplying the student's percentage of participation in the meeting he attended by the total initiated interaction for the meeting he missed. To minimize the influence of uncontrolled factors, students' initiated activity for Meetings 15 and 16 was also averaged. Table 13 in Appendix E preserves groupings according to team assignments and shows students' computed initiated interaction for Meetings 13/14 and 15/16. Again, the number in parentheses beside each identifying number shows the student's ranking based on his total initiated interaction.

To measure the effects of team assignments and concomitant seat changes, a Meeting x Team two factor, repeated measures analysis of variance was computed. Table 14 below presents a summary of these calculations. Only the main effect due to Meetings attained significance.

Discussion

As conceived in this research, intermediate processes can be considered short term system effects. An understanding of intermediate processes would be important to planners and leaders of group discussion, who might on occasion attempt to influence the outcomes of discussion by manipulating factors

TABLE 14

ANALYSIS OF VARIANCE BASED ON TOTAL INITIATED INTERACTION BY STUDENTS IN MEETINGS 13/14 AND 15/16, THE LATTER BEING A COMPOSITE OF TWO MEETINGS FOR WHICH TEAM ASSIGNMENTS WERE MADE

Source of Variation	SS	df	MS	F	
Between Subjects	69,353.87	15			
Teams	20,546.70	4	5,136.68	1.16	
Subjects within groups	48,807.17	11	4,437.02		
Within Subjects	15,716.00	16			
Meetings	7,200.00	1	7,200.00	12.49	$p<.01$
Teams X Meetings	2,175.00	4	543.75	--	
Meeting X Subjects within groups	6,341.00	11	576.45		

that control them. Results of efforts to isolate two such factors were relatively successful.

Examination of the data shown in Table 10 indicates that while all four of the students in Grouping A_1, who were moved to more central positions, increased their initiated activity, three of the four in Grouping A_2, who were moved into end positions, also increased their initiated activity. On the other hand, three of the five students who ranked highest in total initiated interaction for nine meetings, and who remained in relatively central positions, decreased their initiated activity. These mixed responses, and the very slight difference in total interaction initiated in these sessions probably account for the absence of main effects. As

noted above, the interaction, Seating x Meetings, is significant.

Student reaction also supports the conclusion that seating arrangements affect interaction patterns. One student, who had been moved to an end position, remarked after class, "You just wave your hand in the air until it's ready to drop off, before you get a chance to speak." In fact, the record shows he waved his hand so persistently that he nearly doubled the amount of his initiated activity. In addition, when students were allowed to select their own seats at the beginning of Meeting 13, they avoided seats at the open ends, and chose instead seats on the second tier at the closed end of the horseshoe (see Figure 13). Moreover, except when professors specified seating arrangements to suit their purposes, no student sat in the seats at the open ends for the rest of the Institute.

Examination of the data in Table 12 discloses the most obvious result of team assignments to have been an increase in total initiated interaction, which is reflected in a significant main effect due to Meetings. Net increases in total initiated activity by teams ranged from 187 to 47, but the Team main effect is not significant. Absence of an interaction effect was unexpected and remains unexplained, unless it is an artifact of the strength of the Meeting effect.

Differences in individual participation ranged from an increase of 127 to a decrease of five. However, there appears

to have been a slightly better spread of participation among students in Meeting 15/16. The ratio of total activity initiated by the eight least active students compared to the eight most active students was .475 in Meeting 13/14 and .522 in Meeting 15/16; the ratio of interaction received by the eight least active students compared to the eight most active students was .413 for Meeting 13/14 and .478 for Meeting 15/16. There was also a significant increase in the number of directed, two-person communication, both during Meetings 15 and 16, and in subsequent meetings (see pages 93-94 and Table 18 following).

CHAPTER V

INDIVIDUAL RESPONSES

The effects described under system effects and intermediate processes are, of course, based upon individual behavior which is grouped and measured according to some unifying principle. The underlying assumption is that any group of subjects would react in a roughly similar manner to the same situation, with its concomitant constraints to solve the problem and to maintain the group, provided only that they had been raised in this culture. Although the present chapter deals with individual responses, the underlying assumption that situation and role constrain behavior remains. In other words, the focus is not on Student 7, for example, but on 'most active communicator' or 'clique member.'

Communication Patterns

Bales and his students described increasing differentiation between the highest and second highest members in amount of initiated interaction, and between the second highest member and the rest of the group, as group size increased to eight. On the other hand, the work of Hare and Miller suggests the likelihood of clique formation in larger

groups. If cliques formed in this sixteen-member class, such formation might be expected to inhibit the sharp differentiation in total activity and the centralization of communication in two or three persons that Bales reported. Figure 14 following displays the information from Table 5 in Appendix C in graphic form. As the table suggests, and as the graph shows clearly, there was no sharp break in total initiated activity between highest and second highest, or between second highest and the rest of the class. On the other hand, there were differences in amounts of initiated communication.

To obtain a quantitative measure of the extent of these apparent differences, students were arbitrarily divided into three groupings on the basis of their total interaction for nine meetings: the five most active students; the six students intermediate in activity; and the five least active students. Table 15 in Appendix F gives groupings, individual totals, and means for each grouping. One-tailed t-tests were used to compare means of adjacent groupings.[53] The results of these calculations appear below.

	t	p
Most Active v Intermediate	4.57	< .01
Intermediate v Least Active	5.00	< .01

Thus analysis confirms that there were significant differences in amounts of initiated activity between groupings of students

[53]Walker and Lev, Statistical Inference, pp. 155-157.

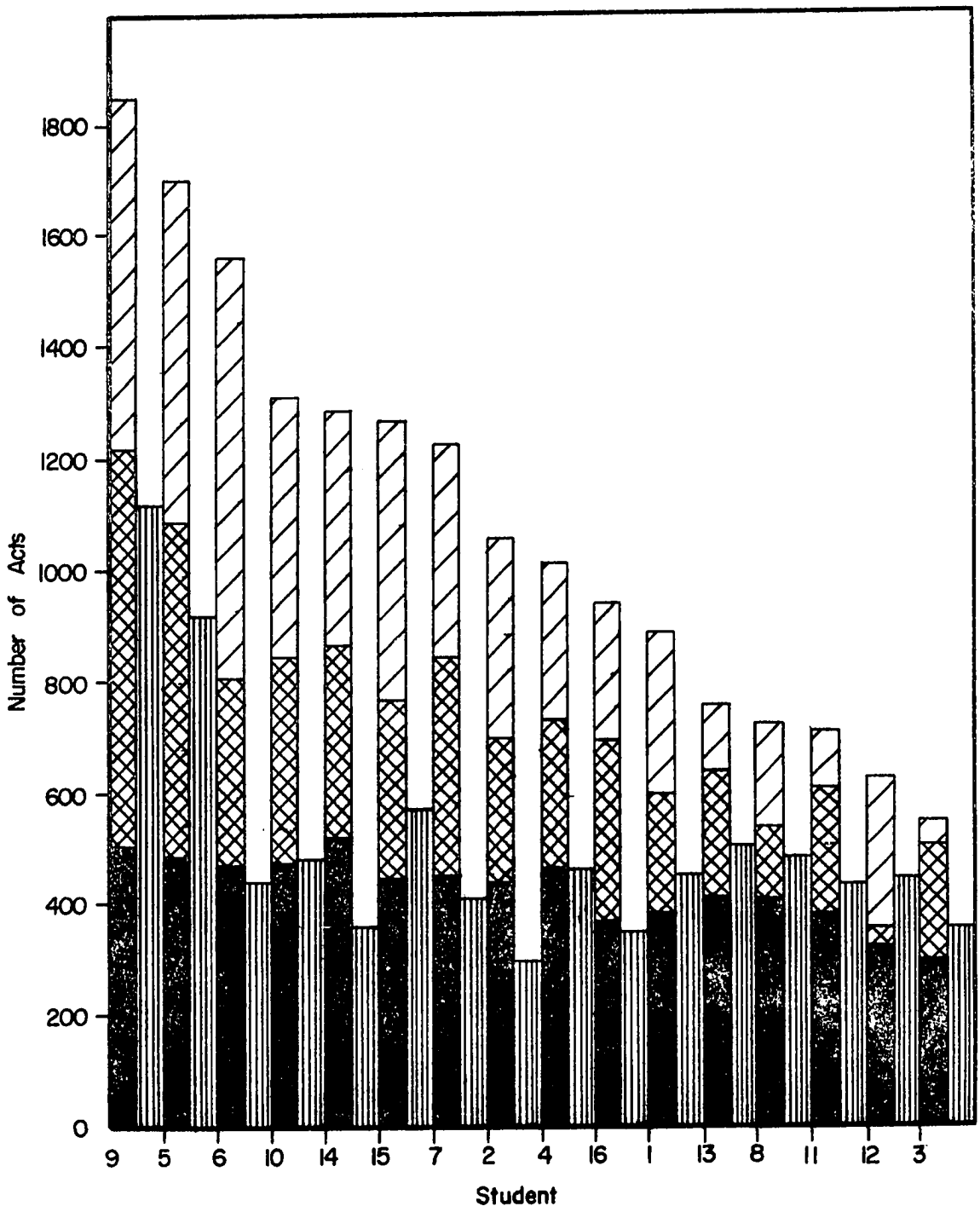

Figure 14. Total number of acts initiated by each student during nine meetings of the seminar, divided into acts addressed to the group as a whole (▓), acts addressed to the professor (▒), and acts addressed to other students (▒). Adjacent column shows interaction received by each student (▒).

in this seminar, although there was no sharp break in amounts of initiated interaction between individual students.

Bales also reported that most active students address more of their communication to the group as a whole, and that they receive more interaction from other group members. The same groupings and the same statistical procedures were used to test these expectations. Table 15 also gives students' communication addressed to the group and received from the group, as well as means for groupings. The outcome of these calculations is shown below.

	t	p
For Communication Addressed To Group:		
Most Active v Intermediate	3.23	< .01
Intermediate v Least Active	2.26	.025
For Communication Received From Group:		
Most Active v Intermediate	1.65	< .10
Intermediate v Least Active	< 1	

Thus the data for this seminar confirm the expectation that the most active students address more communication to the group as a whole than intermediate students, and intermediate students, more than least active students. But the data do not confirm the expectation that the most active students receive more communication from other group members than intermediate students, and intermediate students, more than least active students.

To investigate the reported systematic differences in amounts of interaction in various categories by students according to their basic initiating ranking, selections were made at random of three students from each of the three groupings based on total initiated activity, and of one meeting each from early, intermediate and late meetings in the course of the Institute. Table 16 in Appendix F shows the initiated interaction by these students during these meetings under Positive reactions, Attempted answers, Questions, and Negative reactions. A three factor, Grouping x Meeting x Category, repeated measures analysis of variance was calculated. A summary of the results appears below as Table 17. Analysis of selected data from this seminar shows all three main effects to be significant. That the main effect due to Grouping is significant reinforces the results of t-tests reported above. That the main effect due to Meeting is significant underscores the importance of differences in formal leadership and group task, which were the major uncontrolled variables in this study and the most obvious dimensions in which sessions differed. That the main effect due to Category is significant confirms the relevance of the interaction profile to understanding group processes.

Equally interesting are the interaction effects. The significant Category x Grouping interaction provides general support for the finding in previous research that profiles for active participants differ from profiles for less active

TABLE 17

ANALYSIS OF VARIANCE BASED ON INTERACTION BY NINE SELECTED STUDENTS DURING THREE SELECTED MEETINGS, CATEGORIZED AS POSITIVE AND NEGATIVE REACTIONS, ATTEMPTED ANSWERS, AND QUESTIONS

Source of Variation	SS	df	MS	F
Between Subjects	7,224.52	8		
Grouping	6,089.41	2	3,044.71	16.09*
Subjects within groups	1,135.11	6	189.19	
Within Subjects	57,726.25	99		
Meeting	5,960.24	2	2,980.12	20.81*
Meeting x Grouping	915.70	4	228.92	1.60
Meeting x Subjects within groups	1,718.56	12	143.21	
Category	27,802.55	3	9,267.51	52.55*
Category x Grouping	6,042.59	6	1,007.10	5.71*
Category x Subjects within groups	3,174.44	18	176.36	
Meeting x Category	6,128.65	6	1,021.44	7.38*
Meeting x Category x Grouping	1,002.96	12	82.58	< 1
Meeting x Category x Subjects within groups	4,980.56	36	138.39	

*Associated probability less than .01.

participants. The significant Meeting x Category interaction again points to the importance of formal leadership and group task. The lack of a significant Meeting x Grouping interaction lends indirect support to previous work that disclosed underlying consistency in individual behavior: Despite the significant main effect due to Meeting, the most active students continued to be most active, and the less active

students, to be less active. The most obvious explanation for the insignificant Meeting x Category x Grouping interaction seems to be that these factors have conflicting effects. In other words, the tendency of students toward consistency of performance counteracts tendencies toward variability in performance due to Category and Meeting.

With regard to use of available person-to-person channels, the decrease reported by Castore seems to be a direct function of size, and it might be anticipated that this student seminar would use less than twenty percent of available channels. To test this expectation, the protocols were reexamined to determine the number of direct, personal contacts established during each meeting, applying Castore's definition.

> To be recorded as a directed response, the response should possess one of the following four qualities: mention of the recipient's name; mention of a second person singular "you" in such a way that there is no doubt about the referent; a complete sentence answer to another person's question which was directed to the subsequent speaker; and looking directly at the person with whom he is speaking. The implication here is that only one person among those present can be identified as capable of meeting the needs of the speaker at that moment.
>
> There are also some qualities which definitely exclude remarks from being recorded as directed ones. These are simple Yes-No answers or answers which are incomplete or incoherent sentences. A response which elaborates on the response of another but is not directed to anyone particularly as well as a broadcasting response which is said to the group as a whole or for anyone who chooses to be concerned, likewise is not credited. Where there is the slightest doubt as to whether or not a response is directed to a specific person, the response should

> not be tabulated. The type of response that may be described as "thinking aloud" most often is undirected.[54]

Then the percentage of one-to-one channels used in each session was computed. For meetings in which all students were present, 272 channels were available, and the critical value (twenty percent of 272) is 54. For meetings in which a student was absent, 249 channels were available, and 49 is the critical value. Table 18 in Appendix F shows the number, and calculated percentage, of available channels used during each of twelve meetings.

No statistical test is needed to evaluate this result. Inspection discloses the smallest obtained percentage to be 21.3, and the largest, 39.7 Clearly this student group differed radically from the therapy groups Castore observed in the number of direct, two-person channels used.

Clique Influences

Despite the fact that the professors actively directed group interaction in the task area, the consistently observed relationship between high rate of activity and recognition for leadership might well pertain to this class, and clique leaders might be expected to be in the most active grouping, and isolates either in the most active or least active grouping.

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[54]Castore, Journal of Abnormal and Social Psychology, LXIV (1962), 457.

To identify cliques, a who-to-whom matrix was constructed from students' sociometric responses. Only reciprocated choices, and only first and second choices were entered. Rotation was performed manually, and continued until a maximum number of entries appeared along the diagonal. Negative nominations were used for guidance as to the outer boundaries of the cliques. Although answers to the questionnaires regarding out-of-class activities proved to be rather sketchy, in general they confirmed that students identified as belonging to cliques did interact socially. When cliques were identified, the student in each group having the most "Like very much" nominations from members, or in case of tie, the most "Like very much" and "Like" nominations from non-members, was designated leader.

The final sociometric matrix appears in Table 19 in Appendix F. In addition, Figures 15 and 16 following present "Like" and "Dislike" sociograms. Both the matrix and the sociograms indicate the class included two very well liked and over-chosen individuals. The most economical interpretation of the data appears to be that one of these popular students was the center for two cliques, while the other was leader of one, with a minimal overlap of membership. The following cliques were identified.

6	10*	16	15	8	1*
10*	12	4*	7	5*	3
	13	15	14*	2	
			8		

*Leader

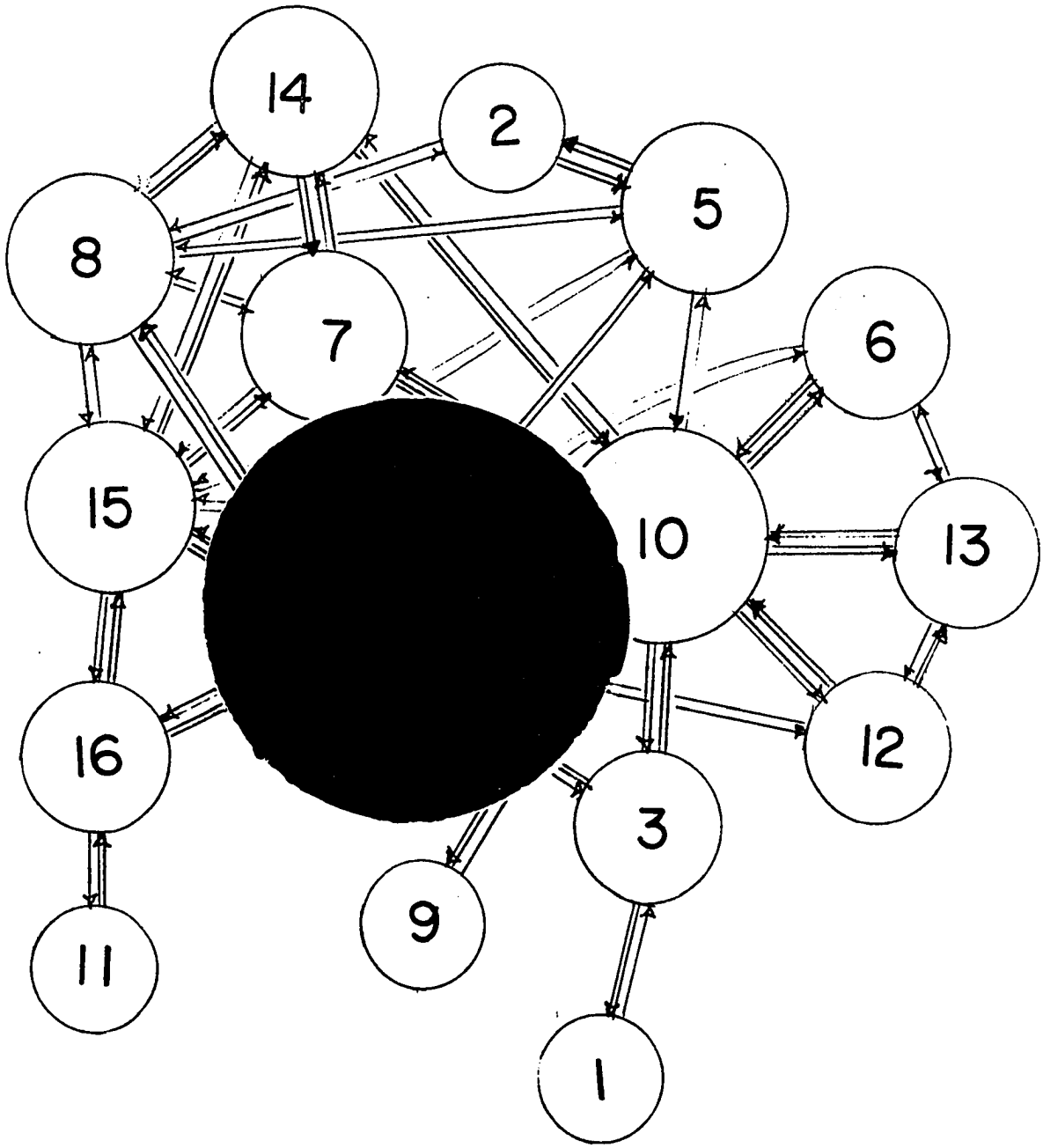

Figure 15. Sociogram Showing "Like Very Much" (Double Line Arrows) and "Like" (Single Line Arrows) Choices among Students.

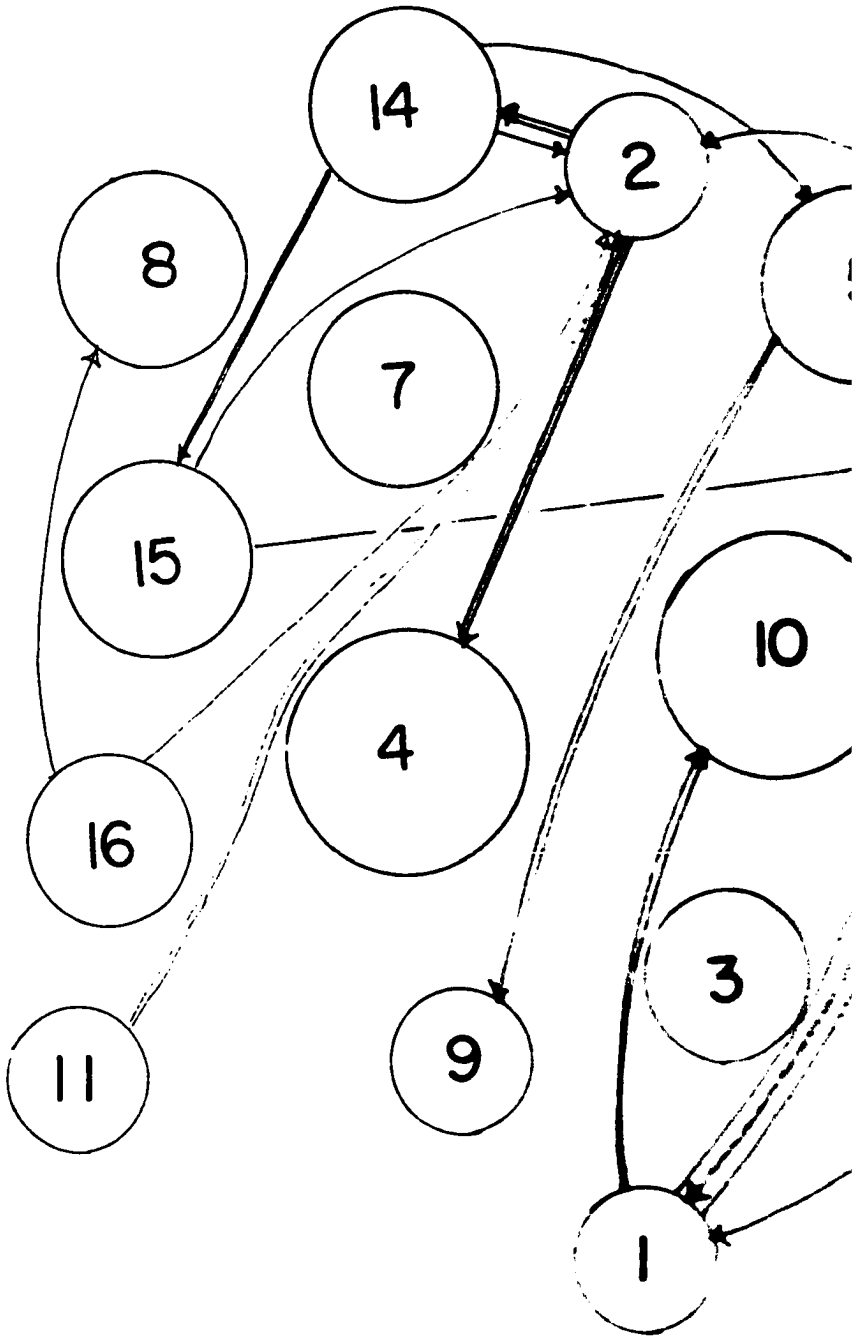

Figure 16. Sociogram Showing "Dislike" (Si
and "Dislike Heartily" (Double
Choices among Students.

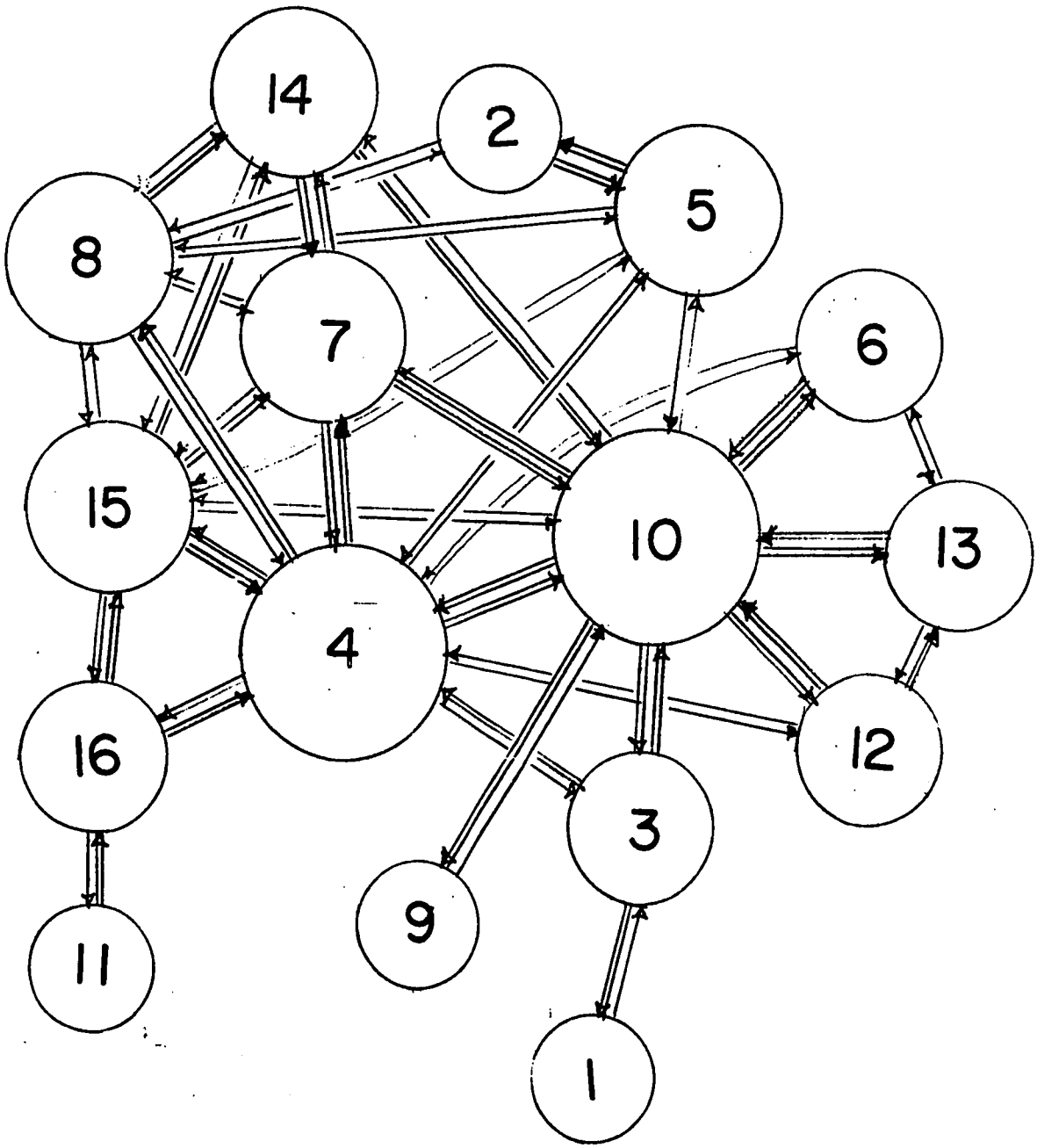

Figure 15. Sociogram Showing "Like Very Much" (Double Line Arrows) and "Like" (Single Line Arrows) Choices among Students.

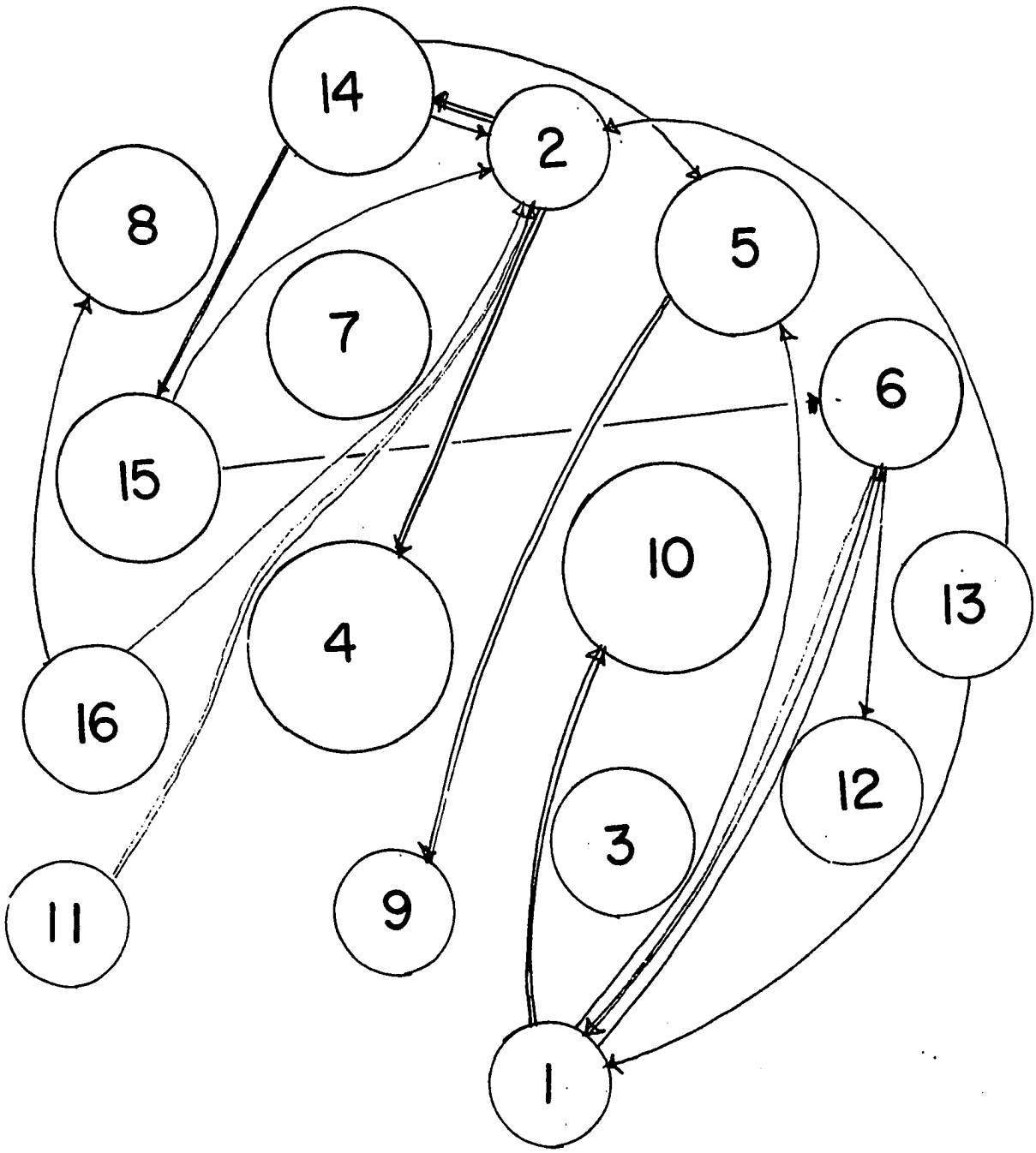

Figure 16. Sociogram Showing "Dislike" (Single Line Arrows) and "Dislike Heartily" (Double Line Arrows) Choices among Students.

Students 9 and 11 seem to have been isolates.

On the basis of theoretical considerations, and cliques and clique leaders as identified, the expected pattern, as well as the obtained pattern, is shown below.

	Most Active	Intermediate	Least Active
Expected	Leader Leader Leader Leader OR Isolate Leader OR Isolate	Leader OR Member Leader OR Member Member Member Member Member	Isolate OR Member Isolate OR Member Member Member Member
Obtained	Leader Leader Leader Isolate Member	Leader Leader Member Member Member Member	Isolate Member Member Member Member

Applying combinatorial analysis to these findings yields probabilities of .138 for having three clique leaders in the most active grouping, and 0.76 for having one clique member in the most active grouping.[55] The two isolates filled expected positions, but no probability was computed. Thus analysis of the data for this student seminar reveals no direct or simple relationship between initiated activity in class discussion and informal leadership.

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[55] H. M. Walker, Mathematics Essential for Elementary Statistics (rev. ed.; New York: Holt, Rinehart and Winston, 1951), pp. 250-260.

By definition clique membership entails in-group/out-group awareness. However, since professors carried the burden of directing task-related activity, emergent informal leadership might be expected to be more akin to Talland's unidimensional pattern than to Bales' dual pattern. To test this expectation rankings of all class members by all other class members in quality of ideas, of social facilitation, and of overall leadership were entered into the sociometric matrix. Then mean rankings of clique members by all own-clique members (in-group), as well as mean rankings by all non-members (out-group) were computed for all three criteria. Table 20 in Appendix F gives the results of the computations.

The sign test was used to test the expectation that within their cliques, leaders rank highest for the quality of their ideas, their social facilitation, and their overall leadership ability. There were six cliques, and the computation was based on six leaders, although only five persons were involved because one student held the central role in two cliques. Of the seventeen comparisons (there was one tie), thirteen are in the predicted direction. The sign test yields a z of 1.90 ($p = .0287$). Thus the data suggests that leadership in this seminar was unidimensional, rather than dual.

Another facet of in-group/out-group awareness is a tendency for clique members to rank themselves high on relevant criteria. Data given in Table 20 were used to test the

expectation that clique members rank themselves higher than the rest of the class ranked them for the quality of their ideas, their social facilitation, and their overall leadership ability. Although the two isolates are included in the table (entries under "in-group" are their rankings of themselves), analysis was confined to the fourteen class members identified as belonging to cliques. Of the forty-two comparisons, thirty-three are in the expected direction. The sign test yields a z of 3.54 ($p < .0003$). Thus the data confirm that for students in this seminar, clique membership entailed mutual high rankings on three leadership criteria.

Discussion

As mentioned above, the extreme differentiation in amounts of communication between the first and second, and between the second and third most active participants, which Bales inferred to be a function of increased group size (see page 25), did not occur in this student seminar. Probably a major factor was the situation itself. It was a formal classroom situation, and although the student sessions were called seminars, the professors ranked first in amount of initiated interaction in ten of the twelve meetings, and second in the remaining two. As formal leaders they exercised active control. And as experienced teachers, this undoubtedly means that they consciously attempted to equalize student participation. It seems plausible, however, that clique formation

also contributed to an equalizing of participation among the students, since three clique leaders were in the most active grouping.

As explained above, the test of the expectation that most active students address more communication to the group than students in other groupings was based on the total number of acts each student addressed to the group. Examination of the individualized who-to-whom Matrix (Table 5) and of Figure 14, however, suggested that this finding might be an artifact of the greater total interaction of these students. Accordingly, the percentage of his own total interaction that each student addressed to the group was computed. Table 21 below retains groupings based on total activity and gives these figures.

Applying a one-tailed t-test to these means gave the following results:

	t	p
Most Active v Intermediate	-2.75	< .025 > .01
Intermediate v Least Active	-4.80	< .0005

Thus, when each student acts as his own control, the data clearly disclose a significant reciprocal relationship between the amount of total activity by individual students and the amount of interaction they address to the group as a whole. For this class the least active members addressed a greater percentage of activity to the group as a whole than did intermediate students, and intermediate students addressed a larger

TABLE 21

RATIO OF COMMUNICATION TO GROUP OVER TOTAL INITIATED COMMUNICATION FOR EACH STUDENT, BASED ON TOTALS FOR NINE SESSIONS, PLUS MEANS FOR GROUPINGS

Student	Communication to group/Total	Mean
Most Active Grouping		
9	27	
5	28	
6	30	
10	35	
14	42	32
Intermediate Grouping		
15	36	
7	37	
2	41	
4	46	
16	39	
1	44	41
Least Active Grouping		
13	53	
8	55	
11	48	
12	56	
3	55	53

percentage of their communication to the group as a whole than did the most active students. This is a most unexpected outcome for which the writer offers no explanation.

It seemed possible that the results concerning communication received from other class members might become more clear if a similar procedure were applied. Therefore, each student's R/I, or feedback ratio (see pages 15-16) was computed. Table 22 below shows the percentage of total interaction during nine sessions each student received from other

TABLE 22

PERCENTAGE OF TOTAL INTERACTION RECEIVED, RANKING BASED THEREON, RATIO OF COMMUNICATION RECEIVED OVER TOTAL INITIATED COMMUNICATION, AND RANKING BASED THEREON FOR EACH STUDENT, FROM TOTALS FOR NINE MEETINGS

Student	Communication Percent FROM Group	Ranking	Communication Received/Initiated	Ranking
9	8.5	(1)	60	(5)
5	7.2	(2)	57	(7)
6	3.2	(10)	27	(16)
10	3.5	(8)	35	(12)
14	2.8	(13)	29	(15)
15	4.4	(4)	46	(10)
7	3.0	(12)	33	(13)
2	2.3	(16)	29	(14)
4	3.6	(6.5)	47	(9)
16	2.6	(15)	37	(11)
1	4.7	(3)	51	(8)
13	4.0	(5)	65	(3)
8	3.6	(6.5)	66	(2)
11	3.2	(10)	59	(6)
12	3.2	(10)	69	(1)
3	2.7	(14)	64	(4)

group members, a ranking based on this percentage, his ratio of communication received over communication initiated, and a ranking based on this ratio. Students are listed in the same order, from most to least active, that has been used for other analyses in this chapter.

The mean feedback ratio for the five most active students is 42, for the six intermediate students, 41, and for the five least active students, 65. Computation reveals that

there is no difference between ratios for the most active and intermediate groupings, but that the difference between mean feedback ratios for intermediate and least active groupings is significant ($t = 5.71$; $p < .0005$).

This finding is also unexpected, because it seems to contradict Bales' results. Bales found that the most active students, who also had high feedback ratios, were well liked. Yet the student in the most active grouping who was one of the two most popular members of the class has a feedback ratio of only 35. And the other over-chosen student, who appears in the intermediate grouping, has a feedback ratio of 46. The mean feedback ratio for the five clique leaders is 44.

Turning to another aspect of communication patterns, the most obvious explanation for the unexpectedly large number of two-person communication channels used during these student sessions is, again, the guidance of the professors. There also appears to have been an increase in amount of directed communication after Meetings 15 and 16. Although role playing assignments which required groups of students to take a common point of view during the ongoing discussion were used by several professors, team assignments which required groups of students to create and present a common solution were used only during these meetings. The mean percentage of available two-person channels used during the five meetings prior to Meetings 15 and 16 is 26.0. The mean percentage of channels used during these two sessions was 37.2. The mean percentage

of channels used during the following five meetings was 33.6. The unusually high percentage of directed communication that occurred during Meetings 15 and 16 is probably an artifact of IPA scoring, but the before-and-after difference seemed highly suggestive. To assess the strength of the difference, a one-tailed t-test was used. The calculation gives a t of 2.00 ($p < .05$). For this student seminar the conclusion seems warranted that effects of group size in curtailing the amount of two-party interaction can be overcome by strong leadership, and by arrangements that permit--or require--cooperation and competition among members.

Regarding the attempt to identify some effects of clique membership on communication patterns within class discussions, although lacking statistical significance, the outcome appears to be a good first try. Analyses which take into account qualitative differences in interaction, in addition to quantitative differences, might prove fruitful.

CHAPTER VI

EVALUATION

The Present Study

Strictly speaking, the observations reported in this study, and the conclusions based on these observations, apply only to the interaction among participants in the student seminar at the Summer Institute on Case Methods in Engineering held at Stanford University during August and September, 1967, and could not be replicated in exact detail, even if the same individuals were assembled for another Institute. However, in view (1) of the strong support for the basic paradigm of the interaction profile--one person acts and another person reacts--and the regularities in participant behavior disclosed in the individualized who-to-whom matrix, and (2) of the fundamental differences in realness, size, and duration between this student seminar and the groups from which these measures were developed, there seems to be justification for assuming that these system effects pertain widely to human interaction and communication in groups.

The same arguments can be extended to the behavior of individual participants: Although their actions seem to have

been strongly influenced by the situation and their expectations regarding it, much of this same behavior conformed to expected patterns of intragroup activity.

It seems appropriate to mention that the presence and influence of a formal leader was probably not atypical. Experience and observation, although admittedly non-systematic, strongly suggest that a recognized leader--whether supported by status and role relationships from inside the group or by power relationships from outside the group--is necessary in a group as large as seventeen members. A leader seems essential, first, to provide a focal point and prevent participants from fragmenting into many smaller groups, and second, to control participation and enable the group to accomplish its purpose.

Nor does the strong influence of the situation--in this case, the fact that group members were enrolled (or teaching) in a credit-bearing course--appear to be exceptional. Studies of natural groups have consistently appealed to forces outside the group to explain interaction within it.[56] In addition, a major thrust of the findings regarding experimenter influence in laboratory studies is that subjects respond in

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[56]See e.g., W. F. Whyte, Street Corner Society (Chicago: University of Chicago Press, 1943); G. C. Homans, Social Behavior: Its Elementary Forms (New York: Harcourt, Brace & World, Inc., 1961); M. Sherif and C. W. Sherif, Reference Groups: Exploration into Conformity and Deviation of Adolescents (New York: Harper and Row, Publishers, 1964).

ways they believe the experimenter expects or approves, that is to say, they respond in terms of the larger social system (see footnotes 31 and 32).

For the most part, the observations and conclusions in this study assumed and support a "quasi-mechanical" model of human groups.[57] But this is only part of the story. The differences between meetings, and the variability in individual behavior are equally evident, and the overall order provides a baseline from which to observe and measure these differences and variabilities. This overall order also provides some basis for expecting that these differences and variabilities are amenable to explanation and--in some degree--to control.

Finally, since IPA yields only nominal and interval data, and since this study is based on observations of only one functioning group, there were severe restrictions on the kinds of statistical test that could be appropriately used. However, conclusions based on possible future research using instruments with interval, or even ratio, scales and sophisticated statistical analyses, will be no stronger than those data which provide empirical support for the idea that there is basic order in intragroup processes.

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[57] See, for example, T. M. Mills, The Sociology of Small Groups (Englewood Cliffs, 1967), pp. 10-24, for a discussion of models used at present to guide small group research.

Future Research

In the opinion of the writer it was necessary to establish the existence of underlying regularity in interaction within a large, natural group in order to have a foundation for studying differences in group processes and individual behavior. This was an exploratory study and it has raised more questions that it has answered. It has also disclosed a most pressing methodological problem.

As explained previously, it is not possible to observe and categorize interaction as it occurs in a seventeen-member group. As a matter of fact, it is the writer's opinion that eight-man groups represent the outer limit for simultaneous scoring under IPA--and this is the largest group size for which normative data are available. But the time and work required to transcribe, unitize and categorize recordings and observers' logs for a seventeen-member group, and then tabulate the scores are forbidding. On the other hand, it would not be too difficult to perform these operations for, say, ten minutes of a sixty-minute session. Determination of the best sampling method then becomes a matter of comparing outcomes from different methods with the results obtained from observing and scoring whole meetings. Would twenty half-minute segments provide the best fit? Ten one-minute segments? Six hundred-second segments? Should the time segments be selected at random from the entire meeting? At random from each half, or each third of the meeting? Or would a fixed schedule of

observations yield the best fit? Since many natural information-sharing and decision-making groups are larger than eight members, and since the importance of realness becomes greater as more searching questions are asked regarding individual responses, a resolution of this methodological problem seems essential for future meaningful research into the intra-group processes of large, natural groups.

Assuming a satisfactory solution to this methodological difficulty, the first order of business would seem to be to confirm the findings of this research with regard to the interaction profile and the who-to-whom matrix for other seventeen-member groups. Given such confirmation, other questions immediately occur: What is the upper limit as to the size of gatherings of people in which these system effects pertain? Is this size limit a fixed value? Or is it influenced by other factors such as leadership quality, task requirements, membership involvement?

The results of this study suggest that phase movements are extremely sensitive to task requirements and to a group's previous interaction. Considering only tasks in which ideas are manipulated, is it possible to invent a typology of discussion topics that will permit prediction as to phase movements? Three dimensions that seem to merit investigation on the basis of this research are problem type--new problem, recurring problem, old problem; discussion purpose--information-sharing or decision-making; and time available.

In dealing with real groups, power appears to be an essential dimension. The influence (power) of leaders whose position is supported by roles and statuses within the group has been investigated (see footnote 56), but the influence (power) of leaders whose position is supported by outside forces, by the relationship of the group to the larger social situation, has proved to be elusive. In view of the strong egalitarian value in our culture, such power would seldom be used directly in a discussion situation. Yet it seems intuitively necessary that such formal power affect group interaction. Can manifestations of power in a discussion group be isolated, measured--and controlled?

With regard to intermediate processes, one question immediately arises: What factor (or factors) operated in this student seminar to counteract the effects of seat changes other investigators have reported? In view of the response of one student cited above, personality appears to be one such factor: A participant with enough determination can overcome the disadvantage of a peripheral location.

As to team assignments, this study is apparently the first attempt to apply or extend research findings regarding members' partiality to their own group's products. And since team assignments strongly influenced subsequent interaction within the group, a replication of this phase of this study would be highly desirable.

Another dimension of interpersonal behavior that can be considered under intermediate processes or under individual responses is the emergence of informal structure. Bales used the word "crisis" to describe the struggle for leadership that occurred in his laboratory groups. No such crisis was observed in the student seminar. As mentioned, it is possible that this crisis occurred in meetings at which data were not collected. But it is also possible that it occurred in interaction among members outside the formal classroom situation. Since members of all natural groups presumably interact frequently outside formal meetings--and therefore in the absence of formal leadership--an important research question becomes, Can the effects of informal leadership be detected in a formal discussion situation?

The attempt in this research to relate clique leadership to high rate of interaction was a first cut at answering this question. In view of the negative outcome, other questions invite investigation: Do clique leaders differ in kinds of interaction they initiate and receive? Do they initiate a greater amount of positive affective interaction? Do they communicate more frequently in areas of evaluation and control? Are questions more often directed to them? Do they arouse a greater amount of negative affect? Do the kinds of communication initiated and received by clique leaders differ from the kinds of interaction by high participators who are not clique leaders?

What is the meaning of the findings in this study with regard to feedback ratio and the amount of communication addressed to the group? As mentioned, the disparity regarding communication addressed to the group may be an artifact of the method of calculation. But the discrepancy regarding feedback ratio seems real. One possibility seems to be that interaction in an initially leaderless laboratory group more nearly resembles informal communication than does interaction in a classroom in the presence of a formal leader, and that Bales' results relate to informal situations only. If this be so, did recognition of the power of the professor and of the relation between high participation and high grades permit (encourage?) behavior that would not be acceptable in less formal interaction?

Other questions about leadership remain to be answered: Is the writer's hunch that groups as large as this student seminar must have a recognized leader sound? If so, what is the upper size limit for a group to function without a formally recognized leader?

In many instances researchers infer the identity of leaders from their subjects' answers to explicit sociometric questions--as in this study, or from their observations of ongoing interaction. Yet other studies reveal that members of natural groups insist that their groups have no leaders,

that everyone is equal.[58] Some apparently unasked questions are, Would members of natural groups accept the investigator's analysis of the structure of their groups? Would knowledge of the investigator's conclusions affect members' perception of their groups?

Returning to issues raised by this research, professors were treated as one composite individual, but in fact, they differed markedly in the amount of their interaction. Did they also differ in the kinds of interaction they initiated? Assuming such differences, would IPA data permit identification of leadership styles analogous to the classical descriptions of Lippitt and his associates?[59] Again assuming such differences, what effects, if any, did differences in professors' style have on participants' positive and/or negative affective responses? On task-related communication? Were various categories of students affected differently by the leader's communication? How much of the professor's communication concerned procedural matters? Was this amount relatively stable among professors?

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[58] D. C. Dunphy, "The Social Structure of Urban Adolescent Peer Groups," Sociometry XXVI (1963), pp. 230-246.

[59] R. Lippitt and R. K. White, "An Experimental Study of Leadership and Group Life," in Readings in Social Psychology, ed. by E. E. Maccoby, T. M. Newcomb, and E. L. Hartley (3rd ed.; New York: Holt, Rinehart and Winston, 1958), pp. 496-511.

The spread of participation, as reflected in the individualized who-to-whom matrix, differed from meeting to meeting (see page 52 and Table 5). Was this a function of subject matter? Of leadership style? Or of factors extraneous to the classroom interaction? Students also differed in the number of direct, one-to-one interaction they initiated, as well as the number they received. In part this is probably a function of the amount of activity initiated, but that seems not to be the complete explanation. Were the differences due to some interaction between amount and kind of initiated interaction and feedback ratio? Or must personality factors be considered?

Some of these questions could be answered with the data in hand, and the answers used as the basis for formulating sharper questions and predictions for research with other large, natural groups. Others would require different methods, different measures. All invite further research.

APPENDIX A

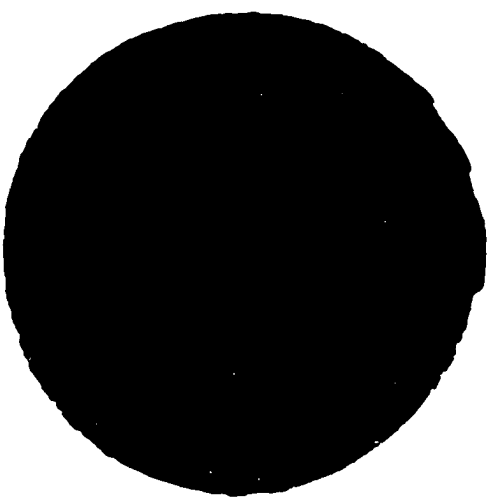
A LISTING OF STUDENT SEMINAR SESSIONS

The spread of participation, as reflected in the individualized who-to-whom matrix, differed from meeting to meeting (see page 52 and Table 5). Was this a function of subject matter? Of leadership style? Or of factors extraneous to the classroom interaction? Students also differed in the number of direct, one-to-one interaction they initiated, as well as the number they received. In part this is probably a function of the amount of activity initiated, but that seems not to be the complete explanation. Were the differences due to some interaction between amount and kind of initiated interaction and feedback ratio? Or must personality factors be considered?

Some of these questions could be answered with the data in hand, and the answers used as the basis for formulating sharper questions and predictions for research with other large, natural groups. Others would require different methods, different measures. All invite further research.

APPENDIX A

A LISTING OF STUDENT SEMINAR SESSIONS



Meeting	(Tape)	Case	Remarks
1		Vitar Electronics	Students selected seats, signed seating chart Used for training observers
2		Thermal Dynamics	Used for training observers
3		Hewlett-Packard Inc.	Used for training observers
4	(1)	Simular, Inc.	Collected data Relevant to questions re system effects and intermediate processes
5	(2)	Philco II	Collected data Relevant to questions re system effects and intermediate processes
6	(3)	American Tractor Equipment Corp.	Assigned students different seats Collected data Relevant to questions re system effects and intermediate processes
7		Lab Equipment Co.	Collected no data
8		Gar Wood Company	Collected no data
9		John Laub	Collected no data
10		Task Corporation (A)	Collected no data
11		Task Corp. (B, C)	Collected no usable data
12		Oil Well Stripper	Collected no usable data
13		U.S. Bureau of Reclamation	Students selected own seats Student #12 absent Collected data Relevant to questions re system effects and intermediate processes

Meeting	(Tape)	Case	Remarks
14	(5)	Task Corp, (D, E)	Student #1 absent Collected data Relevant to questions re system effects and intermediate processes
15	(6)	Radonics, Inc. (A)	Teams & seats assigned prior to class meeting Collected data Relevant to questions re system effects and intermediate processes
16	(7)	FMC Corporation (A)	Teams & seats assigned prior to class meeting Collected data Relevant to questions re intermediate processes
17	(8)	Radonics, Inc. (B,C)	Students selected own seats Collected data
18	(9)	Data International II	Collected data
19	(10)	IBM Corporation (A)	Collected data
20	(11)	FMC Corp. (B,C)	Collected data
21	(12)	IBM Corporation (B)	Collected data
22	(13)	Data International III	Collected data
23	(14)	FMC Corp. (D, E)	Collected data
24		IBM Corp. (C, D)	Collected no usable data
25	(15)	Hendrik Van Ark	Role playing during class Individual reports assigned after class Collected data Relevant to questions re system effects

Meeting	(Tape)	Case	Remarks
26	(16)	Art Whiting	Collected data Relevant to questions re system effects
27	(17)	Bob Knowlton	Role playing during class Seats assigned during class Collected data Relevant to questions re system effects
28	(18)	Oxford Prothrometer	Role playing during class Seats assigned during class Collected data Relevant to questions re system effects
29	(19)	FMC Corporation	Student #9 absent Collected data
30	(20)	General Electric Company (A,B,C,D)	Student #9 absent Written team reports assigned Collected data
31	(21)	Travaglio Engineering Company	Student #9 absent Collected data Relevant to questions re system effects

APPENDIX B

SOCIOMETRIC QUESTIONNAIRES

PART I

Page 1.

Below is a list of student participants in the Stanford Case Studies Institute.

(Students listed by last name down the page in a randomized order)

Page 2.

Some people have better ideas than others--ideas that suggest new solutions or questions that lead the group to new understanding. Please rank the participants from 1 (He has produced the most good ideas) to 16 (He has produced the fewest good ideas). Include yourself.

1. _____	9. _____
.	.
.	.
.	.
8. _____	16. _____

Some people say and do things in a seminar that somehow makes the discussion move more effectively and easily. Please rank the participants from 1 (He has done this most and best) to 16 (He has done this least). Include yourself.

1. _____	9. _____
.	.
.	.
.	.
8. _____	16. _____

Page 3.

Considering all sessions and discussions, which members functioned most definitely as leader? Please rank the participants, including yourself, from 1 (He has functioned most often and most effectively as leader) to 16 (He has seldom or never functioned as leader).

1. _____	9. _____
.	.
.	.
.	.
8. _____	16. _____

Page 4.

People inevitably form opinions of others with whom they interact. Please rate each of the participants on a scale from +3 (I like him very much) through 0 (I feel perfectly neutral toward him) to -3 (I dislike him heartily).

(Students listed by last name down the page in the same randomized order as on Page 1.)

Name _____

PART II

Page 5.

I am sure you've engated in a variety of activities and that you've met other members of this Institute throughout the day. Please report briefly your activities and your companions (if they are also members of this Institute) for the following days.

Monday, September 4 (Labor Day)	Wednesday, September 6
7 AM	7 AM
.	.
.	.
.	.
10 PM	10 PM

Page 6.

Thursday, September 7	Saturday, September 9
7 AM	7 AM
.	.
.	.
.	.
10 PM	10 PM

APPENDIX C

TABLES OF OBSERVED DATA FOR SYSTEM EFFECTS

TABLE 1

OBSERVED INTERACTION PROFILES FOR TWELVE MEETINGS OF THE STUDENT SEMINAR PLUS TOTALS FOR EACH CATEGORY AND PERCENTAGES BASED ON THE TOTALS

MEETING	4	5	6	13	14	15	16	25	26	27	28	31	Total	%
CATEGORY														
A. Social-Emotional Area: Positive														
1. Shows solidarity	15	3	10	21	5	17	32	14	12	20	30	9	188	0.7
2. Shows tention release	409	186	307	204	116	633	436	237	258	1214	433	158	4591	16.4
3. Agrees	136	124	129	233	128	86	216	124	172	145	171	201	1865	6.7
B. Task Area: Attempted Answers														
4. Gives suggestions	241	43	166	263	139	376	384	146	83	244	584	122	2771	9.9
5. Gives opinion	453	428	513	489	423	415	440	436	532	778	761	586	6254	22.4
6. Gives orientation	571	478	640	540	656	387	502	489	377	596	631	422	6289	22.5
C. Task Area: Questions														
7. Asks for orientation	26	22	22	51	70	41	34	62	41	40	78	62	549	2.0
8. Asks for opinion	62	46	90	95	123	93	86	94	82	137	99	101	1108	4.0
9. Asks for suggestion	29	14	16	6	18	4	18	10	5	39	21	14	194	0.7
D. Social-Emotional Area: Negative														
10. Disagrees	202	192	179	306	224	459	362	205	320	159	381	365	3354	12.0
11. Shows tension	47	61	101	61	87	27	29	85	23	6	15	8	550	2.0
12. Shows antagonism	5	13	1	9	14	38	16	11	17	43	9	2	178	0.6
TOTAL	2196	1610	2174	2278	2003	2576	2555	1913	1922	3401	3213	2050	27891	99.9

TABLE 2

CATEGORY PROFILES, GIVING TOTAL PERCENTAGES FOR EACH CATEGORY, AS WELL AS SUBTOTALS FOR REACTIVE BEHAVIOR, FROM BALES' THEORETICAL MODEL, BALES' LABORATORY GROUPS, TALLAND'S THERAPY GROUPS, AND TWELVE MEETINGS OF THE STUDENT SEMINAR

		PERCENTAGE RATE OF ACTS+							
		Theoretical* Equilibrium		Laboratory* Groups		Therapy* Groups		Student Seminar	
			Reactive		Reactive		Reactive		Reactive
CATEGORY									
A 1.	Shows solidarity	3.8		3.42		2.0		0.7	
2.	Shows tension release	7.7		5.97		--		16.5	
3.	Agrees	15.2		16.54		4.8		6.7	
			26.7		25.93		8.6		23.9
B 4.	Gives suggestion	7.6		7.94		3.5		9.9	
5.	Gives opinion	30.4		30.06		20.2		22.4	
6.	Gives orientation	15.3		17.89		59.2		22.6	
			6.7		6.97		8.5		6.7
C 7.	Asks for orientation	3.8		3.53		5.5		2.0	
8.	Asks for opinion	1.9		2.39		2.3		4.0	
9.	Asks for suggestion	1.0		1.05		0.7		0.7	
			6.7		6.97		8.5		6.7
D 10.	Disagrees	7.6		7.78		1.8		12.0	
11.	Shows tension	3.8		2.66		--		2.0	
12.	Shows antagonism	1.9		0.73		--		0.6	
			13.3		10.67		1.8		14.6
	TOTAL	100.0	53.4	99.96	50.54	100.0	25.6	100.1	59.9

+The asterisked columns in the table are from Talland's 1955 report of his

TABLE 2--Continued.

study of interaction in therapy groups (see pages 20-21). In that report Talland stated, "The theoretical values postulated for interaction tending towards equilibrium and the percentage rates of categories in problem-solving groups are based on records as yet unpublished by Dr. Bales. The latter represents averages of 96 meetings, each lasting 40 minutes." The writer has been unable to find that Bales ever published this material, but both Talland and Psathas used the figures as a standard for comparison.

TABLE 3

REACTIVE BEHAVIOR

Meeting	Observed Frequency	Calculated Frequency (Bales)	Difference	Calculated Frequency (Talland)	Difference
#4 Positive Rs	560	586	26*	149	411
Questions	117	147	30*	187	70
Negative Rs	254	292	38*	40	214
#5 Positive Rs	313	430	117*	109	204
Questions	82	108	26*	137	55
Negative Rs	266	214	52*	29	237
#6 Positive Rs	446	580	134*	148	258
Questions	128	148	18*	185	57
Negative Rs	281	289	8*	39	242
#13 Positive Rs	458	608	150*	155	303
Questions	152	153	1*	194	42
Negative Rs	376	303	73*	41	335
#14 Positive Rs	249	535	286	136	113
Questions	211	134	77	170	41
Negative Rs	325	266	59*	36	289
#15 Positive Rs	736	688	48*	175	561
Questions	138	173	35*	219	81
Negative Rs	524	343	181*	46	478
#16 Positive Rs	684	682	2*	174	510
Questions	138	171	33*	217	79
Negative Rs	407	340	67*	46	361
#25 Positive Rs	375	511	136*	130	245
Questions	166	128	38	163	3
Negative Rs	301	254	47*	34	267
#26 Positive Rs	442	513	71*	131	311
Questions	128	129	1*	163	35
Negative Rs	360	256	4*	35	325

*Asterisks mark differences between observed and calculated frequencies (Bales) that are smaller than differences between observed and calculated frequencies (Talland) as expected.

TABLE 3--Continued.

Meeting		Observed Frequency	Calculated Frequency (Bales)	Difference	Calculated Frequency (Talland)	Difference
#27	Positive Rs	1379	908	471*	231	1148
	Questions	216	228	12*	289	73
	Negative Rs	208	452	244	61	147
#28	Positive Rs	634	858	224*	218	416
	Questions	198	215	17*	273	75
	Negative Rs	405	427	22*	58	347
#31	Positive Rs	368	547	179*	139	229
	Questions	177	137	40	174	3
	Negative Rs	375	273	102*	37	338

*Asterisks mark differences between observed and calculated frequencies (Bales) that are smaller than differences between observed and calculated frequencies (Talland) as expected.

TABLE 4

AGGREGATE WHO-TO-WHOM MATRIX FOR TWELVE STUDENT SESSIONS

Ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total Inds.	Total Group	Grand Total
1	°	653	332	291	372	219	208	235	217	247	176	126	141	112	129	116	82	3574	1874	5448
2	1063	°	108	94	129	67	112	53	106	44	86	22	9	76	58	56	53	2083	812	2895
3	777	255	°	82	60	56	82	49	49	54	61	25	24	45	38	49	33	1706	599	2305
4	685	178	42	°	79	49	133	64	28	48	67	20	17	36	86	37	35	1569	571	2140
5	510	175	65	76	°	62	77	27	19	20	35	12	13	44	22	18	16	1175	688	1863
6	488	110	72	46	43	°	90	41	42	36	41	12	28	41	22	14	20	1126	592	1718
7	464	129	56	64	77	58	°	62	35	34	17	19	15	10	6	1	7	1047	565	1612
8	405	76	31	80	31	40	61	°	64	16	67	8	14	27	27	26	26	973	496	1469
9	378	113	25	46	28	27	47	41	°	11	37	28	--	23	10	15	10	829	545	1374
10	357	130	26	56	18	60	31	26	15	°	22	2	4	10	6	6	6	769	491	1260
11	341	77	41	39	12	22	9	14	42	21	°	10	17	14	6	--	10	665	446	1111
12	290	57	19	27	13	25	27	14	35	4	10	°	13	10	5	6	5	555	434	989
13	275	34	18	24	4	9	24	2	6	3	15	8	°	4	6	3	3	435	419	854
14	174	69	4	8	18	15	8	1	17	7	5	1	--	°	--	4	--	331	457	788
15	176	44	6	10	4	6	4	7	1	7	17	2	1	--	°	--	--	285	418	703
16	149	27	10	12	4	2	3	--	7	1	3	5	--	2	--	°	--	225	403	628
17	81	19	3	2	3	2	2	4	--	--	2	1	--	--	--	--	°	119	319	438
Totals	6532	2127	855	955	892	717	916	636	683	553	659	300	296	454	421	351				

TABLE 5

INDIVIDUALIZED WHO-TO-WHOM MATRIX FOR NINE STUDENT SESSIONS

Participant	31	9	5	6	10	14	15	7	2	4	16	1	13	8	11	12	3	Total Inds.	Total Group	Grand Total
31	°	320	320	143	146	156	201	160	111	186	118	132	154	137	143	113	121	2661	1420	4081
9	704	°	99	68	39	44	51	48	54	46	32	102	38	14	6	8	4	1357	505	1862
5	602	94	°	16	23	24	76	14	26	20	31	11	93	45	43	48	42	1208	489	1697
6	329	160	60	°	68	11	38	28	17	47	33	18	63	60	52	61	49	1094	475	1569
10	371	65	40	68	°	30	32	16	11	22	16	49	34	31	21	29	29	864	471	1335
14	326	67	74	11	34	°	35	9	8	39	40	13	12	29	6	26	20	749	536	1285
15	334	96	77	33	31	16	°	38	12	20	16	11	37	22	25	23	12	803	450	1253
7	388	52	47	26	38	15	41	°	22	37	17	24	10	21	5	7	7	757	454	1211
2	273	62	16	2	2	3	25	11	°	1	1	7	36	45	49	46	39	618	430	1048
4	263	49	26	11	1	13	21	18	4	°	1	11	24	23	33	27	16	541	469	1005
16	333	34	41	18	17	20	25	22	2	4	°	14	11	16	7	8	5	577	365	942
1	214	64	25	4	42	3	11	9	11	6	8	°	12	30	27	14	12	492	385	877
13	230	15	33	11	4	6	7	5	2	4	14	13	°	5	--	9	--	358	408	766
8	140	14	48	7	3	19	10	25	4	17	17	14	1	°	3	3	--	324	402	726
11	223	15	26	1	9	2	10	--	13	19	--	14	--	2	°	9	--	337	384	721
12	233	12	17	1	7	4	3	--	--	2	2	1	--	2	1	°	--	285	330	615
3	200	4	16	3	4	2	2	--	5	2	--	9	--	--	2	2	°	251	308	559
Totals	5163	1123	965	423	468	368	588	403	302	468	346	443	499	482	423	427	356			

TABLE 6

AMOUNTS AND PERCENTAGES OF OBSERVED BEHAVIOR IN FIVE CATEGORIES FOR THREE EARLY SESSIONS OF THE STUDENT SEMINAR

Period	Total Interaction	Positive Reaction		Negative Reaction		Communication Orientation		Communication Evaluation		Communication Control	
		Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount
Meeting 4											
1	857	20.9	179	9.9	85	32.3	277	18.4	158	18.4	158
2	773	30.9	239	11.5	89	23.4	181	24.5	189	9.7	75
3	566	25.1	142	14.1	80	24.6	139	29.7	168	6.5	37
Totals	2196		560		254		597		515		270
Meeting 5											
1	514	14.4	74	13.8	71	40.5	208	28.0	144	3.3	17
2	547	19.3	106	13.5	74	33.8	185	30.9	169	2.4	13
3	549	24.2	133	22.0	121	19.5	107	29.3	161	4.9	27
Totals	1610		313		266		500		474		57
Meeting 6											
1	721	25.3	183	8.5	61	29.3	211	29.4	212	7.5	54
2	701	10.2	72	12.8	90	37.7	264	28.0	196	11.3	79
3	752	25.4	191	17.3	130	26.9	187	25.9	195	6.5	49
Totals	2174		466		281		662		603		182

TABLE 7

AMOUNTS AND PERCENTAGES OF OBSERVED BEHAVIOR IN FIVE CATEGORIES FOR THREE INTERMEDIATE SESSIONS OF THE STUDENT SEMINAR

Period	Total Interaction	Positive Reaction		Negative Reaction		Communication Orientation		Communication Evaluation		Communication Control	
		Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount
Meeting 13											
1	781	20.2	158	8.4	66	31.2	277	29.4	230	10.6	83
2	795	19.0	151	18.6	148	25.7	204	28.3	225	8.4	67
3	702	21.2	149	23.1	162	20.4	143	18.4	129	17.0	119
Totals	2278		458		376		591		584		269
Meeting 14											
1	701	10.6	74	13.7	96	42.7	299	20.7	145	12.4	87
2	763	11.3	86	22.9	175	30.4	232	29.5	225	5.9	45
3	539	16.5	89	10.0	54	36.2	195	32.6	176	4.6	25
Totals	2003		249		325		726		546		157
Meeting 15											
1	645	27.9	180	23.1	149	14.0	90	11.2	72	23.9	154
2	849	16.1	137	16.6	141	22.9	194	29.6	251	14.8	126
3	1082	38.7	419	21.6	234	13.3	144	17.1	185	9.2	100
Totals	2576		736		524		428		508		380

TABLE 8

AMOUNTS AND PERCENTAGES OF OBSERVED BEHAVIOR IN FIVE CATEGORIES FOR THREE LATE SESSIONS OF THE STUDENT SEMINAR

Period	Total Interaction	Positive Reaction		Negative Reaction		Communication Orientation		Communication Evaluation		Communication Control	
		Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount
Meeting 26											
1	623	17.5	109	10.0	62	29.5	184	38.4	239	4.7	29
2	641	27.9	179	14.0	90	20.7	133	35.1	225	2.2	14
3	658	23.4	154	31.6	208	15.4	101	22.8	150	6.8	45
Totals	1922		442		360		418		614		88
Meeting 27											
1	1132	38.4	435	4.1	46	18.5	209	32.6	369	6.4	73
2	1349	39.0	526	5.9	79	21.9	295	25.4	343	7.9	106
3	920	45.4	418	9.0	83	14.3	132	22.1	203	9.1	84
Totals	3401		1379		208		636		915		263
Meeting 28											
1	1485	19.9	296	17.4	259	21.0	312	26.0	387	15.5	231
2	1146	19.3	221	6.1	70	22.9	263	27.5	315	24.2	277
3	582	20.1	117	13.1	76	23.0	134	27.1	158	16.7	97
Totals	3213		634		405		709		860		605

TABLE 9

OBTAINED PERCENTAGES OF TOTAL INTERACTION IN VARIOUS CATEGORIES AND/OR COMBINATIONS OF CATEGORIES FOR EARLY, INTERMEDIATE AND LATE MEETINGS OF THE STUDENT SEMINAR

Category: Meeting	1 & 2	3	4	5	6	7, 8 & 9	10	11 & 12
4	19.3	6.2	11.0	20.6	26.0	5.3	9.2	2.4
5	11.7	7.7	2.7	26.6	29.7	5.1	11.9	4.6
6	14.6	5.9	7.6	23.6	29.4	5.9	8.2	4.7
Average	15.2	6.6	7.1	23.6	28.4	5.4	9.8	3.9
13	9.9	10.2	11.5	21.5	23.7	6.7	13.4	3.1
14	6.0	6.4	6.9	21.1	32.7	10.5	11.2	5.0
15	25.2	3.3	14.6	16.1	15.0	5.4	17.8	2.5
Average	13.7	6.6	11.0	18.9	23.8	7.5	14.1	3.5
25	13.1	6.5	7.6	22.8	25.6	8.7	10.7	5.0
26	14.0	8.9	4.3	27.7	19.6	6.7	16.6	2.1
27	36.3	4.3	6.6	22.9	17.5	6.4	4.7	1.4
Average	21.1	6.6	6.2	24.5	20.9	7.3	10.7	2.8

APPENDIX D

PROFESSORS' OPENING QUESTIONS IN STUDENT SESSIONS

Meeting	Question	Categorization
4	What do you think of Irv's efforts . . . generally?	Evaluation
5	What is the problem that . . . Mr. Fish has faced, or is given to him?	Orientation
6	Would you buy stock in Ateco, and why?	Evaluation
13	The first thing is . . . that we have to decide what the problem is.	Orientation
14	I would like to ask one of you to summarize for me and for the rest of us where you have come or where you are on this Task case.	Orientation
15	You have been asked to provide a design for this fixture in accordance with Don's assignment.	Control
16	After the final drawings are on the board . . . each group will pick an individual . . . who will present the design on behalf of the group . . . and this is to be without criticism at this stage.	Control
25	(Role playing) We'll call on each of you to exercise his specialty as it contributes to the company project: what do you need to know and to have done in the building, to be sure you work goes ahead?	Orientation
26	First of all, we might go through the case and get the history of the particular case . . . and the thing on here I want to talk about are the constraints that Art had to work under.	Orientation
27	(Role playing) Will you please give us a very quick and brief rundown on the facts of the case.	Orientation

Meeting	Question	Categorization
28	(Role playing) Mr. XXX, would you start out the proceedings, please, by telling this panel . . . what would you propose to do with regard to this redesign?	Control
31	(Role playing) Well, the stage is set now for the drama and . . . let's start now with some of the chemical engineers in terms of defining the problem which they have in mind . . . what the problem is.	Orientation

APPENDIX E

TABLES OF OBSERVED DATA FOR INTERMEDIATE PROCESSES

TABLE 11

STUDENTS' INITIATED INTERACTION FOR MEETING 4/5 AND FOR MEETING 6, AT WHICH SEAT ASSIGNMENTS WERE CHANGED*

	Student	Meeting 4/5	Meeting 6
Seating A_1	15 (6)	97	127
	2 (8)	67	166
	16 (10)	86	130
	1 (11)	44	72
Seating A_2	6 (3)	70	129
	10 (4)	119	133
	7 (7)	119	115
	11 (14)	50	72
Seating A_3	9 (1)	182	178
	5 (2)	193	142
	14 (5)	136	118
	4 (9)	77	60
	13 (12)	65	82
	8 (13)	64	49
	12 (15)	67	51
	3 (16)	54	75
TOTAL		1490	1699

*Seating A_1 includes students who moved to more central positions; Seating A_2, students who moved to end positions; Seating A_3, students who changed seats but remained in relatively central positions. Numbers in parentheses indicate students' rankings based on total initiated interaction for nine meetings.

TABLE 13

STUDENTS' INITIATED INTERACTION FOR MEETING 13/14 AND FOR MEETING 15/16, FOR WHICH TEAM ASSIGNMENTS WERE MADE*

	Student	Meeting 13/14	Meeting 15/16
Team A_1	6 (3)	106	233
	7 (7)	93	159
	1 (11)	66	61
Team A_2	9 (1)	154	202
	5 (2)	174	176
	10 (4)	117	155
Team A_3	2 (8)	110	106
	13 (12)	74	108
	12 (15)	45	60
Team A_4	15 (6)	150	152
	4 (9)	97	134
	16 (10)	78	132
	3 (16)	42	53
Team A_5	14 (5)	197	200
	8 (13)	70	95
	11 (14)	52	79
TOTAL		1625	2105

*Students are grouped according to team membership. Numbers in parentheses indicate students' rankings based on total initiated activity for nine meetings.

APPENDIX F

TABLES OF OBSERVED DATA FOR INDIVIDUAL RESPONSES

TABLE 15

GROUPINGS OF MOST ACTIVE, INTERMEDIATE AND LEAST ACTIVE STUDENTS*

Student	Total Initiated Interaction	Communication to Group	Communication from Group
Most Active Grouping			
9	1862	505	1123
5	1697	489	965
6	1569	475	423
10	1335	471	468
14	1285	536	368
Mean	1549.6	495.2	669.4
Intermediate Grouping			
15	1253	450	588
7	1211	454	403
2	1048	430	302
4	1005	469	468
16	942	365	346
1	877	385	442
Mean	1056.0	425.5	425.0
Least Active Grouping			
13	766	408	499
8	726	402	482
11	721	384	423
12	615	330	427
3	550	308	356
Mean	677.4	366.4	437.4

*Based on total initiated activity for nine meetings, showing total interaction, communication addressed to the group, and communication received from the group for each student, as well as means for groupings.

TABLE 16

POSITIVE AND NEGATIVE REACTIONS, ATTEMPTED ANSWERS, AND QUESTIONS BY NINE SELECTED STUDENTS IN THREE GROUPINGS DURING SELECTED EARLY, INTERMEDIATE AND LATE MEETINGS

Grouping	Student	Positive Reactions	Attempted Answers	Questions	Negative Reactions	Total
Meeting 6						
A	5	30	96	3	13	142
	6	28	71	10	20	129
	10	25	85	6	17	133
B	2	25	125	3	13	166
	4	21	27	1	11	60
	16	23	88	1	18	130
C	3	21	42	1	8	72
	8	19	16	1	13	49
	11	23	42	1	6	72
Meeting 15						
A	5	47	62	8	50	167
	6	45	85	12	45	187
	10	45	93	17	28	183
B	2	45	73	6	41	165
	4	43	47	8	31	129
	16	43	70	13	35	161
C	3	39	5	2	16	62
	8	40	7	0	22	69
	11	39	46	0	16	101
Meeting 25						
A	5	23	75	9	24	131
	6	14	48	0	14	76
	10	16	20	7	18	61
B	2	15	5	0	22	42
	4	20	22	4	15	61
	16	19	38	3	9	69
C	3	14	8	0	11	33
	8	17	6	0	24	47
	11	15	25	9	3	52

TABLE 18

NUMBER OF AVAILABLE TWO-PERSON CHANNELS, EXPECTED AND OBSERVED NUMBER USED, AND PERCENT OF AVAILABLE CHANNELS USED DURING EACH OF TWELVE STUDENT SESSIONS

Meeting	2-Person Channels Available	Number Used		Calculated Percentage
		Expected	Observed	
4	272	54	58	21.3
5	272	54	76	27.9
6	272	54	62	22.8
13	240	49	87	36.3
14	240	49	52	21.7
15	272	54	102	37.5
16	272	54	100	36.8
25	272	54	68	25.0
26	272	54	93	34.2
27	272	54	86	31.6
28	272	54	108	39.7
31	240	49	90	37.5

TABLE 19

ROTATED SOCIOMETRIC MATRIX SHOWING CLIQUES ALONG DIAGONAL

Symbols used are "like very much" (XX), "Like" (X), "Dislike" (0), and "Dislike heartily" (00).

CHOOSER/ /CHOSEN	6	10	12	13	16	4	15	7	14	8	5	2	3	1	11	9
6	°	XX	0	X		X								00		
*10	XX	°	XX	XX		XX	X	XX	X		X		XX			XX
12		XX	°	XX		X										
13	X	XX	X	°								0		0		
16					°	XX	XX			0					X	
* 4	X	XX	X		XX	°	XX	XX		XX	X		X			
15	0	X			XX	XX	°	XX	XX	X	X	0				
7		XX				XX	X	°	XX	X						
*14		XX					X OU	XX	°	X	0	0				
8						X	X	X	XX	°	X	X				
* 5		X				X	X			X	°	XX				00
2						00			00	X	XX	°				
3		XX				XX							°	XX		
* 1	0	00									0		X	°		
11					XX							00			°	
9		X														°

*Leader.

TABLE 20

MEAN IN-GROUP (CLIQUE MEMBER) AND OUT-GROUP RANKINGS OF STUDENTS ON THREE LEADERSHIP CRITERIA+

Student		Discussion Ideas		Social Facilitation		Overall Leadership	
		In-Group	Out-Group	In-Group	Out-Group	In-Group	Out-Group
	6	9.5	8.8	4.0*	7.5	8.0*	9.4
(L)	10	**5.0*	7.9	**3.8*	7.3	**4.3*	7.3
	12	15.0	14.6	15.0*	15.2	14.7*	14.9
	13	9.0	7.8	8.7	8.6	8.0*	8.4
	16	2.7*	6.4	8.3	7.0	3.3*	6.0
(L)	4	6.0	4.3	6.0	5.2	6.7	6.1
	15	4.7*	5.3	5.3*	6.8	4.5*	5.0
	7	7.3*	9.9	4.8*	7.8	7.8*	8.6
(L)	14	6.5*	7.5	*3.8*	8.7	4.5*	6.8
	8	11.8*	12.0	9.2*	11.4	9.7*	12.5
(L)	5	*3.3*	6.4	*1.7*	3.8	*5.0	4.2
	2	8.3*	10.9	7.0*	10.5	9.0*	11.5
	3	7.3*	12.5	10.0*	13.4	10.5*	12.5
(L)	1	*5.8*	9.1	*6.5*	10.8	*9.0*	9.5
	11	2.0	13.0	10.0	14.3	5.0	14.7
	9	5.0	4.4	4.0	4.5	3.0	3.2

+Low score = high rank. Asterisk in front of in-group ranking indicates leader ranked higher than members, as expected. Asterisk behind in-group ranking indicates in-group ranking is higher than out-group ranking, as anticipated.

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