DOCUMENT RESUME

ED 132 624 CS 501 567

| | |
|---|---|
| AUTHOR | Baxter, Leslie A.; Ward, Jean M. |
| TITLE | Task Difficulty, Relational Interaction, and Performance Outputs in Ad Hoc Problem-Solving Groups. |
| PUB DATE | 76 |
| NOTE | 33p. |
| EDRS PRICE | MF-$0.83 HC-$2.06 Plus Postage. |
| DESCRIPTORS | Behavioral Science Research; *Communication Skills; *Decision Making; *Group Relations; Higher Education; Information Theory; *Interaction Process Analysis; *Interpersonal Relationship; *Problem Solving |

ABSTRACT

Twelve groups of five to seven college students each were randomly formed and assigned one of two decision-making tasks as part of a study of the relational, or control, dimension of interpersonal communication. Group discussions were recorded and transcribed for analysis of act, interact, and double interact patterns. Results indicated significant variance of interaction patterns with the difficulty of the task, a nonsignificant relationship between interaction structure and performance outputs, a tendency for interaction structure to increase as the level of analysis moved from the act to the interact to the double interact, and, in contrast to existing data, smaller interaction structure values and more one-upmanship. (Author/AA)

# TASK DIFFICULTY, RELATIONAL INTERACTION, AND PERFORMANCE OUTPUTS IN AD HOC PROBLEM-SOLVING GROUPS

Leslie A. Baxter and Jean M. Ward

Leslie A. Baxter
Assistant Professor
Department of Communications
Lewis and Clark College
Portland, Oregon 97219

Jean M. Ward
Associate Professor
Department of Communications
Lewis and Clark College
Portland, Oregon 97219

## Abstract

This study extends upon the existing small body of literature which examines relational communication in decision-making groups. Extensions are found in the following areas: examination of the effects of task difficulty on relational interaction; use of an alternative relational interaction coding scheme; consideration of a larger data base; and, examination of interrelationships between relational interaction and performance outputs. Twelve groups, with five to seven members each, were randomly formed and assigned one of two tasks (New Truck Problem or Winter Survival Problem) for completion within thirty minutes. Tasks were pre-tested for difficulty and were evaluated for difficulty in a post-questionnaire. Participant satisfaction and solution quality were assessed.

The Rogers and Farace (1975) relational coding scheme was used to analyze transcripts. Act, interact, and double interact analyses were derived for each group and average matrices were derived for the two tasks. Relational patterning was assessed with multivariate information analysis. Uncertainty, relative uncertainty, and stereotypy statistics were derived for all interaction levels of each group. Average stereotypy values were computed for each task. Chi square tests were employed to determine likelihood of frequency matrices due to chance. Pearson r correlation was the measure of association used to analyze relationships between interaction pattern and performance outputs.

This study found the following: significant interaction patterns as a function of task difficulty; a nonsignificant, low correlation between interaction structure and performance outputs; a tendency for interaction structure to increase as level of analysis moved from the act to the interact to the double interact; compared to the existing data base, generally smaller interaction structure values; and, contrasted to the existing data base, a much more predominant interaction pattern of "one-upmanship."

# TASK DIFFICULTY, RELATIONAL INTERACTION, AND PERFORMANCE OUTPUTS IN AD HOC PROBLEM-SOLVING GROUPS

In their delineation of the Interact System Model, Fisher and Hawes (1971) urge small group researchers to focus on the communication process and the interrelationships of this process with more social psychological variables such as cohesiveness, power, task efficiency, etc. Ironically, comparatively little research provides this focus despite the crucial organizing function which communication performs in the small group (Fisher and Hawes, 1971, 448). As Helmreich, Bakeman and Scherwitz (1973) observed in their review of small group research, small group researchers have analyzed input-output relationships without full consideration of the mediating functions of process.

This paper summarizes work from the ISM perspective; first it attempts to describe the pattern of relational interaction in task groups, and second, it assesses the interrelationships between this interaction and selected other small group variables.

Over the years, a variety of interaction coding techniques have been applied to small groups in an effort to capture the essence of communication as it functions in the group context. Most of these coding schemes, however, have focused largely on the task-related communication of the group (e.g., giving information, asking for clarification). As most references in small group behavior indicate, a group functions with at least two basic dimensions--task ("getting the job done") and maintenance (the interpersonal relationships which exist among the group members), (Shaw, 1976). Much of what happens in a group relates to the interpersonal relationships among the members--role differentiation, leadership emergence, status and power, cohesion, etc. Most importantly, interpersonal functioning in a group affects task performance, at least indirectly (Steiner, 1972; Hackman and Morris, 1975). It would seem useful, then, to examine the interaction of a group with a coding technique which taps the interpersonal relationships directly rather than continued reliance on content (task)-oriented schemes.

Considerable research suggests that interpersonal relationships vary along two key dimensions: dominance-submission and like-dislike (Carson, 1969). Relational interaction concentrates on the dominance-submission dimension. As Watzlawick, Beavin, and Jackson (1967) noted in their near classic analysis of communication, all interaction functions simultaneously at both a content and a relational level. Interpreted at the content, or task, level, the statement, "I think the plan of attack of our group should be..." refers to a suggested solution to the task. At the relational level, however, such a comment might be interpreted as a control statement, a "one-up" attempt to define behaviors of self and others. A relational interaction analysis interprets interaction in terms of its attempt to control the situation or relationship. As originated, interaction was viewed as either one-up or one-down (Watzlawick, et al.,1967). Complementarity was defined as a dyadic exchange of one-upmanship coupled with one-downmanship. Symmetry was defined as a dyadic exchange of like response, usually one-up and one-up (Watzlawick, et al., 1967).

Mark (1971) was one of the first to systematize a relational interaction coding scheme. More recently, Rogers and Farace (1975) offered a similar relational coding technique. As operationalized by Rogers and Farace (1975), a given communication act functions as one-up, one-down, or one-across, the latter of which implies neither an attempt to control nor submission to the control of the other.

Basic to relational analysis is consideration of interaction beyond the monadic act level. At a minimum, relational analysis employs the interact level, i.e., exchanges of two contiguous acts. At the interact level, then, message exchanges can be viewed appropriately in a ninefold typology depending on the particular combination of relational utterances (see Figure 1).

Symmetry is defined by interacts ↑↑, ↓↓, and →→; complementarity is defined by interacts ↑↓ and ↓↑; and so-called transitory interacts constitute the remainder, →↑, →↓, ↑→, and ↓→ (Rogers and Farace, 1975).

| | ↑ one-up | ↓ one-down | → one-across |
|---|---|---|---|
| ↑ one-up | | | |
| ↓ one-down | | | |
| → one-across | | | |

Figure 1. Typology of relational interact types.

At a more complex level of analysis, the double interact, messages are viewed in sequences of three contiguous acts. Thus, at the double interact level, a possible twenty-seven combinations exist: ↑↑↑, ↑↑↓, ↑↓↑, ↑↑→, and so forth.

The relational, or control dimension of interpersonal relationships proves compatible conceptually with several of the more important group processes. Leadership emergence, status and power, conflict, and deviance, for example, would appear to reflect group members' functioning in the dominance-submission realm. However, little research directly examines group process from a relational interaction perspective. Watzlawick et al. (1967) presented heuristic insights drawn mainly from their background in therapy. Rogers (1972), Ericson (1973), and Parks et al. (1975, 1976) examined relational interaction in marital dyads. Of direct relevance to the small group is the research of Fisher, Glover, and Ellis (1975), Fisher (1976), and Ellis (1976). Fisher, et al. (1975) compared several coding schemes at several levels of interaction analysis (act, interact, double interact, and triple interact) from the perspective of multivariate information analysis. Data were derived from six families and three decision-making groups. Mark's coding technique (1971) was used to assess relational interaction. Fisher (1976) appeared to employ the same data base in reporting results of the Mark System analysis. Ellis (1976) similarly appeared to use the same three decision groups in presenting a phase analysis of the Mark System data.

## PURPOSES OF THIS STUDY

This study extends the research foundation provided by the Fisher et al. (1975), Fisher (1976) and Ellis (1976) work. Specifically, it employs the Rogers and Farace (1975) relational coding scheme in order to provide comparative data with that presented through the Mark System. Rogers and Farace (1975) created their coding scheme because of inconsistencies in the Mark System (p.227). Existing research has employed the Mark System exclusively as a measurement tool to assess relational communication in the small group context.

Second, this study extends the data base from the three decision-making groups employed in the above series of investigations. It would appear that the three groups examined by Fisher et al. (1975), Fisher (1976) and Ellis (1976) were ad hoc classroom groups which met over the period of a term; the groups were free to solve a task/problem of their choice. The data base for the present study is taken from twelve ad hoc classroom groups, each of which solved a designated task within a specified time period. Although such a data base lacks the longitudinal element which is present in the three-group data base, it affords control over key small group variables to which group interaction can be related.

This study examines the nature of group interaction in groups solving different tasks; specifically, six of the twelve groups were randomly assigned to one task and the remainder of the groups solved a second task. Considerable research suggests that the nature of the task affects group functioning. However, this research is scattered and incomplete; little systematic research has been undertaken to explore fully the external variable of the task. What research is available, however, denies continued complacency in small group research (Bochner, 1974). Researchers of the small group process have several options available with regard to the task variable: 1) continue to ignore the task as an important contributor to group functioning; 2) employ counterbalanced designs in which groups solve a variety of tasks; and 3) develop and employ standardized tasks. The difficulty with the first option is obvious; failure to consider the task variable may contribute considerable error to our understanding of group functioning. Research which has employed the data base provided by the three decision-making groups has reported relatively low degrees of redundancy and pattern in the interaction. In part, this may be a consequence of the fact that the groups were solving uncontrolled tasks, thereby contributing to variation which existed among the groups. The second and third research options, however, are equally as problematic. Without systematic research into the task variable, it is impossible to determine which features of the task contribute to differential group functioning. Some task features may be irrelevant, in which case their inclusion in a study would be unnecessary and costly. The third option has been attempted by some researchers (Zajonc, 1965). The obvious problem with a standardized task, however, is one of external validity. Can the standardized task be generalized to other tasks? This study involves the systematic study of one element of the task in order to enhance the viability of the second research option.

This study attempts a systematic examination of one dimension of the task--task difficulty. Conceptually, task difficulty refers to "the amount of effort required to complete the task" (Morris, 1966, p. 546). Difficult tasks are those requiring more knowledge and demanding more operations and inputs (Shaw, 1976, p. 311). This dimension was selected for manipulation because it is the strongest and most stable of Marvin Shaw's dimensions upon which tasks vary (Shaw, 1976). Specifically, this study examines the patterns of relational interaction in groups solving tasks of differing levels of difficulty. To the knowledge of the investigators, only one study has systematically considered interaction differences as a function of task difficulty. Morris (1966) employed a task-oriented coding scheme in groups solving tasks pre-tested to differ in difficulty. He reported that groups solving more difficult tasks tended to provide more structuring of answers. Extending the analysis to relational, as opposed to task-oriented, interaction, it seems reasonable to look for interaction differences between tasks of differential difficulty. If one extends Morris' (1966) work, perhaps the greater structuring of task answers in the task realm manifests itself in the relational dimension as well. Groups solving more difficult tasks may be characterized by greater interaction structure at the act, interact, and double interact levels. In an attempt to cope with difficult tasks, groups may find it necessary to organize interpersonally to facilitate problem-solving. Further, some research suggests that group members attempt leadership more frequently when the task is difficult than when it is easy (Shaw, 1976, p. 330). Translated to relational interaction, this might imply more one-upmanship in the structure of groups with more difficult tasks. Patterning differences as a function of task difficulty are explored in this study at act, interact and double interact levels.

Finally, this study extends current literature by exploring the relationship between relational interaction process and group outcome. As Hackman and Morris (1975, p. 57) observe, "research that directly relates measured characteristics of group process to performance outcomes is scarce." The few studies which have undertaken such integrations of the ISM and HSM models have found little systematic closure on the relationship between interaction process and performance outputs (Hackman and Morris, 1975; Sorenson, 1971; Katzell, Miller, Rotter, and Venet, 1970). In examining "throughputs," it seems useful to consider relationships between interaction and outputs. Because functioning in the maintenance realm affects performance, it seems especially productive to examine relationships between <u>relational</u> interaction and performance. Existing literature has examined primarily task-oriented interaction.

Performance outputs can be found in both task and maintenance realms of group functioning. In the task realm, performance output can be assessed usefully through solution quality. In the maintenance realm, satisfaction constitutes a key ingredient in performance output. Heslin and Dunphy (1964) isolated three sources of member satisfaction in the small group--status consensus, perception of progress toward the goal, and perceived freedom to participate. The present study most closely approximates the latter source in assessing member satisfaction with their participation in the group experience.

In summary, this study extends upon the existing small body of literature which examines relational communication in decision-making groups. The extensions are found in the following areas: systematic examination of the effects of task difficulty on relational interaction; use of an alternative relational interaction coding scheme; consideration of a larger data base in terms of the number of groups investigated; examination of interrelationships between relational interaction and performance outputs.

## RESEARCH QUESTIONS

The primary thrust of this study is exploratory in nature. Summarizing the discussion above, the following research questions are explored:

1. Does interaction structuring, or patterning, at the act, interact, and double interact levels differ by task difficulty?
2. Is interaction structuring, or patterning, at the act, interact, and double interact levels related to group performance outputs?

## METHODS

### Participants

Participants were taken from beginning classes in small group behavior. Before the presentation of material related to the research questions under investigation, participants were randomly assigned to small groups which ranged in size from five to seven members. Each group solved a designated task while being taped. A total of twelve groups were examined.

### Selection of Tasks

In the term prior to data selection, students enrolled in the undergraduate small groups class assessed a series of tasks along Shaw's (1976) basic deimensions of group tasks. On the basis of this pre-test information, two tasks were selected for the current study--Maier's New Truck Problem (Maier, 1970) and the Winter Survival Problem (Johnson and Johnson, 1975). In the typology of task types employed by Hackman (1968; 1969; 1970) and by Morris (1966), both tasks represent problem-solving in contrast to creativity or negotiation tasks. The New Truck Problem involves assessment of the needs of five truckers in prioritizing who receives a new truck. The Winter Survival Problem involves an assessment of the importance of fifteen items to a hypothetical survival situation. The Winter Survival Problem requires more knowledge on the part of members and demands the examination of more problem components than does the New Truck Problem. Further, most people are more familiar with the issues and concerns in the New Truck Problem (seniority, job satisfaction, etc.) than with the issues and concerns raised in the Winter Survival Problem. Groups were randomly assigned to solve either the New Truck Problem or the Winter Survival Problem. The pre-test decision to employ the two problems was confirmed in the actual task difficulty manipulation. Although all groups were given a maximum of half an hour to solve their respective problems, groups working on the New Truck generally finished earlier earlier and with fewer interactions than the Winter Survival groups. Finally, the task difficulty manipulation was checked after completion of the task by asking each person to indicate how easy (7) or difficult (1) the task was on a seven-point scale. Participants solving the New Truck Problem perceived that task to be significantly easier than participants solving the Winter Survival Problem ($\bar{X} = 4.56$ and $\bar{X} = 2.53$, respectively; $t = 4.69$, 62df, one-tailed $p < .01$).

Assessment of Performance Outputs

Upon completion of the task, all group members were asked to respond to a post-questionnaire which assessed reactions to the experience. Participants indicated their satisfaction with their participation on a seven-point scale ranging from "not at all" to "completely." A mean satisfaction score was derived for each group.

Solution quality was determined on the Winter Survival Problem by deriving each solution's mean deviation from the correct item ranking provided in Johnson and Johnson (1975). The solution quality of the New Truck Problem was assessed by having two judges independently evaluate the solutions on the criteria employed by DiSalvo and Seiler (1974) in their work with the New Truck Problem--

1. **action orientation** (the degree to which a solution states or implies that a specific course of action should be followed);
2. **solution adequacy**(the degree to which the solution takes into consideration the requirements of the task);
3. **people involvement** (the degree to which the solution includes the personal needs of the people in the problem).

Scores on the three criteria were summed and averaged to provide a single index of solution quality for New Truck solutions. The agreement between the two judges produced a reliability coefficient of .94.

Coding Procedures

The group discussions were recorded and later transcribed for coding analysis, producing a total of 4642 acts (1480 New Truck acts and 3162 Winter Survival acts). A total of four trained coders analyzed the written transcripts with the Rogers and Farace (1975) relational coding scheme, with a minimum of two coders per transcript. The average intercoder reliability was .82.

Data Analyses

The act, interact, and double interact analyses were derived separately for each of the twelve groups. After performing separate analyses for each group, average act, interact and double interact matrices were derived for the two tasks. Fisher et al. (1975) reported that the most useful data analysis for the Mark System was at the double interact level; hence, this analysis did not go beyond the double interact to the triple and higher interact levels. Relational patterning was assessed with multivariate information analysis (Attneave, 1959). Uncertainty, relative uncertainty, and redundancy (stereotypy) statistics were derived for all interaction levels of each of the twelve groups. In addition, average stereotypy values were computed for each task. The C function (redundancy or stereotypy) ranges from 0.00 to 1.00 with larger values indicative of more structure or non-random patterning of interaction. As Miller and Frick (1949) observed, the C index provides a useful data summary, permitting direct comparison between transition matrices. Although information theory statistics provide useful data summaries, they do not constitute statistical tests of significance. Following Attneave's suggestion (1959, p. 27), chi square tests were employed to determine the likelihood of frequency matrices due to chance. Pearson r correlation was the measure of associa. on used to analyze relationships between interaction pattern and performance outputs.

## RESULTS

According to Stech (1970), interaction st- cture takes one of two forms--distributional structure and sequential structure. Table 1 summarizes the distributional act structure for the two tasks. Average proportions were derived for each task from the separate group data. From Table 1, it is apparent that one-up (↑) acts occur with greatest frequency for both tasks, although the proportion is greater for the Winter Survival task. Both tasks exhibit the lowest frequency of occurrence for one-across (→) acts.

If the distributional structures reflect random processes, then one would anticipate only random departure from a .33 equal probability model. Employing $\chi^2$ analyses, both the New Truck and Winter Survival act distributions reflect non-random findings ($\chi^2$ = 201.07, 2df, $p < .001$, and $\chi^2$= 615.9, 2df, $p < .001$, respectively).

Since the act distributional structures of both tasks depart from an equal probability model, one can determine if the act structures differ significantly from one another. A $\chi^2$ analysis indicates that the structures do indeed differ ($\chi^2$=2.51, 2df, $p < .001$).

Turning from distributional structure to sequential structure, Table 2 presents the average proportions with which each act type follows an antecedent act. From these average matrices, it is apparent that a ↑ act is most likely followed by a ↑ act, especially in the Winter Survival task. Similarly, a ↓ act is most likely followed by a ↑ ; this probability is higher with the Winter Survival task. Finally, a → act most probably is followed by a ↑ act; again, this sequence pattern is more likely with the Winter Survival task. Least likely for both tasks is a ↑ and a ↓ act followed by a → act. The interact matrices for both tasks depart from a random model of equal cell probability ($\chi^2_{NT}$ = 451.7, 4df, $p < .001$; $\chi^2_{WS}$ = 1518.0, 4df, $p < .001$).

However, the discovery that the interact matrices are non-random does not determine the extent to which the sequential structures are functions of the act distributions. Perhaps the non-random structure is simply a reflection of the non-random process which operates in the act distributional structures. If the two tasks possess no significant interact sequence structure beyond that contributed by the act distributions, then the relative proportion of each subsequent act should be equal to the distributional proportions in each task's act distribution. Thus, in the absence of sequential structure, the proportional distributions of subsequent acts should correspond within error to those of Table 1. Chi square analyses were employed to assess the extent to which the non-random interact matrices were attributable to the act distributional structures. For the New Truck task, the antecedent acts ↑ and → were followed by significant departures from the act distributional structures ($\chi^2$ = 12.2, 2df, $p < .01$ and $\chi^2$ = 22.46, 2df, $p < .001$, respectively). However, the ↓ antecedent act was not followed by subsequent acts whose distribution departed significantly from that represented in the act distributional structure ($\chi^2$ = 1.23, 2df, $p > .05$). For the Winter Survival task, the antecedent acts ↑ and → were similarly followed by significant sequential acts ($\chi^2$ = 16.53, 2df, $p < .01$, and $\chi^2$ = 20.89, 2df, $p < .001$, respectively). As with the New Truck task, however, the ↓ act was followed by subsequent acts whose distribution did not depart from the distributional structure ($\chi^2$ = 1.84, 2df, $p > .05$).

Finally, the interact sequential structures of the two tasks were compared through a series of $\chi^2$ analyses. The two tasks had significantly different sequential structures for the ↑ antecedent ($\chi^2$ = 20.52, 2df, $p < .001$). The sequential structures for the → antecedent approached marginal significance ($\chi^2$ = 4.47, 2df, $.15 > p > .10$). With the ↓ antecedent, the two tasks did not differ significantly in sequential structure ($\chi^2$ = 2.59, 2df, $p > .05$).

Table 3 presents the sequential structure at the double interact level for both tasks. First, both matrices reflect a non-random process ($\chi^2_{NT} = 886.2$, 16df, $p < .001$; $\chi^2_{WS} = 2694$, 16df, $p < .001$).

Beyond this, however, it is useful to determine to what extent the non-random structure is attributable to the act distributional structure. If the double interact matrices reflect no structure beyond that contributed by the distributional structure, then the probability of the subsequent acts for any given antecedent interact should correspond to the proportions of Table 1. Table 4 presents the summary $\chi^2$ analyses for both tasks which determine departure from the distribution expected on the basis of act distributional structure. For the New Truck task, the $\uparrow\uparrow$ antecedent interact is sequentially structured beyond that expected from the act distributional structure. Similarly, the $\uparrow\rightarrow$ antecedent interact is sequentially structured. The $\downarrow\uparrow$ antecedent approaches significance. With the Winter Survival task, the $\uparrow\rightarrow$ antecedent interact departs from the distribution expected on the basis of the act distribution alone. The $\uparrow\uparrow$, $\rightarrow\uparrow$, and $\downarrow\rightarrow$ antecedent interacts approach significance.

Further, it is useful to determine the extent to which the double interact sequential structure departs significantly from the structure contributed at the interact level of analysis. Table 5 summarizes the $\chi^2$ analyses which compared the double interact sequential structures to the sequential structure expected at the interact level. If the $\uparrow\uparrow$ antecedent, for example, does not differ in sequence from the $\uparrow$ antecedent, then knowledge of two prior acts does not contribute information different from that gained in knowledge of just one prior act. It is apparent from Table 5 that the $\uparrow\rightarrow$ and $\downarrow\rightarrow$ antecedents provide significantly different sequences from that expected with the $\rightarrow$ antecedent for the New Truck Problem. None of the double interact sequences departs from the interact sequential expectations for the Winter Survival Problem.

The New Truck and Winter Survival tasks were compared at the double interact level with a series of $\chi^2$ analyses. Results indicate that the double interact sequential structures differ on the following antecedent interacts: $\uparrow\uparrow$ ($\chi^2 = 11.37$, 2df, $p < .01$); $\uparrow\rightarrow$ ($\chi^2 = 5.9$, 2df, $.10 > p > .05$); $\downarrow\rightarrow$ ($\chi^2 = 9.23$, 2df, $p < .01$); and $\rightarrow\uparrow$ ($\chi^2 = 8.16$, 2df, $p < .01$).

Table 6 summarizes the stereotypy values for each task at the act, interact, and double interact levels. These values were derived by taking the means of the stereotypy values of the separate task groups. The degree of structure tends to increase somewhat from the act through the double interact levels of analysis. However, throughout the table, redundancy values remain quite low. These stereotypy values do not correspond exactly with the redundancy in the average task matrices presented in Tables, 1, 2, and 3; if some groups are structured but in differing ways, the average matrix will suggest lower stereotypy values than actually exist. Imagine two matrices which are distributed differently but with equal structure: (1.00,0,0) and (0, 0, 1.00). Both are highly predictable when considered separately and a mean of the two stereotypy values is 1.00. But when the average matrix is derived, (.50, 0, .50), the redundancy level is reduced considerably. Although the extent of variation among the respective task groups is not to this extreme, it accounts for the minor discrepancies which exist. Based on the average matrices presented in Tables 1 - 3, the New Truck stereotypy values are: .06, .07, and .08; the Winter Survival values are: .08, .09, and .09. There is still a trend toward increased redundancy as the interaction unit increases, and the Winter Survival task has slightly higher redundancy than the New Truck task (see Table 6). The general magnitude of the C values is slightly lower than in Table 6, however. Although low in magnitude, the stereotypy values of the average task matrices all departed from a random model, as presented above.

The second exploratory question examines the relationship between interaction structure and performance outputs. To assess the structure-solution quality relationship, a series of correlational analyses were performed separately on the groups comprising each task. For both tasks, a correlation value of -1.00 indicates higher solution quality with higher magnitudes of interaction structure. The relationship between interaction structure and satisfaction similarly was assessed with correlational analyses performed separately for each task. A correlation value of +1.00 indicates higher satisfaction with higher magnitudes of structure. Table 7 presents the summary statistics. Given the small number of degrees of freedom and the small variation which exists in the stereotypy values, it is not surprising that the correlations fail to reach significance at the .05 level.

## DISCUSSION ISSUES

It appears useful to organize this discussion in three parts:

1. Before examining differences between the tasks and the relationship between interaction structure and performance outputs, the results as a whole will be compared to existing literature.
2. Second, the results will be analyzed in terms of differences between tasks.
3. Finally, the relationship between interaction structure and performance outputs will be discussed.

### Results Compared to Existing Data Base

Several researchers have examined group interaction structure when focusing on the content, or task, level of interaction (Gouran and Baird, 1972; Stech, 1970; Stech, 1975). However, research which concentrates exclusively on the relationship dimension of interaction is limited. To the knowledge of these authors, the existing data base consists of three classroom decision-making groups (Fisher, Glover, Ellis, 1975; Fisher, 1976; Ellis, 1976). The Mark relational coding scheme was used exclusively in the analysis of these groups.

Using the Rogers and Farace relational coding scheme, the present study confirmed existing literature for increasing structure (stereotypy) from the act to the interact to the double interact levels. However, the $\chi^2$ analyses suggest that antecedent acts and interacts contribute differently to the significance of these changes. Importantly, this confirmation reinforces the need to examine interaction as more than a collection of isolated acts or utterances.

The magnitudes of the stereotypy values were smaller in this study than in the existing data base. Analysis of the three decision-making groups established stereotypy values of .03, .18, and .22 at act, interact, and double interact levels. The present study found New Truck values of .06, .07, and .08, and Winter Survival values of .08, .09, and .09. Why were C values smaller in this study?

There are several possible explanations for the differences in the stereotypy values. First, the differences in the coding schemes which were used may account for the variance. Although both schemes focus on relational communication, they are not identical. While Fisher, Glover and Ellis (1975) did not compare the Mark scheme with the Rogers and Farace system, their paper found discrepancy in structure depending on which coding technique was used. It is possible that coding system differences account for the contrasting stereotypy magnitudes.

Stereotypy values may also have been affected by the nature of the tasks employed. As discussed below, the nature of the task can affect structure. The character of the tasks used in the three decision-making groups is unclear in the literature, making additional insights on this possible explanation difficult to assess.

Differences in group history may also have affected stereotypy values. The present study employed zero-history, LGD (Leaderless Group Discussion) groups which were formed randomly to meet for a maximum of thirty minutes. From the descriptions of the three decision-making groups, it is difficult to assess their histories. If the groups met for a more extensive period of time, either in a single meeting or across several sessions, that could account for the higher structure in those groups contrasted with the lower structure in the groups of the present study. Ellis (1976) reported lower structure in the first third of the decision-making groups' history than in the latter two phases. Groups with longer histories are more likely to have developed stable status and role structures, increased goal consensus, increased normative consensus, and so forth. All of these characteristics should be conducive to increased interaction structure. Also, the composition of the groups in the existing data base is unclear. If the decision-making groups were formed voluntarily, differing cohesion levels may be present in the existing literature and the present study. If decision-making group members had working knowledge of group process, their interaction structure might be different, as well.

Finally, stereotypy value differences in the existing data base and the present study may have been affected by possible differences in group sizes. The present study involved groups which ranged from five to seven members each. As Stech (1975) argued, smaller sized groups should be characterized by greater structure. Because the sizes of the three groups employed by Fisher et al. are not known, this may constitute a possible explanation for stereotypy variations if the Fisher et al. groups were smaller in size.

In terms of a basic content analysis, Fisher (1976) and Ellis (1976) reported that symmetrical and complementary interaction constituted 72% of their groups' interact matrix, with complementary interacts comprising 29% and symmetry comprising 43%. Symmetrical interaction was comprised mainly of "neutralized" symmetry ($\leftrightarrow\rightarrow$) interacts and constituted 32% of the total interacts. In comparison, the present study also found an average of 72% of the interacts comprised of complementary and symmetrical interacts. Paralleling the Fisher et al. data, complementary interacts constituted approximately 30% of the total interacts. Although symmetry occupied a comparable proportion of the total interacts, the distribution was different in this study. Overall, 28% of the interacts were competitive symmetrical ($\uparrow\uparrow$); transitory symmetry comprised but 6% of the total interacts in contrast to 32% for Fisher et al.

At the double interact level, Ellis (1976) reported that "one-upmanship" did not maintain itself. Contrary to Ellis' finding, the groups in the present study evidenced a highly probable continuation of the "one-upmanship" interaction mode. A $\uparrow\uparrow$ interact was most probably followed by another $\uparrow$ act; with the exception of the $\uparrow\rightarrow$ antecedent for the New Truck task, the $\uparrow$ act was the most probable resolution attempt for all of the antecedents. This reflects a basic tendency toward "one-upmanship" in these groups.

One-across behaviors were overwhelmingly the most infrequent interaction mode in the present study. At the interact level, for instance, 66% of all interacts were comprised of one-up and/or one-down combinations. The avoidance of transitory, or neutral, one-across behavior may reflect member attempts for clear relationships (whether dominant or submissive). Based on these data, members characteristically prefer dominance to submission interaction. Ellis (1976) suggested that power relationships may emerge through deference to authority rather than assertion of control. For the current set of data, power relationships clearly are defined through the assertion of control, or "one-upmanship."

Given longer group histories, the avoidance of transitory interaction might have disappeared. Likewise, with longer histories these groups might have realized the potential dysfunctions of continued "one-upmanship." (Jacobson, 1972, p.97). Alternatively, the relative infrequency of transitory interaction may have been a function of the Rogers and Farace (1975) coding scheme. Fisher (1976) criticized the coding technique for a built-in bias against the discovery of equal relationships.

As suggested above, it is also possible that the specific assignment of problems to be solved within a specified time period may have affected the transitory interaction in the present study. As Fisher _et al_. did not report on the nature of the tasks performed by their three groups, it is not possible to draw comparisons on this level.

Differences by Task

The New Truck and Winter Survival tasks did differ significantly in perceived difficulty, although the difference was not as great as expected on the basis of pre-testing. If the tasks had been even more extreme in their difference, the interaction differences that emerged might have been even greater.

In addition, these tasks were compared only in terms of their difficulty. Other simultaneous differences may exist between the two tasks which might have contributed to the differences found (eg. novelty, interest, relevance to "real-life" experiences, etc.).

Difference-by-task findings relate to the act, interact and double interact levels and to mean stereotypy values. At the act level, the two tasks had significantly different distributions; the Winter Survival task is characterized by more one-up (↑) acts and fewer one-down (↓) acts. This finding seems consistent with existing literature which reports more leadership attempts with more difficult tasks.

At the interact level, the two tasks had significantly different sequential structures with the ↑ antecedent and marginal significance for the → antecedent. Descriptively, in the more difficult task (Winter Survival), a ↑ act is more likely to be followed by a ↑ act, less likely to be followed by a ↓ act, and slightly more likely to be followed by a → act. Thus, when faced with a definition attempt, persons are more likely to counter-dominate than to acquiesce. The greater complexity of the more difficult task may provide the motivating force for this behavior; the greater diversity of perspectives in the more difficult task may produce less consensus on the problem and manifestation of more control efforts.

At the double interact levels, the two tasks differ significantly on the antecedent interacts ↑↑, ↑→, ↓→, and →↑. In the more difficult task (Winter Survival), the ↑↑ is more likely to be followed by a ↑ act, less likely to be followed by a ↓ act, and slightly more likely to be followed by a → act. The ↑→ interact is more likely to be resolved with a ↑ act, and less likely to be resolved with a → act in the more difficult task. The Winter Survival ↓→ interact is more likely to be resolved with a ↑ act, less likely to be followed with a ↓ act, and slightly more likely to be followed with a → act. Finally, the →↑ interact is more likely to be followed with a ↑ and less likely to be followed with a ↓ act in the more difficult task. Basically, these structuring differences reflect the tendency for members of groups performing more difficult tasks to perpetuate the "one-upmanship" more often than members of groups performing less difficult tasks. When resolution is between ↓ and →, members with the more difficult task opt for the less submissive act (→).

In terms of mean stereotypy values, the more difficult task is characterized by slightly higher patterning, although the differences are by no means overwhelming. In part, these differences may have been reduced due to the length of the group discussions. Stech (1970, p. 253) reported a "pronounced trend toward less structuring as the number of interaction units required to achieve solution increased." In general, the more difficult task was characterized by longer discussions and more total acts (3162 for Winter Survival and 1480 for New Truck).

Stech (1970, 1975) urged consideration of the effects of the task on interaction structure. This study is an initial attempt in that direction. Additional research in the task variable is necessary as we explore relational interaction.

Interaction Structure and Performance

In general, the hope of finding statistically significant relationships was diminished because of 1) statistical tests based on N=6, and 2) the small range among stereotypy values. Clearly, more groups of greater structural diversity are necessary for a meaningful analysis of the relationship between interaction structure and performance outputs. Further, this study used only one single item indicator to assess the satisfaction performance output. Multiple items, designed to capture the multidimensional nature of satisfaction (Heslin and Dunphy,1964), would improve any effort to relate it to interaction structure. In brief, these results can, at best, be interpreted for their heuristic capacity.

First, Table 7 suggests, perhaps, that tasks probably have differing optimum levels of interaction structure; the New Truck and Winter Survival tasks in these data have inverse relationships between interaction structure and solution quality. Watzlawick, Beavin, and Jackson (1967) suggest that interaction rigidity (symmetry to the near exclusion of complementarity or the reverse pattern) is characteristic of unhealthy relationships. Yet, little systematic research has explored the degree of interaction structure which optimizes effectiveness for a variety of relationships. More difficult tasks may require more structure for effective problem-solving, as these data suggest. Less difficult tasks may be capable of solution with considerably less structure. Further, the relationship between interaction structure is likely to be a curvilinear one--either too much or too little interaction predictability is likely to have dysfunctional consequences for solution quality. The relationship may also be a function of time--differing degrees of structure may be necessary at different phases of the problem-solving process; a group's tolerance of uncertainty during initial interaction is no doubt greater than its tolerance just prior to the deadline for a decision. Finally, the nature of the structure, as well as its magnitude, probably affects solution quality. A group may have 100% predictability in $\uparrow\uparrow$ interacts and another group may have 100% predictability in $\rightarrow\rightarrow$ interacts. Yet, the different patterns reflected in these equivalent interact sequential structures may greatly affect solution quality.

Similarly, the relationship between interaction structure and satisfaction is likely to be a complex one. The relationship probably is curvilinear with boredom and chaos leading to dissatisfaction at either extreme. A member's satisfaction probably is related as well to his/her expectations of what is goal promotive, and this would change as a function of task. Individual difference variables would also affect one's satisfaction with interaction structure; thus groups of differing compositions would have different optimum levels of structure. Finally, satisfaction probably is a function of the nature of interaction structure as well as its magnitude.

## SUMMARY

This study found:

1. Significant interaction patterns as a function of task difficulty. The stereotypy values indicated slightly more structure with the more difficult task. Further, content differences emerged in the nature of the structuring. The more difficult task is characterized by a tendency to define relationships more through "one-upmanship."

2. A nonsignificant, low correlation between interaction structure and performance outputs. Methodological issues aside, this finding is probably attributable to the complex nature of the relationship between interaction patterning and both task and performance outputs.

3. A tendency for interaction structure to increase as the level of analysis moved from the act to the interact to the double interact. The magnitude of the change was small, however, and the $\chi^2$ analyses suggest that some sequential patterns do not differ significantly from those at lower levels of interaction analysis.

4. Compared to the existing data base, generally smaller interaction structure values. Although the nature of the groups which comprise the existing data base is unclear, the small magnitudes of stereotypy in the present study are probably attributable to the brief histories of the groups, although other possible explanations are discussed in the body of the paper.

5. In contrast to existing data, a much more predominant interaction pattern of "one-upmanship." Reasons for this discrepancy are discussed in the text of the paper.

IMPLICATIONS

This study raises a variety of issues which should be explored in future research. Investigators need to explore other aspects of the task to understand more fully its effects on interaction. The link between interaction pattern and performance output should be pursued to fill the gap created by the lack of available systematic research in that area. In general, there is a need to integrate interaction patterning with other group variables such as cohesiveness, size, etc.

Important questions concerning coding schemes should be investigated. In the main, research which has explored group process from an information theory perspective has found relatively low degrees of structuring. In part, this finding may reflect our tendency to isolate one aspect of interaction within a particular coding scheme without placing the dimension in a more holistic pattern of total interaction. Given a more holistic approach, we may find interaction to be more predictable than we think in our isolated, segmented approach.

The appropriateness of the coding scheme may also affect structuring findings. Stech (1975) and Fisher *et al*. (1975) argue that the nature of the coding scheme affects the interaction pattern which one observes. The Rogers and Farace (1975) coding scheme has been used primarily with marital dyads. Perhaps the system is in need of alteration before application to small problem-solving groups. At a minimum, the coding scheme needs indicators of intensity for the control directions; "That's wrong!" and "But what about...?" are two very different degrees of expressed disagreement.

Further, it seems of maximum use to study relational communication from a phenomenological perspective. Rossiter and Pearce (1975) imply that relational overtones take on differing saliences, depending on the state of the interactants' relationship. Such perceptions would be difficult to capture from the perspective of the outside observer alone. Perhaps the group members could view videotapes of their interaction and engage in after-the-fact phenomenological insights.

Basic to any additional work in relational communication, however, is inclusion of the nonverbal modality. Watzlawick et al. (1967) claim that nonverbal cues constitute the primary source of relational information--a source excluded in the Rogers and Farace (1975) measure.

Finally, there is a significant need for future research on "one-upmanship" in small problem-solving groups. We have been socialized to interact in a competitive fashion and "one-upmanship" emerges as a characteristic interaction behavior (Filley, 1975). If, in fact, people in small problem-solving groups do respond with competitiveness, this is consistent with research in interpersonal conflict. As we explore "one-upmanship" in groups, we should seek groups and settings outside the classroom environment. We should determine whether or not "one-upmanship" is more suitable for some tasks than others. We should ascertain at what point "one-upmanship" becomes dysfunctional in the group problem-solving process. Failure to pursue questions such as these would be concomitant to disregard for salient features of our society--competition and conflict.

REFERENCES

Attneave, F. Application of Information Theory to Psychology. New York: Holt, Rinehart & Winston, 1959.

Blalock, Hubert M. Social Statistics. New York: McGraw-Hill, 1972.

Bochner, Arthur. "Task and Instrumentation Variables as Factors Jeopardizing the Validity of Published Group Communication Research." Speech Monographs, 1974, 41, 169-78.

Carson, R.C. Interaction Concepts of Personality. Chicago: Aldine, 1969.

DiSalvo, Vincent, and Seiler, William. "The Small Group as an Information Processing System." Paper presented to the Central States Speech Association Convention, 1974.

Ellis, Donald. "Relational Interaction in Decision-Making Groups." Paper presented to the International Communication Association Convention, 1976.

Ericson, Philip M. "Relational Communication: Complementarity and Symmetry and Their Relation to Dominance-Submission." Unpublished Ph.D. Dissertation, Michigan State University, 1972.

Ericson, Philip M., and Rogers, L. Edna. "New Procedures for Analyzing Relational Communication." Family Process, 1973, 12, 245-67.

Filley, Alan. Interpersonal Conflict Resolution. Glencoe, Illinois: Scott, Foresman, 1975.

Fisher, B.A. "Relationship Rules: Still Another Step Toward Communication Theory." Paper presented to the International Communication Association Convention, 1976.

Fisher, B.A.; Glover, T.; Ellis, D. "The Nature of Complex Communication Systems." Paper presented to Western Speech Communication Association Convention, 1975.

Fisher, B.A., and Hawes, L.C. "An Interact System Model: Generating Grounded Theory of Small Groups." Quarterly Journal of Speech, 1971, 37, 444-53.

Gouran, D.C., and Baird, J.E., Jr. "An Analysis of Distributional and Sequential Structure in Problem-Solving and Informal Group Discussion." Speech Monographs, 1972, 39, 16-22.

Hackman, J. Richard. "Effects of Task Characteristics on Group Products." JESP, 1968, 4, 162-87.

Hackman, J. Richard. "Toward Understanding the Role of Tasks in Behavioral Research." Acta Psychologica, 1969, 31, 97-128.

Hackman, J. Richard, and Morris, Charles. In Advances in Experimental Social Psychology, vol. 8, ed. by Leonard Berkowitz. New York: Academic Press, 1975.

Helmreich, Robert; Bakeman, Roger; and Scherwitz, Larry. "The Study of Small Groups." In The Annual Review of Psychology. Palo Alto: Annual Review, 1973.

Heslin, Richard, and Dunphy, Dexter. "Three Dimensions of Member Satisfaction in Small Groups." Human Relations, 1964, 17, 99-112.

Holsti, Ole. Content Analysis for the Social Sciences and Humanities. Reading: Addison-Wesley, 1969.

Jacobson, Wally. Power and Interpersonal Relations. Belmont: Wadsworth, 1972.

Johnson, David, and Johnson, Frank. Joining Together: Group Theory and Group Skills. Englewood Cliffs: Prentice-Hall, 1975.

Katzell, R.A.; Miller, C.E.; Rotter, N.G.; Venet, T.G. "Effects of Leadership and other Inputs on Group Processes and Outputs." JSP, 1970, 80, 157-69.

Lashbrook, Velma. "A Critique of 'Competitive Papers: A Potpourri'." Critique presented to the Western Speech Communication Association Convention, 1975.

Maier, Norman R. F. Problem Solving and Creativity: In Individuals and Groups. Belmont: Brooks/Cole, 1970.

Mark, Robert. "Coding Communication at the Relationship Level." Journal of Communication, 1971, 21, 221-32.

Miller, George A., and Frick, Frederick. "Statistical Behavioristics and Sequences of Responses." Psych. Review, 1949, 56, 311-24.

Morris, Charles. "Task Effects on G[illegible] Interaction." JPSP, 1966, 4, 545-54.

Parks, Malcolm; Farace, R.; Rogers, L.E. "A Stochastic Description of Relational Communication Systems." Paper presented to Speech Communication Association Convention, 1975.

Parks, Malcolm; Farace, R.; Rogers, L.E.; Albrecht, T.; and Abbott, R. "Stochastic Process Analysis of Relational Communication in Marital Dyads." Paper presented to International Communication Association Convention, 1976.

Rogers, L. Edna. "Dyadic Systems and Transactional Communication in a Family Context." Unpublished Ph.D. Dissertation, Michigan State University, 1972.

Rogers, L. Edna, and Farace, Richard. "Relational Communication Analysis: New Measurement Procedures." Human Communication Research, 1975, 1, 222-39.

Rossiter, Charles, and Pearce, W. Barnett. Communicating Personally. Indianapolis: Bobbs-Merrill, 1975.

Shaw, Marvin. Group Dynamics. 2nd ed. New York: McGraw-Hill, 1976.

Siegel, Sidney. Nonparametric Statistics. New York: McGraw-Hill, 195

Sorenson, J.R. "Task Demands, Group Interaction, and Group Performance." Sociometry, 1971, 34, 483-95.

Stech, Ernest. "An Analysis of Interaction Structure in the Discussion of a Ranking Task." Speech Monographs, 1970, 37, 249-56.

Stech, Ernest. "Sequential Structure in Human Social Communication." Human Communication Research, 1975, 1, 168-79.

Steiner, Ivan. Group Process and Productivity. New York: Academic Press, 1972.

Watzlawick, P.; Beavin, J.H.; and Jackson, D.D. Pragmatics of Human Communication. New York: Norton, 1967.

Weick, Karl E. The Social Psychology of Organizing. Reading: Addison-Wesley, 1969.

Zajonc, Robert. "The Requirements and Design of a Standard Group Task." JESP, 1965, 1, 71-88.

Table 1

Average Act Distributional Structure by Task

| Task: | Act Unit: ↑ | ↓ | → |
|---|---|---|---|
| New Truck (NT) | .49 | .32 | .19 |
| Winter Survival (WS) | .54 | .25 | .21 |

Table 2

Average Interact Structure by Task

| Antecedent Act: | Subsequent Act: ↑ | ↓ | → |
|---|---|---|---|
| ↑ | (NT) .51 / .57 (WS) | .35 / .26 | .14 / .17 |
| ↓ | .48 / .52 | .31 / .27 | .21 / .21 |
| → | .44 / .51 | .26 / .21 | .30 / .28 |

Table 3

Average Double Interact Structure by Task

| Antecedent Act: | Subsequent Act: ↑ (NT) | ↑ (WS) | ↓ (NT) | ↓ (WS) | → (NT) | → (WS) |
|---|---|---|---|---|---|---|
| ↑↑ | .51 | .56 | .35 | .26 | .14 | .18 |
| ↓↑ | .54 | .57 | .33 | .26 | .13 | .17 |
| →↑ | .48 | .60 | .36 | .23 | .16 | .17 |
| ↑↓ | .48 | .50 | .33 | .28 | .19 | .22 |
| ↓↓ | .47 | .53 | .35 | .28 | .18 | .19 |
| →↓ | .48 | .56 | .25 | .20 | .27 | .24 |
| ↑→ | .39 | .52 | .19 | .18 | .42 | .30 |
| ↓→ | .42 | .51 | .38 | .21 | .20 | .28 |
| →→ | .49 | .51 | .27 | .23 | .24 | .26 |

Table 4

Summary of $\chi^2$ Analyses for Double Interact Structures vs. Act Distributional Structures

| Antecedent Interact: | $\chi^2$ Values (2df) New Truck Task | Winter Survival Task |
|---|---|---|
| ↑ ↑ | 6.21[b] | 5.28[a] |
| ↓ ↑ | 5.56[a] | 3.93 |
| → ↑ | 1.24 | 5.40[a] |
| ↑ ↓ | .13 | 3.09 |
| ↓ ↓ | .62 | 1.18 |
| → ↓ | 3.55 | 2.11 |
| ↑ → | 35.40[d] | 17.08[d] |
| ↓ → | 2.18 | 5.18[a] |
| → → | 1.76 | 2.80 |

[a] significance at the .10 level

[b] significance at the .05 level

[c] significance at the .01 level

[d] si nificance at the .001 level

Table 5

Summary of $\chi^2$ Analyses for Double Interact Structures vs. Interact Distributional Structures

| Antecedent Interact: | $\chi^2$ Values (2df) New Truck Task | Winter Survival Task |
|---|---|---|
| ↑↑ | 0.00 | .67 |
| ↓↑ | .84 | 0.00 |
| →↑ | .61 | 1.47 |
| ↑↓ | .82 | .97 |
| ↓↓ | 1.43 | .61 |
| →↓ | 2.05 | 4.42 |
| ↑→ | 7.27[a] | 1.424 |
| ↓→ | 8.90[a] | 0.00 |
| →→ | 1.53 | .35 |

[a]significant at .05 level

Table 6

Stereotypy (redundancy) Values (C) at the Act, Interact, and Double Interact Levels by Task Group

| Group: | Level of Analysis: Act | Interact | Double Interact |
|---|---|---|---|
| NT#1 | .07 | .11 | .13 |
| NT#2 | .06 | .08 | .10 |
| NT#3 | .13 | .16 | .19 |
| NT#4 | .05 | .07 | .09 |
| NT#5 | .11 | .12 | .12 |
| NT#6 | .10 | .12 | .14 |
| WS#1 | .14 | .17 | .19 |
| WS#2 | .15 | .15 | .16 |
| WS#3 | .06 | .07 | .18 |
| WS#4 | .13 | .14 | .15 |
| WS#5 | .04 | .04 | .08 |
| WS#6 | .06 | .08 | .09 |
| New Truck $\bar{C}$ | .09 | .11 | .13 |
| Winter Survival $\bar{C}$ | .10 | .11 | .14 |

Table 7

Summary of Correlations Between Interaction Structure (C) and Performance Outputs

| Task: | Interaction Level: | Corr. w/ Soln. Quality: | Corr. w/ Satisfaction: |
|---|---|---|---|
| New Truck | act | .35 | .13 |
| | interact | .08 | -.09 |
| | double interact | .01 | -.27 |
| Winter Survival | act | -.27 | -.30 |
| | interact | -.12 | -.21 |
| | double interact | -.24 | -.41 |

[a]significance at the .05 level