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EFFECTS OF TASK PERFORMANCE STRATEGIES ON GROUP PERFORMANCE EFFECTIVENESS

J. Richard Hackman, et al

Yale University

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Norms controlling how members deal with performance strategies were altered experimentally in small task-oriented groups. The basic task required assembly of small electrical components. In one task condition (equal information) all task-relevant information was provided to each group member; in another (unequal information) it was spread unevenly among members, requiring exchange of information for optimum group performance. In the unequal information condition, an intervention inducing explicit discussion of task performance strategies facilitated group effectiveness. In the equal information condition, effectiveness was enhanced by an intervention that reinforced existing norms against explicit discussion of performance strategies. Spontaneous discussion of strategy did not take place in control groups for either task condition, and control groups were lowest in performance effectiveness. Measures of interaction process and of member reactions to the group were obtained, and were affected substantially by the experimental interventions.

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of task performance strategies facilitated group effectiveness. In the equal information condition, effectiveness was enhanced by an intervention that reinforced existing norms against explicit discussion of performance strategies. Spontaneous discussion of strategy did not take place in control groups for either task condition, and control groups were lowest in performance effectiveness. Measures of interaction process and of member reactions to the group were obtained, and were affected substantially by the experimental interventions.

EFFECTS OF TASK PERFORMANCE STRATEGIES ON GROUP PERFORMANCE EFFECTIVENESS[1]

J. Richard Hackman, Janet A. Weiss,[2] and Kenneth R. Brousseau

Yale University

The performance records of groups operating on the national scene over the last decade--from those involved in illegal campaign activities to those who administer social welfare programs to those responsible for the design and production of military hardware--provide damaging testimonials to the ability of interacting groups to make effective decisions or to perform successfully important tasks.

The pessimistic view of group performance effectiveness derived from such observations is corrobated by findings from social psychological laboratories: existing evidence strongly suggests that for most tasks the output of interacting groups generally is poorer than that which would be obtained by pooling the outputs of individuals acting indendently (Davis, 1969; Shaw, 1971; Steiner, 1972). And, despite years of research on small groups, relatively little is known about the reasons for the failure of groups to perform better than they do. Even less is known about what changes might be made to improve the performance of interacting groups (McGrath & Altman, 1966; Herold, 1974; Hackman & Morris, 1975).

This paper reports an experiment designed to test the usefulness of certain interventions into the interaction process of task-oriented groups as a means for improving group performance effectiveness.

The Crucial Role of Group Interaction Process

We believe that the key to understanding and changing small group effectiveness may lie in the social interaction that takes place among group members as they work on a task. At one extreme, for example, group members might deliberately withhold from one another individually-held information

that is crucial to task success--and the quality of the group product would suffer as a consequence. At the other extreme, there are instances where something seems to "click" in the group process, such that the inputs of one member prompt quick and innovative responses in another, which in turn lead a third to see a synthesis between the ideas of the other two--and a genuinely creative outcome results.

Social psychological research has tended to emphasize group process barriers to effective performance, and ways that group interaction is dysfunctional for productivity (e.g., Davis, 1969; Steiner, 1972). Little attention has been given to the other side of the coin: that is, why and how groups "click" when they do. Part of the reason for this one-sidedness in the literature on group process may derive from the difficulty of studying empirically phenomena which occur infrequently. For all practical purposes, truly effective patterns of group behavior may not be accessible to scientific study--simply because they occur so rarely. Thus, findings from studies of groups as they operate normally may inevitably emphasize those sub-optimal patterns of interaction which do typify most task-oriented groups (Argyris, 1969; Hackman & Morris, 1975).

Accordingly, studies are needed in which new (and potentially more task-effective) patterns of interpersonal behavior are experimentally created in groups, and thereby made amenable to empirical investigation. The present research employs this approach: specifically, we attempt experimentally to alter and improve those aspects of the group interaction process which are central to the selection and implementation of the performance strategies that guide work on the group task.

Task Performance Strategies

Given a task of any complexity, group members have numerous options about how they might coordinate their task-performance activities and about

the specific kinds of performance outcomes toward which they will focus the energy of the group. The specific options they select--whether explicitly or not--comprise the task performance strategy of the group.

There is considerable evidence that the performance strategies used strongly can affect the nature and the quality of the outcomes produced by a group (Davis, 1973; Maier, 1963; Shiflett, 1972; Shure, Rogers, Larsen & Tassone, 1962; Stone, 1971). It might be expected, therefore, that group productivity could be predicted directly from measures of how successful group members are in generating performance strategies that are particularly appropriate to their specific task.

In fact, however, most task-oriented groups rarely deal explicitly with matters of strategy at all--especially if their task is relatively familiar or well-structured (Hackman & Morris, 1975; March & Simon, 1958, p. 185; Shure et al., 1962; Weick, 1969, pp. 11-12). Instead, group members tend to develop private hypotheses (based on cues in the task) about how the task "ought" to be done, and then proceed to behave in accord with those hypotheses. Such strategies often are shared among group members, because of commonalities in their previous task experiences. In such circumstances, a group norm may develop among members, enforcing adherence to the shared strategies--even though their adequacy for the task at hand never has been explicitly examined.

Such a norm appears to have been operative in groups studied by Hackman and Morris (1975). One hundred interaction transcripts of three-person groups working on intellective tasks were scored for the frequency of strategy-relevant comments or suggestions made by group members. A total of only 143 comments about strategy were found--less than 1.5 per group. In 36 of the transcripts there was no mention whatever of anything having to do with performance strategy. Moreover, when strategy comments were made, they usually occurred after someone had behaved in a way that varied from the shared views

of other group members about how the task "ought" to be done. Apparently, attention to strategy was prompted in these cases by a desire of group members to bring the deviant back into line.

Despite the very low level of interaction about strategy, Hackman and Morris obtained a significantly positive relationship between the number of strategy-relevant comments made in the group and the creativity of the group outcome. This finding is correlational, and of course does not permit a conclusion that strategy discussion "caused" increased group creativity. Nevertheless, the finding does raise the possibility that overt discussion of performance strategy may be a useful device for helping group members identify and consider alternative ways of proceeding with work on the task--ways that otherwise might never come to the attention of the group members.

Sometimes such discussions of performance strategy would be expected to enhance group effectiveness, and sometimes they would not--depending on the nature of the group task. In particular, overt consideration of performance strategy should facilitate effectiveness for tasks which contain potentially "misleading" cues (i.e., cues which prompt sub-optimal hypotheses about how to proceed), and for tasks which require especially complex or non-traditional ways of proceeding for effective performance. If, on the other hand, cues in the task prompt member hypotheses about strategy that are fully task-appropriate, then explicit attention to matters of strategy probably would serve only to waste time that otherwise could be used for productive work on the task.

Focus of the Present Study

The notions presented above lead to the following three research questions, which form the specific focus of the experiment reported here:

1. Can task-appropriate discussion of performance strategies be induced in groups via relatively straightforward interventions into the norms of the

group? Given that spontaneous discussion of performance strategy occurs rarely in groups, it is important to know whether or not group members are capable of changing their strategy-inhibiting norms in response to a direct intervention. If, for example, most groups are not capable of engaging in useful discussions of strategy even when instructed to do so (and given some guidance about how to do so), then there would be little value in interventions aimed at improving group effectiveness through direct alteration of group norms about strategy.

2. If strategy discussions can be induced, what is their impact on group performance effectiveness? It was suggested above that explicit consideration of performance strategy should facilitate performance effectiveness only for certain kinds of tasks. The research tests the impact of strategy discussion on group performance for two versions of the same basic task. In one version, optimum performance requires substantial coordination and sharing of information among members--but this is not apparent from an initial, cursory examination of the task. In the other version of the task (which contains essentially the same set of external cues) substantial information-sharing and coordination is not required for optimum group performance. It is expected that explicit discussion of strategy will facilitate performance effectiveness to a greater extent for the former version of the task than for the latter.

3. If strategy discussions can be induced, what are their effects on member experiences in the group and on other aspects of the group interaction process? It may be that discussions of performance strategy have little impact on other aspects of the group process--or that the overall quality of the group experience is improved when issues of strategy are dealt with openly. On the other hand, strategy discussions may generate personal or interpersonal problems which, if neglected, could negate any effects that such discussions otherwise would have on the task productivity of the group. Data are collected

in the present study to explore such "spin-off" effects of strategy discussions on the quality of member experiences in the group and on other aspects of the group interaction process.

Method

Overview

The research examined the effects of three process intervention conditions (strategy intervention, anti-strategy intervention, and control) under two task conditions (equal information and unequal information). The design of the study is shown in Table 1.

The experimental task required groups of four subjects to assemble various kinds of electrical components. When subjects arrived at the laboratory, the experimenter explained the purpose of the study, demonstrated use of the tools and apparatus, and gave the group specific directions for assembling the components. Each subject received a "task order list" which specified the worth (in dollars and cents) of each component on his order list, and the quantity requested for each listed component. A commitment was obtained from members of each group to try to maximize the total dollar worth of the components assembled during the 35 minute work period. Members were informed that they could work together however they wished in order to achieve that group goal.

One-third of the groups (the strategy condition) were further instructed to spend the first five minutes of their work time in explicit strategy-planning activities, and were given information about what "strategy-planning" might involve. Another third of the groups (the anti-strategy condition) were instructed not to "waste time" in preliminary discussion, and instead to get immediately to work assembling components. The remainder of the groups (the control condition) were given no special instructions about how to proceed on the task.

Table 1

Design of the Study

Task Condition	Process Intervention: Strategy	Process Intervention: Anti-Strategy	Process Intervention: Control
Unequal Information			
Equal Information			

Half of the groups in each intervention condition were given a version of the task requiring substantial coordination and sharing among members for effective group performance (the "unequal information" condition); and half were given a more straightforward version of the same basic task (the "equal information" condition).

Dependent measures included the quantity and quality of the components produced by the group, measures of group interaction process obtained from observations made of the group, and member reports of their reactions to the group experience on a post-session questionnaire.

Details of methodology are provided below.

Subjects

The 144 subjects were male undergraduate, graduate, and professional students at Yale University. Most subjects were recruited by letters of solicitation mailed to a random sample of the student body, and were paid for their time. Some subjects were recruited through posted sign-up sheets, through personal solicitation, and through the introductory psychology course subject pool. Subjects recruited in different ways were spread evenly throughout the experimental design, and groups were randomly assigned to experimental conditions.

Apparatus

The four members of each group worked around a single square table. Tape marked off work areas for each member. A set of tools (large screwdriver, small screwdriver, wirestripper, wire cutter) and a large spool of electrical cord were provided in each work area. Next to the chair of each group member was a container labelled "Completed Components." Name tags (first name only) were taped in each of the work areas. A clock and blackboard were in the room for group members to use if they wished.

Procedure

When all four subjects had arrived for the experiment, they were conducted into the laboratory by an assistant, seated at the work table, and introduced to the experimenter. The experimenter explained that the research was aimed at increasing understanding of the determinants of task performance in small groups. He then instructed the subjects in the use of the tools (allowing them to practice individually with any which were unfamiliar), and showed them completed models of the four types of components they would be building.

After all subjects indicated that they were comfortable using the tools and that they understood the technical procedures involved in assembling the components, the experimenter gave each group member his own "task order list." The lists used (for both equal information and unequal information task conditions) are shown in Appendix A. The experimenter explained the lists to the group, pointing out that the lists showed (a) what the finished components should look like; (b) the size of the task order for each component ("the number of each component we need were we actually to be purchasing them from you"); and (c) the value of each component ("how much we hypothetically would pay for each one of the various kinds of components you can produce"). Values were assigned to the components (on the basis of timed pre-tests) so that one of the components (the receptacle and wire) was relatively over-priced--i.e., groups could earn more dollars per minute by producing receptacles than by producing any of the other components. Group members were not informed that this was the case.

When group members understood the information on the task order lists, the experimenter informed the group that observations would be made of the group interaction through the one-way mirror and that they would be asked to fill out a questionnaire when the 35 minute work period was over. In the strategy and anti-strategy conditions, the experimental interventions were

given at this point (see below).

The experimenter then emphasized that the measure of group performance to be used in the research was the total dollar amount of acceptable-quality components produced by the group, and he obtained an explicit commitment from group members to work hard and effectively to maximize group productivity. Finally, group members were informed that it would not be possible for them to produce everything on all four lists in the 35 minutes of work time--i.e., that they would have to make some choices about what to produce--and that they could work together however they wished in assembling the components. Further questions about procedure were discouraged by a re-iteration that "you can do whatever you as a group want to, so long as you follow the task and the general instructions I've given you."

The experimenter then left the room and started the 35 minute timer. Groups were warned when five minutes remained. When all time had expired, work was stopped immediately and only those components fully completed were counted in computing group performance. Group members then completed a post-session questionnaire (under instructions not to compare their answers), were given a second task (not relevant to the present research), were fully debriefed, paid, and dismissed.

Experimental Manipulations

Task condition. The cues in the basic task and in the experimental apparatus were such that group members could easily "fall into" a pattern of individual production--each person had his own task order list, his own work area, his own container for completed components, and so on. Other than the presence of the other group members and the commitment made to maximize group productivity, there was no pressure on group members to adopt a collaborative, interdependent strategy in carrying out the task.

Two versions of this basic task were used. In the equal information

condition the task order lists of each member contained all four components requested, and the number of each type of component that could be produced by the group as a whole was spread equally among all four members (see Appendix A-1 for the task order list given to each member in this condition). Thus, members had the option of making their own individual decisions about what components to produce to maximize the dollar productivity of the group, and then proceeding to assemble these components--all without any task-relevant interaction with other group members.

In the unequal information condition, only three of the four types of components were on the task order lists of any one member. Although the total number of components "ordered" from the group as a whole was the same as for groups in the equal task condition, the number of components on the lists given to group members varied from member to member (see Appendix A-2 for the four lists used in this condition). For example, of the 16 switch-and-plug components ordered from the group as a whole, the list of one member contained eight, that of two other members contained four each, and the list of the fourth member did not include the switch-and-plug at all. Orders for the other three components were distributed in a similar, uneven fashion among the four members.

Exchanging information among members potentially could facilitate group productivity for both task conditions--for example, by increasing the chance that the group would discover that the receptacle was relatively over-valued and decide to produce as many receptacles as possible. Because of the uneven distribution of task-relevant data in the unequal information condition, however, use of a collaborative performance strategy should be especially critical to the productivity of groups in that condition.

Group process conditions. The two experimental process conditions (strategy and anti-strategy) were created via instructions from the experimenter

prior to the beginning of the work period. Aside from the uniform exhortation to try to maximize the dollar productivity of the group as a whole, groups in the control condition received no special instructions. The instructional materials used by the experimenter were arranged so that he remained blind to condition until the moment he actually began a group process induction.

Groups in the strategy condition were asked to spend about five minutes of their 35 minute performance time in an explicit discussion of what they were trying to achieve, what they needed to know to reach their goal, and how they could work together most effectively. As a guide to this discussion, groups in the strategy condition were given a three-step "preliminary task" to perform which encouraged group members to deal explicitly with matters of task performance strategy.[3] After completing the preliminary task, groups were to begin assembling the components according to the strategy they had decided upon. Groups were cautioned against spending excessive time in strategy-planning activities (because each minute spent on planning left less time for actual task work). Materials used in the strategy intervention are included in Appendix B, including a copy of the preliminary task (B-1) and a rough "script" used by the experimenter in making the induction (B-2).

In the anti-strategy condition, groups were explicitly asked not to "waste any time" in unnecessary discussions of procedure or strategy, on the grounds that sometimes such discussion sets a tone in the group which is not conducive to hard, task-oriented work. Instead, these groups were asked to begin actual productive work as soon as the experimenter left the room. This intervention was aimed at preventing any spontaneous emergence of strategy discussion--while at the same time providing the positive motivation of an experimental instruction to work hard and effectively on the task. The rough script used by the experimenter in the anti-strategy

condition is provided in Appendix B-3.

Measures

Measures were obtained to reflect (a) the level of performance effectiveness of each group in the study, (b) the amount of strategy-planning done by each group, and (c) the characteristics of the interaction which took place among members of each group. These measures were derived from assessments of the components produced by the group, from observations of the on-going process of groups (through a one-way mirror) as they worked on the task, and from a 52-item questionnaire completed by all subjects immediately following the work period. Both the post-session questionnaire and the process observation checklist were factor analyzed, and measures were constructed based on the results of these factor analyses. Detailed descriptions of all measures are provided below; means, standard deviations, and the intercorrelations among measures are presented in Appendix C.

Group performance. Objective performance measures were computed for each group by a clerk who was blind to experimental condition. The following performance measures were obtained:

1. Gross performance. The total dollar productivity of the group, computed by multiplying the dollar "value" of each type of component by the number of components of that type produced by the group.

2. Net performance. Group members were informed in their pre-task instructions that their output would be assessed for quality, and that components that were wired incorrectly would be rejected. The net performance measure was computed the same way as the gross performance measure--but only for components which met the objective quality standards.

3. Number of receptacles produced. It will be recalled that the receptacle was the most over-valued of the four components that could be produced. The number of receptacles produced, then, should reflect the degree

to which group members "solved" the task--in the sense of producing the component which would most rapidly increase the total dollar productivity of the group.

Strategy-planning activity. Two independent measures of the amount of strategy-planning engaged in by group members were obtained, one from observations made of group members as they worked and one from member responses to the post-session questionnaire.

1. Observational measure. A 20-item observational checklist for assessing group process was developed in pre-tests of the research. Two observers were trained until they achieved near-perfect agreement in the use of the checklist. A scale reflecting the amount of strategy-planning activity was formed from the following six checklist items:

a. Do group members decide on a group goal?
b. Do they share the contents of the task order sheets?
c. Do they compare the difficulty of the items?
d. Do they compare the costs of the items?
e. Do they decide explicitly which items would be optimal to build?
f. Do they discuss the quantities of each item?

Each item was scored as "1" if the behavior occurred in the group, and as "0" if it did not. The six items were summed to obtain a single scale score for each group. Internal consistency reliability of the scale (obtained by applying Spearman-Brown procedures to the median inter-item correlation) is .93.

2. Questionnaire measure. A second measure of strategy-planning activity was constructed from subject responses to the following eight Likert-type items (using seven-point scales) on the post-session questionnaire:

a. There was participation among us in reaching a decision about what to construct and how we would go about it.
b. We discussed our strategy for working together very effectively.
c. We reached a group decision as to how to go about the task.
d. We shared the information on our task order sheets.
e. The way jobs were performed was decided by individual group members pretty much on their own. (reversed scoring)
f. It seemed appropriate to discuss fully the task and our approach to working on it.
g. We discussed our individual task-relevant skills.
h. We evaluated our performance as we worked throughout the experiment.

A single score was obtained for each group by computing an average score for each individual across the eight items, and then taking the mean of these averages across the four group members. Internal consistency reliability of the scale is .89. The correlation between the questionnaire-based and the observation-based measures of strategy-planning activity is .79.

Group process and member reactions. Ten additional dependent measures were obtained from subject responses to the post-session questionnaire. These measures were designed to reveal the impact of the experimental conditions on the internal processes of the group, and on the reactions of members to the group experience. Group scores on each measure were obtained by averaging individual responses across both the specific items composing the scale and the four group members. Two of the measures consist of single items. The items making up each of the measures and the internal consistency reliabilities of the measures are reported in Appendix D. A brief description of each measure is provided below.

1. Amount of verbal interaction. Member views of the quantity of discussion that took place in the group.

2. Clarity of communication. The degree to which members felt that others understood them--and that they understood others--as they worked on the task.

3. Change of task procedures. The degree to which the procedural strategy of the group changed (if at all) once actual work on the task had begun.

4. Procedural confusion. The degree to which members did not clearly understand what they were to do or how they were to do it.

5. Interpersonal conflict. Member views of the level of conflict and hostility present in the group interaction.

6. Obedience to the experimenter's instructions. How closely the group followed the experimental instructions.

7. Group atmosphere. The overall affective tone of the group as experienced by group members.

8. Comfort in the experimental setting. The degree to which members found the workplace comfortable and appropriate.

9. Level of task motivation. The degree to which members were motivated to achieve high group productivity on the task.

10. Personal feeling of leadership. The degree to which each member felt that he personally played a leadership role in the group.

Results

Manipulation Checks

To assess the effectiveness of the experimental interventions, 2 X 3 analyses of variance (two task conditions by three intervention conditions) were computed for three measures: (a) amount of strategy discussion as assessed by observation; (b) amount of strategy discussion as assessed by member post-session questionnaire; and (c) level of task motivation reported by group members on the questionnaire. Results are summarized in Table 2.

Groups in the strategy condition engaged in substantially more discussion of strategy than did groups in the anti-strategy and control conditions, as indicated by both questionnaire-based and observation-based measures. The observational data show that groups in the anti-strategy and control conditions engaged in almost no strategy discussion whatever. The questionnaire-based data suggest that control groups may have engaged in slightly more strategy discussion than did groups in the anti-strategy condition--but a planned comparison between these two conditions shows that the difference is not statistically significant (t (20) = 1.38, $p < .10$). In sum, these results suggest that the strategy intervention "took" as intended. Moreover, the very low means for groups in the control condition confirm the expectation that groups rarely initiate discussions of strategy spontaneously, even when (as in the unequal task condition) it is to their objective advantage to do so.

Both the strategy and anti-strategy interventions were designed to be persuasive to group members (i.e., to cause them to believe that following the instructions provided could increase their group productivity). And, when queried, subjects almost unanimously reported that they found the interventions convincing. Because of the persuasiveness of the interventions, we anticipated that groups in the strategy and anti-strategy conditions would show stronger motivation to perform well than would groups in the control condition.

To test this possibility, a planned comparison was made between groups in the control condition and all other groups in the study (i.e., strategy

Table 2

Mean Levels of Strategy Discussion and Task Motivation by Experimental Condition

Variable	Means						F-ratios		
	Unequal Information Task			Equal Information Task			Task (T)	Process Condition (P)	T x P
	Strategy	Anti-Strategy	Control	Strategy	Anti-Strategy	Control			
Amount of strategy discussion (data from observations)	5.50	0.17	0.17	3.83	0.50	0.00	2.87	101.74**	4.15*
Amount of strategy discussion (data from questionnaires)	5.05	2.64	3.28	5.32	2.73	2.10	0.11	31.32**	2.04
Level of task motivation	4.71	4.07	3.77	4.64	4.17	3.83	0.02	4.59*	0.05
df							1,30	2,30	2,30

Note. $n = 6$ in each cell

*$p < .05$

**$p < .01$

and anti-strategy groups combined). Results confirmed that groups in the control condition were less strongly motivated than were groups receiving an experimental intervention (t (30) = 2.35, $p < .025$). In addition, a comparison made between groups in the strategy condition and those in the anti-strategy condition showed that strategy groups had significantly higher task motivation than did anti-strategy groups (t (20) = 1.88, $p < .05$).[4]

Group Performance Effectiveness

The effects of the interventions on group performance effectiveness (for the measure of gross productivity) are shown in Figure 1 and Table 3. As predicted, groups receiving the strategy induction performed especially well in the unequal task condition, and groups receiving the anti-strategy induction performed especially well in the equal task condition. Moreover, performance was substantially lowered for the strategy groups in the equal task condition, and for the anti-strategy groups in the unequal task condition. Control groups were low for both task conditions.

The interaction between task condition and type of intervention was tested by a planned comparison, and is statistically significant (see Table 3). While the control group means were lower than those for groups in the two intervention conditions for both tasks, planned comparisons showed that the depression of control group means is not statistically reliable.

Means for other performance measures (net performance and number of receptacles produced) are reported in Table 4. Findings for net performance closely parallel those obtained for the gross performance measure, except for a depression of the mean of the equal information-control cell.[5] For the number of receptacles (the most lucrative component) produced, strategy groups showed a decided advantage in the unequal task condition, and a slight disadvantage in the equal task condition.

Correlational demonstration that the task moderates the impact of strategy planning activity on performance is provided in Table 5. Correlations were computed between the amount of strategy planning engaged in by a group and

Figure 1

Task-Condition Interaction for Measure of Gross Group Productivity

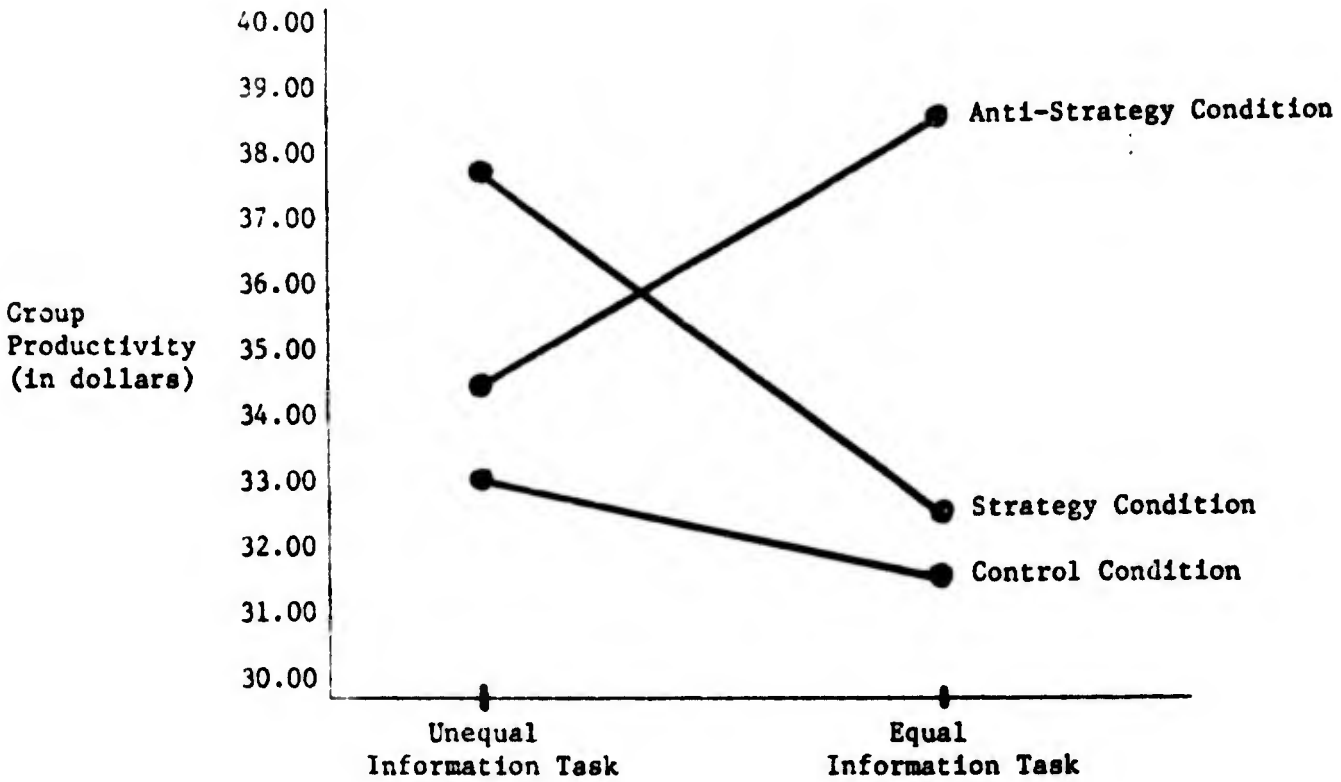


Table 3

Means and Planned Comparisons for Gross Group Productivity

Task Condition	Process Condition: Strategy	Process Condition: Anti-Strategy	Process Condition: Control	$\bar{X}$
Unequal Information Task	(1) 37.75	(2) 34.59	(3) 32.97	$35.10
Equal Information Task	(4) 32.42	(5) 38.70	(6) 31.64	$34.25
$\bar{X}$	$35.08	$36.64	$32.30	$34.68

Note. Cell numbers are in parentheses. Planned comparisons are:

(a) Cells (1 + 5) vs. (2 + 4). t (30) = 1.89, p <.05

(b) Cells (1 + 2) vs. 3. t = 1.05 (n.s.)

(c) Cells (4 + 5) vs. 6. t = 1.28 (n.s.)

Table 4

Means of Supplementary Performance Measures

Variable	Means by Task and Process Condition						F-ratios		
	Unequal Information Task			Equal Information Task			Task (T)	Process Condition (P)	T x P
	Strategy	Anti-Strategy	Control	Strategy	Anti-Strategy	Control			
Net Performance (i.e., after defective components were eliminated)	$34.73	$28.15	$29.21	$27.95	$31.35	$22.18	3.00	2.73	2.74
Number of receptacles (the most lucrative component) made	21.7	9.7	8.8	13.8	17.0	12.7	0.49	6.59**	8.30**
df							1,30	2,30	2,30

**p <.01

Table 5

Correlations Between Amount of Strategy Discussion and Group Performance

	Gross Performance	Net Performance	Number of Recepticles Produced	n
All Groups	.32*	.46**	.64**	36
Unequal Information Task	.54**	.69**	.91**	18
Equal Information Task	.19	.34	.25	18

* $p < .05$ (one-tailed)
** $p < .01$

Note. Correlations reported here use observational measures of the amount of strategy discussion. Use of questionnaire-based measeures of strategy discussion yields a nearly-identical pattern of relationships, although the overall magnitude of all relationships is slightly attenuated.

its performance effectiveness. For the sample taken as a whole, the relationship between strategy planning and productivity is statistically significant and moderate in size. For groups working on unequal-information tasks, the size of the same relationship is increased; for groups working on the equal-information task, it is attenuated. Thus, while strategy planning activities appear to generally facilitate performance effectiveness, they are much more helpful for the task which implicitly requires high inter-member coordination for optimum productivity than for a more straightforward version of the same task.

Group Process and Member Reactions

Table 6 summarizes the "spin-off" effects of the experimental interventions on group process and member attitudes, as reported by members on the post-session questionnaire. A 2 X 3 analysis of variance was computed for each dependent measure, and F-ratios are reported in the table for task condition, process intervention condition, and their interaction. Means are provided only for process condition, as there were no significant task effects and only one significant interaction between task and process condition (see note a in Table 6).

The results suggest that the strategy intervention had both positive and negative effects on the group and its members. On the positive side, groups in the strategy condition showed higher flexibility in how they approached the task than did groups in other conditions: they were more likely to change task procedures in mid-stream (when, for example, things obviously were not going well on the task), they were less strictly obedient to the instructions provided by the experimenter, and members communicated with one another slightly more clearly and understandably than was the case for groups in other conditions.

Of special interest is the very substantial (sixty percent of the dependent

Table 6

Post-Session Reactions of Group Members

Variable	Means by Process Condition			F-ratios		
	Strategy	Anti-Strategy	Control	Task	Process Condition	T x P
Procedural Confusion	4.19	3.30	3.35	0.27	5.02*	0.87
Interpersonal Conflict[a]	1.84	1.53	1.59	0.57	2.19	3.53*
Change of Task Procedures	2.64	1.82	1.58	1.33	6.81**	1.43
Obedience to Experimenter's Instructions	5.87	6.24	6.23	0.18	4.08*	1.30
Clarity of Communication	5.40	4.90	4.88	0.57	2.56	3.06
Personal Feeling of Leadership	4.03	2.30	2.57	0.12	23.12**	0.42
Group Atmosphere	5.21	4.60	5.07	0.69	3.66*	0.01
Amount of Verbal Interaction	4.23	2.68	3.67	0.92	8.16**	0.60
Comfort in Experimental Setting	4.36	4.01	4.30	1.66	1.21	0.11
df				1,30	2,30	2,30

[a]Examination of the T x P interaction for Interpersonal Conflict reveals that there was a substantial and statistically significant elevation of conflict for strategy groups in the unequal information task condition--but not in the equal information task condition.

** $p < .01$
* $p < .05$

variable variance) effect of the process intervention on the degree to which members experienced themselves as personally playing a leadership role in the group. Members of groups in the strategy condition were considerably more inclined to rate themselves as high on leadership and influence than were members of groups in other conditions. Apparently the strategy induction created a condition of shared leadership in which all members had considerably more "say" in what the group did than was the case for groups in the anti-strategy and control conditions.

Finally, groups in the strategy condition were higher than others on three variables which reflect on the overall climate of the group: the affective "atmosphere" of the group as experienced by members, the amount of interaction which took place while the group worked, and the degree to which members were comfortable in the total experimental setting (although differences between conditions on the last variable were not statistically significant). Interestingly, higher scores on these three variables were obtained by control groups than by groups in the anti-strategy condition; for all other variables reported in Table 6, differences between control and anti-strategy groups were small and not statistically reliable.

On the negative side, members of groups receiving the strategy intervention reported experiencing more confusion about how to proceed on the task, and that there was a higher level of interpersonal conflict in the group than was the case for members of control and anti-strategy groups. And, consistent with these findings, a tally of "problems experienced" (in response to an open-end question on the post-session questionnaire) showed that strategy groups encountered more task and interpersonal problems than did other groups (70 such problems were mentioned by members of strategy groups, compared to 34 for anti-strategy groups and 31 for control groups; χ^2 (2) = 20.9, $p < .01$).

The problems reported by members of strategy groups were more severe

and more frequent in the unequal than in the equal task condition--yet group productivity was especially high for strategy groups in the unequal task condition. At the least this suggests that such problems were not severely debilitating to the group, and it raises the possibility that dealing with the problems may have contributed positively to group effectiveness. That is, the strategy intervention may have forced group members to face up to task and interpersonal issues which, if overlooked or suppressed, would have compromised group performance. In contrast, the anti-strategy and control groups had a very low incidence of task difficulties and interpersonal conflict, but did not perform well in the unequal task condition.

In sum, the results reported above suggest that, while strategy groups encountered more task and interpersonal problems that did groups in other conditions, these problems apparently were not debilitating: strategy groups demonstrated more flexibility and shared influence in carrying out the task than did other groups, and members of strategy groups found the overall group experience to be more positive than did other subjects.

Discussion

Impact of the Strategy Intervention

The results of this study show that explicit discussions of group performance strategy facilitated group productivity--but only when the task objectively required coordination and sharing among members for effective performance. When the task was quite straightforward, strategy discussions led to a deterioration of performance--apparently because such discussions served no genuinely useful purpose for that task, and may have served only to waste group members' time (cf. Katzell, Miller, Rotter & Venet, 1970, p. 168).

On the other hand, exhortation to a hard-working, task-oriented set (as induced in the anti-strategy condition) enhanced group productivity when all members had equal information about the task, but impaired performance

when the task required coordination and information-sharing. Control groups performed relatively poorly on both versions of the task; they received neither the strategy intervention (an advantage in the unequal task condition) nor the exhortation to hard work (the advantage in the equal task condition).

Groups in the strategy conditions had the methodological cards stacked against them; they spent at least five minutes (1/7 of the total work time) in planning activities which were not directly productive. Others groups were using this time to produce components. Thus, the superior performance of the strategy groups in the unequal task condition reflects a rate of performance which greatly exceeded that of other groups once the actual assembly of components began.[6]

The effects of the interventions extended beyond matters of group productivity. For example, members of strategy groups reported that they played a leadership role in the group more often than did members of other groups. Such a widely shared influence structure could be expected to lead to increased conflict. And strategy group members did report more task and interpersonal "problems" (including more inter-member conflict) than did members of other groups. Yet despite these problems members of strategy groups expressed more liking for each other and for the group as a whole than did other subjects. This may be due to the increased level of interaction stimulated by the strategy discussions in these groups. Group members who received the anti-strategy intervention often interpreted their instructions to suggest silence while working. The resulting low level of interaction may have precluded the development of high attraction for the other members or for the group as a whole.

The interpersonal dynamics that gave rise to these outcomes cannot be fully explored with the present data. Nevertheless, the implication of the findings summarized above is intriguing--namely, that interventions aimed

solely at altering group norms about performance strategy apparently can influence many aspects of the group process and numerous member attitudes, including some which have little apparent connection with the norm originally modified. These unintended consequences deserve further investigation, as they may be critical in determining the ultimate effectiveness of task-oriented groups.

Implications for Research on Group Effectiveness

Creating non-traditional processes in groups. The findings of this study reaffirm the proposition that the study of group performance effectiveness can benefit from an approach which involves the experimental creation of non-traditional patterns of interpersonal behavior in groups. It would be near-impossible to assess the effects of strategy-development activities on group productivity, for example, if one were simply to wait for such activities to appear--as the low incidence of strategy discussion in our control groups makes clear. The indications are that existing norms about "appropriate" behavior in groups may constrain the richness and diversity of interaction that takes place among group members around many crucial aspects of group life. Accordingly, such norms may have to be "opened up" experimentally to allow study of alternative and potentially more effective ways that members of task-oriented groups might work together.

Identifying moderating conditions. Those patterns of interaction in groups that enhance effectiveness in one case will not work in other situations. The characteristics of the people involved, the task they are working on, the history of the group, and the broader social system in which the group is operating all can and do moderate the relationship between how group members interact and how well they perform (cf. Hackman & Morris, 1975).

We know embarrassingly little about the effects of these moderating conditions. In the present study, for example, the impact on productivity

of the strategy intervention was positive for one task and negative for the other--and the situation was reversed for the anti-strategy intervention. Clearly the group task was a powerful moderator of the process-performance relationship. Yet despite repeated calls for increased attention to task description and classification, and despite a number of attempts to develop schemes for differentiating conceptually among group tasks, no satisfactory method for describing the moderating functions of tasks has yet emerged (cf. Davis, 1969, Ch. 3; Hackman, 1969; Hackman & Morris, 1975; Herold, 1974; Roby & Lanzetta, 1958; Shaw, 1971; Zajonc, 1965). Until knowledge about such moderating conditions becomes available, it will remain next to impossible to develop and implement useful strategies for improving group effectiveness through modification of norms about process.

Refining and extending intervention techniques. The development of interventions to change patterns of interaction in groups is not a simple matter. Although the strategy intervention reported here appears straightforward and easily introduced in a group, a great deal of pretesting was required before the intervention would work for most groups. Simple instructions to "discuss your strategy for carrying out the task prior to starting actual work on it," did not provide enough guidance, and led to confusion and frustration on the part of most group members. Yet we did not want to provide too much structure, for fear that group members would rely totally on our guidance, and never learn how to carry out explorations of their strategic options. The device of the semi-structured preliminary task hit the middle ground. It enabled group members to understand what they were to do and to have some guidance about how to begin work on an activity that did not come easily to them, but it also encouraged them to work in their own way and to reopen strategy discussion when they saw renewed need for it.

Our results suggest that experimental interventions which focus on group norms and group interaction may require a two step process of implementation: first, helping members understand and accept as potentially useful the non-traditional activity they are asked to try; and second, providing members with some initial structure so that they can begin to develop the skill to perform the activity on their own if they find it useful. Designing such interventions so that they provide neither too little structure and guidance nor too much appears to be a significant and worthwhile research challenge.

Refining and extending measurement techniques. If research on group effectiveness is to aid in improving group performance, advances will have to be made in our ability to observe, record, and summarize the interactive behavior of group members. The behavior coding system used here was rudimentary; it served simply to document that the experimental manipulations had their intended effects. As yet, there are few elaborated coding systems available which are useful for examining the broader impact of process-oriented interventions. At minimum such systems should be capable of dealing with interaction process as it develops and changes over time, and should address those aspects of interaction that are uniquely important in affecting performance outcomes for the class of tasks being performed. The problem, of course, lies in deciding which aspects of interaction have a high probability of being "uniquely important" for specific types of tasks. This is one of the most difficult problems researchers of group performance are likely to confront; but it is a problem which must be solved if research in this area is to move forward.

* * *

The list of inter-related research problems outlined above is near-staggering. It is likely that solutions to these problems will be slow in coming, and limited in scope. Yet the cause is a good one. Most of the world's business continues to be conducted in groups, and it is to the

advantage of all that groups function effectively. Our research suggests that it is possible to develop and implement intervention techniques that can help group members work together more effectively. But the consequences of such interventions--for a variety of groups performing different tasks in a range of settings--must be researched and evaluated with great care before the techniques can become useful for general practice.

References

Argyris, C. The incompleteness of social psychological theory: Examples from small group, cognitive consistency, and attribution research. American Psychologist, 1969, 24, 893-908.

Davis, J. H. Group performance. Reading, Mass.: Addison-Wesley, 1969.

Davis, J. H. Group decision and social interaction: A theory of social decision schemes. Psychological Review, 1973, 80, 97-125.

Hackman, J. R. Toward understanding the role of tasks in behavioral research. Acta Psychologica, 1969, 31, 97-128.

Hackman, J. R. & Morris, C. G. Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L Berkowitz (Ed.) Advances in experimental social psychology (Vol. 9). New York: Academic Press, 1975.

Herold, D. M. (Georgia Institute of Technology) Group effectiveness as a function of task-appropriate interaction processes. Paper presented at the American Institute for Decision Sciences meetings, Atlanta, 1974.

Katzell, R. A., Miller, C. E., Rotter, N. G., & Venet, T. G. Effects of leadership and other inputs on group processes and outputs. Journal of Social Psychology, 1970, 80, 157-169.

Maier, N. R. F. Problem solving discussions and conferences: Leadership methods and skills. New York: McGraw-Hill, 1963.

March, J. G. & Simon, H. A. Organizations. New York: Wiley, 1958.

McGrath, J. E. & Altman, I. Small group research: A synthesis and critique of the field. New York: Holt, Rinehart & Winston, 1966.

Roby, T. B. & Lanzetta, J. T. Considerations in the analysis of group tasks. Psychological Bulletin, 1958, 55, 88-101.

Shaw, M. E. Group dynamics. New York: McGraw-Hill, 1971.

Shiflett, S. C. Group performance as a functic of task difficulty and organizational interdependence. Organizational Behavior and Human Performance, 19 2, 7, 442-456.

Shure, G. H., Rogers, M. S., Larsen, I. M., & Tassone, J. Group planning and task effectiveness. Sociometry, 1962, 25, 263-282.

Steiner, I. D. Group process and productivity. New York: Academic Press, 1972.

Stone, T. H. Effects of mode of organization and feedback level on creative task groups Journal of Applied Psychology, 1971, 55, 324-330.

Weick, K. E. The social psychology of organizing. Reading, Mass.: Addison-Wesley, 1969.

Zajonc, R. B. The requirements and design of a standard group task. Journal of Experimental Social Psychology, 1965, 1, 71-88.

Footnotes

1. The authors gratefully acknowledge the assistance of Thomas L. Costanzo, Martin Greller, Judith D. Hackman, and G. Douglas Jenkins, Jr. in the design and execution of this research.

2. Now at Harvard University.

3. Pre-testing revealed the need for a structured device such as this to ensure that meaningful discussion of strategy did actually occur. When merely asked to engage in "discussions of the strategy you will use in pursuing your group goal," most groups in the pre-test were unable or unwilling to engage in this "unusual" behavior. Such instructions often were almost completely ignored by group members (e.g., they would start work immediately on the task, perhaps with a comment that they could "discuss strategy as we go"--which they rarely did). The difficulty members had in carrying out discussions of strategy is further illustrated by the failure of some subjects in the strategy condition to complete their preliminary task sheets. While observations confirmed that all groups in the strategy condition did in fact have such discussions, group members sometimes did not record their decisions about strategy on the preliminary task sheets as they had been instructed.

4. These findings could cause interpretative difficulties if it should turn out that group performance effectiveness were consistently highest for strategy groups and lowest for control groups. In such a case, results could be explained solely in terms of task motivation, regardless of the actual content of the interaction which took place in the groups. Fortunately (as will be seen below) productivity data did not show this pattern.

5. Inspection of the data reveals that this depression is caused by a single group which produced inordinate numbers of "sloppy" components. While this

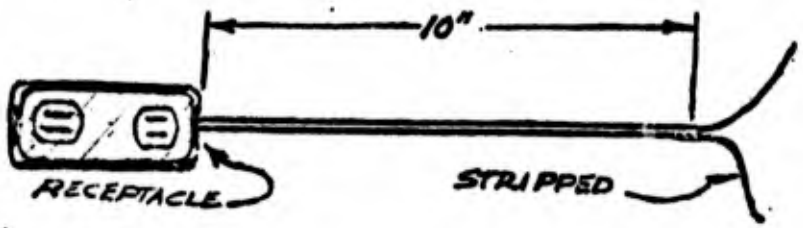
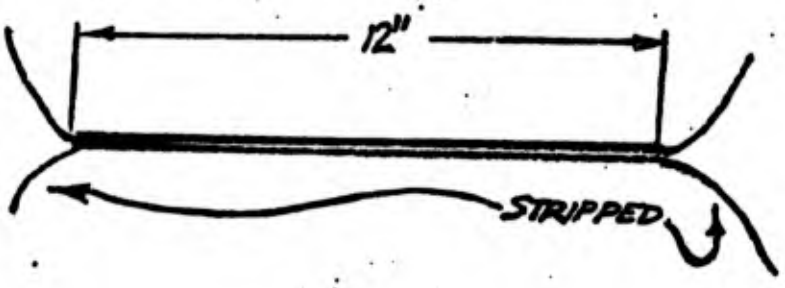
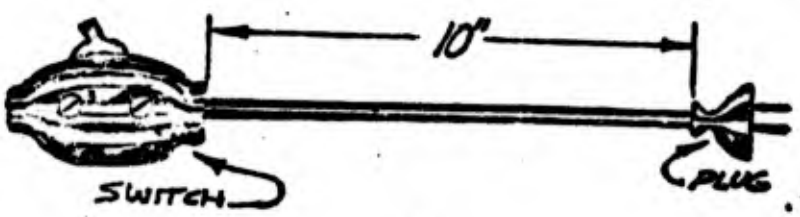
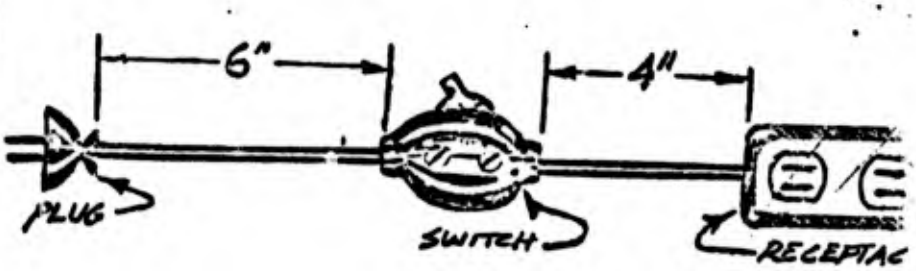
did not affect the gross productivity mean for the cell, it did lower the mean net performance. Re-computation of the mean for the cell with that group removed yields a cell average nearly identical with that obtained for the unequal information-control cell.

6. A measure of performance rate was computed by dividing the net performance score by the number of minutes the group actually spent assembling components. In the unequal task condition, strategy groups produced at a rate of $1.23 per minute, compared to $0.80 per minute for anti-strategy groups. In the equal task condition, however, the productivity rates of strategy and anti-strategy groups were very similar ($0.92 and $0.90 respectively). An analysis of variance of the rate measure showed this task by process condition interaction to be statistically significant (F (2,30) = 3.76, $p < .05$).

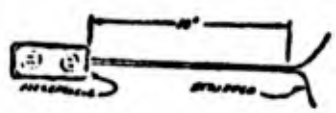
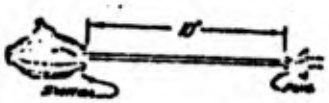
APPENDIX A

Task Order Lists Supplied to Group Members

ORDER LIST

PE	VALUE	QUANTITY	DESCRIPTION
A	$1.60	6	
B	$.25	4	
C	$2.00	4	
D	$2.25	3	

Order List No 1

Type	Value	Quantity	Description
B	$1.60	2	
C	$2.00	8	
D	$2.25	2	

Order List No 2

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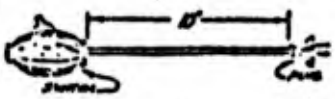
C	$2.00	4	
D	$2.25	8	
A	$.25	4	

Order List No 3

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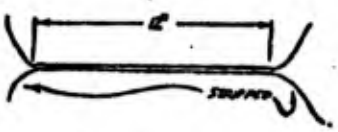
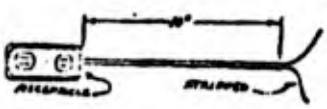
A.	$.25	8	
B	$1.60	2	
D	$2.25	2	

Order List No 4

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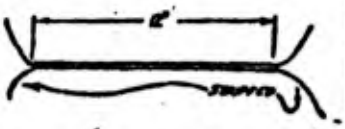
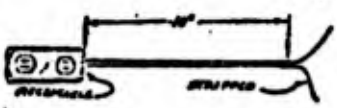
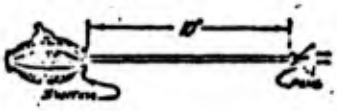
A.	$.25	4	
B	$1.60	20	
C	$2.00	4	

APPENDIX B

B-1 The "Preliminary Task" given to groups in the strategy condition to guide their strategy-planning activities.

B-2 The rough script used by the experimenter in inducing the strategy condition.

B-3 The rough script used by the experimenter in inducing the anti-strategy condition.

PRELIMINARY TASK

Please discuss each of the points listed below as a group. Spend no more than five minutes total on this preliminary task.

It is very important that you take the steps one by one, and do them in the order listed.

When each step is completed, place a check mark in the blank and go on to the next step. When all three are finished, begin actual work on the components.

_____STEP ONE. What are you going to try to achieve when you start working on the main task? That is, what is your group goal?

When you are sure all members agree on the goal of the group, each member should write the goal in his own words in the space below.

Our goal for the task is:

_____STEP TWO. What information do you need to have in order to most effectively achieve the goal you wrote down above? That is, what do you need to know to be able to do as well as possible?

When you have identified what information is important to your success as a group, exchange any information that some group members may have that is not available to others.

When all goal-relevant information has been shared among group members, go on to step three.

_____STEP THREE. How should you go about working on the group task? That is, on the basis of the goal you have accepted and the information you have shared, how should you proceed so as to maximize your overall performance effectiveness?

Make sure that the strategy you develop for proceeding with your work on the task is consistent with:

--the goal you are trying to achieve;
--the information you shared about how best to achieve the goal; and
--the requirements and constraints of the task itself

When all members agree on your group work strategy, begin actual wor

FEEL FREE TO RE-OPEN YOUR DISCUSSION OF ANY OF THESE THREE ITEMS DURING YOUR WORK PERIOD IF THE NEED ARISES

Experimenter's Script for the Strategy Induction

...now, one more thing. One big problem with many groups is that members plunge right into work on the task without really deciding first what it is they are trying to accomplish or how they should go about it to perform as well as possible.

One possibility that we're testing in this research is that the productivity of groups can be raised simply by asking members to sit back for a few minutes before they start work and to check out three things:

1. Making sure that all group members agree on what the group is trying to accomplish.

2. Making sure that the group has at hand (and that members share) all the information needed to achieve the group goal.

3. Deciding explicitly how group members should go about working on the task to achieve that goal as fully as possible.

So we are asking you to check out these three points in the first five minutes of your work session--that is, before you actually start work on the task. The points are listed on this sheet. (Distribute "preliminary task" sheets and make sure members understand how to use them).

Are you willing, before you actually start work on the task, to discuss these three items explicitly--if briefly? (gain assent.)

Fine. Just keep two things in mind as you work:

1. Keep your preliminary discussion to no more than five minutes--try to have all three items discussed and checked off by then.

2. Feel free to re-open your discussion of strategy at any point during the work period--if, for example, it turns out that the strategy you decide on first does <u>not</u> work as well as you expected.

Okay? Begin now, starting by discussing Step One on the preliminary task. You have a total of 35 minutes.

Experimenter's Script for the Anti-Strategy Induction

...now, one more thing. As I said earlier, we're looking at various factors which can improve the productivity of task groups in this research. Some of them are very simple. They merely involve asking group members to deliberately break some old habits, habits that may make the group less effective than it could be.

The habit I'd like to talk with you about involves what happens in the first few minutes of the group's work on the task. Often group members tend to waste that time away--that is, they get to know each other, talk about various ways they might proceed to do the task, and generally screw around. You no doubt have observed this happen in committees you have been on, right?

Well, this can result in at least two problems.

1. The group wastes valuable time that members otherwise could use for actual productive work.

2. A kind of "loose" or casual climate may get established right off the bat, which can keep a group operating in a casual, non-productive mode throughout the entire time it has to do the task. That is, what happens in the first few minutes may "set the tone" for the whole session.

Today we'd like to see if you can break this old habit by starting out to work <u>immediately</u>--plunging right into actual work on the task. By doing this you will certainly make best use of your work time, and you may establish a good, task-oriented climate as well.

We expect that you will be able to do what we are asking with no difficulty. What we're especially interested in is what happens <u>later</u>--that is, whether you find that doing away with the usual "warm up" time helps or hurts your performance, whether you like the group better this way or not, and so on. We will ask you about these things at the end of the session.

Are you willing to try to plunge immediately into the actual task work--that is, start right off doing the assemblies required? (Gain assent.)

Fine. Then begin now assembling the components. You have a total of 35 minutes.

APPENDIX C

Means, Standard Deviations, and Intercorrelations of Dependent Variable Measures

	$\bar{X}$	S.D.	Intercorrelations														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Gross performance	34.68	6.28	-														
2 Net performance	28.93	6.84	.72**	-													
3 Net performance rate	0.89	0.25	.62**	.93**	-												
4 Number of receptacles produced	13.94	6.27	.72**	.58**	.67**	-											
5 Strategy planning: observational data	1.69	2.34	.32	.46**	.72**	.64**	-										
6 Strategy planning: questionnaire data	3.28	1.52	.11	.32	.53**	.45**	.79**	-									
7 Amount of verbal interaction	3.52	1.11	.03	.20	.33*	.23	.47**	.58**	-								
8 Clarity of communication	5.06	0.69	.18	.45**	.47**	.18	.41**	.63**	.66**	-							
9 Change of task procedures	2.02	0.86	.06	.02	.14	.12	.41**	.60**	.03	.22	-						
10 Procedural confusion	3.61	0.84	-.09	-.08	.12	.21	.41**	.51**	.28	.12	.30	-					
11 Interpersonal conflict	1.66	0.41	.31	.25	.39*	.45**	.42**	.13	.12	-.08	-.02	.13	-				
12 Obedience to experimenter's instructions	6.11	0.38	-.11	-.11	-.30	-.35*	-.50**	-.25	-.16	.07	.02	-.40**	-.39*	-			
13 Group atmosphere	4.96	0.60	.09	.26	.33*	.23	.37*	.58**	.70**	.68**	.12	.14	-.01	.10	-		
14 Comfort in the experimental setting	4.22	0.60	.00	.11	.18	.19	.19	.29	.20	.17	.01	-.02	.04	.05	.62**	-	
15 Level of task motivation	4.20	0.76	.17	.25	.35*	.27	.42**	.55**	.03	.20	.66**	.29	-.01	.05	.29	.18	-
16 Personal feeling of leadership	2.97	1.00	.11	.35*	.58**	.48**	.80**	.83**	.71**	.60**	.31	.42**	.34*	-.28	.64**	.31	.33*

n = 36 groups

* p<.05 (two-tailed)
** p<.01

APPENDIX D

Items Composing Measures of Group Process and Member Reactions

Measure	Internal Consistency Reliability	Items Averaged to Obtain Summary Score
Amount of Verbal Interaction	.67	We talked a lot about irrelevant things. We felt free to express our own ideas and opinions in the group. During the experiment, I felt that we were spending too much time talking about the task rather than actually building the components.
Clarity of Communication	.81	It was fairly easy for me to make others understand what I meant. The others seemed to fairly easily make themselves understood.
Change of Task Procedures	.70	Once we actually started building components we did not change our strategy. (reversed scoring) Did the procedure your group used for assembling the components change during the time you were making them? (scored "yes" = "1" and "no" = "0")
Procedural Confusion	.64	The way to go about performing the task was clear and unambiguous. (reversed scoring) We were confused about exactly how to go about doing the task.
Interpersonal Conflict	.64	There was a noticeable hostility among group members. There was a great deal of conflict among members of the group.
Obedience to Experimenter's Instructions	-	We followed the experimenter's instructions
Group Atmosphere	.85	I enjoyed being a member of this group. I felt quite comfortable and at ease during this experiment. The other members seemed to like and accept me. The other members of the group seemed to be relaxed and comfortable during the experiment. I liked the other members of the group. The other members seemed to enjoy being in this group.

-continued-

Measure	Reliability	Items Averaged to Obtain Summary Score
Comfort in the Experimental Setting	.65	The work room was pleasant. The work room was too large. (reversed scoring) The work room was comfortable. I felt quite comfortable and at ease durir the experiment.
Level of Task Motivation	.73	It was important to me that my group be among the best. I felt that my group was in competition with other groups which have participated in the experiment. As a group, we were motivated to do a good job. I felt motivated to do a good job.
Personal Feeling of Leadership	-	I found myself playing a leadership role.