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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report summarizes research using various productivity measures of group problem solving. Conclusions and suggestions for future research are made.

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INFLUENCES ON GROUP PRODUCTIVITY I:

FACTORS INHERENT IN THE TASK

A Bibliographic Synopsis

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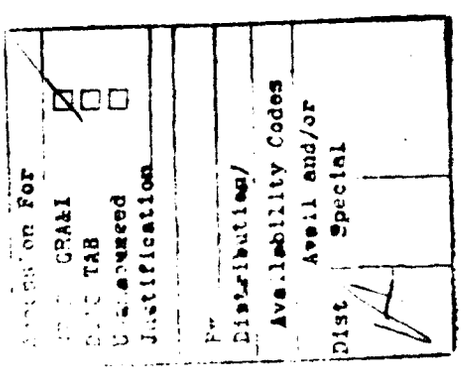

Comments on Task Factors

The study of group processes has a long and sometimes distinguished history in social psychology. Indeed, the template study of the field of social psychology is one in which the effects of a group on some behavior is studied. The classic study of Floyd Allport (1920) fits this description. Of course, in most of these studies the subject is viewed as passive, a target of the persuasive behaviors of either the group members or some audience (as in the social facilitation studies of e.g. Martens, 1969 and Zajonc, 1965).

A second line of research, which is of more interest to us here, deals with the effect of group structure and composition on some behavior of interest. These situational variables (Detweiler, Brislin and McCormack, 1983) include such things as group size, status differences, racial and cultural heterogenity, and so on. Usually, but not always, the dependent variable is the solution of some kind of problem in the group setting. We say, "sometimes" for occassionally we see more interest in the group processes itself than in any outcome of that interaction. Examples of this concern with situational variables are given in Brislin, (1981) and Detweiler, et. al., (1983).

The present research summary was undertaken to examine the types of tasks which have been used to study group problem solving. Our rationale for focussing on what, we admit, has been

seen to be a rather uninteresting problem is a pervasive feeling that the nature of the dependent variable has been neglected in group problem solving studies. Indeed, the neglect is puzzling inasmuch as most researchers would not use a test as a dependent variable which had not be subjected to reasonable validity and reliability studies; yet that is precisely what seems to have been the norm over the past three or four decades. The literature which is cited and summarized in the Appendix is limited to those studies which a) describe the task in sufficient detail to permit a reasonable reader understanding, b) used groups of at least 3 subjects and c) was not a pure replication of some previous study (to reduce redundancy). We also restricted ourselves to articles that present empirical research, with one or two exceptions. So, the excellent reviews of Heslin, (1964) and Mann, (1959) are not included.

The studies are summarized in Tables 1, 2, 3 and 4. Table 1 extracts information on the demographic characteristics of the Ss. As is rather common, the 18-21 year-old subject looms large. Table 2 uses Steiner's 1972 typology to categorize the decendent variables used in the studies. While the slotting is not perfect, it does give a reasonable over-all picture of the breath of the types of tasks commonly employed. Finally, Table 3 tabulates the studies according to some additional variables: 1) were the tasks chained (ie. did the completion of the task, or a part of one, lead to the beginning of another task) 2) did subjects receive multiple or single tasks in the experimental setting? and 3) when the group made a decision, how was that

point reached?

The review suggests the following conclusions:

1. Most of the studies do not use direct measures based on the subject's efforts (see Table 4). Such a measure as e.g. number of widgets per hour constructed has the advantage of metric properties which are most desirable, e.g. interval scaling. Rather, the tendency seems to be to use observer "ratings" of the adequacy of the product reaching some criterion. This is not necessarily a criticism since such approaches may have considerable external validity. That is, many "real" efforts are judged using subjective criteria by others. Kabanoff and O'Brien, 1979 is one such study.

2. The tasks used tend to be independent of one another with little chaining. In Steiner's 1972 typology, we see a large number of unitary tasks with relatively few divisible ones. Unitary tasks have the advantage, of course, that they do not require group effort in order to be completed. It is true that many tasks we do, outside of the laboratory, can be done in solitary bliss; however, it is problematic that such tasks can be generalized to the true group situation.

3. The majority of studies used a design which gives a single task to single subjects or groups. Even when multiple tasks are used within subjects, order effects and [illegible] relationships are not assessed.

4. Tasks seem largely chosen for ease of administration and

"cuteness" and less for being a sample along some important task dimension. This probably reflects the fact that the task, itself, has been of less interest than the independent variables that are manipulated. However, without attention being given to sampling of tasks from some population (as Brunswik recommended so many years ago) the external validity of the researches is open to question. We showed some time ago that merely structuring a display markedly changing the functioning of many common dependent variables (e.g. Landis and Slivka, 1972).

The above points become even more important when we recall that a major incentive to positive intercultural contact is agreement on superordinate goals. Such goals themselves would, it seems, require tasks which are seen as important not only for the individual but perhaps for the group. It is hard to see many of the tasks as being perceived as very important (or superordinate) by the subjects.

The above comments lead to the following initial recommendations:

1. It would be useful, and perhaps necessary, to carry out a parametric study of group problem solving tasks. Such a study should articulate in advance a set of important task dimensions and sample tasks along these dimensions. Subjects should be used in a within-Ss design and validity coefficients assessed. A good beginning typology may well be Steiner's 1972 structure, although Guilford's structure of intellect model may provide an even richer set of ecologically valid tasks.

In defining the task dimensions, it may be useful to do a naturalistic elicitation of work related tasks that involve group activity. Subjects could be asked to recall tasks that they did over some period of time and which were either 1) done as part of a group or 2) could have required group activity for completion. These tasks could then be clustered by additional subjects and the basic dimensions named. Adapted versions of the tasks could then form the basis for future studies.

2. Largely unstudied (at least in this sample) has been the reward structure of the task. In large measure, the subjects are working off a class requirement and successful performance on the task has no instrumental value. It may be that some tasks are much more susceptable to reward effects than others. This relative lack is bothersome unless one wants to assume that rewards merely produce linear enhancements in the response rate.

3. With a few exceptions, "insight" or "Eureka" type tasks have not been used in group problem solving studies, although they have been used in studies of individual "creative" problem solving (e.g. the series by Luchins and Maier). While there may be good reasons for this lacuna, there are, nontheless a large number of group situations in which such solutions are the norm rather than the exception. Indeed, groups, it would seem, are better at coming up with the unusual answer than they are doing production type tasks. It would seem reasonable that we should focus some of the effort on the development and standardization of "insight" tasks as a possible dependent variable in later

studies.

4. Our restriction to studies in which groups of at least 3 people worked at some problem eliminated many possible useful tasks. For example, over the past 2 or 3 decades the development of individual problem solving tasks which could be used to assess alternative engineering designs has been a prime activity of human factors psychologists. Some of these tasks could possibly be adapted for group useage. It is thus reasonable to review this literature with the idea of extracting a set of possible tasks and trying them out in a group setting.

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TABLE I

DEMOGRAPHIC SUMMARY OF STUDIES

STUDY	N	SEX	GROUP SIZE	POPULATION
Deutsch, 1949(b)	50	?	5	undergraduates
Schacter, et al 1951	50	F	3	undergraudates
Pepinsky, Pepinsky & Pavlik, 1960	72	M	3	undergraduates
Hammond & Goldman, 1961	60	?	5-6	undergraduates
Shaw & Blum, 1966	90	M	5	undergraduates
Hackman, 1968	300	M	3	undergraduates
Kent & McGarth, 1969	300	both	3	undergraduates
Stone, 1971	72	?	3	undergraduates
Freedman, Klevansky & Ehrlich, 1971: I	126	both	5-9	high school
II	306	both	7-9	high school
III	180	F	9	25 - 5[illegible] year old Ss.
Shiflett, 1972	144	M	2*	undergraduates
Spoedlers-Claes, 1973(a)	108	M	4	undergraduates
Spoedlers-Claes, 1973(b)	192	both	4**	undergraduates
Young, 1974	360	?	?	?
Hewett, O'Brien & Hornik, 1974	96	both	3**	undergraduates
Kanekar & Neelakantan, 1976	120	F	3	girl's high school
Hackman, Brousseau & Weiss, 1976	144	M	3	undergraduates
Lord, 1976	144	both	5**	undergraduates
Seta, Paulus & Schkade, 1976	63	both	2-4	undergraduates

? indicates information was unavailable in original report.
* individual subjects used as well.
** balanced by sex.

STUDY	N	SEX	GROUP SIZE	POPULATION
Shaw & Ashton, 1976	80	both	3*	undergraduates
Goldman, Stockbauer & McAuliffe, 1977	128	M	4	undergraduates
Carlson, 1978	?	?	?	undergradutes
Kabanoff & O'Brien, 1979(a)	72	both	3**	paid undergraduates
Kabanoff & O'Brien, 1979(b)	144	?	3	undergraduates
Norris & Niebuhr, 1980	18	?	various	undergraduates
Isenberg, 1981	72	both	4	undergraduates

? indicates information was unavailable in original report.
* individual subjects used as well.
** balanced by sex.

TABLE II

TYPOLOGY OF TASKS BY STUDIES: PART I

(after Steiner, 1972)

STUDY	TASK(S)	STEINER'S TASK TYPES:
Deutsch, 1949(b)	1.Human relations	unitary: optimizing & discretionary
	2.Puzzle problems	unitary: optimizing & disjunctive
Schacter, et al, 1951	1.Production of checkerboards	unitary: maximizing & disjunctive
Pepinsky, Pepinsky, & Pavlik, 1960	1.Model assembly/ disassembly	divisible: assigned & specified
Hammond & Goldman, 1961	1.Human relations	unitary: optimizing & discretionary
Shaw & Blum, 1966	1.Discussion of success traits	unitary: optimizing & discretionary
	2.Human relations	unitary: optimizing & discretionary
	3.Object identification	unitary: optimizing & disjunctive
Hackman, 1968	1.Production (ideas)	unitary: optimizing & discretionary
	2.Discussion	unitary: optimizing & discretionary
	3.Problem-solving	unitary: maximizing & disjunctive (?)
Kent & McGarth, 1969	1.Production (ideas)	unitary: optimizing & discretionary
	2.Discussion	unitary: optimizing & discretionary
	3.Problem-solving	unitary: maximizing & disjunctive (?)
Stone, 1971	1.word-construction	unitary: optimizing & discretionary
Freedman, Klevansky & Ehrlich, 1971 (Study I)	1.Discussion	unitary: optimizing & discretionary
	2.Cross-out #s	unitary: maximizing & additive
	3.Forming words	unitary: optimizing & discretionary
	4.Object use (indiv)	unitary: optimizing & discretionary
	5.Memory	unitary: maximizing & conjunctive
	6.Concentration	unitary: maximizing & conjunctive
	7.Object use (group)	unitary: optimizing & discretionary
(Studies II & III)	1.Cross-out #s	unitary: maximizing & additive
	2.Forming words	unitary: optimizing & discretionary
	3.anagrams	unitary: optimizing & disjunctive
Shiflett, 1972	1.Crossword puzzles	unitary: maximizing & disjunctive
Spoelders-Claes, 1973(a)	1.Block assembly/ disassembly	divisible: unassigned & unspecified

? indicates information was unavailable or unclear in original report.

STUDY	TASK(S)	STEINER'S TASK TYPES:
Spoelders-Claes, 1973(b)	1.Punch card manipulation	divisible: assigned & specified
Hewett, O'Brien, & Hornik, 1974	1.Molecular model construction	unitary: maximizing & disjunctive
Kanekar and Neelakantan, 1976	1.Word construction	unitary: optimizing & discretionary
Hackman, Brousseau & Weiss, 1976	1.Assemble electrical components	divisible: unassigned & specified
Lord, 1976	1.Cryptograms	unitary: optimizing & disjunctive
	2.Labor allocation in mock job	unitary: optimizing & discretionary
	3.Moving matches in a circle	unitary: maximizing & conjunctive
	4.Double classification, 2 concepts	unitary: optimizing & disjunctive
	5.Evaluate a value statement	unitary: optimizing & discretionary
	6.Evaluate a theme for discussion	unitary: optimizing & discretionary
Seta, Paulus & Schkade, 1976	1.Learning & recall of 20 words	unitary: maximizing & conjunctive
Shaw & Ashton, 1976	1.Crossword puzzles	unitary: optimizing & disjunctive
Goldman, Stockbauer & McAuliffe, 1977	1.Anagrams	unitary: maximizing & additive
Kabanoff & O'Brien, 1979(a)	1.Production (ideas)	unitary: optimizing & discretionary
	2.Discussion	unitary: optimizing & discretionary
	3.Problem-solving	unitary: maximizing & disjunctive
Kabanoff & O'Brien, 1979(b)	1.Production of novel ideas	unitary: optimizing & discretionary
Morris & Niebuhr, 1980	1.The Executive Game*	unitary: maximizing & disjunctive
Isenberg, 1981	1."Search For Oil"**	unitary: maximizing & disjunctive

* task involves maximizing owner's return on "initial investment".
** task involves maximizing rewards through problem solution in "finding oil".

TABLE III

TYPOLOGY OF TASKS BY STUDIES: PART II

(other characteristics)

STUDY	TASK(S)	CHAINED?	MULTIPLE?	IF GROUP MADE DECISION, HOW?
Deutsch, 1949(b)	1.Human Relations	N	N	consensus
	2.Puzzle problems	?	?	not applicable
Schacter, et al, 1951	1.Production of checkerboards	N	N	not applicable
Pepinsky, Pepinsky, & Pavlik, 1960	1.Model assembly/ disassembly	Y	Y	not applicable
Hammond & Goldman, 1961	1.Human relations	N	N	consensus
Shaw & Blum, 1966	1.Discussion/list 5 success traits	N	N	consensus
	2.Human relations	N	N	consensus
	3.Object identification	Y	N	consensus
Hackman, 1968	1.Production (ideas)	N	N	consensus
	2.Discussion	N	N	consensus
	3.Problem-solving	N	N	consensus
Kent & McGarth, 1969	1.Production (ideas)	N	N	consensus
	2.Discussion	N	N	consensus
	3.Problem-solving	N	N	consensus
Stone, 1971	1.word construction	N	N	consensus/debate
Freedman, Klevansky & Ehrlich, 1971	1.Discussion	N	N	consensus
	2.Cross-out #s	N	N	not applicable
	3.Forming words	N	N	consensus
	4.Object use (indiv)	N	N	not applicalbe
(Study I)	5.Memory	N	N	not applicable
	6.Concentration	N	N	not applicable
	7.Object use (group)	N	N	consensus
	1.Cross-out #s	N	N	not applicable
(Studies II & III)	2.Forming words	N	N	consensus
	3.anagrams	N	N	consensus
Shiflett, 1972	1.Crossword puzzles	Y	N	consensus
Spoelders-Claes, 1973(a)	1.Block assembly/ disassembly	Y	N	not applicable

STUDY	TASK(S)	CHAINED?	MULTIPLE?	IF GROUP MADE DECISION, HOW?
Spoelders Claes, 1973(b)	1.Punch card manipulation	Y	Y	not appliable
Hewett, O'Brien, & Hornik, 1974	1.Molecular model construction	Y	Y	not applicable
Kanekar and Neelakantan, 1976	1.Word construction	N	N	consensus
Hackman, Brousseau & Weiss, 1976	1.Assemble electrical components	Y	Y	not applicable
Lord, 1976	1.Cryptograms	N	N	consensus
	2.Labor allocation in mock job	N	N	consensus
	3.Moving matches in a circle	N	N	not applicable
	4.Double classification, 2 concepts	Y	N	consensus
	5.Evaluate a value statement	N	N	consensus/debate
	6.Evaluate a theme for discussion	N	N	consensus/debate
Seta, Paulus & Schkade, 1976	1.Learning & recall of 20 words	Y	N	not applicable
Shaw & Ashton, 1976	1.Crossword puzzles	N	N	consensus
Goldman, Stockbauer & McAuliffe, 1977	1.Anagrams	N	N	consensus
Kabanoff & O'Brien, 1979(a)	1.Production (ideas)	N	N	consensus
	2.Discussion	N	N	consensus
	3.Problem-solving	N	N	consensus
Kabanoff & O'Brien, 1979(b)	1.Production of novel ideas	N	N	open forum
Norris & Niebuhr, 1980	1.The Executive Game*	Y	N	consensus/debate
Isenberg, 1981	1."Search For Oil"**	Y	Y	consensus/debate

* task involves maximizing owner's return on "initial investment".
** task involves maximizing rewards through best solution in "finding oil".

TABLE IV

INDEPENDENT VARIABLES IN STUDIES

STUDY	INDEPENDENT VARIABLE(S)
Deutsch, 1949b.	1. situations: cooperative vs. competitive.
Schacter, et al 1951	1. group cohesion (high/low); 2. direction of induction (increase or decrease production).
Pepinsky, Pepinsky & Pavlik, 1960	1. task complexity; 2. time pressure.
Hammond & Goldman, 1961	1. competition vs. non-competition; 2. individual vs. group.
Shaw & Blum, 1966	1. group task favorability (favorable dimension); 2. leadership behavior (directive vs. non-directive).
Hackman, 1968	1. task type (production, discussion, problem-solving); 2. level of difficulty (determined judgementally); 3. order of presentation (order tasks worked on).
Kent & McGarth, 1969	1. task type (production, discussion, problem-solving); 2. sex composition (MMM, MMF, MFF, FFF groups); 3. serial order of task presentation.
Stone, 1971	1. mode of organization (specialization vs. project teams); 2. feedback level (group or individual).
Freedman, Klevansky & Ehrlich, 1971: I	1. density (rooms 160, 80 or 35 ft^2 with 3 - 9 Sb in each room); 2. sex composition (M, F, MF); 3. n of tasks performed increased;
also for study II	same as above 2, with different sample.
III	
Shiflett, 1972	1. group or individual working conditions (divided labor, shared labor, free choice, vs. individual).
Spoedlers-Claes, 1973(a)	1. feedback (varied in occurance and content).
Spoedlers-Claes, 1973(b)	1. knowledge of results (feedback, varied on 4 levels).
Young, 1974	1. task structures (component redundancy, complexity, organization); 2. task component distributions (2 or 3 components); 3. work interactions (restricted vs. unrestricted); 4. trials arranged in 4 blocks.

STUDY	INDEPENDENT VARIABLE(S)
Hewett, O'Brien & Hornik, 1974	1. task organization (coacting, coordination, collaboration, coordination/collaboration); 2. leadership style (based on Fiedler's LPC and Schutz' FIRO-B scales).
Kanekar & Neelakantan, 1976	1. group type (real vs. nominal); 2. group ability compositon (high, high/low, low).
Hackman, Brousseau & Weiss, 1976	1. task conditions (equal vs. unequal information); 2. group process conditions (strategy, anti-strategy, vs. control).
Lord, 1976	1. degree of task structure (according to Shaw's (1963) dimensions).
Seta, Paulus & Schkade, 1976	1. group size (2 or 4); 2. instructional set (competition vs. cooperation); 3. individual vs. individual, or group vs. group comparisons).
Shaw & Ashton, 1976	1. individual vs. group problem solving; 2. sex composition (same sex groups); 3. task difficulty (hard and easy, counterbalanced, repeated measures design); 4. task order (of presentation, controlled by design).
Goldman, Stockbauer & McAuliffe, 1977	1. intergroup relations: competition vs. cooperation; 2. intragroup relations: competition vs. cooperation; 3. task means-interdependence: low and high.
Carlson, 1978	1. leader position power (strong, moderate or weak: according to Fiedler's LPC scale).
Kabanoff & O'Brien, 1979(a)	1. coordination (with or without cooperation); 2. collaboration (with or without cooperation); 3. task type (repeated measures design, 2 tasks x 3 levels).
Kabanoff & O'Brien, 1979(b)	1. coordination (2 levels); 2. collaboration (2 levels); 3. leader ability (2 levels); 4. subordinate ability (2 levels).
Norris & Niebuhr, 1980	1. voluntarily vs. assigned team membership.

STUDY	INDEPENDENT VARIABLE(S)
Isenberg, 1981	1. time pressure (high, moderate, low); 2. group (nested within time; n=18); 3. ranking of members' level of communication (1 [most] to 4 [least] communicative).

TABLE V

DEPENDENT MEASURES IN STUDIES

STUDY	DEPENDENT MEASURES
Deutsch, 1949(b)	1. observer ratings of participation and use of over-all rating scales (on-going); 2. subjects' ratings of interpersonal interactions and group dynamics (post-test) and different aspects of the group (weekly).
Schacter, et al 1951	1. difference in number of cardboards between baseline and two experimental phases.
Pepinsky, Pepinsky & Pavlik, 1960	1. number of operations performed in a work session; a ratio of mean time spent in assembly/disassembly for all 24 teams was computed.
Hammond & Goldman, 1961	1. written reports, evaluated by judges on the basis of adequacy of recommendations, alternate courses of action and logically related consequences. 2. quality of discussion, rated by observers for task-oriented and non-task oriented remarks. Five performance related variables rated.
Shaw & Blum, 1966	1. time required for completion; 2. final solutions to each task; 3. questionaires by subjects rating satisfaction with group process, leadership qualities and performance.
Hackman, 1968	1. general dimensions made without knowledge of tasks: action orientation, length, originality, optimism, equality of presentation, and issue involvement; 2. task-dependent dimensions: global creativity, and adequacy of product. NB: judges in both cases were undergraduate students (projected reliabilities = .72 to .91 given).
Kent & McGarth, 1969	1. numerical scores for each of 18 scales defining the six general dimensions, obtained by a seven-pile sort-resort procedure. Task dependent dimensions were creativity and product adequacy, judged by undergraduate students (projected r=.54 to .95).
Stone, 1971	1. word score = {(n of letters)(20)}-points accrued by rules; 2. creativity, rated by judges on a 7 point scale; 3. time; 4. task satisfaction measure: unspecified, subjective.

STUDY	DEPENDENT MEASURES
Freedman, Klevansky & Ehrlich, 1971:	1. written report of group discussion; 2. n of crossed out #s on a page; 3. n of words formed from 6 letters; 4. n of object uses; 5. n of items remembered; 6. n of successful counts of clicks; 7. group decision on object use. NB: specific dependent measures were not well specified for all the above task-associated measures. All measures listed were used in some or all of the three sub-studies.
Shiflett, 1972	1. number of words correctly filled in. 2. 2 minute intervals of direct observation used for word frequency tally and when word was written in.
Spoedlers-Claes, 1973(a)	1. quantity: time of assembly/disassembly; 2. quality: comparison of group product with photograph of construction (rated on quota system).
Spoedlers-Claes, 1973(b)	1. production measured in time, seconds and n of errors per group; 2. semantic differential (to assess group atmosphere);
Young, 1974	not noted.
Hewett, O'Brien & Hornik, 1974	1. n of joins on completed model (ideal=60).
Kanekar & Neelakantan, 1976	1. solutions (words) formed; 2. group interactions; 3. inidvidual verbalizations.
Hackman, Brousseau & Weiss, 1976	1. gross performance: total dollar productivity (=n of components completed x dollar value for each component); 2. net performance: same as gross performance, but only for criterion matching components; 3. observation of strategy planning activity; 4. subjects' ratings of strategy planning activity; 5. group mean of questionaire responses re: group process and member reactions.
Lord, 1976	1. n of correct crypts; 2. production time for solution adopted; 3. n of correctly placed matches; 4. n of properly placed cards; 5. n of reasons supporting conclusion; 6. n of arguments listed; 7. leadership behavior: coded on standardized code.

STUDY	DEPENDENT MEASURES
Seta, Paulus & Schkade, 1976	1. n of correct words recalled.
Shaw & Ashton, 1976	1. record of whether task was completed successfully, time took to complete it, and n of wrong answers before correct one found or time expired; 2. questionarie completed by subjects' reactions to, & (?previous) experience with task.
Goldman, Stockbauer & McAuliffe, 1977	1. group performance; 2. feelings toward other members (comparison of ratings of subjects on ten bipolar, 7 cateogry scales, post-experiment); also evaluated a "typical student" to serve as baseline for other ratings; also used pre-post-experiment comparisons of ratings of feelings).
Carlson, 1978	not noted.
Kabanoff & O'Brien, 1979(a)	1. group products rated on 17 descriptive scales (2 raters using 5 point Likert-type scales); 2. three evaluative measures of adequacy, quality and creativity (three raters, using a 7 point Likert-type scale).
Kabanoff & O'Brien, 1979(b)	1. pre-test verbal creativity assessed (for group assignment) 2. tasks scored by 3 raters on fluency, flexibility and originality (total score = sum of all indicies).
Norris & Niebuhr, 1980	1. group cohesiveness: post-test, modified version of Seasnore's (1954) scale; 2. group performance: return on investment obtained by each group for their firm.
Isenberg, 1981	1. decision making accuracy: number of related indicies (n of finds, n of mistakes, frequency of hits and misses, hits-misses, hits+misses); 2. amount of communication: 2 observers; 3. sociometric ratings: two 7 point scales; 4. group process: six 7 point scales and "how time manipulation affected members"; 5. self-report scales: leadership, satisfaction with group functioning, pleasantness of task, amount of stress and sufficiency of time given.

Independent variables: Co-operative situation: Ss were told that their group as a whole would be rated in comparison with the other groups; each member would receive the same reward which would be determined by the relative position of his group in contrast with the other groups. Competitive situation: Ss were told that they would be rated in comparison with the other members of their groups; each reward would be different and determined by the S's position relative to the other members of his group.

Subjects: Ten groups of five students enrolled in Introductory Psychology sections. Groups were matched in terms of their productivity on a "human relations" problem (rated on a 9-point scale) and then by pairs, at random assigned to either co-operative or competitive situations.

Tasks: The function of the problem was to provide a medium for the occurence of group process. Not all media are alike. The process that occurs is a result of both the properties of the group and the properties of the group's medium or environment. 1) Human relations problem: a discussion and written recommendation required; no clearly discernible "objective" criteria; likely to evoke strongly-held personal value systems. 2) Puzzle-problems: tests of clear logical thinking; "objective" solution; provided the possibility for more individual work that the human relation problem.

Measurements: Trained observers 1) categorize each partici-

Appendix

Deutsch, M. "A theory of co-operation and competition." Human Relations, 1949, 2, 129-152

Purpose: To outline a theory of the effect of cooperation and competition on small (face-to-face) group functioning.

Thirty-four hypotheses were developed with respect to the effects of cooperation and competition on group processes. Group concepts were developed and the relationship between those concepts, "groups" and "co-operative social situation" were discussed.

Co-operation is defined as working together to one end when the end sought can be achieved by all or almost all of the individuals concerned.

Competition is defined as gaining what another is endeavoring to gain at the same time when the end can be achieved by some but not by all. (What one gains another can not gain.)

Such behavior oriented toward a goal and is to be distinguished from rivalry which is behavior oriented toward another human being.

Deutsch, M. "An experimental study of the effects of co-operation and competition upon group process." Human Relations, 1949, 2, 199-231

Purpose: To test the hypotheses and evaluate the theory of of co-operation and competition which were developed by Deutsch (see above entry); to stimulate the use of experimental methods in group research.

pation of members; and 2) over-all rating scales. Instruments used by subjects: 1) weekly questionnaire to rate different aspects of the group, and 2) post-experimental questionnaire covering a range of topics including interpersonal interactions and group dymanics.

Results: reported for a) instructions manipulating the experimental conditions; b) perceived interdependence; c) organization; d) motivation; e) communication; f) orientation (with respect to position and direction to goal); g) productivity (discussion insight; time per solution; and number of words in written product); h) interpersonal relations;
Five hypotheses were supported and the theory outlined earlier by Deutsch (see above entry) was given experimental support.

Schacter. S; Ellertson, N.; McBride, D. and Gregory, D. "An experimental study of cohesiveness and productivity". Human Relations, 1951, 4, 229-238

Purpose: To test implications of the cohesiveness-attraction theory for productivity.

Independent variables: Four combinations of cohesion and direction of induction. Cohesiveness defined as the force acting on members to remain in the group. High and Low cohesiveness produced by manipulating attractiveness of group members. Ss were told recent research had made it possible to select people who "would be genuinely fond" of each other. High cohesive groups were told they were part of "extremely congenial" groups and that there "was every reason to expect" them all to like each other. Low cohesive groups were told that scheduling difficulties had made it impossible to form

a congenial group and that there was "no particular reason" to think you will like each other. Direction of induction defined as attempts by the group to influence a member to increase or decrease rate of production. Manipulated by notes which Ss believed were from other members of her group.

Subjects: Female student volunteers from undergraduate education and psychology classes.

Tasks: The cooperative production of card board checkerboards. Experimental groups were composed of three people who were introduced to each other and then assigned to different work rooms. There were supposedly three jobs - cutting cardboard, mounting and pasting it on stock and painting the boards trhough a stencil. All subjects actually were assigned to the cutting task.

Measures: Experimental sessions lasted thirty-two minutes and were divided into four eight minute periods. The period from eight to sixteen minutes was taken as a base line during which no attempt was made to influence the rate of production. The difference in the number of cardboards cut during the baseline period and during the two periods of induction manipulation is taken as an indication of the extent of acceptance of induction.

Results: For increased production, no significant differences between high and low cohesive groups. When notes urged a reduction in production, Ss in high cohesive groups decreased continuously from induction period to induction period. Scores for both periods were significantly below base rate. In low cohesive groups, Ss decreased slightly in the first in-

duction period and then increased their output. Neither of these scores is significantly below base line rate. In the negative induction condition, low cohesive Ss were less accepting of induction and more productive than high cohesives. The data indicate no necessary relationship between cohesiveness and high productivity. Cohesiveness appears to be a determining variable in negative but not positive induction conditions.

Results were discussed in terms of (1) "force to be an accepted member of group" and (2) "force to 'please experimenter'", under the presumption that (2) is similar in all experimental variations but that (1) is greater in the high cohesive condition than in the low.

Pepinsky, P. N.; Pepinsky, H. B. and Pavlik, W. B. "The effects of task complexity and time pressure upon team productivity." Journal of Applied Psychology, 1960, 44, 34-38

Purpose: To control the effects of differences in individual abilities, group structure and organization in order to assess in a precise way the effects of the particular situational variables of task complexity and time pressure.

Independent variables: Task complexity and time pressure conditions. Task complexity defined as (a) the number of operations required to assemble model; (b) the necessity for coordination among team members in contrast to individual sequential operations, (c) amount of variety in the ordered pattern of operations and (d) number of spatial dimensions in the completed model. Time pressure conditions manipulated by varying the frequency of standard verbal signals: Condition L,

1 signal given at end of 10 minutes; Condition M, a signal every three minutes up to eighteen after which the stop signal in two minutes; Condition H, signals delivered at accelerated pace beginning with 1 every minute and increasing to 1 every fifteen seconds.

Subjects: Seventy-two volunteer male previously unacquainted students enrolled in introductory Psychology.

Tasks: Repeated assembly and disassembly by a three man team of as many replicas of a nonrepresentational Tinkertoy model as possible during a twenty minute session. All teams followed a rehearsed procedure, performing interlocked operations in a specified order. The two tasks were not widely discrepant in difficulty but were discernably different in respect to complexity.

Measures: A team's score was an adjusted total of the number of operations performed during a work session. The number of operations credited for disassembly of both models and for final assembly of the complex model were determined by the mean proportionate amounts of time spent by all 24 teams in these phases of the task. A ratio based on all teams was considered more reliable than one computed for each separate team.

Results: Checks on the experimental conditions revealed that Ss did identify the complex task as being more complex and that Ss liked it better than the simple task. Time pressure manipulation was successful. Complex task scores were consistently larger than simple task scores and there appears to be a curvilinear variation in productivity from time pressure

conditions. The differences between tasks and the interaction of task and task sequence are primarily responsible for the variability in total scores in separate work sessions.

Greater task complexity is associated with greater productivity. Increased complexity has a motivational effect through maintaining interest in the performance of a repetitive operation.

Time pressure acts as an incentive only when it is made to connote success or failure in a given situation.

Small, trained teams will be more "motivated to increase output if their assigned tasks are sufficiently complex to provide some intrinsic interest and variety. Whether the task is simple or complex, an acceleration in time-pressure up to a moderate level can produce an acceleration in output, but an increase from low to high pressure is apt to have an adverse effect.

Hammond, L. K. and Goldman, M. "Competition and non-competition and its relationship to individual and group productivity." Sociometry, 1961, 46-60

Purpose: To explore the following questions: (a) is there a difference between competition (C) and non-competition (NC) generally; (b) is there a difference between C & NC only when individuals are working for themselves; (c) is there a difference between N and NC only when the individuals are working for the groups they are in; (d) is there a difference between working as a group (G) and working as an individual (I) that extends across C and NC; (e) is there a difference between working as G and working as I only in competition; and (f) is there a difference in working as G and working as I only in non-competition?

Independent variables: Competition or non-competition by group or individual. Individual Non-competition: credit to depend on individual contribution; possible for everyone to receive maximum points. Group non-competition: credit to depend on total participation of all group members; all members to receive same amount of points. Individual competition: credit to depend on individual contribution; each member to receive different amount of credit; performance of each member compared to performance of other members of his group. Group competition: credit to depend on total participation of all group members; all members of a group receive same amount of credit; group performance compared to performance of other groups.

Subjects: Sixty student volunteers from general psychology classes. Groups balanced on a sociometric scale and the F-scale. Groups consisted of 5 or 6 individuals.

Tasks: Four human relations-type problems presented for discussion and written report. The report represented the contributions of the group as a whole.

Measurement: Written reports were evaluated by judges on the basis of adequacy of recommendations; points for alternate courses of action and for logically related consequences used to rate group product. Quality of discussion evaluated by observers on basis of task-oriented or non-task oriented remarks. Each discussion was rated on five performance-related variables: a) coordination of effort; b) orientation of effort; c) communication; d) involvement and attentiveness; and e) recognition of relevant factors.

Results: No significant differences for task and non-task

remarks. No significant differences among treatment groups for orientation of effort, but when non-competition conditions were combined and compared with combined competition conditions, the differences were significant. Individual non-competition significantly higher than individual competition for ratings on involvement and attentiveness. The combined non-competition distribution was also significantly higher than combined competition distribution. On the adequacy of recommendations, there were no significant differences between C and NC, but the differences between I and G were significant, favoring the group. The overall order was GC > GNC > INC > IC.

Results obtained on the group process measures clearly show superiority of non-competition. In terms of group process, competition is detrimental in both (individual and group) cases. Results obtained on the group product measure show a significantly large difference between I and G treatments in favor of group. It is suggested that a group yields a better quality decision than an individual. The discrepancy between measures of process and product indicates these two variables do not have a simple, direct relationship. The implication drawn is that competition is not necessary to motivate performance to best effect; competition seems detrimental to most phases of group process; and in terms of the final product, working as a group appears superior to working as individuals.

Shaw, M. E. and Blum, J. M. "Effects of leadership style upon group performance as a function of task structure." Journal of Personality and Social Psychology, 1966, 3, 238-242

Purpose: To test the generality of Fiedler's theory (the type of

leadership behavior required for effective group performance is contingent upon the favorableness of the group-task situation for the leader) by experimentally manipulating the group task favorability dimension and the behavior of the leader.

Independent variable: Group task favorability; leadership behavior. Group task situation refers to the degree to which the group environment makes it easy or difficult for the leader to influence group members. The favorableness is determined by 1) the affective relation between leader and member; 2) the power inherent in the leadership position; and3) the degree to which the task is structured. In Fiedler's study task structure was operationally defined in terms of four task dimensions: 1) decision verifiability; 2) goal clarity; 3) goal path multiplicity; and 4) solution specificity. This study manipulated group task favorability by means of task structure only. Leadership style was manipulated by instruction to assigned leader. Half were instructed to behave in a controlling, directive manner and half were instructed to behave in a permissive and nondirective manner.

Subjects: Ninety male undergraduates assigned to five member groups.

Tasks: Task A: a discussion task which required the group to list the five most important traits needed for success. This was the most unfavorable group-task situation (leader-member relations good, position power strong, task unstructured.) Task B: a discussion task (human relations-type question) which required the group to decide which of five possible courses of action would be best. This was the intermediate level of group-task situation. Task C: called for group to identify

some object (40 questions) after being told it was animal, vegetable or mineral. This was the most favorable group-task situation.

Measurements: Records were kept of time required for completion and of final solutions for each task. The time scores were the only measures of performance comparable across tasks and raw scores were transformed before analysis. Each S responded to a questionnaire which called for rating satisfaction with group, group cooperation, group performance, leadership performance and directiveness of leader.

Results: ANOVA yielded significant values for tasks and for leadership style X task interaction. Directive leadership more effective than nondirective leadership on Task C; on Tasks A and B, nondirective leadership was more effective. Although ratings of satisfaction, cooperation, group performance, and leader performance were all higher for nondirective leadership, differences were significant only for cooperation. Directive leadership is more effective when there is only one solution and one (or very few) ways of obtaining the solution. On tasks that require varied information and approaches, nondirective leadership is more effective. Task structure is an important variable in the determination of leadership effectiveness. Variations in difficulty and cooperation requirements probably call for different leader behavior.

Porter, L. W. and Lawler, E. E. III, "Properties of organization structure in relation to job attitude and job behavior." Psychological Bulletin, 1965, 64, 23-51

Purpose: Review of the results of empirical field studies

that have investigated the relationship between properties of organization structure and job attitudes and job behavior.

Variables: Structure defined as the positions and parts of organizations and their systematic and relatively enduring relationship to each other. Attitudes defined in the broadest sense of "opinion concerning some object." Job behavior is performance and output ratio, turnover rates, absenteeism rates, accident rates and employee-grievance rates.

Findings: All studies reviewed compared at least two degrees of structure along a given property. Studies of the relationships between organizational levels and individuals' behavior are relatively infrequent. Level seems to affect the amount of information a person receives in his job, the types of interpersonal relationships he has on his job and the types and nature of the decisions he must make in his position. Individuals at different organizational levels may vary systematically in intelligence and/or personality traits.

Line and staff hierarchies: Those concerned with the main operations of the organization and within the direct chain of command are "line". "Staff" provides specialized aid to the line. Staff turnover rate appears to be higher than line. Staff managers are better informed than line, probably because of greater mobility and greater communication flexibility. The staff manager is required to be knowledgeable about his speciality and yet provides little opportunity for decision-making. The line manager is expected to take advice on decisions for which he has responsibility from someone who is not "supposed" to know the whole picture.

Subunits: any grouping of the members of an organization that systematically excludes part of the membership. Previous summaries indicate that "The size of the work group affects output and attitudes, which both tend to be better in smaller sized groups (p. 34)". A positive linear relationship was found between absence rates and subunit size. No consistent pattern of relationships was found for accident rate and subunit size. A positive relationship found for labor disputes and subunit size. The studies on the relationship between performance and subunit size do not present a clear-cut picture. At present, the weight of the evidence suggests small-sized subunits are desirable because they are associated with low turnover and absenteeism. The impact of structural variables is clearer on attitudes (not reported here) than on behavioral variables but there appears to be an abundance of implications for productivity rates awaiting empirical testing.

Hackman, J. R. "Effects of task characteristics on group products." Journal of Experimental Social Psychology, 1968, 4, 162-187

Purpose: An attempt to assess both the nature and the magnitude of the relationships between selected characteristics of "intellective" group tasks and selected measures of group output.

Independent variables: Task type, level of difficulty and order of presentation. All tasks require a written report; all are "intellective" tasks. Task types: (A) tasks calling for production of ideas, images, or arrangements (production tasks); (B) tasks calling for a discussion of values or issues, usually with group consensus (discussion tasks); (C) tasks requiring a

solution to a specific problem (problem solving tasks). Task difficulty: defined as "the amount of effort required to complete the task" was determined by a judgmental procedure. Order of presentation: a pretest indicated that the order in which a group worked on a task affected the nature of the group interaction and the characteristics of the group products.

Subjects: One hundred eight groups of three undergraduate males who participated as a requirement for an introductory psychology class.

Tasks: The study design required 108 different group tasks. Only tasks requiring the production of a coherent verbal passage were included. Tasks requiring "reasoning" or "thinking" and those with high solution multiplicity (cf. Shaw and Blum, 1966) were included.

Measures: Two kinds of descriptive measures used to assess the characteristics of the group products: a) general dimensions, made without knowledge of the particular task and b) task-dependent dimensions for which familiarity with the specific nature and requirements of the task was necessary for judgment. General dimensions: a) action orientation; b) length; c) originality; d) optimism; e) quality of presentation and f) issue involvement. Task-dependent dimensions: a) global creativity and b) the judged adequacy with which the product satisfied the specific requirements of the task. Undergraduate students judged both dimensions with projected reliabilities ranging from .72 to .91.

Results: Characteristics of group products are strongly affected by the type of task with which group works. Difficulty has a moderate effect. The order of presentation of tasks is not related substantially to product characteristics. Task type was significantly related to all of the group product characteris-

tics except product adequacy, and was strikingly related to action orientation, originality and issue involvement. Problem solving tasks were characterized by high action orientation, production tasks by high originality and discussion tasks by high issue involvement. Task difficulty was significantly associated with 6 of the 8 measures of product characteristics. Products from more difficult tasks tended to be more original and more issue involved while easier tasks were better presented and met specific task requirements more adequately. Groups with more difficult tasks fulfilled specific requirements less adequately but the products were more original. Task type X difficulty interactions were significant for 4 of the 8 dimensions although none accounted for a substantial amount of product variance. Largest interaction involved length.

Discussion: Originally, the distinction among the three task types depended on the "content" or "mental material" with which the group worked. The process requirement did not differ across task types. Contrary to the implications of the original formulations, different aspects of "process" appear to be emphasized by groups dealing with tasks of different types. The task content has both direct and indirect effect on product characteristics. The kind of content affects the group interaction and thereby indirectly the output. Some aspects of task content seem to affect the output largely independently of the interaction process. Differences in process emphases probably do not affect output except through changes in the group interaction process. It is suggested that a full understanding of the ways in which the two task parameters affect output characteristics requires examination of three separate

substantive links: task input to interaction process; task input to group output; and interaction process to group output. Tasks to be used in small group studies must be constructed or selected with considerable care.

Kent, R. N. and McGarth, J. E. "Task and group characteristics as factors influencing group performance." Journal of Experimental Social Psychology, 1969, 5, 429-440

Purpose: 1) To replicate the findings of Hackman (1968 - see above entry) concerning the effects of task type on written group products and 2) to extend those findings by assessing the generality of task type differences as a function of a major group structural factor: sex composition of the group.

Independent variables: Task type, sex composition and serial order of presentation of tasks. Task types: production tasks involving the presentation of ideas; discussion tasks involve evaluation of issues; problem solving tasks involve instruction with respect to some overt action. Sex composition: the four possible sex combinations of a triad.

Subjects: Forty-eight groups of three undergraduate students who served as a requirement for an introductory psychology course.

Tasks: Forty-eight tasks selected from the set of 108 "intellective" group tasks employed by Hackman (1968, see above). Tasks were chosen so that any which were 1) shown empirically to be a combination of 2 or more types or 2) rated extremely high or low on dimensions of difficulty, population familiarity or intrinsic interest were eliminated.

Measures: Numerical scores for each of the 18 scales defining the 6 general dimensions were obtained by a seven-pile "sort-

resort" procedure. Task-dependent dimensions included 1) global "creativity" and 2) the judged "adequacy" with which the product satisfied the specific requirements of the task. All judges were undergraduate students; projected reliabilities ranged from .54 to .95.

Results: Task-type was significantly and substantially related to 7 of 8 product dimensions and to all measures of product characteristics except adequacy. Task type controlled over 50% of the variance on action orientation, originality and issue involvement. Sex composition was significantly related to action orientation, originality and optimism, but accounted for less than 4% of the variance of products on any dimension. Task type X sex composition yielded significant interactions of moderate importance, 13 to 0.4% of the variance for 5 of the 8 product dimensions. Order of presentation effects was minimal. The most substantial determinant of product variance were task type and specific task. Task type main effects control between 2 and 63% of the variance of the 8 product measures. Groups with a female majority generated products which were more action oriented than other groups. Sexually homogeneous groups generated more original products than those from sexually heterogeneous groups. All female groups were more optimistic. The tasks which give rise to products may be much more important in determining product characteristics than the groups which actually produce them.

Collins, B. E. Social Psychology, Social Influence, Attitude Change, Group Processes and Prejudice. Addison-Wesley Publishing Co., Reading, Mass.: 1970

(textbook in Social Psychology)

The extent to which a task makes possible a division of labor is an important criterion for tasks which are used to compare group and individuals. Some divisions of labor allow a group to use full resources, some limit the group to the ability of its poorest member. The task demands for a division of labor or for a wide background of information is a critical factor in determining whether a group can exceed the productivity of an individual.

Proposition A: For tasks involving random errors, combining several individual estimates or solutions into a group product increases accuracy. (Error must be random - combination does not eliminate constant bias.)

Proposition B: For tasks which involve creating ideas of remembering bits of information, there is a greater probability that several persons will produce a particular idea than that a single person will produce it by himself.

Proposition C: Groups are efficient when the critical demands of the task emphasize the gain a) from duplication of effort or b) from a division of labor.

Duplication of effort occurs when 2 or more people perform exactly the same task. Division of labor occurs when the task is subdivided so that 2 or more people work on different components.

Although task complexity enables a group to use its resources, a point may be reached at which the task creates so many interpersonal problems that the group cannot apply itself to the task problems. Mainly a group seems likely to exceed an individual on complex problems.

When quantitative judgments must be made, increase group size to include persons with wide variety of experiences. A group cannot utilize all information available to it.

Proposition A: The final group product excludes some ideas and information available to each member.

Proposition B: The accuracy and quality of the final group product is increased because the group is more likely to eliminate inferior contributions than useful ones.

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

Purpose: To test the effects of mode of organization (specialization versus project teams) and feedback level (group or individual) on the performance and satisfaction of creative task groups.

Independent variables: mode of organization and feedback level.

Mode of organization: Specialization: when each person approaches the task as a specialist or specializes in one part of the task - involves a clear division of labor. Organization by task: (project team) groups organized around a certain task, do not seek to dissect the problem into areas of speciality but attack the problem or task as a group. Feedback level: directed toward individual or toward group as a whole organizational unit. Ss rated other members of his group individually or the group as a whole.

Subjects: Seventy-two elementary psychology students divided into twenty-four groups of three

Tasks: word construction task - to make as creative and as high scoring a word as possible using a number of letters and three rules. In the "specialization" group, each S was given

a rule. He was to advocate the use of his rule and to encourage others in his group to use it. In the "project team" group Ss were instructed to work cooperatively with each other using the same three rules.

Measures: Three measures of task performance were used: word score (calculated by multiplying the number of letters used by 20 and subtracting the points accrued by using the rules); creativity (panel of judges using a 7-point scale); and time. A task satisfaction measure touched on how Ss felt, how much fun it was, and how they liked it.

Results: Significant effects of mode of organization on time and task satisfaction supported the Hypothesis that performance and satisfaction would be higher in "project team" groups. No significant effects for mode of organization on word score or creativity. Effect of feedback level on word score was significant showing individual level feedback more effective than group.

Freedman, J. L.; Klevansky, S. and Ehrlich, P. R. "The effect of crowding on human task performance." Journal of Applied Social Psychology, 1971, 1, 7-25

Purpose: To investigate the effects of high density per se (not the other factors that tend to go along with high density.)

Independent variable: (Study I) Density: using rooms of 160, 80 or 35 square feet and placing either 9 or 5 Ss in each room.

Subjects: 126 highschool students (84 boys, 42 girls), 18 groups: 12 all males, 6 all females; half had 5 group members and half had 9 members.

Tasks: 1) group discussion, written report; 2) crossing-out task, cross out all of a particular member found on a page of

random numbers; 3) forming words from 6 letters; 4) object uses (creative thinking); 5) memory task; 6) concentration - count the number of clicks sounded at a rate of about 3 per second, but not at a fixed rhythm; 7) object use with group working as a whole.

Results: Data summarized in terms of the number of times each level of density produced the best performance on a task. There were no effects of density.

(Study II): major change was in the number of tasks performed with the idea that Ss were not given time for high motivation and interest to abate during Study I.

Subjects: 306 high school students divided into 34 groups of 7 to 9 each. Eighteen groups were all male, 16 all female.

Tasks: 1) cross-out numbers; 2) forming words; 3) anagrams. Work periods were long enough to produce boredom, to reduce motivation and to maximize any effects of stress.

Motivation was manipulated by offering half the Ss a bonus for particularly good work.

Results: The "usual sex differences and temporal effects" did appear. The high motivation condition did more work on crossing out numbers but was slightly inferior in the more creative tasks. Density did not affect performance.

Study III

Subjects: 180 women 25 - 60 years old recruited through a temporary employment agency, divided into groups of 9.

Procedure was identical to Study II. There were no effects of any kind of density on performance.

Discussion: Density per se does not function as an ordinary aversive stimulus. Whatever effects density has will be largely

on interactions among people rather than on the performance.

Shiflett, S. C. "Group performance as a function of task difficulty and organizational interdependence." Organizational Behavior and Human Performance, 1972, 7, 442-456

Purpose: To determine whether different labor strategies could effect relative differences in performance on the same task at various points in time and to determine whether these patterns of group performance differed as a function of task difficulty.

Independent variables: Group or individual working conditions Divided labor: one S worked horizontal words, other worked vertical words. Shared labor: Ss worked together and agreed on each word. Free choice: Ss told to solve the puzzle any way they wished. Individual: Ss seated at opposite end of table and told to work silently and alone. Ss always worked in presence of another.

Subjects: 144 male undergraduates working in 60 groups of 2 and 24 individually.

Tasks: Four crossword puzzles, each containing 48 4-letter words. Two puzzles were used as a warm-up. The experimental puzzles consisted on one that was relatively easy, one relatively difficult.

Measures: Puzzles scored by counting the number of words correctly filled in. Misspelled words were counted correct if they reasonably approximated the correct word. An observer noted when words were written in and word frequencies for two minute intervals were tallied.

Results: Divided labor strategy produced significantly fewer words per interval than either shared labor or free choice.

Divided labor was less effective than shared labor at both levels of task difficulty. Shared labor yielded greater performance as effectively as shared labor groups and more efficiently than either of the other labor strategies. Individuals generally performed at a lower level than any of the groups on both tasks but approximated the total performance of the divided labor group in the later minutes. Performance efficiency and effectiveness are related. Performance effectiveness was equated on the easy task by arbitrarily redefining maximum performance as 45 correct words and eliminating all groups who did not attain criterion. Time-to-criterion scores were obtained and subjected to 1-way ANOVA. Shared labor groups were significantly slower than either divided labor or free-choice groups. Similar but statistically unreliable results occurred on the difficult task. Labor strategy produced significant effects with shared labor showing greatest task satisfaction, most perceived activity and best interpersonal relations while divided labor was lowest on all 3 variables. Task satisfaction is greater when the task is relatively easy, and when labor is shared.

Discussion: Divided labor was a potentially more efficient use of member ability but shared labor resulted in substantially greater group effectiveness. The free-choice condition appears to have attained the best of both performance criteria. When the task requires little coordination, a divided labor strategy may be most efficient, but when the task becomes more complicated shared labor becomes appropriate and the ability to switch from one to the other is the most

efficient and effective of all. High levels of interaction were associated with high performance but when task is easy it is not essential. There was a signi cant increase in interaction from the easy to the difficult task indicating that as the task becomes more difficult, interaction among group membersbecomes more essential for high performance levels.

Steiner, I.D. Group Process and Productivity, NY:Academic Press, 1972.

Outlined a partial typology of tasks. Initial division of tasks into two broad categories:

UNITARY TASKS: Those tasks that cannot logically permit division of labor among group members.

DIVISIBLE TASKS: Division of labor possible for these tasks.

Subdivided each broad category into component subtask types. The following descriptions have been excerpted from the reference cited above (viz: Steiner, 1972).

UNITARY TASKS may be group according to whether they are maximizing or optimizing. Maximizing tasks refer to those tasks that make success a function of how much or how rapidly something is accomplished. Optimizing tasks make success a function of how closely a predetermined "best" or preferred outcome is approximated. Examples of the former would be rapidity of solving anagrams, or the number of anagrams solved. Optimizing tasks would include solving a mathematical problem with a definite answer and reaching a decision in a logic problem.

Unitary tasks, in addition to being either maximizing or optimizing, may be further classified in one of four ways:

1. - Disjunctive tasks
2. - Conjunctive tasks
3. - Additive tasks
4. - Discretionary tasks

Disjunctive tasks refer to those tasks that force acceptance of one correct response from the group. There can be discussion as to what that answer is, but the final selection is made in favor of one individual's response. The group's potential productivity is determined by the resources of its most competent member. Actual productivity may differ from potential productivity when: 1/ the most competent member does not use his resources to perform the task, or 2/ other members do not accept his response as the correct one. Process may be faulty when (a) the majority of group members favor an outcome other than that proposed by the most competent member; (b) the most competent member has low group membership status; (c) the most competent member is not confident of his own ability to perform the task; or (d) the most competent member does not advocate his decision assertively enough and does not evoke support from other members. Steiner further notes that if the task is of the "eureka type" (ie. when the correct solution is quickly discernible and easily demonstrable to others), the probability of effective process is enhanced. With disjunctive tasks, any member's outcome may be selected by the group as their final choice, irrespective of the accuracy of the decision and outcome. Problem solving tasks are examples of disjunctive tasks, when the group must arrive at a consensus as to what the correct response may be.

Conjunctive tasks are those tasks in which each group member is required to perform the same task and the effectiveness of the group is determined by the effectiveness of the least competent member in meeting the task requirements. Many conjunctive tasks are not unitary and any division of labor introduces an element of conjunctivity into the task (as each member's performance is dependent upon the ability of his predecessor). Thus, the least effective member receives total weight in the determining the group's performance. Thus, not all members have equal probability of having their solutions selected as the optimal, or correct one. The nature of the task has determined in advance that

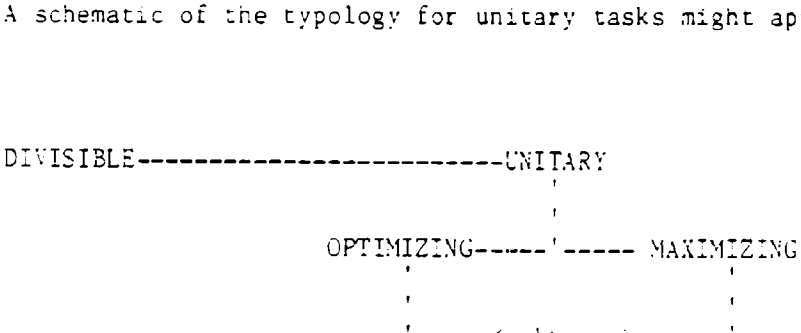
productivity will be dependent upon the ability of the least competent member. Tasks are most likely to be conjunctive when rapid performance is the critical goal (ie. maximizing types of tasks; eg. speed of a marching column). In some cases, tasks may be conjunctive only because they involve speed; another dependent criterion might have rendered the task disjunctive or additive. In problem solving, for example, consensus as to the correct response would make the task disjunctive; speed of solving the problem by the whole group would render it conjunctive (as the group's ability to perform well will depend directly on the speed of the slowest member).

Additive tasks are different from the above in that they permit the contributions of various members to be summed. The group product is a combination of various members' individual outcomes, rather than a single member's outcome. When the criterion of productivity is the number of units performed, and all members are capable of working on the task, regardless of actual productive-ability level, the task may potentially be additive in nature (eg. shovelling snow). Outside of the laboratory, completely additive tasks are rare.

Discretionary tasks involve applying differential or equal weights to each member's contribution in arriving at a consensus on a final outcome. Here, one member may decide for all, with group agreement; one solution may be selected from several given; an averaging of all decisions may be made with equal or different weights formally or informaly assigned to each decision. In most cases, an informally derived weighted average is used by the group to arrive at a final solution. Thus, an example of a discretionary task would be judging the ambient temperature of a room, where one individual may decide the temperature, various temperatures may be given by different members and one selected as "closest", or all members give estimates of temperatures, weights applied to each member's estimate (based on an informal appraisal of the member's ability

during discussion), and an average temperature derived from a summation of the weighted scores. In contrast to the other task types, discretionary tasks permit the group to weigh each member's contribution freely, combine the weighted scores in any manner desired and arrive at a conclusion (Recall that disjunctive tasks place the total weight of a final decision on one member's contribution (or several members with the same solution); conjunctive tasks also require that the total weight be assigned to one individual, but in addition, that individual must be the least competent, or productive member of the group; additive tasks permit equal weighing of individuals and the final product is the sum of these equally weighted contributions). Maximizing tasks seem never to be discretionary; when maximum performance is required, group members may not increase their accuracy or attractiveness of the outcome through mathematical manipulation of individual solutions. Furthermore, an averaging process would be inconsistent with the task purpose.

A schematic of the typology for unitary tasks might appear as follows:



Spoelders-Claes, Rita "The effect of varying feedback on the effectiveness of a small group on a physical task" Psychologica Belg., 1973, 1, 51-68

Purpose: A pilot study in the frome of a broader investigation into the influencing factors of small group effectiveness.

Independent variables: feedback varied in occurence and content. Feedback consisted of the achieved quantitative level of the group performance as compared with other groups. All feedback was fictitious and was either favorable, unfavorable or not provided, creating three experimental conditions.

Subjects: 108 male university students assigned to 27 4 man groups.

Tasks: Physical task involving a) 2 fixed pillars and 5 loose blocks to be built up and b) broken down. Cooperation among group members is a necessary condition for completing the task.

Measures: The quantity of group productivity was expressed in time for build up and break down. Quality was evaluated by comparing the group's product with a photograph of the construction, by means of a quota system.

Results: Varying feedback does not significantly effect the quantity or quality of group performance. Additional studies examining different aspects of feedback are recommended.

Spoelders-Claes, Rita. "Small group effectiveness on an administrative task as influenced by knowledge of results and sex composition of the group." European Journal of Social Psychology, 1973, 3(4),389-401

Purpose: To investigate some possible extensions to Locke's theory of task motivation and incentives. (Informational knowledge of results implies the possibility of correcting behavior whereas motivational knowledge of results does not.)

Independent variables: Knowledge of results (feedback) varied on 4 levels: 1) pretest time for group; 2) pretest time and number of errors for group; 3) pretest time and number of errors for group and number of errors for group members; 4) no feedback.

Subjects: Forty eight 4 person groups of students, most groups were all male, some 2 males and 2 females, and some 3 males and 1 female.

Tasks: Manipulation of a number of punch cards: 4 sub-tasks corresponding to position 1 - 4 over which Ss were rotated during the pretest. Using 1 card at a time, position 1 wrote the card number on a report sheet and checked for punches in a particular column; position 2 wrote the number of the rows punched in the designated column; position 3, multiplied the numbers written by position 2 and plotted the results on the report sheet; position 4 computed the multiplications and summed the products and entered the total on the report sheet.

Measures: Correct answers were preregistered with the Experimenter. Production was measured in time, in seconds and number of errors per group. A semantic differential scale was used to determine group atmosphere. Small group effectiveness was defined as "the attainment of the group

goals in a way which is fast as well as correct, through means of the group level and on the individual member level in a group atmosphere characterized as friendly, solidary, motivating and satisfying."

Results: One way ANOVA computed on T-scores. None of the results were significant. The knowledge of results variable did not have any influence on small group effectiveness nor on the productivity aspect or on the group atmosphere.

Study II

Independent variable: sex composition of group.

Subjects: Sixteen 4 person groups; eight all male and eight all female.

Tasks: same as study I

Measurements: same as Study I

Results: The sex variable had no significant influence on small group effectiveness.

Young, Douglas Lee. "Team performance as a function of task structure and work structure." Dissertations Abstracts International, 1974 (Jan), Vol. 34 (7-B), 3550

Purpose: To evaluate the Dickenson-Naylor model concepts for triadic teams.

Independent variables: Three task structures (component redundancy, complexity or organization); two task component distributions (2-component or 3-component); 2 work interactions (restricted or unrestricted) and 4 blocks of 25 trials.

Subjects: 120 3 member teams

Hypotheses tested: A) Task structure will interact with task component distribution; B) Task structure will interact

with work interaction; and C) Task-component distribution will interact with work interaction.

Results: Planned comparisons indicated limited support for the 3 hypotheses due to failure of Ss to recognize the relationship between their work and criterion in the task characterized by organization. Additional tests were conducted which implied support for the model.

Hewett, T. T.; O'Brien, G. E.; and Hornik, J. "The effects of work organization, leadership style and member compatibility upon the productivity of small groups working on a manipulation task." Organizational Behavior and Human Performance, 1974, 11, 283-301

Purpose: To vary systematically the cooperation requirement of work organizations so that differences in productivity could be analyzed as a function of the degree and type of cooperation and to investigate the interaction between work organization member compatibility and leadership style in their determination of group productivity.

Independent variables: Two levels of coordination, two levels of collaboration, two levels of leadership style and two levels of group member compatibility. Task organization 1: coacting (each individual worked on 1 model at a time and was the only one to work on it.) Task organization 2: coordination (each member was responsible for a particular section of the model - assembly line style). Task organization 3: collaboration (group worked together on each stage, five models constructed at a time). Task organization 4: coor-

dination - collaboration (models constructed one at a time with all members working together.) Leadership style: Two weeks before the experimental sessions Ss given Fiedler's LPC scale and Schutz's FIRO-B scales. Groups were assigned leaders with either high LPC scores (mean 82.69) or low LPC scores (mean 33.75). Compatible groups were constructed by using the results of Schutz's FIRO-B scales.

Subjects: 96 undergraduate students divided into 36 3-person all male or all female groups.

Tasks: Construction of as many molecular models as possible during a 40 minute work period. Models consist of 3 sections, each independent. Each section required the same number of joins between atoms and connecting pieces.

Measures: A unit of productivity used as a quantity measure was the join. There are xisty joins on the completed model. Errors were counted for a) the use of a wrong component; b) improper alignment; c) a ball in the base which failed to touch a flat surface and d) a ball in the top which failed to touch a flat surface when the model was inverted.

Results: There were no significant differences in quality. The only significant effects in quantity are the main effects for collaboration, for compatibility and for the interaction of coordination and collaboration. Imposing the coordination requirement increased the already significant differences between the collaboration vs noncollaboration groups even though the coordination groups did not perform significantly

better than the coacting group and the coordination-collaboration groups did not perform significantly worse than the collaboration groups.

Discussion: The work organization of a group significantly affects productivity. Group task organization accounts for a major portion of the variance in the productivity scores while leadership style and member compatibility account for a relatively small portion of the variance. It was expected that compatibility would interact with work organization but this hypothesis was not supported. The significant main effects for compatibility indicated that compatible groups did tend to have higher productivity than incompatible groups.

Lord, R. G. "Group performance as a function of leadership behavior and task structure." Dissertations Abstracts International, 1975 (June), Vol 35 (12-B) pt 1, 6155

Purpose: To operationally define leadership behavior in a manner consistent over task and to attempt to systematically and theoretically classify tasks.

Discussion: Twelve general leadership functions were identified: 1) developing orientation and defining a problem; 2) facilitating information exchange; 3) facilitating evaluation and analysis; 4) developing plans; 5) proposing solutions; 6) initiating required behavior; 7) coordinating or directing behavior; 8) removing barriers and providing resources; 9) enhancing task motivation; 10) fulfilling non-task needs of members; 11) reducing or avoiding conflict; and 12) developing a positive atmosphere. The relation of these leadership functions to performance was investigated over tasks which varied in structure. A curvilinear re-

lationship occured with leadership orientation development and evaluation facilitation negatively related to performance on tasks of high and low structure but positively related on moderately structured tasks. Factors affecting the production of leadership behavior were discussed but the nature of tasks and productivity wer not included.

Kanekar, S. and Neelakantan, P. "Group performance as a function of group type and group composition." European Journal of Social Psychology, 1976, 6(3), 381-385

Purpose: To test the hypothesis: The difference on errors between heterogeneous nominal groups and heterogeneous real groups should be greater than the difference between homogeneous nominal groups and homogeneous real groups. (Hetero- or homogeneous on competency.)

Independent variable: Group type (nominal vs real) and group composition (High ability, high/low ability, low ability.) Ability determined by prestests. Extreme groups were composed of those selected from the highest high pretest - lowest low pretest scores.

Subjects students from an English medium girls' high school: 60 two member groups.

Tasks: To construct words out of a set of 12 letters. Real groups worked cooperatively as a team to correct, discuss and consult with each other on any matter such as spelling or admissibility of words. Nominal groups were formed of individuals working alone and pooling solutions after eliminating duplicates.

Measures: Solutions (words formed); group interactions and individual verbalizations.

Results: ANOVA indicated a significant main effect of extremity of scores with extreme groups producing more words than moderate groups. There was a weak interaction between group composition and extremity of scores. The largest difference on errors was between extreme HL nominal groups and extreme HL real groups. The predicted main effect of group composition did not materialize.

Hackman, J. R.; Brousseau, K. R. and Weiss, J. A. "The interaction of task design and group performance strategies in determining group effectiveness." Organizational Behavior and Human Performance, 1976, 16, 350-365

Purpose: An experimental test of propositions about how group effectiveness can be improved with normative intervention into the process members use to select and implement their task-performance strategies. The study examines the consequences of strategy discussions for outcomes such as the quality of interpersonal relationships and attitudes of group members about the group experience.

Independent variables: Task conditions: Equal information condition - all members had all information and could make individual decisions without any task-relevant interaction with other group members. Unequal information condition - complete information was not provided to any one member of the group: coordination and information sharing were necessary to perform effectivly. Group process conditions: Strategy: group asked to spend 5 minutes in explicit discussion of what they were trying to achieve, what they needed to know and how to work together most effectively

Anti-strategy: groups were asked not to "waste time" in unnecessary discussion of procedure. Control group: no instructions.

Subjects: 144 paid male undergraduates, graduate and professional students, divided into 4 man groups.

Tasks: To assemble various electrical components from "order lists". Groups were told to maximize the dollar worth of component produced. Groups could choose which components to make and how to carry out the assembly process.

Measures: Gross performance was the total dollar productivity computed by multiplying the dollar value for each type of component by the number of that type of component completed. Net performance computed the same way as gross performance but only for components which met preestablished quality standards. Strategy planning activity: observational measures by trained observers and questionnaire completed by Ss. Group process and member reactions: responses to questionnaire averaged across group members.

Results: Strong support for the hypothesis: Discussions of strategy rarely occur spontaneously in task-oriented groups but such discussions can be fostered by normative intervention. Hypothesis: Under unequal information task conditions strategy group will be more productive than other groups while under the equal information condition the anti-strategy group will be more productive: Supported. Strategy intervention groups showed higher flexibility in approach to task but more confusion about how to proceed. Those group members experienced more task and interpersonal problems than other groups.

Lord, R. B. "Group performance as a function of leadership behavior and task structure: Toward an explanatory theory." Organizational Behavior and Human Performance, 1976, 17, 76-96

Purpose: To develop a cognitively based theory specifying the relations among task structure, leadership behavior and group performance.

Independent variables: Degree of structure of task (according to dimensions defined by Shaw, 1963.)

Subjects: 74 females and 70 males recruited from undergraduate classes and the university-associated community, divided into 5 person groups. 92% of the groups were mixed sex, 4% all male and 4% all female.

Tasks: Two sets of tasks were used. Each set was performed by 18 groups and consisted of 3 tasks which varied in degree of structure. Task 1 involved solving 3 short cryptograms or ciphers. Groups were instructed to work together. Task 2 involved imagining the group was a work team which was to manufacture products by operating 5 machines. They were presented a table of operating times for each member on the machines and an indication of machine preference. The task was to allocate men to machines to minimize performance time and satisfy preferences of operators. Task 3 involved moving matches around a circle subject to several constraints. Task 4 was a double classification task which required the arrangement of 16 cards according to 2 concepts which had to be discovered. Task 5 required the group to evaluate and either accept or reject a controversial value statement. Task 6 required the group to evaluate a theme which maintained that rigorous and dangerous military training was beneficial

to Japanese society.

Measures: Task 1 was measured by the number of crypts correctly solved. Task 2 measured in terms of production time for the solution they adopted. Task 3 was measured by the number of matches correctly placed. Task 4 measured by the number of cards properly arranged. Task 5 by the number of reasons supporting their conclusion. Task 6 by the number of arguments listed. Leadership was conceptualized as behavior fulfilling functions demanded by a task rather than the behavior of a designated individual. A system for coding leadership behavior corresponding to a set of leadership functions was developed.

Results: The goal was to delinate mechanisms accounting for the effects of task structure on (leadership) behavior andfor the interactive effects of task structure and behavior on performance. Task structure could explain 27 and 28% of the between task differences in the leadership behaviors of developing orientation on the individual and group levels, respectively. The dimension of task structure is an important component of the behavioral consequences attributable to differences among tasks. The correlation between performance and the number of behaviors related to developing orientation was highly dependent on the particular task and was a curvilinear function of task structure. The correlation was positive for moderately structured tasks; negative for higher or lower structured tasks.

Seta, J. J.; Paulus, P. B. and Schkade, J. K. "Effects of group size and proximity under cooperative and competitive conditions." Journal of Personality and Social Psychology,

1976, 34(1), 47-53

Purpose: To investigate the effects of group size under conditions in which others were a potential source or arousal induction or reduction.

Independent variables: Group size (2 or 4) and instructional set (competition or cooperation: individual compared to individual or group to other groups)

Subjects: 63 introductory psychology students arranged into same-sex groups of either 2 or 4 with a total of 24 groups; all conditions contained 8 males and 8 females.

Tasks: novel learning and recall of a list consisting of 20 words representing an ordinary deck of cards. Subjects were given 1 minute to memorize the list and 2 minutes to recall as many words as possible.

Measurements: The correct number of words recalled.

Results: Within the cooperative condition the large groups Ss recalled more words than those in the small groups while in the competitive condition the small groups Ss recalled more. On a novel learning task Ss can perform better in large groups when cooperating but better in small when competing. Results were also discussed in terms of crowding effects. It is suggested that individuals that are confined with similar others may feel less threatened and less aroused if they were confined with others of dissimilar attitudes, beliefs, or abilities.

Shaw, M. E. and Ashton, N. "Do assembly bonus effects occur on disjunctive tasks? A test of Steiner's theory." Bulletin of the Psychonomic Society, 1976, 8, 469-471

Purpose: To examine the possibility of "assembly bonus effects" (the inputs of one group member can stimulate other members and produce new ideas and innovative responses so that the net outcome is an increase in the effectiveness of a group) for disjunctive tasks.

Independent variables: Individual vs group problem solving, male and female subjects, 2 levels of task difficulty and 2 task order. Task difficulty involved repeated measures: individuals and groups attempted both easy and difficult tasks in counterbalanced order.

Subjects: Forty males and forty females drawn from undergraduates courses in psychology, randomly assigned to individual or 3 person, same-sex groups.

Tasks: crossword puzzles selected to vary in difficulty. The goal was to identify a single entry. The task is similar to the horse-trading problems cited by Steiner as an example of a disjunctive task. A disjuctive task is one that requires an either-or decision or a choice among alternatives.

Measures: A record was kept of whether or not the task was successfully completed, how long it took to complete it and how many wrong answers were submitted before the correct solution was found or the time limit expired. Ss filled out a short questionnaire probing their reaction to the task and their experience with crossword puzzles.

Results: There was no significant difference between observed and predicted group performance on either task. The ratio of actual performance to predicted performance was greater for the more difficult task.

Experiment II replicated Experiment I using more difficult tasks: All subjects were male college students.

Results: No significant difference was found between observed and predicted performance on the less difficult task; groups performed significantly better on the more difficult task than predicted on the basis of individual performance. This finding is consistent with the hypothesis that assembly bonus effects may occur in groups and contrary to Steiner's prediction that group performance will not exceed the potential expected on the basis of the most competent group member. Both faulty group processes and assembly bonus effects contribute to group performance on disjunctive tasks.

Goldman, M.; Stockbauer, J. W. and McAuliffe, T. G. "Intergroup and Intragroup competition and cooperation." Journal of Experimental Social Psychology, 1977, 13, 81-88

Purpose: To examine the effects on group performance and evaluation of intergroup competition or cooperation, intragroup competition or cooperation and task means-interdependence.

Independent variables: Two levels of intergroup relationship (competition or cooperation), two levels of intragroup relationship (competition or cooperation) and two levels of task means-interdependence (low and high). Subjects in the low means interdependence (LMI) treatment were told to write their words as soon as they thought of them. Ss in the high means interdependence (HMI) treatment were told they had to allow 45 seconds for the other member to write a word. If 45 seconds elapsed and the 2nd team member could not think of a word, either member could write the next word.

Intergroup competition: two teams competed - if one won, the other lost. Intergroup cooperation: two teams would cooperate and their combined performance was compared against a fixed standard. Intragroup competition: each member of the team competed against his team members. Intragroup cooperation: two members of the team cooperate with each other and their combined individual performance would be compared with a fixed standard. Ss were told only unique words (those listed by fewer than 25% of the other groups) would count for score.

Subjects: 128 male undergraduates enrolled in introductory psychology. Four subjects worked together in 2 dyadic teams.

Tasks: Anagrams - to form as many words as possible from the key word presented.

Measures: Dependent variables were group performance and individual member feelings toward other members. Winning or losing were manipulated by means of the "unique" word instruction and controlled so that each team and team member won and lost twice. Post task questionnaire evaluated a "typical student" and each of the team members by means of ten bipolar, 7 category scales. The "typical student" ratings served as a base line measure for evaluating the subsequent ratings. The basic measure of member feelings was defined as the difference between the base line and each subsequent set of ratings.

Results: Each team completed four anagram tasks. One point was allotted for each word and scores averaged over four trials. In - out group evaluation: Each S judgment along each of the 10 scales were scored 1 (favorable) to 7 (unfavorable) and the judgment averaged to provide a single

evaluation for the person being rated. In group evaluations were obtained by averaging the difference scores for the two team members ratings of each other. Out group evaluations were obtained by averaging the difference scores for the two team members' ratings of members of the other team. ANOVA for evaluations of ingroup members were significantly higher under intragroup cooperation than under intragroup competition. Evaluations of outgroup members were higher under intergroup cooperation than under intergroup competition. This latter effect was not significant nor were the effects of other experimental variables. Performance was higher under LMI conditions than under HMI conditions; a result predictable due to procedure used. The motive induced by intragroup competition is greater than the motive induced by intragroup cooperation. Performance motive for inter group cooperation was stronger. When groups are competing with one another, the relative importance of within group motives appears small. If groups are cooperating with one another, the effects of within group motives seem to predominate. Intragroup cooperation is positively related to performance of a HMI task and negatively related on a LMI task. Intergroup competition was not necessary to produce better ingroup liking, nor were differential liking effects found as a consequence of the means-interdependence factor.

Carlson, J. "The effect of leadership style and leader position power on group performance." Dissertation Abstracts International, 1978 (April), Vol 38 (10-A), 6004

Purpose: To examine the effect of formal and informal power sanctions used by educators.

Independent variable: leader position power - strong, moderate, or weak - as differentiated by Fiedler's LPC scale.

Subjects: Students from freshman psychology classes

Tasks: structured and unstructured

Results: Strong power favored low LPC leaders more than high LPC and as power decreased, high LPC group performance increased. (Not significant results for group performance) High LPC leaders performed significantly better than low LPC on unstructured task as power decreased.

Kabanoff, B. and O'Brien, G. E. "The effects of task type and cooperation upon group products and performance." Organizational Behavior and Human Performance, 1979, 23, 163-181

Purpose: To investigate systematically the direct and interactive effects of task type and group structure on the characteristics of group products and selected performance dimensions.

Independent variables: Two levels of coordination, two levels of collaboration, three levels of task type. For the first two factors, the absence of that type of cooperation constituted the first level and its presence the second level. The third factor was a repeated measures with a production problem-solving and discussion type task representing each level. Coordination: each group member began work on one of the tasks; after 15 minutes tasks were passed to another member so that each member spent 15 minutes on each task. Collaboration: all group members worked together on each task. Coordination and collaboration: For the first 15 minutes, tasks were discussed by group; for remaining 30 minutes, they followed the coordination plan, making passes every 10 minutes.

Subjects: 72 paid undergraduate psychology students formed into 24 3 person, sexually homogeneous groups.

Tasks: Nine tasks which have previously been identified (Hackman, 1966) as being distinctively(cognitive) production, problem-solving or discussion. All tasks were high difficulty type.

Measures: Group products rated on 17 descriptive scales; 3 evaluatively oriented measures - adequacy, quality and creativity - were also used. Two raters rated all products on the descriptive scales using a 5-point Likert scale. Three raters scored the evaluative dimensions on a 7-point scale.

Results: Task type was significantly related to 4 of 6 descriptive task characteristics. Problem-solving tasks were high in action orientation. Production tasks were high on originality. Production and porblem-solving tasks were rated as more creative than discussion tasks. Collaboration and coordination were related to 3 of 6 descriptive characteristics and all 3 evaluative measures. Collaboration had the larger influence, accounting for 36% of the variance in length. Significant interaction between coordination and collaboration in issue involvement, length, adequacy, quality and creativity. There were 3 significant 2-way interactions between structure and task type and significant 3-way interactions. The group task is a major determinant of group output. Collaboration seems ineffective for a task that requires evaluation of multiple solutions and when no single correct solution is specifiable. Coordinated structures produced more adequate outputs. Gains from

coordination should be maximal when group members have high ability. Process losses tend to be maximal with low ability members in the group. Coordination and collaboration have quite divergent implications and point to a need for more sophisticated understanding of "cooperation."

Kabanoff, B, and O'Brien, G. E. "Cooperation structure and the relationship of leader and member ability to group performance." Journal of Applied Psychology, 1979, 64, 526-532

Purpose: To examine experimentally the moderating effects of cooperation structure on the group ability/group production relationship.

Independent variable: Two levels of coordination, two levels of collaboration, two levels of leader ability and two levels of subordinate ability. Subordinates in each group were always matched on ability. Collaboration is when group members work simultaneously with each other on each aspect of a task. Coordination refers to group members working on sub-tasks.

Subjects; 144 undergraduate students fromed into 48 3 person groups

Tasks: To produce as many relevant and novel ideas as they could in response to three different creative problems.

Measures: Before participating all Ss completed a test of verbal creativity and were assigned a composite creativity score. High ability leaders and subordinates were similar in ability as were low ability leaders and subordinates. Tasks were scored by 3 raters on fluency, flexibility and originality and a total score obtained by summing across all indices.

Result: Coordinated structures were significantly more productive than noncoordinated structures. Collaboration was inferior to non collaboration. Groups with high ability leaders or subordinates were more productive than groups with low ability leaders or subordinates. There was a significant two-way interaction between collaboration and leader ability so that when collaboration was present, the ability of the group leader did not have a significant effect on the group's performance, but when absent, groups with high ability leaders were more creative than groups with low ability leaders. The creativity ability of group members was a significant determinant of productivity; the way in which members cooperated was as important a determinant of group performance as member ability; and organization significantly moderated the effect of leader ability on performance. The superiority of coordination may be due to the stimulation of members by others' ideas without the usual requirement of a high level of verbal interaction.

Norris, D. R. and Niebuhr, R. E. "Group variables and gaming success." Simulation and Games, 1980, 11, 30 -312

Purpose: To determine the effects of group cohesiveness on groupperformance in a management game and to examine the effects of voluntary vs assigned group membership on the cohesiveness of the group.

Independent variable: Voluntarily assembled teams vs assigned team membership. Three hypotheses tested: 1) Voluntarily assembled teams will exhibit greater levels of cohesiveness than groups formed by assignment; 2) The groups exhibiting greater cohesiveness will achieve higher levels of game

performance success; and 3) There will be no difference in game performance between voluntarily formed or assigned teams.

Subjects: 68 undergraduate students in a business policy course formed into 14 voluntary groups and 4 assigned groups; 9 groups had 4 members, 6 had 3 members, 2 had 5 members and 1 group finished with 6 members

Task: The Executive Game - the object of which is to maximize the firm's ROI (return on owners' equity)

Measures: Group cohesiveness was measured at the end of the game by a modified version of a scale developed by Seashore (1954). The criterion measure of group performance was the ROI obtained by each group for their firm.

Results: Preliminary analysis revealed no significant differences between voluntary and assigned groups which would have influenced cohesiveness or performance. Neither cohesiveness nor performance measures were significantly different between the two groups. Performance was significantly correlated with cohesiveness. Group cohesiveness may develop over time as a result of successful group performance.

Isenberg, D. J. "Some effects of time-pressure on vertical structure and decision-making accuracy in small groups." Organizational Behavior and Human Performance, 1981, 27, 119-134

Purpose: To further document the effects of time-pressure on vertical structure and decision-making accuracy in small groups; to explore one possible explanation for this phenomenon; to explore the effects of time-pressure on decision-making accuracy

Independent variables: Time (high, moderate and low); group, nested within time, and rank for each group member, from most (1) to least (4) communicative.

Subjects: 42 male and 30 female undergraduates formed into 18 groups of 4 each.

Tasks: A decision-making task "Search for Oil", adapted from Fosmire's VOCOM task (Fosmire, 1970). The object is to make as much money as possible by making accurate recommendations and suffering a penalty for errors. Both quantity and accuracy are rewarded.

Measure: Decision-making accuracy was assessed by a number of related indices: # of finds, # of mistakes, frequency of hits and misses and 2 indices of efficiency (hits - misses)/(hits + misses). Two observers assessed the amount of communication. Sociometric ratings were collected, using 2 7-point scales. Group process varialbes assessed by 6 7-point scales and how the time manipulation affected members. Self report scales assessed leadership, satisfaction with output, satisfaction with the way the group functioned, pleasantness of task, amount of stress and time sufficience.

Results: As time-pressure increased, members experienced the task as less pleasant and more stressful while communication frequency increased. For this task, high time pressure was aversive and stimulated communication. Predictions stating that increased time-pressure leads to unequal sharing of air time (vertical structuring, reflecting an increased differentiation among members) and increased rating of leadership were supported. Unequal sharing of speaking time is accompanied by lack of attraction when there is no time

pressure, but this is not true for high time pressure conditions. Decision-accuracy variables were analyzed for linear and quadratic trends both of which were significant for the number of hits. The total number of decisions made showed both a linear and quadratic trend. No measure of efficiency showed significant effects of time pressure. Increase in time pressure increased communication frequency and increased arousal. Increase in arousal above a certain point has a detrimental effect.

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