

**WINNING THE COMPETITIVE EDGE THROUGH COOPERATIVE
GROUP INTERACTION -- IT DEPENDS ON THE TASK**

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ABSTRACT

Our conventional wisdom contains several adages that deal with the relative capabilities of groups and individuals. Sayings such as "Too many cooks spoil the broth" and "Two heads are better than one" reflect the diversity of opinion that characterizes present positions. Across time, one of the most frequently asked questions is "Which is better at performing tasks--groups or individuals?". This paper reviews theory and research relevant to one specific element of this question, task structure. Additional elements of group structure and reward systems are related to the task structure content.

INTRODUCTION

In value management (VM), heterogeneous groups are employed to implement the job plan. This clearly demonstrates the belief that a group can perform information, speculation, analysis and evaluation functions more effectively than individuals operating independently. This paper is the first in a series of papers which will examine the theories and research relevant to various features exhibited in small group activities to provide greater understanding of those features and to identify implications for improvement of the group operations part of value management programs. The element discussed in this paper, task structure, is central to group behavior. Later papers will focus on other elements such as group interdependencies, communication, organization and reward systems.

**PERSPECTIVES ON GROUP
PERFORMANCE**

The question of relative value of group versus individual performance was one of the first issues examined by early social psychologists. From the 1920's through the present, two major perspectives have been apparent in both theory and practice. The first perspective, "wholism", had a major influence on early research. The basic assumption of wholism is that the whole is greater than the sum of its parts. Further, early social scientists presumed that the positive effects of assembly were accelerated as group size increased. (Below)

Studies conducted by Gordon¹ and Shaw² are typical of early holistic research. Using judgement and problem-solving tasks, both researchers found groups to be more effective than individuals. Unfortunately, those studies were seriously flawed. The judgement task outcome was actually a function of compensating random errors, while the problem-solving outcome was a best-member result rather than a group interaction effect. Studies in the 1950's, more carefully examined the relative outcomes of interacting groups versus non-interacting aggregates. Such research identified the number of times an interacting group would perform better than expected for the number of individuals. Results were disappointing for those holding holistic biases. In a number of studies the group's performance was significantly below that of individuals and aggregates, leading many theorists and practitioners to adopt a new position called

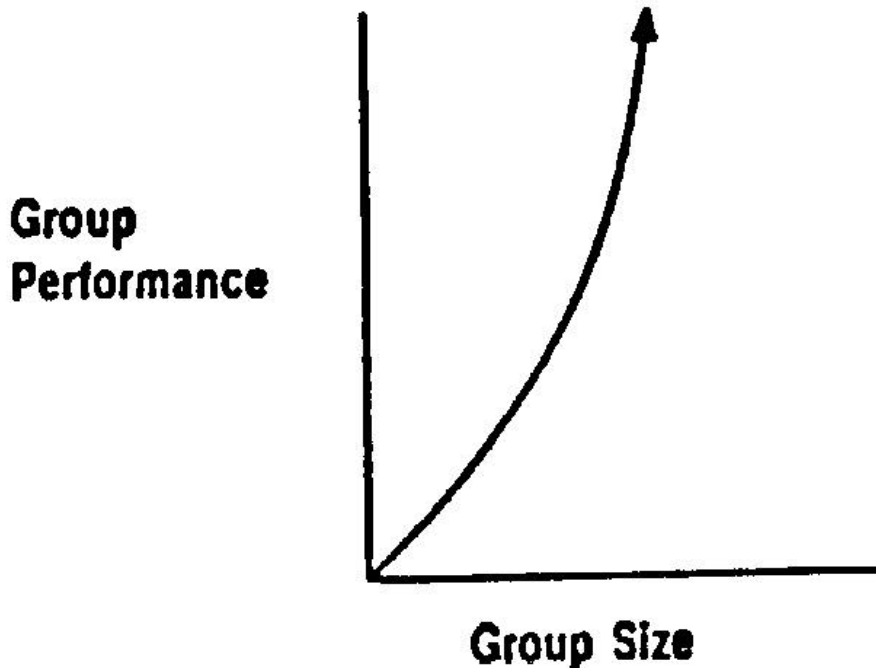


Figure 1

Wholistic Theory of Group Performance

"reductionism" (Figure 2).

as long as even one member can perform the task well.

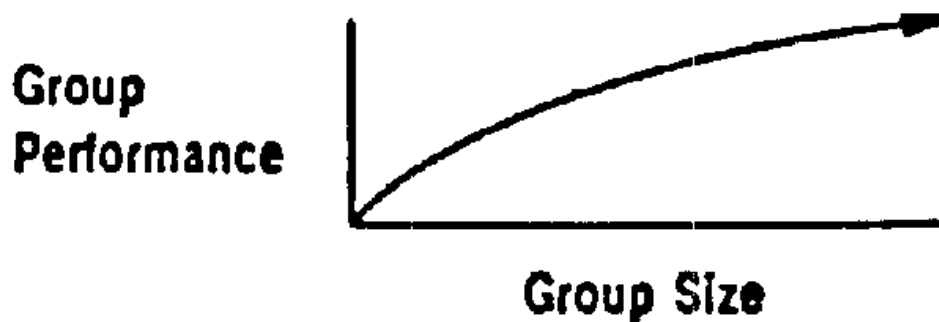


Figure 2
Reductionist Theory of Group Performance

This perspective holds that the whole group, at best, is equal to the sum of its parts. However, the equality of outcome holds only when interaction is optimum. Since optimum interaction does not occur in most cases, especially as group size increases, the group performance would be significantly less than the sum of the individual efforts. Reductionists view actual group productivity as a function of optimum (or theoretical) productivity minus losses due to faulty group interaction processes.

CLARIFYING THE BASIC QUESTION

More recent investigators have found the question "Which is better at performing tasks -- groups or individuals?" too vague to be research-able. Terms such as "better" and "tasks" had to be more clearly specified. First, what does the term "better" mean? Better in terms of what? Both individual and group activities result in a number of output variables, including accuracy, solution quality, speed, satisfaction and overall productivity. Any one or combination of these variables can provide reference points for identifying "better" performance. To clarify the second term, "tasks", several taxonomies have been developed. The classification scheme used in this paper was developed by Ivan Steiner³, who identified four major types of tasks.

In "additive" tasks, the outcome is simply a total of individuals' products. For example, I might hire three secretaries to type copies of a paper. If one person typed four copies, the second typed six copies and the third typed five; then as a whole, the group typed fifteen copies.

Performance on such additive tasks can be measured in terms of overall productivity and speed. In "conjunctive" tasks, the outcome is also considered as the members combined output. But in these tasks, each person must perform a different function. The entire group must work "together" in a serial sense. If we were involved in some research that required a large number of subjects, we could structure the task so that one person had the specific job of locating possible subjects that fit certain criteria, the next person would contact the individuals, and the third person set up specific times that the subjects were to be present. In such an "assembly line" approach, if one worker is absent or works slowly, the entire process is affected. As with additive tasks, overall performance on conjunctive tasks is a function of the least competent member.

Performance on the third taxonomic type, "disjunctive" tasks, requires that group members choose the best answer from a set of possible options. In this type of task, the least competent member of the group need not affect overall performance. It is theoretically possible for the group to succeed

Hackman⁴ further divided disjunctive tasks into three subsets. "Judgement" tasks have answers that are objectively correct. However, the validity of the group response cannot be determined by group members and must be verified by external sources. Group activities such as "Lost on the Moon" or the "Occupational Ranking" task require that an established "right" answer (from NASA in the former case or the National Occupational Ranking Center in the latter) be consulted to evaluate the correctness of the group judgement. Group performance on judgement-type projects is generally evaluated in terms of speed and accuracy.

Disjunctive "problem solving" tasks also require "best" answers to be identified. In this case, however, the group members can recognize the appropriateness of their response. The "Ages" puzzle (Fraser⁵) is a good example of this type of problem in which once the necessary insight has occurred, the group members can clearly identify that their answer is correct. The third sub-category of disjunctive tasks, "decision making activities", have no convergent "right" answers. No verifiable standards exist to determine whether a given policy or plan recommended is the most appropriate. Group action is judged by the methods used and the extent to which they were used well. "Accuracy" cannot be equated with successful implementation of the decision reached since external conditions or other mitigating factors might affect implementation so that even the best available decision might have less than favorable results.

"Complementary" tasks, the last major taxonomic type, are generally similar to disjunctive tasks. However, complementary tasks can be broken down into component parts or stages. Thus, such tasks can involve multiple judgement, decision-making and/or problem solving activities. Each activity or phase can be operated on by various members of the whole group, depending on specific expertise required. This is significantly different from disjunctive tasks that involve a single decision.

RESEARCH ON GROUP PERFORMANCE BY TASK TYPE

Additive tasks. Strong support for the reductionist perspective was provided by an early study performed by Ringleman (as reported in Kravitz & Martin⁶). The amount of force exerted by different numbers of people was measured to determine the performance per worker. Results clearly demonstrated a drop in productivity per person as the group size increased. Numerous studies conducted since this "Ringleman effect" was identified, most involving additive tasks, have replicated the original findings.

Further, studies conducted by Ingham, Graves & Peckham⁷

isolated the source of the decline as a function of motivation rather than demands for coordination. In a rather ingenious study, Ingham et al. replicated the Ringlemann rope-pull study. Although all participants were operating as individuals, half of the subjects were made to think they were working as members of groups. Data were interpreted as support for a "social loafing" tendency, since exertion levels dropped when persons thought they were working in a group compared with the same individuals' exertion when operating as individuals. Social loafing seems most apparent in additive tasks in which specific contributions cannot be determined. Reduction in social loafing has been associated with perceived task importance and/or challenge, individual accountability and responsibility for specific tasks.

Conjunctive tasks.

The Reductionist perspective is also supported by studies of group performance on conjunctive tasks. In a study conducted by Frank & Anderson⁸ groups of different sizes performed idea generation tasks (i.e. each person was to list three reasons for and three against legalizing gambling). The task was made conjunctive by specifying that the group as a whole could not move on to the next task until each member finished the present one. As expected, group size was inversely correlated with efficiency (speed) of the output. Such evidence suggests that when working with additive or conjunctive tasks, it is wise to keep group sizes as small as possible and minimize incompetence among members through selection, retraining or replacement. At this point in our review, advocates of the holistic perspective have little basis for optimism. The evidence strongly supports the position that the effects of assembly are not positive with regard to performance -- at least in the cases of additive or conjunctive tasks. However, the nature of VM activities is not apt to be additive or conjunctive.

To obtain the benefits of the heterogeneous teams selected to perform a VM study, the task should be organized in disjunctive or complementary ways. Disjunctive tasks. As described earlier, both judgement and problem solving types of disjunctive tasks have objectively correct answers. Researchers test two assumptions when examining group performance on these disjunctive tasks. First, given at least one competent member, the group should be able to reach a correct solution. Second, it is assumed that interaction needs are limited to simply communicating the solution once determined. Presumably, the correct answer will be recognized by the other group members or they will be persuaded by the competent participant. Johnson & Torcivia⁹ tested those assumptions by presenting a problem to be solved to individual participants. After solving, the participants were to report the extent to which they were certain their answers were correct. The participants were assigned to one of six conditions: 1. individuals who got the right answer (R), 2. individuals who got the wrong answer (W), 3. dyads of correct respondents (RR), 4. dyads of members who got the same wrong answer or 5. different wrong answers (WW), and 6. dyads of one right/one wrong in the previous solution (RW).

The task was then performed again with the following results (in percentage correct):

RR - 100%	RW - 72%	WW (same answer)-10%
R - 96%	W - 9%	WW (diff. answer) - 8%

The participants who had previously been right continued to be right, while those who had previously reached incorrect conclusion were still unsuccessful. In the case of two wrong dyads, two heads were not significantly better than one. Even in the dyads in which the participants had earlier reached different wrong answers (possibly giving them some dissonance that might generate discussions leading to the correct answer), incompetent problem solvers could not help one another reach better solutions. However, given at least one competent member, the outcomes indicated positive assembly effects. In the RW dyads, the competent member generally had greater influence on the outcome than the less competent member, even though truth did not always win out.

Thus, for those with holistic biases, the question remains

"given at least one competent member, why was the interaction in RW dyads insufficient to provide for correct solutions in a greater percentage of cases?" In the Johnson & Torcivia¹⁰ RW groups were generally the member who reported greater certainty. Sometimes this was the more competent member, but not in all cases. In a related study, Zaleska¹¹ uncovered additional information regarding the relationship between competence and persuasiveness. In that experiment, samples of college students and vocational high school students attempted to solve a verbal problem and then rated their confidence in their responses. Next, all the participants were placed in groups containing at least one member who had previously been correct. After a period of discussion, the participants made a second attempt to solve the problem, rated their own confidence and then rated the confidence that they thought others had. The college sample improved in 17% of the cases, while the percentage of vocational students who were correct fell 4%. In the college sample, although the most competent members did not necessarily rank themselves as most confident, they were the most talkative. Other group members judged them to have the greatest assurance. In the vocational sample, the most talkative members also had the greatest influence on others. Unfortunately, in that sample the most talkative member was not generally the most competent. As the authors of the study concluded, if competence wins, holistic outcomes occur.

Complementary tasks.

Holistic approaches have been supported further by results of studies that involve complementary tasks. In a representative study, Laughlin and Johnson¹² gave participants two tests in which 148 items had to be categorized as synonyms, antonyms or analogies. Competence of each participant was determined by results on the first test and subjects were classified as high (H), or low (L). For the second test, participants either worked alone or in dyads combining various ability levels. Results on the second test were:

HH - 126.3	MM - 84.2	LL - 54.4
HM - 114.1	M - 76.5	L - 48.1
H - 95.2	ML - 74.4	HL - 92.9

Much of this data provide support for the holistic perspective. Subjects who worked with H or M ability did better than if they worked alone. Positive assembly effects are demonstrated especially well in the HM dyads that performed even better than H individuals alone. The key factor in the improved performance of the groups was clearly competence. Again, the implication may be drawn that if competency wins out, group performance is superior.

GROUP STRUCTURE AND VM ACTIVITY

A number of implications for VM group activities can be derived from this review of task structure research. First, it is clear that group task is a major determinant of the group output. The task builds into the group a common sense of what constitutes appropriate ways to respond to the problem. It is to a group's advantage to turn lower level tasks into complementary tasks. As the group engages various phases of the job plan, this would provide for most effective use of the different abilities of group members. The likelihood of best outcomes is significantly improved by allowing different member's competencies to emerge as appropriate. While some members are more skillful at generating ideas, others are best at evaluating proposals.

However, it is important to recognize that these different competencies will be effectively manifest only if the group is organized properly. VM groups should be staffed with competent individuals with a range of experience, backgrounds, points of view and talents. We know that individual differences are the primary source of the power and potential advantages of group activity. Complementary tasks allow these group aspects to be optimized, while lower-order tasks depress or eliminate the potential of positive effects of assembly.

THE NEED FOR VM-ACTIVITY BASED RESEARCH

Research regarding competence and influence (cf. Zaleska¹³) suggest that VM group leaders should be aware of the

possible misuse of "open group communication". While the subjects of group interaction and structure will be discussed more fully in later papers in this series, a few highlights are appropriate here. In 1979, Kabanoff and O'Brien¹⁴ examined two forms of cooperative group structures--collaborative and coordinated--in comparison with coactive (individualistic) structures. The researchers found that "Coordination resulted in products that were longer, more issue involved, adequate, creative and of higher quality" (p.173). Although the particular task involved was a discussion type rather than problem solving or decision making, this result might shed some light on ways to reduce inappropriate influence by less capable members. Extensive reviews of the cooperative-competitive group structure literature have resulted in contradictory conclusions. It is clear that Deutsch's¹⁵ initial prediction that cooperative structures yield greater group productivity than competitive structures did not account for confounds as reward systems, member ability, organization or task type. Pettigrew¹⁶, a major proponent of competitive designs, commented that "in a competitive society such as ours, the satisfaction of the differentiating reward and the feeling of competitive success more than compensate for the interpersonal loss." Despite extensive research aimed at elucidating the effects of reward structures on group productivity, there is little evidence supporting Pettigrew's contention. Research related to the reward structure has obvious implications for development of performance appraisal techniques in organizations that provide members with both individualistic and group goals.

Very little empirical evidence has been documented regarding the interaction of group process variables and group outcomes in VM. Practice has been based largely on conventional wisdom, modeling, or implications from research focusing on groups operating under experimental conditions. Some naturalistic research related to group problem solving is available, but little or none that employs groups operating with the structures, reinforces leadership, tasks, etc. that characterize our field. While research reviews commonly end with a "need for further research" clause, such an appeal is especially appropriate here. The external validity of common group research is questionable given the specifics of VM activity. We have the need to develop a knowledge base founded on naturalistic study of VM teams. We have personnel with necessary behavioral science skill. We have sufficient numbers of VM teams operating in different environments, on different tasks to examine the relative impact of differences in conditions. Continuing interest in increasing the professionalism of VM requires that we match our resources with the information needs and begin serious, systematic study of the people part of our work.

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