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The task-tuned organization of groups

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SUMMARY

This study deals exclusively with problem solving; no propositions are made bearing on emotions and motives. The focus of the study is on problem solving in groups. It is assumed throughout that the members of the group want nothing else than to cooperate in order to solve over-all problems ('integrative bargaining'); thus, situations in which members strive to maximize their own payoffs, eventually to the detriment of their fellow members ('distributive bargaining'), are excluded from consideration.

The Chapters I, II, and III are of theoretical nature. The Chapters IV, V, VI, and VII deal with small group laboratory experiments. In Chapter III, the main propositions that are elaborated in Chapters I and II are refined and pinpointed into our experimental hypotheses.

In Chapter I, the emphasis is on general aspects of problem solving, both by human individuals, by groups and by electronic devices. It is argued that no information processing takes place without hierarchical structure. Comprehensiveness of the problem field requires a strong monitoring system in order to keep track of incompleting cognitive sequences and to apply goal rules in a consistent way. Availability of such a monitoring system is thought to be paramount the more comprehensive the field is, and the more 'embedded' the subproblems are. Operations that are repeatedly needed will be routinized and subsequently coupled to higher-ordered search procedures. The more complex the problem solving apparatus is and the more delicate the search behavior required, the more levels the hierarchy of the control mechanism should have.

Chapter II deals specifically with groups as problem solving units. Each problem solving system has to perform the following functions: sensing (intake of

information), controlling (comparing information received with reference signals and emitting effector signals) and effecting (performing an action on the environment). Group tasks can be classified as 'sensor-', 'control-', and 'effector'-type tasks respectively depending on the relative amount of energy to be spent on the three functions distinguished. The proposition is put forward that for sensor-type tasks a group structure of a rather low degree of centrality is most adequate, whereas for control-type tasks the group structure should be more central. Generally, centralization of the group structure is thought to reinforce the control function and concomitantly to weaken the sensing function; similarly, decentralization would weaken the control function and strengthen the sensing function.

In Chapter III, the main concepts, 'interdependency,' 'coordination,' and 'group centrality,' are defined.

'Interdependency,' being a characteristic of group tasks, is the degree to which decisions made by one or more members affect the alternatives (or, more generally, the payoff vectors) of other members.

'Coordination' is the processing of 'if - then' relationships in the realm of group problem solving; it is the operation of the control function in group problem solving.

A group structure is central to the extent that a specialization among group members has taken place in 'goal-emitters' and 'goal-receivers.' *A hierarchical group structure exists* when a goal emitted by some member to another is a sub-goal of a goal received from a third.

It is proposed that the decision points of the group decision tree (*i.e.*, the pattern of decision points) should be allocated to members in such a way that the need for inter-member message transmission is minimal. Generally, it is propounded that the form of the group structure should 'match' the structure of the group decision tree. To be specific, when group tasks are characterized by a high degree of interdependency, they are of a control type and should, therefore, be performed by a centrally structured group. If the group is hierarchically structured, a form of incongruency prevails when the most important decision points are controlled by the 'bottom.' Another form of incongruency is present when the hierarchical relations among group members are not matched with the channels of the communication network. All these diverse forms of incongruency are hypothesized to affect group productivity negatively.

Chapters IV and V deal with the expectation that groups will adapt the structure of their inter-member interactions to the requirements of their task; thus, when the tasks are relatively interdependent, the groups are expected

to develop a central interaction pattern. The evidence that was obtained was considered insufficient to support this hypothesis.

In Chapter V, both task interdependency and group centrality are varied independently. It is expected that centrality of group structure as compared to non-centrality becomes more beneficial to the output of problem solving as the task becomes more interdependent. This hypothesis received support as far as speed is concerned. Imposed leadership appeared to be particularly detrimental to group problem solving when the task interdependency was low. However, it could not be demonstrated that in the high interdependency situation it was particularly advantageous; here, centrality only ceased to be disadvantageous. The only evidence favoring the latter expectation was of correlational nature: solely when the interdependency was highest, did the groups that had centralized their interaction pattern perform faster and make fewer erroneous decisions than non-centralized groups; in task situations of lesser interdependency such a correlation was absent.

It could not be demonstrated that, as was expected, availability to the group of a 'technical device' by means of which selection of relevant data could be facilitated, is functionally equivalent (with respect to the outcome of problem solving) to 'presence of leadership': no interaction effect of this factor with task interdependency was apparent.

In Chapter VI, keeping the group structure constant at the non-central level, the degree to which the members need each other's data in order to find a group solution is varied. It is expected that the group's capacity to change its working procedure as the problem environment demands it is more impeded the more the members have been accustomed to a situation of dependency on data exchange with others (at least, as long as no coordinating agency is present to counteract this tendency). The data obtained were consistent with this prediction. *Ex post facto*, however, the results could be explained in two ways:

1. Barriers of communication existing between members cause available information to be prematurely considered sufficient;
2. those group members who, in the high self-containment situation, at first were prevented from contributing to solutions because they lacked the necessary information, grew probably extra zealous in finding an opportunity to improve the group's performance.

In Chapter VII, the task structure is held constant at a fairly high level of interdependency and, in all conditions, the groups working in a situation of restricted communication possibilities are hierarchically structured. Variation

is created in relative influence on the final group product assigned to the 'bottom' relative to the 'top,' and in the allocation of central and peripheral positions of the communication network to top and bottom respectively. It is expected that congruency between the distribution over members of influence to affect the final group product on the one hand and hierarchy on the other, results in a higher productivity than incongruency. This hypothesis received support. When such a congruency prevails, the first decisions can be made largely as a result of *local* problem solving by the top; in the case of incongruency, a higher rate of transmission of decisions and instructions throughout the group is required which may result in loss of information and is time consuming. Phrased in more general terms, one might say that evidence was obtained that, when the possibilities of communication are restricted, a pluricentral social system is more difficult to manage than a unicentral one.

In the same chapter, it was expected that congruency between the network of communication channels and the hierarchy of the group structure yields a higher productivity than incongruency. This hypothesis received some support in one experiment but not in another.

Results obtained in the first experiment of Chapter VII led to the formulation of a hypothesis that was supported by the data of the second: this hypothesis is that the negative effect on problem solving performance of a relatively large amount of influence of the bottom member will be counteracted (partially) when this highly influential bottom member occupies a central position in the communication network. This is, again, a congruency hypothesis: congruency between influence and communication centrality is expected (and found) to have positive effects on problem solving performance of the group, whereas incongruency does not. Stating this again in more general terms, one might say that some evidence was obtained that in a pluricentral social system the various centers of influence should have an easy communicative access to all parts of the organization.