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ABSTRACT

The "psychological isotope" technique was used to study the effect of leadership style on group process and productivity, by planting identifiable units of information with specific group members. Data indicated that the movement of these traceable bits provides data on the flow of information in the group, the relative influence and impact of specific group members, and the sources of conflict. Strong and reliable results identified the effects of leadership style on group process and the positive and negative effects of interpersonal conflict. (Author)

Leadership Style and Communication Process: An Experiment Using the Psychological Isotope Techniques

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Leadership Style and Communication Process: An Experiment Using the Psychological Isotope Technique

Most contemporary theories of leadership take an interaction or contingency view of leadership effectiveness in which personal attributes of the leader are hypothesized to interact with situational parameters in effecting group or organizational productivity. The most widely researched and well known of the interaction leadership theories is Fiedler's (1967) Contingency Model.

The Contingency Model hypothesizes that effective leadership performance is the result of the interaction of a leader attribute, measured by the "esteem for the least preferred co-worker" (LPC) scale, with parameters of the leadership situation including the affective relationship between leader and followers, the degree of task structure, and the leader's formal and informal authority. The central leader attribute in this model is the leader's LPC score which is measured by asking the leader to rate, on eighteen bi-polar adjective scales, the one co-worker in the leader's experience with whom the leader had the hardest time accomplishing an assigned task.

The interpretation of the LPC score has varied over the 27-year period of research with the measure. Originally thought to reflect the leader's degree of distance from co-workers and subordinates, the LPC score has been described as a measure of leader behavior tendency, cognitive complexity, and motivational orientation. Indeed, the confusion over the meaning of the LPC scores has led some reviewers (e.g. Korman, 1972) to

argue that without a clear theoretical meaning for the LPC score, the Contingency Model is of dubious theoretical or practical value. These arguments persist in spite of the fact that the research evidence indicates that the Contingency Model is a reasonably good predictor of leadership effectiveness (Fiedler, 1971; Chemers and Skrzypek, 1972).

Recently, Rice (1975, Note 1) completed a comprehensive analytical review of 66 randomly selected studies which have employed the LPC construct. Based on the pattern of significant findings Rice concluded that the LPC scale taps a reliable and stable aspect of the leader's orientation to task group goals. Labelling LPC as a value-attitude orientation, Rice reported that persons who rate their least preferred co-worker in a very negative manner, low LPC persons, value and derive esteem from successful task performance. Such leaders were found to be more aware of task than interpersonal aspects of group situations, more optimistic about and more satisfied with successful task performance, and more likely to value and behave in a directive, structuring manner. Conversely, the person who rates a least preferred co-worker in a relatively positive manner, the high LPC person, derives esteem and satisfaction from successful interpersonal relations. He/she is more attuned to affective processes, and tends to value and behave in a considerate and participative style.

Rice's (1975) findings, while adding considerably to our understanding of LPC, still fail to clearly explain the process by which each leader type achieves effective group performance. Although some studies have shown a relationship between LPC and traditional leader behavior like

consideration and initiation of structure (Rice and Chemers, 1975) the behavior differences were often unrelated to task performance.

The present study attacked the problem from a different perspective. The authors reasoned that high LPC leaders are most effective in situations involving uncertain and unpredictable task or interpersonal demands because their participative, conflict avoidance leadership styles enhanced information sharing, and follower participation and commitment. Low LPC leaders, while successful in high certainty, predictable situations, were thought to fail in less certain situations because their directive and structuring style precluded full information exchange and exacerbated interpersonal tension. The authors hypothesized that if these process scenarios were correct it should be possible to design a group problem-solving situation in which differential processes could be highlighted and observed.

To this end, the psychological isotope technique was developed. Group members were given a task to solve in which information needed to be shared and evaluated in order to reach a correct solution. Prior to group problem solving group members were given information about aspects of the task. This information, which varied across group members and was sometimes contradictory, included specific, traceable items of information. By following the flow of these traceable bits from individual to group solution, group process could be inferred. Augmented by post-session questionnaires, this technique might reveal the nature of group process in a more comprehensive and holistic manner than is normally achieved through behavior ratings or process analysis.

Method

Overview

After being classified as high or low LPC, subjects were randomly assigned to triads. Subjects read instruction booklets describing a situation in which they were to imagine themselves as members of a sailboat crew which was abandoning ship. They then made individual decisions concerning the order in which they would transfer 15 items from the boat to a life raft. The instruction booklets introduced the situation identically for all three crew members. However, subsequent information concerning "critical items" which might be considered for transfer differed for each of the members. Without benefit of the instruction booklets, using only their individual ranking sheets, the three group members then came to a group decision. Finally, post-experimental questionnaires were completed.

Subjects

Subjects were 31 female and 83 male introductory psychology students recruited from the University of Utah subject pool. Subjects received class credit for participation in the experiment, and were provided alternative methods for receiving that credit.

Procedure

Groups of 12 to 33 subjects were assembled in a classroom, where they completed the LPC scale (Fiedler, Chemers, and Mahar, 1976). High and low LPC subjects were randomly assigned to triads, with two levels (high and low LPC) at each group position. For member A, the cutoff for high LPC was 70; for low LPC, the cutoff was 63. The cutoff between high and low LPC

for members B and C was 65. Maximum disparity on LPC was considered critical for the group leader, member A. (For a more thorough discussion of LPC assignment, see Fiedler and Chemers, 1974.)

Member A, the leader, was always a male. Females were randomly assigned to B and C positions in the triads. One female and one male experimenter conducted the groups.

Each group member was handed an envelope marked with his or her group number and group member letter (i.e. A, B, or C). The process of the experiment was summarized by the experimenters. The group members were assembled, however they worked individually as they read their instruction booklets and came to individual decisions concerning the problem contained in the instruction booklet. Subjects were asked to read carefully and remember the information contained in their booklets, as they were allowed to take only their individual ranking sheets into the group decision-making situation.

Introduction to the problem was identical for members A, B and C. The ostensible purpose of this experiment was to determine the decision-making processes of novice seafarers experiencing a sea disaster requiring abandonment of the craft. Subjects were asked to imagine themselves in this situation. Three World War II buddies made a pact 30 years ago to spend a summer sailing from Okinawa, Japan to Los Angeles. During the 11-week voyage, each member of the crew would fulfill one job on the ship for about three weeks, rotating jobs so that each member would be an expert in all aspects of sailing by the end of the voyage. After two weeks at sea, the

boat started taking on water, and it became necessary to abandon ship to the rubber life raft. The exact location of the craft was unknown.

The crew estimated they had a maximum of 30 minutes in which the vessel would remain afloat. During this time, they were to determine which items on the boat were important to transfer to the rubber raft. A list of 15 items (see Figure 1) was provided. Since they might not have time

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Insert Figure 1 about here

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to collect and transfer all 15 items, the crew was asked to rank these items in order of importance. Subjects familiarized themselves with this list, then read the remaining briefing information, which contained the knowledge that each member had attained by serving in her or his crew position during the two weeks of the voyage. These briefings, therefore, varied for each of the three crew members.

Member A was reminded that as Captain, he was responsible for finalizing the decisions to be made in preparation for abandonment of the ship, and for the safety and survival of the crew. Member A's attention was focused on the importance of navigation tools, the fishing kit, and the transistor radio as a possible location-finder. Member A's briefing explained the operation of these items but did not say that they should be ranked highly. Member B's information booklet described the navigation items as useless, therefore these items should be ranked at the bottom of the list. The radio should have also been ranked low, as it was described as useful only within a 20-mile radius of a signalling station. Member C's

information suggested that being found was of the utmost importance and that the oil-gas mixture was an excellent signalling device. Therefore, the oil-gas can should be ranked first by C. Turning attention to the next important issue, survival, Member C should have listed the water, then the C-rations, then the opaque plastic, which can serve as protection from the elements and a collector of rain water.

Subjects were given 20 minutes to read their information packets and make their individual decisions. The experimenter then collected the briefing booklets and distributed the group ranking sheet to Member A. Member A was asked to read the instructions to the crew, and the triads were given 30 minutes in which to come to a group decision. The instructions reminded the group that the quality of their decision was determined by ranking the 15 items in order of their importance and that Member A, as Captain, had final authority for the group decision. At the end of the 30 minutes, the group ranking sheets and all three individual ranking sheets were collected, and the members individually completed the post-experimental questionnaires.

Dependent Measures

1. Group error

The ideal group decision, combining information from the briefings of all members, was determined by E. If all members remembered the information in their booklets, shared that information with the others, and persuaded the others of the validity of that information, it was determined that the oil-gas can should be listed first, followed by water, C-rations, and opaque plastic. Other food and signalling devices, as redundant, but still important,

should be listed next. Navigation items and the transistor radio should be listed as least important. The first four and last five items were therefore used as criteria for quality of decision. Deviations from this ideal listing for each of the nine items were summed and defined as group error.

2. Individual critical items

Critical items for each of the members were those which had been specifically highlighted in their information booklet. For Member A, these items were: sextant, star finder, fishing kit, transistor radio, compass, ocean maps. These items should have all been ranked high by A on his individual ranking sheet, but the navigational tools should have been ranked low on the group decision. Member B's critical items were: compass, maps, sextant, and transistor radio, which were discussed as useless items. The star finder was not mentioned. Therefore, all these items should have been ranked very low on both B's individual ranking sheet and the group ranking. For Member C, the oil-gas can, water, C-rations, and opaque plastic were discussed and should have been placed in highest priority on both C's individual ranking and the group ranking.

Three measures were obtained for each of these critical items. Individual error--the extent to which the individual ranked the critical items in accord with the information read in the briefing. The rankings of these items were compared with keys developed on the basis of the individual briefings. Deviation from these individual briefing keys was determined for each item. Group error for each of the critical items was determined

by comparing the ranking of each critical item to the group key. Change score--a change score for each critical item was obtained by comparing the individual rating of the member for whom that item was critical to the group ranking for that item.

3. Post-experimental questionnaire

Group atmosphere. Group atmosphere was determined by asking subjects to describe their perceptions of the group, using 10 bipolar adjectives (e.g. warm-cold, effective-ineffective) on an eight-point Likert-type scale. Responses were summed, providing a potential range of 10-80.

Subjects were asked to describe their perceptions of other aspects of the group process described below. Their responses to each of these questions were made on eight-point Likert-type scales.

Perceived success. Subjects were asked to describe how successful they considered the group to be at arriving at a decision.

Task structure. Two questions related to task structure: "How clear was your understanding of your task in the group?" and "How clearly defined were the steps necessary to accomplish the task?" Responses to these questions were added for a task structure sum.

Process variables. Subjects were asked to describe their perceptions of the group process, with particular emphasis on leader behaviors. These questions were:

Leader authority. How much authority did you perceive the leader to have?

Leader control. How much did the leader control group discussion?

How much did the leader determine the procedures followed by the group? How much did the leader allow all group members to discuss their ideas? How much time did the leader spend participating in discussion? How much time did the other group members participate in the discussion?

Leader kindness. How much did the leader make group members feel or look foolish because of their ideas? This question was reverse-scored.

Leader seriousness. How seriously did the leader take this task?

Own ideas considered. How much were your ideas taken into consideration during the decision-making process?

Satisfaction. Satisfaction was determined by asking questions about personal satisfaction and satisfaction with the group process. These questions were: "How personally satisfying was this experience for you?" and "How satisfied were you with the manner in which the decision was reached?"

Expected success. Expected success was determined by asking: "How well would you expect your group to perform on a future task?"

Attributions. Subjects were asked to judge to what extent the following factors contributed to the success or failure of the group: leader, followers, knowledge brought to the situation, ambiguity of the task, task difficulty, luck, time pressure. They responded on an eight-point scale varying from "none" to "very much," separately for each of the seven factors. The first three responses were summed for an internal attribution composite. The last four items were summed for an external attribution composite.

Results

Results are reported on two sets of data: group productivity expressed in terms of degree of error in final solutions, and post-task questionnaire items measuring group members' perception of group process. Significant findings follow a pattern revealed by a prominent interaction involving the LPC scores of the leader and follower B, and a more subtle and complex three-way interaction involving the LPC scores of all three group members.

Productivity

Total group error. Figure 2 portrays an interaction of the LPC scores of the leader (A) and follower B on group error ($F = 5.697$, $p = .023$). The leader and follower B have been given contradictory information about the

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Insert Figure 2 about here

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utility of navigational devices, with B's information being more correct. The highest mean error is recorded for groups in which both leader and follower are low LPC. Lowest mean error is recorded for groups with a high LPC leader and low LPC follower.

Individual critical items. Certain items in the list of materials to be ranked were considered critical for analysis, since discussion of these items was included in the individual's training information. Clearest results were obtained for critical items of members A and B, reflecting their conflict. The dependent measure used in these analyses is the amount of change in pre-post rankings for individual group members. Based on best solutions, A should change most and B least to obtain correct solution.

The significant interaction shown in Figure 2 was repeated on the following critical items for the leader: fishing kit ($F = 9.724$, $p = .004$), sextant ($F = 7.069$, $p = .012$), and maps ($F = 10.219$, $p = .003$). The same pattern was found for follower B on sextant and maps reflecting the mirror image dependency between A's movement and B's movement.

A revealing three-way interaction was also found on A's critical items: maps ($F = 5.772$, $p = .023$) and sextant ($F = 6.325$, $p = .017$). This interaction, shown in Figure 3, reveals that follower C, depending on his/her LPC

Insert Figure 3 about here

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score, can either enhance or depress the AB interaction shown earlier. A high LPC follower C lowers the performance of the best groups (i.e. high LPC leader with low LPC follower B) and improves the performance of the worst groups (i.e. low LPC leader with low LPC follower B). A low LPC follower C has the opposite effect. This three-way interaction was marginally significant ($F = 3.052$, $p = .091$) for total group error as well.

Perceptions of Group Process

A pattern of AB, AC, and ABC interactions on member perceptions helps to explain the results found on the productivity measures. The ABC interaction shown in Figure 3 was repeated on the leader's perception of his authority ($F = 6.061$, $p = .020$), follower B's perception of group responsibility for success ($F = 5.094$, $p = .031$), and for follower C's perception of his group atmosphere ($F = 5.079$, $p = .032$), and the leader's allowing of group discussion ($F = 12.628$, $p = .001$).

The AB interaction shown in Figure 2 was repeated on follower C's

perceptions of the leader's authority ($F = 4.134$, $p = .051$) and the amount of time the leader monopolized discussion ($F = 5.483$, $p = .026$).

An AC interaction, shown in Figure 4, was found for the leader's perception of task clarity ($F = 7.273$, $p = .011$) and in reversed form on leader's perception of his authority ($F = 4.628$, $p = .040$). The AC effect was

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Insert Figure 4 about here

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found for follower B's perception of task clarity except that it was the mirror image of the effect found for the leader. AC interactions were found for follower C on the degree to which the leader allows discussion ($F = 5.411$, $p = .027$) in which the pattern follows the same effect found for the leader, and on task clarity ($F = 4.394$, $p = .045$) in which the pattern follows the same interaction for follower B.

Finally several main effects indicate that if follower C was a high LPC, he/she was seen as more active and impactful on group process.

This set of admittedly extremely complex interactions and main effects taken as a whole indicate that a high LPC follower C was an active mediator who helped to suppress the degree of conflict between the leader and follower B. This tended to enhance the leader's authority and control over the situation. However, in the most productive groups the suppression of conflict, which was mild, reduced group performance, while in the worst groups, where conflict was very high, it enhanced performance.

Discussion

The psychological isotope technique proved to be a potentially very

useful tool in the examination of group process. It is, however, a tool that must be used with caution. In the present study, a number of complex effects were found which were repeated through productivity and perception of process data. In interpreting these results, the authors provide scenarios which, of necessity, go somewhat beyond the data.

The data indicate quite clearly that the interaction of the leader and follower B was crucial in arriving at a correct solution. The data also reveal that follower C, depending on his/her LPC score, also impacted on solution and process. The pattern of findings suggest that the most effective groups were those in which a high LPC leader, by avoiding conflict and allowing participation, allows follower B to direct the group towards the correct solution. This best case process was interfered with if follower C acted to suppress the constructive conflict between leader and follower. The least effective groups were those in which a low LPC leader maintained strong authority and control, frustrating follower B and blocking a potentially useful exchange of information. This maladaptive degree of conflict was alleviated if follower C took an active role as mediator.

The results presented in this paper were the replication of an earlier full-scale pilot study. Thus, the authors feel confident about the reliability of the observed effects. This first test of the psychological isotope technique suggests that it offers considerable promise for studying information exchange in groups. Beyond the study of leadership style variables, it offers a possibility for the study of variables which affect the acceptance of information provided by group members as related to variables such as sex, status, race, or expertise.

Reference Notes

1. Rice, R. W. The esteem for the least preferred co-worker (LPC) score: What does it measure? Unpublished doctoral dissertation, University of Utah, 1975.

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Figure 1

List of Items To Be Ranked

____ Sextant

____ Shaving mirror

____ One case of U. S. Army C-rations

____ Mosquito netting

____ Maps of the Pacific Ocean

____ Seat cushion (flotation device approved by the Coast Guard)

____ Simex star finder

____ Five-gallon can of water

____ Fishing kit

____ Ship's compass

____ Two-gallon can of oil-gas mixture

____ Small transistor radio

____ Twenty square feet of opaque plastic

____ Fifteen feet of nylon rope

____ Two boxes of chocolate bars

Figure 2

Effect of LPC of Members A and B on Group Error

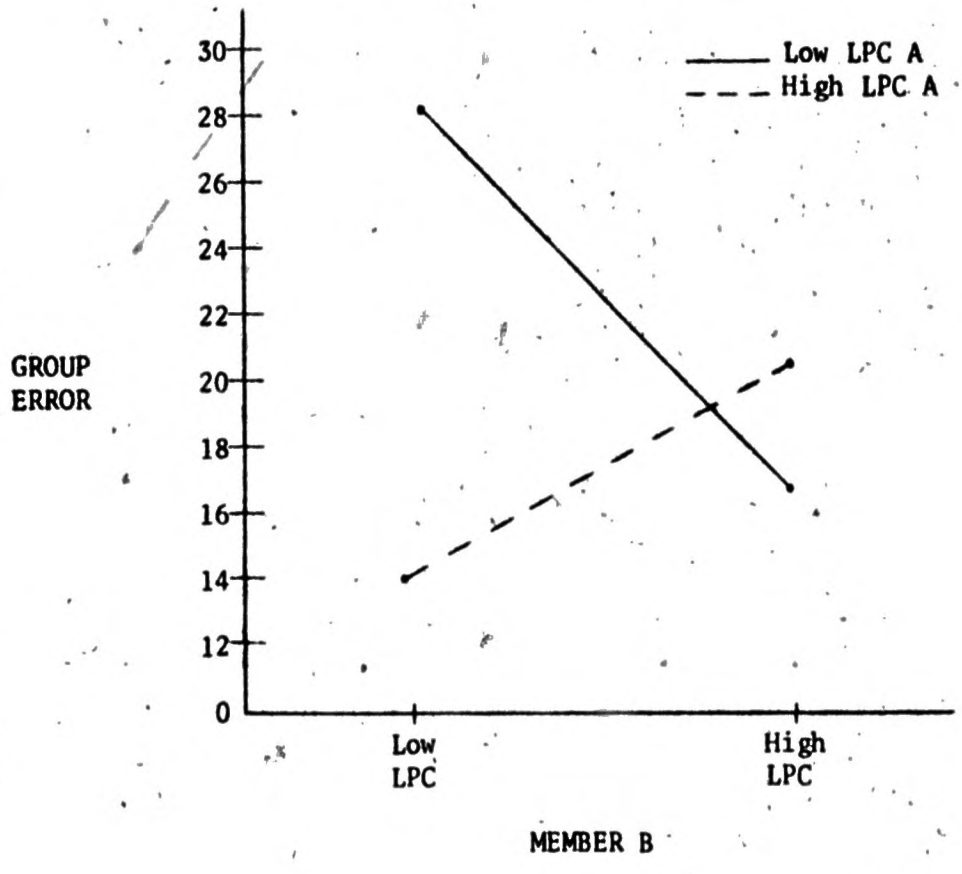

Figure 3

Effect of LPC Composition

on Group Error of A's Critical Item Sextant

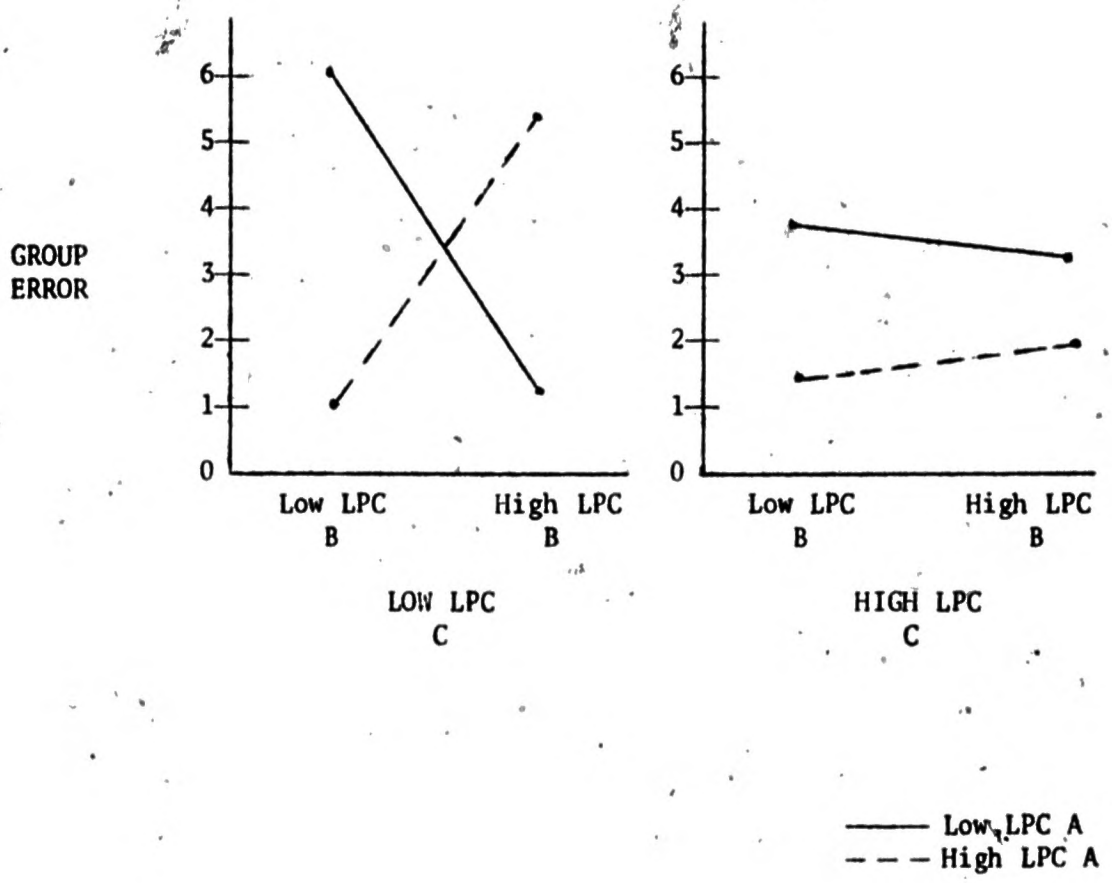

Figure 4

Effect of LPC of Members A and C
on A's Perception of Task Clarity