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ANNUAL REPORT

October 1, 1962

Scale Analysis of Group Tasks

Nonr - 580(11)

Marvin E. Shaw

Principal Investigator

Abstract

During the past year, a pilot study has been completed in which 40 arithmetic tasks were sorted on the dimensions of Difficulty and Goal Path Clarity. Results demonstrated the feasibility of using the Thurstone procedure for the analysis of group tasks.

In consultation with a number of persons engaged in small group research, 10 a priori task dimensions were identified and described, and a procedure for scaling tasks was worked out in detail.

A group of 104 tasks has been assembled in a form suitable for analysis.

Currently, judges are sorting this group of tasks into 8 categories on each of the 10 a priori dimensions. Fourteen judges have completed the task to date.

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October 1, 1962

Contract No.: Nonr - 580(11)

Title: Scale Analysis of Group Tasks

Personnel: Marvin E. Shaw, Ph.D., Principal Investigator  
William T. Penrod, Jr., M. A., Research Assistant, February 1, 1962 to June 15, 1962  
William F. Stone, M. A., Research Assistant, October 1, 1961 to August 31, 1962  
Michael Blum, M. A., Research Assistant, September 1, 1962 to present

Progress:

1. A pilot study using 40 arithmetic tasks was conducted by two Es. Eighteen graduate students sorted the 40 tasks into 9 categories on each of two dimensions (Difficulty and Goal Path Clarity), using the Thurstone Scaling procedure.  
A Q-value of three or less was arbitrarily established as the criterion of consistency. On this basis, 32 of the 40 tasks were sorted consistently on the dimension of Goal Path Clarity and 25 on the dimension of Difficulty. Twenty-five tasks were sorted consistently on both dimensions. The correlation between scale values for Difficulty and Goal Path Clarity was .90 for all 40 tasks and .94 for the 25 that were sorted consistently on both dimensions. Scale values obtained by the two Es correlated .90 in each instance. The following conclusions seem justified.
  - a. Consistent sortings (scale values) can be obtained with as few as 18 judges.
  - b. Goal Path Clarity and Difficulty are a single dimension, at least as understood by the judges in this study.
  - c. Obtained scale values are not markedly influenced by the person who administers the sorting task.
  
2. A trip to visit other universities for the purpose of consulting with knowledgeable others has been completed. The following persons were consulted:  
Dr. Clinton DeSoto, John Hopkins University  
Dr. Robert Ziller, University of Delaware  
Dr. Edgar Schein, Massachusetts Institute of Technology  
Dr. Thornton Roby, Tufts University  
Dr. Warren Torgerson, Lincoln Laboratories  
Dr. Edwin Lawson, State University of New York  
Dr. Joseph McGrath, University of Illinois  
Dr. Wilson Kimbrough, University of Arkansas  
As a result of these consultations, the following procedural decisions were made:
  - a. Expand the pool of tasks to include action tasks, such as model building, switch setting tasks, etc., and more manipulative-apparatus type tasks, such as the ball and spiral task.

b. Limit dimensions on which tasks are sorted to the following:

- (1) Cooperation requirements. The degree to which integrated action on the part of group members is required in order to complete the task. By this is meant the number of persons who are dependent on one another for performances of their functions required for task solution, and the amount of such dependence. For example, a task which required for solution that Person A perform action  $a_1$  at the same time that Person B performs action  $a_2$  would have higher cooperation requirements than a task which did not involve these integrated actions, but would have lower cooperation requirements than a task which required that Person A perform actions  $a_1$ ,  $b_1$ , and  $c_1$  at the same time as Person B performs actions  $a_2$ ,  $b_2$ , and  $c_2$ , respectively. In short, cooperation requirements refers to the degree to which goal attainment depends upon mutually interrelated action by group members.
- (2) Decision verifiability. The degree to which the "correctness" of the solution or decision can be demonstrated, either by appeal to authority (e.g., the census of 1960), by logical procedures (e.g., mathematical demonstration), or by feedback (e.g., examination of consequences of decision, as in action tasks).
- (3) Difficulty. Amount of effort required to complete task (e.g., time to solve, number of errors or failures to complete, etc., would be measures of difficulty). Tasks would be scaled for a single criterion or measure. Difficulty is included largely for purposes of validating the scaling procedure.
- (4) Goal clarity. The degree to which the requirements of the task are clearly stated or known to the group members.
- (5) Goal path multiplicity. The degree to which the task can be solved by a variety of procedures (number of different paths to the goal - number of alternatives for solution - number of different ways that the task can be completed).
- (6) Intellectual-manipulative requirements. The ratio of mental requirements to motor requirements. (For example, a task which requires only reasoning-thinking activities would be highest on this dimension; one requiring only motor skills, such as placing pegs in holes, would be lowest; and one that requires both mental and motor activities, such as deciding which pegs to put in which holes and doing same would be somewhere between the two extremes.)
- (7) Intrinsic interest. The degree to which the task in and of itself is interesting, motivating, or attractive to group members.
- (8) Operational requirements. The number of different kinds of operations or skills (number of specialized operations) required to complete the task. This would include number of different types of skills or knowledge needed for task solution.
- (9) Population familiarity. The degree to which the task is commonly encountered in the larger society; i.e., the probability that the members will have had prior experience with the class to which the task belongs. (This dimension, if such it be, is necessarily culture-bound.)
- (10) Solution Specificity. The degree to which there is more than one "correct" solution. (Some tasks, e.g., arithmetic problems, have only one solution that is acceptable; others have two or more, e.g., a sorting task where items to be sorted have several dimensions; and still others have almost an infinite number of possible solutions, e.g., human relations problems or matters of opinion.)

- c. Use 8 piles or categories. Judges will be asked to sort tasks on each dimension into four piles, then divide each pile into two additional piles to obtain a total of 8. (According to Torgerson, this procedure results in more reliable sortings.) Judges will be encouraged to do much checking back-and-forth-between categories, much reshuffling.
  - d. Same judges will sort tasks on all dimensions, but on different days and in different orders, both with regard to tasks and dimensions.
  - e. Graduate students in psychology will be used as judges. An attempt will be made to obtain persons who are sophisticated enough to understand the procedure and purposes of the study, but not so sophisticated that biases are strongly entrenched. (Most of the consultants believed that persons who had had much experience with group problem-solving, such as themselves, would have certain biases which might interfere with their judgements.)
3. A group of 104 tasks has been assimilated in a form appropriate for analysis. These were drawn from a journal survey, a canvass of small group researchers, and tasks constructed by the principal investigator.

**Current Activity:**

At the present time, we are engaged in an analysis of the 104 tasks according to the dimensions described in 3.b. Fifty judges will sort the tasks into 8 categories along each of the 10 dimensions. Scale scores will be computed using the responses of all judges, Judges will also be divided into two groups of 25 each, and scale scores computed for each group independently. The purpose of this is to determine whether table scale values can be obtained with fewer judges than the fifty we plan to use, and to estimate the internal consistency of scale values. Finally, scale values for the various dimensions will be analyzed to determine independence. To date, 14 judges have completed the sortings.

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