A COMPUTER SIMULATION OF GROUP RISKY SHIFT FOR TEACHING UNDERGRADUATE RESEARCH METHODS

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This paper describes a computer model that simulates the experimental outcome data obtained by the manipulation of thirteen independent variables reported in studies investigating the group risky shift. The model is intended as a tool for teaching research methods in an undergraduate course in social psychology and addresses some of the problems frequently encountered.

Undergraduate laboratory research courses generally require students to design, conduct, analyze, and write up an experimental study while learning about interrelated issues of hypothesis testing and research design. These courses frequently fall

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short of their intended purposes as the student finishes in a mad scramble trying to collect the necessary data under limitations imposed by time restraints and scarcity of subjects and laboratory space. More broadly conceived objectives, such as the study and use of experimental designs to carry out a series of coordinated experiments in any given area, that would allow the students to use the interpretation of data from an earlier study to influence the design of the next are usually dismissed as a "consummation devoutly to be wished."

One solution to some of these problems has been provided by the use of computer models that simulate quantitative data as these might be generated in one or more actual experiments. Such models have been employed to allow students to explore possible determinants of schizophrenia, imprinting, motivational factors in routine task performance (Main and Head, 1971), as well as the variables influencing verbal reinforcement (Johnson, 1971). In all these instances of use, the simulation model is not intended as a substitute for the full set of learning experiences associated with conducting actual experiments. Rather it is intended as a complementary means to augment the teaching of a number of the slighted components of research methods courses.

THE GROUP RISKY SHIFT AREA

Investigations by social scientists of the effects of group processes on individual risk-taking provided the basis for the development of the present model. A well-documented finding in this area is that individuals who have participated in certain group processes choose risk levels which differ significantly from their choices prior to group participation. Most often, the direction of the difference is toward greater risk-taking in groups, and this general finding has been referred to as the "risky shift." Shifts in a conservative direction in some situations have also been reported (Pruitt, 1971a), and as a result, the finding has more recently been referred to as the "choice shift" and the "group-induced shift."

Considerable interest has been generated in this phenomenon as evidenced by the recent spate of articles and evaluative reviews (Cartwright, 1971, 1973; Clark, 1971; Dion et al., 1970; MacKenzie, 1971; Pruitt, 1971a, 1971b; Vinokur, 1971).

Most studies of the group-induced shift have used the Kogan and Wallach (1964) Choice Dilemmas Questionnaire (CDQ) to measure risk-taking. This instrument consists of a description of twelve everyday life situations in which the central person is faced with a choice of two courses of action. One alternative offers a relatively certain outcome; the other offers a potentially more attractive outcome. However, the more attractive outcome may not be realized, thus resulting in a highly undesirable outcome. The Ss are asked to imagine that they are advising the central person and to check the lowest probability of attainment of the potentially more attractive option which would still make that alternative preferable. Some Ss may select the safer alternative regardless of the probability of attaining the more desirable option.

In an intrasubject design characteristically used in these studies, Ss are first given the CDQ individually to establish their individual level of risk-taking. Then Ss are randomly assigned to groups and are asked to take the CDQ again. By group decision they agree on the degree of risk they are willing to accept. The shift index is based on the pre-post change score. Studies have varied the nature of the group interactive process, some quality of the group decision-making procedure, and the characteristics of the Ss sampled.

The risky shift area seems particularly well suited for the structuring of a teaching model of experimental design. As a "line of investigation," it is characterized by a remarkable degree of coherence in the relevant literature (Cartwright, 1973) such that most studies address problems and employ methods explicitly derived from earlier investigations of the same topic. This is evident in the consistent use of a particular dependent measure, the CDQ, and the use of a repeated-measures design. Furthermore, the large number of variables studied and the sizable number of proposed theoretical explanations provide a rich milieu for undergraduate research studies. The overreliance on a single dependent variable and on the repeated-measures design has definite methodological shortcomings which should be pointed out by instructors using the present model. On the other hand, these characteristics of the experiments in this area and the associated increased comparability of findings from such studies greatly enhance the feasibility of developing a computer-based model to represent the existing data with a high degree of accuracy.

DESCRIPTION OF THE MODEL

In developing the model, thirteen variables and their associated levels, ranging in number from two to seven, were selected as independent variables to represent major findings and frequently used manipulations and to provide an opportunity for testing viable competing hypotheses. These variables are as follows: sex of Ss, group size, communication method, physical arrangement, decision process, Ss' degree of anxiety, group risk composition, group risk preference, group cohesiveness, communication time constraint, information about risk preferences of group members, number of risky or cautious arguments presented, and observer role of S. The dependent variable in the model is the sum of the scores of the twelve CDQ items.

In constructing the model, we assigned weights to each level of the thirteen variables to reflect as closely as possible the findings reported in the literature. Using these weights, the model generates scores for each cell of the experimental design in two major steps. First, a theoretical expected cell mean and standard deviation are calculated for both the pretest and group scores. Each cell mean is established as the linear algebraic sum of a base mean and the added effect associated with each level for the full set of variables that define that cell. The standard deviations are similarly calculated for both scores. Second, the model generates sample scores for each cell of the experimental design. Given the cell pretest mean (M_x) and standard deviation (SD_x) from the preceding step and a randomly generated standard score from a normal distribution (e_{x_i}), the program generates the pretest cell scores (X_i):

$$X_i = M_x + SD_x \cdot e_{x_i}.$$

The group post scores (Y_i) are similarly generated from the given group mean (M_y) and standard deviation (SD_y) values, but in addition, the formula introduces any given correlation term (r_{xy}) between the pretest and group scores:

$$Y_i = M_y + SD_y(r_{xy}e_{x_i} + 1 - r_{xy}^2 \cdot e_{y_i}).$$

The risky-shift model described was written in FORTRAN IV and was run under a UCLA-designed variant of a simulation supervisor program developed by Stout (1971). This latter program processes the instructor's models so that students may use it to design their experiments and to obtain their simulated data. In contrast to Stout's program, the UCLA version runs interactively rather than in a batch mode and permits all design specifications to be made in a single run as opposed to separate runs for each experimental condition.

PROCEDURES FOR CLASSROOM USE

To conduct an experiment with the model, the student prepares an experimental design in which one or more of the variables are chosen as independent variables for study. The student next chooses (1) the levels for each variable he wishes to manipulate, (2) the levels for the nonmanipulated variables that remain at a constant value for all cells of the experiment, and (3) the number of replications.

The above steps are taken at one of a number of different display or hard-copy computer terminals at the UCLA Center for Computer-based Behavioral Studies. In response to a clearly presented menu of options, the student is led in less than a minute through a series of choices. At any point the instructor may interrupt to request printed copies of the results. Within a few minutes, each student may receive a printout of the results of his experiment. These include a summary of his experimental design specification, and for each cell in the design, the pretest, group, and shift scores for each replication (group) along with condition cell means and standard deviations. The results reflect the variability that might be obtained from studies in the literature. Thus, students who choose similar designs will obtain results that reflect expected sampling differences.

EVALUATION OF THE ACCURACY OF THE MODEL

Twenty-four cell outcome means of the first step of the model were compared with those from ten studies. Since the model generates data for all twelve CDQ items, whereas some reported studies use only a subset of these, extrapolations were made as needed to make the results comparable.

Since the model was designed to mirror the findings of a large set of empirical studies, it is not surprising that a high degree of correspondence was observed between the model and reported data on the magnitude of the risky shift. The distributions of mean choice shifts for the two data groups were highly similar (t-value for matched pairs = .38). For those experimental conditions where the simulated mean shift score differed most from the empirical, the standard error of the latter far exceeded the difference between the two shift score means and suggested that the simulated mean shift score falls within the range of expected sample variation. For variable combinations which have not been empirically investigated, no assessment at present may be undertaken for these cells. Nevertheless, for those examined, the simulated data seem to be eminently "reasonable."

CLASSROOM EXPERIENCES WITH THE MODEL

While limited, the learning experiences with the present computer model in five UCLA undergraduate classes were consistent with the highly positive evaluations of the use of such models at the University of Michigan (Main and Head, 1971). Use of the risky-shift model facilitated the teaching of various aspects of experimental methodology. Most impressive was the fact that in the course of one quarter, the use of the model in a laboratory research course allowed students to pursue a hypothesis systematically across a series of studies in which data from one study were used to plan and design the next.

We have found that when classroom use of the model is preceded by students taking the CDQ as subjects in one of the pre-post experimental configurations, their understanding and involvement are greatly enhanced. The model can be further "personalized" by substituting the initial scores so obtained for those in the model. This may be done without altering the pre-post shift effects for the variables represented in the model.

FUTURE PLANS FOR MODEL DEVELOPMENT

Two general goals have been set for the future development of the risky-shift model.[1] First, work has begun to expand the scope of such models by providing them with the ability to represent interaction effects generated by crossing two or more independent variables, by providing for multiple, correlated dependent variables, and by providing simulated costs for running the particular experimental design. Second, and on a more general level, work has been completed for the development of a simulation supervisor to accept new model specifications in English rather than in FORTRAN. This capability gives the computer-naive model builder or instructor the opportunity to generate computer-based models rapidly and economically and to modify and update them based on new studies. For example, if new experiments yield findings that suggest a "conformity" effect interpretation of the risky shift, these may be readily incorporated as additional manipulations in the models for student examination. Similarly, the instructor may delete manipulations from the model where these are represented in the model by findings that have been called into question. As a consequence, the model may be kept as current as the most recent reading of the literature. The availability of such a capability should greatly ease the construction, use, and comparison of computer models for educational and research purposes.

NOTE

1. A FORTRAN IV version of the risky-shift model is available from the UCLA Center for Computer-based Behavioral Studies.

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