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TEACHING RESEARCH METHODS WITH A COMPUTER-BASED MODEL OF GROUP-INDUCED SHIFTS[1]

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This paper describes an on-line computer-based model designed to facilitate the teaching of research methods in undergraduate social psychology courses. The model simulates experimental outcome data for three dependent variables obtained through the manipulation of a subset of nineteen independent variables reported in studies investigating the group-induced shift. Without any knowledge of computers, students may "run" simple or complex factorial designs and within moments receive a printout of their experimental data. These data reflect reported findings within the limits of expected sampling variability. Various suggestions for classroom use of the model are presented.

This paper describes a revised and expanded version of a computer-based model (Shure, Malamuth & Johnston, 1975) that simulates experimental outcome data obtained through the manipulation of independent variables reported in studies investigating group-induced shifts. The present model is primarily intended as a tool for teaching research methods in an undergraduate course in social psychology. It is designed to provide a learning environment that helps attenuate some of the problems frequently encountered in such courses.

In learning about interrelated issues of hypothesis testing and research design, students in undergraduate laboratory courses are generally required to design, conduct, analyze and write-up one or more experimental studies. Very often, the student finds himself in a mad rush trying to collect the necessary data under limitations imposed by time constraints and scarcity of subjects and laboratory space, and thus spends most of his time in the actual running rather than in the designing and interpreting of experiments. These research methods courses consequently fall short of their intended purposes. Moreover, broadly conceived objectives, such as the study and use of various experimental designs and research strategies to carry out a series of coordinated projects that would permit the interpretation of data from an earlier study to influence the design of the next, usually fall to the wayside.

One approach aimed at solving problems such as these has been provided by the use of computer-based models that simulate quantitative data such as might be obtained in one or more actual experiments. Interaction with computer-based models can provide the undergraduate student with both an involving learning situation and can also help familiarize him with some of the nuances of research that the student usually comes to realize only after having run, analyzed, and written a number of experiments. Such models have been employed to allow students to explore possible determinants of schizophrenia, imprinting, motivational factors in routine task performance (Main & Head, 1971), and the variables influencing verbal reinforcement (Johnson, 1971). A recent compilation of some of these models as well as additional ones has been made by Thurmond and Cromer (1974) in a system called LESS-Louisville Experiment Simulation System. Reported experiences with these models suggest that computer data simulation techniques can help prepare the student for the "plunge" into real experimentation both in and outside of the psychology laboratory.

The plunge, however, is made in what appears to be shallow waters. While these models allow manipulation of a few key variables, they were rarely intended as serious representations of the phenomenon modelled. For example, all of these models include five or fewer independent variables. Each particular model was primarily used to generate data for studying

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the application of a limited number of statistical procedures covered in an introductory course on statistics and research design. In contrast, the model described in this paper was built to be used in an upper division social psychology laboratory course where students have already taken undergraduate statistics. The present model differs from all of the above models primarily in its complexity. Consisting of nineteen variables, it not only affords the student the opportunity to apply a variety of statistical techniques using a single model, but it does so within the framework of a single substantive area. As a result, a series of research studies may be undertaken to explore a number of contending hypotheses over a number of research designs.

THE GROUP RISKY SHIFT AREA

Investigations by social scientists into 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. 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, Baron, & Miller, 1970; MacKenzie, 1971; Pruitt, 1971a, b). Further scientific interest has resulted from recent data suggesting that the group-induced shift may be a general group phenomenon not limited to decisions involving risk-taking per se (Schroeder, 1973; Baron, Roper, & Baron, 1974).

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. Subjects are asked to imagine that they are advising the central person and then to mark the lowest probability of attainment of the potentially more attractive option which would still make that alternative preferable. Some subjects may select the safer alternative regardless of the probability of attaining the more desirable option.

In the intra-subject design characteristically used in these studies, subjects are first given the CDQ individually to establish their individual level of risk-taking (Individual Pretest). Then, subjects are randomly assigned to groups and asked to indicate the degree of risk they are willing to accept (Group). Studies have varied the nature of the group interactive process, some quality of the group decision-making procedure, and the characteristics of the subjects sampled. Originally, the shift in risk-taking was assessed by comparing the mean individual risk score with the mean group score (Stoner, 1961). In studies following these earlier experiments, investigators generally include a third step, in which subjects are again asked to respond individually to the CDQ (Individual Posttest). The group-induced shift is then defined by the difference in risk-taking prior to and following group participation.

The choice shift area seems particularly well suited for the structuring of a teaching model of experimental design. It is characterized by a remarkable degree of coherence in the relevant literature leading to the development of a "line of investigation" (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 sizeable number of proposed theoretical explanations provide a rich milieu for undergraduate research studies. The over-reliance on a single dependent variable and an intra-subject design has definite methodological shortcomings which need to 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 considerably enhance the feasibility of developing a computer-based model which represents the existing data with a high degree of accuracy.

In a recent investigation, Malamuth (1975) added to the external validity of the choice shift phenomenon by demonstrating that group-induced shifts are *not* *limited* to a particular measuring scale, set of instructions, experimental design, environmental setting, or role-playing task. Most significantly, this experiment found individual-group differences in the decisions of subjects who were led to believe that they were advising someone truly confronting a CDQ dilemma as well as in the corresponding role-playing task.

DESCRIPTION OF THE MODEL

Empirical Basis

The model is largely based upon empirical findings of the effects of various independent variables on the 12-item CDQ, measured at three points in the experiment—individual pretest, group decision, and individual posttest. The nineteen independent variables and associated levels are presented in Table 1. These variables were selected to represent frequently used manipulations and those that are of presumed critical relevance for discrimination among contending interpretations of the choice shift phenomenon. Source studies used in constructing the model are also listed in Table 1.

In general, the description of experimental conditions introduced in the model are identical to their counterparts in the literature. However, in some instances, the independent and dependent variables used in the model are not directly comparable to those in the referent studies. (See footnotes to Table 1). For these variables, assigning weights to each level so as to reflect as closely as possible the findings reported in the literature, required estimation procedures: (*a*) In many instances, published studies did not employ the entire set of twelve CDQ items. Extrapolation of findings, based on the particular subsets of items used in the referent study, were made to estimate scores for the full 12-item CDQ. (*b*) To allow a crossing of variables that would otherwise not be possible, nine modified or new levels were added to three of the variables in the model. Estimation of the effects associated with these new or modified levels were consistent with the trends reported in the

Table 1. Model Variables and Source Studies

VARIABLE	LEVELS	LITERATURE SOURCE
Sex of Subjects	Females	Wallach, et al. (1962)
	Males	"
	*Females & Males	Ebbesen & Bowers (1974)
Size of Group	One Subject	Dion & Miller (1971); Wallach, et al. (1962)
	Two Subjects	Baron, Baron, & Roper (1974); Vidmar & Burdeny (1971)
	Three Subjects	Teger & Pruitt (1967); Vidmar & Burdeny (1971)
	*Four Subjects	"
	Five Subjects	"
	Six Subjects	Wallach, et al. (1962)
	Eight Subjects	Bennett, et al. (1973)
Method of Communication	*Free Discussion of Relevant Material	Wallach, et al. (1962); Kogan & Wallach (1967b)
	Free Discussion of Irrelevant Material	Alker & Kogan (1968); Clark, et al. (1971)
	Choice Information Exchanged	Willems & Clark (1969, 1971); Myers & Bishop (1971)
	Arguments Exchanged	Clark, et al. (1971); Myers, et al. (1971)
	No Communication	Carlson & Davis (1971)

Table 1. *Continued.*

VARIABLE	LEVELS	LITERATURE SOURCE
Physical Arrangement	*Ss Seated in Same Room	Kogan & Wallach (1967c)
	Ss Seated in Different Rooms	"
Decision Process of Group	*Unanimous Group Consensus	Lamm (1967); Wallach & Kogan (1967c)
	No Group Consensus	Lamm (1967); Wallach & Kogan (1965, 1967c)
	No Group Communication Thus No Decision Process	Alker & Kogan (1968); Carlson & Davis (1971)
Object of Decision	Deciding for Hypothetical Other	Runyan (1974)
	*Advising a Hypothetical Other	Baron, Baron, & Roper (1974)
	Deciding for Oneself	"
	Advising a Real Other	Malamuth (1975)
Degree of Anxiety of Ss	High Anxiety Ss	Kogan & Wallach (1967); Myers, et al. (1970)
	Low Anxiety Ss	"
	*Random Variation	"
Choice Composition of Group	Homogeneous Choice Group	Willems & Clark (1971); Vidmar (1970)
	Heterogeneous Choice Group	"
	*Random Variation	"
Risk Self-Perception of Subjects	Ss Believe Themselves At Least As Risky As Peers	Castore, et al. (1970); Clark, et al. (1971)
	Ss Believe Themselves Less Risky Than Peers	"
	*Random Variation	"
Cohesiveness of Group	High Cohesiveness: Ss Told They Are Similar (following pretest)	Dion, et al. (1971)
	Low Cohesiveness: Ss Told They Are Dissimilar (following pretest)	"
	High Cohesiveness: Ss Are Friends[b]	Runyan (1974)
	Low Cohesiveness: Ss Are Strangers[b]	"
Time Constraints on Discussion	Three Minute Time Limit	Bennett, et al. (1973)
	Five Minute Time Limit	"
	*No Time Constraints Imposed	"
Observers of Group Interaction	Viewer: S Sees & Hears Others Discussing Items	Lamm (1967); Bell & Jamieson (1970)
	Listener: S Only Hears Others Discussing	"
	*No Observation	"
Identification of Ss	Subject Signs Name	Baron, et al. (1973)
	Subject Does Not Sign Name	"

Table 1. *Continued.*

VARIABLE	LEVELS	LITERATURE SOURCE
Positions of Confederates in Group	One Confederate Advocating Conservatism[a]	Baron, et al. (1971); Baron, et al. (1973)
	Two Confederates Advocating Conservatism[a]	"
	Three Confederates Advocating Conservatism	"
	One Confederate Advocating Risk-Taking[a]	Baron, et al. (1971); Baron, et al. (1973)
	Two Confederates Advocating Risk-Taking[a]	"
	Three Confederates Advocating Risk-Taking	"
	*No Confederates	"
Perception of Positions of Other Group Members	*Others Arguing for Own Positions	Burnstein & Vinokur (1973)
	Others Arguing for "Mirror-Image" of Positions	"
Positions Undertaken in Group	*Arguing for Own Positions	"
	Arguing for "Mirror-Image" of Positions	"
Exposure (Following Pretest) To Argument Generation (Group size = 1 only)	Risk Arguments Generated Individually[a]	Ebbesen & Bowers (1974); Bell & Jamieson (1970)
	Conservative Arguments Generated Individually[a]	"
	Risk Arguments Generated by Others[a]	"
	Conservative Arguments Generated by Others	"
	*No Arguments Generated	"
No. of Arguments Generated (Group size = 1 only)	Five Arguments	Burnstein, et al. (1973); Roberts & Castore (1972)
	Fifteen Arguments[a]	"
	*No Arguments	"
Exposure (Following Pretest) To Choice of Others (Group size = 1 only)	One Risk Choice of Another	Vinokur, et al. (1973)
	One Conservative Choice Of Another	"
	Five Risk Choices of Others	Teger & Pruitt (1967)
	Five Conservative Choices of Others	"
	*No Choice Exposure	"

*Default value assigned by model-program when student does not assign value for non-manipulated variables.

[a]Condition modified from that of literature source studies.

[b]Literature source study did not employ CDQ.

referent sources. For example, in two choice shift studies (Baron, Monson, & Baron, 1973; Baron, Dion, Baron, & Miller, 1973) three confederates were used in four-person groups. In order to allow crossing of the confederate variable with groups smaller than four persons, one and two confederates were added as levels. (*c*) One referent study (Runyan, 1974) did not use the CDQ as the dependent variable. However, it was similar to the CDQ in that it involved advising another in a risk type situation. Based on the task similarity and the author's judgment of its comparability to the CDQ, estimations of manipulation effects for the CDQ were made from the data reported. (*d*) Data estimation was also required in those instances where the same experimental condition yielded varied results in different studies. For these cases an intermediate value falling between the opposing sets of reported data was used. (*e*) Average correlations among the three CDQ scores incorporated into the model ($r_{pre,\ group}$ =.6; $r_{group,\ post}$=.81; $r_{pre,\ post}$=.71) are based upon data extracted from correlations reported in published studies.

The instructor-user who is concerned about the validity of the estimation procedures employed (and these are admittedly debatable) may readily eliminate or modify the results for any of the variables. (See later section on "Evaluation of the Accuracy of the Model" and "Suggestions for Instructional Use.")

Generation of Outcome Data

The present model was built with the use of MODELR (Shure & Brainerd, 1975), a general program for building models of the kind described in this paper. Using specified weights for condition effects, the model generates the three dependent variable scores (Pretest, Group, Posttest) *for each cell* of the experimental design in two major steps:

1) The program first computes dependent variable population parameters (means, standard deviations) by summing the main and first-order interaction effects on the means and standard deviations of the dependent variables, over independent variables controlled in the experiment design, and applying them (additively and multiplicatively, respectively) to the assigned base means and standard deviations of the three dependent measures.

2) Next, the model generates the required number of 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_{xi}), the program generates the pretest cell scores (X_i):

$$X_i = M_x + SD_x \cdot e_{xi}$$

The scores for the Group, the second dependent variable (Y_i) are similarly generated from the given group mean (M_y) and standard deviation (SD_y) values, but in addition, the formula introduces the correlation term (r_{xy}) between the first and second dependent variables scores:

$$Y_i = M_y + SD_y\ (r_{xy}e_{xi} + 1 - r^2xy \cdot e_{yi})$$

An extension of these same procedures is used for generating scores for the Posttest, the third dependent variable.

Evaluation of the Accuracy of the Model

The population outcome means resulting from step one of the model were compared with those reported in the referent studies.

As the model was designed to mirror the findings of a large set of empirical studies, it is not surprising that for those variable levels extracted from the literature or based on simple extrapolations of these, a high degree of correspondence was observed between the model and reported data on the magnitude of the risky shift. The distributions of mean shifts for the two data groups were highly similar (matched-pairs t value of .56, df=35). 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 those variable levels present in the model in modified form or not yet empirically investigated, no formal assessment may be taken. While such estimates are subjective, the authors judge these simulated data to fall within reasonable limits. For those users of the model who find any of the estimates of the effects to be unreasonable or who wish to use only those variables whose effects are fully supported by reported research findings, variables and/or levels of variables may be suppressed from the model.

CLASSROOM USE

Preparatory Readings

It is intended that the model be used following and in conjunction with the reading of introductory journal articles on the choice shift phenomenon. We have found that the Kogan & Wallach (1967d) chapter in *New Directions in Psychology III,* particularly pages 224-242, as well as the pioneer study by Wallach, Kogan, & Bem (1962), provide an excellent starting point. For the instructor, any of the informative reviews cited earlier would be adequate. We have found Baron, Dion, & Miller (1970) and Cartwright (1971) particularly useful for preparing graduate teaching assistants.

Descriptions of each of the variable levels included in the model as well as brief descriptions of the varied theoretical mechanisms postulated to account for the choice shift phenomenon[5] provide the student with materials he will need in the process of formulating and designing his studies.

Classroom Procedures

At the UCLA Center for Computer-based Behavioral Studies, the steps for specifying an experiment are taken at one of a number of different display or hard-copy computer terminals. Without the necessity for any knowledge of computers, and in response to a clearly presented menu of options, the student is led through a series of choices in less than a minute of elapsed time. In interacting with the model, the student chooses: (1) the variables he wishes to manipulate, (2) the levels for each of these variables, (3) the levels for nonmanipulated background variables that remain at a constant value for all cells of the experiment, and (4) the number of replications. Within minutes, the student-experimenter receives a printout of the results of his experiment. The printout includes a summary of the experimental design specifications, and for each cell in the design, the pretest, group, and posttest scores for each replication (group) along with condition cell means and standard deviations. An example of the printout of an experiment in which the sex of subjects is explored as the independent variable is presented in Figure 1.

If the student-experimenter selects variable level combinations which are logically incompatible (e.g. one subject and group discussion), he is informed in the printout of the inadmissability of the particular cell(s) in his design. The total number of subjects "used" in the experiment is also indicated in the printout. The results of experiments reflect the variability that might be anticipated from studies in the literature. Thus students who choose identical designs will obtain results that reflect expected sampling differences.

[5]The materials may be obtained by writing to Professor Gerald H. Shure.

SUGGESTIONS FOR INSTRUCTIONAL USE

Instructors who obtain both the Choice Shift Model and MODELR may, with ease, implement modifications in the present model so as to tailor it to their individual needs. Desired changes may be made in any aspect of the model including available variables and the weight assigned to the effects of particular manipulations. Although the authors selected the content they judged to be the most suitable for the teaching of experimental methodology in an undergraduate social psychology course, varying modifications may be warranted for the purposes of other instructors.

Various procedures may be followed in using the present model. Main & Head (1971) have outlined some imaginative uses for computer-based teaching models. Our experiences suggest that the following procedures may be useful in conjunction with the model:

Classroom Exercise

We have found that introducing the choice shift area and the model by having the students themselves respond to the dilemmas of the CDQ, individually and as a group, generates interest and enthusiasm for research in the area. The shift seems sufficiently reliable to generally serve the purpose of a class demonstration. Our students, as a result of their experience, quickly generated one or more hypotheses which seemed intuitively appealing to them and were eager to investigate their validity (a pattern similar to that observed among psychologists following the "discovery" of the phenomenon).

Graduated Presentation of the Model

While the model includes a wealth of independent variables that provide varied opportunities for studying the choice shift phenomenon, instructors at a particular point in the course may wish to defer student consideration of the entire set of variables or selected levels of particular variables until later in the course.

John Byron, Section 1 July 1, 1975

EXPERIMENT SPECIFICATIONS

CONDITIONS THAT HOLD FOR ALL CELLS:
SIZE OF GROUP: Four Subjects
METHOD OF COMMUNICATION: Free discussion of relevant material
PHYSICAL ARRANGEMENT OF GROUP: Subjects seated in same room
DECISION PROCESS OF GROUP: Unanimous group consensus
OBJECT OF DECISION: Advising a hypothetical other

CONDITIONS THAT ARE MANIPULATED IN THE EXPERIMENT:
SEX OF SUBJECTS: Males, Females
These specifications call for a 2 cell design
THIS EXPERIMENT USED: 120 subjects

DATA GENERATED FOR EACH CELL

Conditions for Cell I:

Sex of Subjects: Females
Dependent Variables:
(1) Individual pretest score
(2) Group score
(3) Individual posttest score

Dependent Variable Data:

REPLICATION	DV: 1 SCORE	DV: 2 SCORE	DV: 3 SCORE
1	71	57	64
2	72	62	65
3	58	56	57
4	65	56	58
5	61	55	57
6	69	58	61
7	75	64	65
8	79	60	67
9	76	62	64
10	76	63	64
MEANS:	70.20	59.31	62.20
STANDARD DEVIATIONS:	6.942	3.302	3.676

Figure 1. Example of Student Print-out.

This may be done in order to avoid overwhelming the students with too much complexity before they can reasonably cope with it or for other reasons. In either event, independent variables or levels of variables may be suppressed so as to make them inaccessible to the student-experimenter. Our experience indicates that such an approach is useful where students are designing their first few simple experiments before proceeding to more complex designs. Moreover, there is a logical progression for exposure of the variables of the model, certain findings posing questions that may be resolved by other manipulations. (This progression can parallel the development of manipulations in the research literature.)

Or, an instructor might wish to make sure that certain variables are controlled in the same way in all experiments in a particular set. For example, in a series of studies he may require that all subjects be male or use one set of procedures, e.g. unanimous group decision.

Creating a Research Community

An interesting use of the model suggested by Main & Head (1971) has the students "publish" their research. Brief research summaries are made available to all student-experimenters who are then allowed to refer to these results in their own write-ups and plans for conducting their experiments. This idea essentially suggests a functional simulation of a research community and guarantees some lively debates.

Highlighting the Importance of Background Variables

An important instructional feature of the model is the opportunity it provides to make salient the effects of background variables. In psychological research, comparability of findings from one study to the next may be rendered problematical because of the use of different background variables. The failure of researchers to consider the significance of these background variables may seriously jeopardize opportunities for inferences from data.

With the use of the model, the importance of uncontrolled or unarticulated background variables may be clearly illustrated. When similar independent variables are explored against variations in background conditions, problems in generalization or interaction of variables may be demonstrated. As the student may be required to specify any conditions which will be held constant across all experimental cells of the design, comparison of data obtained by students who choose the same independent variables but who have specified similar or dissimilar background levels may reveal the basis for similar or discrepant results. In developing a "line of investigation" or in comparing experimental studies conducted with the model by differing students (members of the "research community"), the role of background variables emerges with considerable force.

Flexibility does exist within the system, however, for exercising control over the assignment of background variables. The instructor who so desires may choose to make use of the "default" option of the model (see Table 1). In this case, the program does not require the student-experimenters to stipulate any background variable levels. If this option is chosen, the model assists the student in achieving a "reasonable" experimental design reflecting the background contextual setting most often found in literature studies. The option we have generally found most suited for our goals was enabling the student-experimenter to assign background levels for some but not all variables; the model then assigns the "defaults" for all other background variables.

Teaching Research Cost

An additional feature of the model may be used to highlight a frequently ignored topic—research cost. Since nearly all research undertakings have the problem of limited resources, the instructor may wish to have his students consider carefully their program of research within the framework of a fixed upper limit of subjects that they may sample with the model in the course of their investigative research. On the basis of the size of the group and the number of replications selected, the cost for subjects is computed by the model for each experiment. Under these conditions, the student learns to give careful consideration to experimental designs that optimize use of his limited resources.

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