

CHAPTER FOUR

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Laboratory Experiments

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Empirical science in general has as its major objective the understanding or control of phenomena as they occur in the real world. Nevertheless, laboratory experimentation generally plays a significant part in the development of a science. It is important to have some understanding of why this should be true and of the exact function which laboratory experimentation should have in relation to the science as a whole.

We shall, consequently, attempt to clarify two aspects of laboratory experimentation—namely, what a laboratory experiment is and how the results of such experiments can be applied to the “real world.” It would be relatively easy to discuss the role of laboratory experimentation by means of examples from the physical sciences, but we shall attempt, rather, to illustrate the points to be made by examples from the problem area of social psychology. Although by doing this we may not be able to make our point as clearly as would otherwise be the case, we hope that the discussion will be more meaningful and carry more weight if it is entirely oriented toward the field which is now under consideration.

THE NATURE OF LABORATORY EXPERIMENTATION

What Constitutes a Laboratory Experiment in Social Psychology?

A laboratory experiment may be defined as one in which the investigator creates a situation with the exact conditions he wants to have and in which he controls some, and manipulates other, variables. He is then able to observe and measure the effect of the manipulation of the independent variables on the dependent variables in a situation in which the operation of other relevant factors is held to a minimum. Such a definition is, however, a great oversimplification. Given the techniques of experimentation today available, an investigator can at best achieve only a rough approximation of the degree of precision implied by the definition. As better techniques are developed, more control over laboratory experiments will, of course, be possible. At present, however, we must include under the term “laboratory experiment” a wide range of studies with varying degrees of control and precision.

We shall attempt, largely by means of examples, to distinguish between what might properly be called “field experiments” and “laboratory experiments.” In many cases, of course, the distinction is clear and easy to make; in other cases it is difficult to maintain. In general, we shall be guided by the two parts of our definition: whether or not there was an attempt to create a specially suited situation, and the degree of precision in the control and manipulation of variables.

It would seem clear that experiments in industry such as have been described in the preceding chapter should not be called laboratory experiments. There is little or no attempt to set up special conditions. Typically, the situation is accepted as it is found and some manipulation is imposed. The manipulation of the independent variable is usually a simultaneous manipulation of a set of factors. The degree of control obtained in these experiments is usually not sufficient to guarantee that the effects observed are unequivocally related to the manipulation of the independent variable.

Let us compare such field experiments with the Lewin, Lippitt, and White study (21) on autocratic and democratic atmospheres. This was a relatively early experiment in social psychology and is perhaps close to the boundary between laboratory and field experiments. In this study a number of boys' clubs were set up for the express purpose of performing the experiment. There was no real-life situation which was taken as given. Rather, a special set of circumstances was created because it was felt that the situation thus achieved would be an appropriate one for the study of the variables in which the experimenters were interested. In this sense it should properly be called a laboratory experiment, although its precision is perhaps not very much greater than the precision of an experiment in industry, such as the one reported by Coch and French (7).

In the Lewin, Lippitt, and White experiment, the manipulation of the independent variables consisted in having one leader of a boys' club behave in a certain prescribed manner as compared to another leader of another club who behaved quite differently. These two sets of behavior, which produced measurable differences in the behavior of the club members, were complex and differed in many dimensions. The experimenters were undoubtedly not clear about all aspects of the differences created. Thus, rather than isolating and precisely manipulating a single variable or small set of variables, the experimenters attempted a large and complex manipulation. There was also little attempt at control in setting up the clubs. In terms of the control achieved and the degree of refinement in manipulation of the independent variables, this study is probably indistinguishable from most field experiments.

We shall now consider, as an example of a laboratory experiment with a relatively high degree of control and precision, an experiment by Festinger (10) on voting behavior. In this experiment an attempt was made to vary a single factor—namely, whether or not the subjects knew the religious affiliation of the other members of the group. Groups were set up for the express purpose of the experiment, with care taken to ensure that every member of the group was initially a stranger to every other member. Exactly comparable conditions were created for each group. The nominees for whom subjects voted were always paid participants whose behavior was standardized. These same paid participants identified

themselves as having different religions in the different experimental groups, thus controlling for a wide variety of personality factors and first impressions.

In such an experiment, we can be more certain than we can in a field experiment that the results obtained are due directly to the variable manipulated by the experimenter. It is probable that a variable such as "whether or not the subjects know the religious affiliation of the other members" is still not a fine or precise factor; it is probably, once more, a cluster of factors. A laboratory experiment should, however, attempt to refine the manipulations as much as the present state of knowledge permits. One of the marks of progress in a science is the extent to which such laboratory manipulation can be refined and specified.

There is frequently a tendency in social psychology to criticize laboratory experiments because of their "artificiality." A word must be said about this criticism, because it probably stems from an inaccurate understanding of the purposes of a laboratory experiment. A laboratory experiment need not, and should not, be an attempt to duplicate a real-life situation. If one wanted to study something in a real-life situation, it would be rather foolish to go to the trouble of setting up a laboratory experiment duplicating the real-life condition. Why not simply go directly to the real-life situation and study it? The laboratory experiment should be an attempt to create a situation in which the operation of variables will be clearly seen under special identified and defined conditions. It matters not whether such a situation would ever be encountered in real life. In most laboratory experiments such a situation would certainly *never* be encountered in real life. In the laboratory, however, we can find out exactly how a certain variable affects behavior or attitudes under special, or "pure," conditions.

This is certainly not the end of the task. One must also find out how these variables interact with other variables. The possibility of application to a real-life situation arises when one knows enough about these relationships to be able to make predictions concerning a real-life situation after measurement and diagnosis of the state of affairs there.

*The Relationship Between Laboratory Experimentation
and the Study of Real-life Situations*

In the conducting of research, there should be an active interrelation between laboratory experimentation and the study of real-life situations. It is relatively rare in social psychology that hypotheses, hunches, and recognition of important variables emerge initially from the laboratory; most often they arise in either the formal or the informal study of real-life situations. In studying real-life situations, we are forced to deal with the factors and variables as they exist in all their complexity. Because of this complexity and lack of control, it is rather rare that definitive conclusions and unequivocal interpretations are reached in such studies, but frequently new variables and new hypotheses are brought to our attention. One can take these suggestions, hypotheses, and hunches and use laboratory experimentation to verify, elaborate, and make more secure the theoretical basis for the empirical results which have been obtained.

In the laboratory experiment, sufficient control can be achieved to obtain definitive answers, and systematic variation of different factors is possible. As a result of this greater control, precision, and manipulability, conclusive answers can be obtained and relatively precise and subtle theoretical points can be tested. For example, in a study of the spread of a rumor in a community (11), it was found that the more friends people had, the more likely they were to have heard the rumor. This finding may suggest the hypothesis that friendship reduces restraints against communication of various types of content; or it may suggest the hypothesis that the existence of a friendship makes for an active pressure to communicate; or it may suggest the hypothesis that those who have more friends see more people and spend more time with these people and consequently are more likely to have an opportunity to hear the rumor. In a laboratory experiment it would be possible to set up a situation in which one could, with a high degree of rigor, collect data which would enable one to choose among these possible interpretations. One could, for example, form groups of strangers and friends mixed together in which the amount of contact among members and the opportunity for communication among them were experimentally held constant. The results would enable one to say whether the

effect of friendship existed in the absence of differential amounts of contact. It would enable one to accept or reject the third hypothesis stated above. In other groups one could experimentally vary the accessibility of other members for communication to obtain evidence as to whether the friendship represented a decrement in restraint against communication or whether there were actual pressures to communicate in the specific direction of friends.

Such an experiment would undoubtedly be difficult to set up, but, since the major body of this chapter will be devoted to the discussion of how to perform such experiments and how to produce the desired conditions, we shall not, at the moment, go into the details of how it might be done. Let it suffice now to say that in the laboratory, by setting up an artificial situation, we should be able to verify, elaborate, and refine our knowledge so as to increase our understanding of important processes in social life. It should be stressed again, however, that the problem of application of the results of such laboratory experiments to the real-life situation is not solved by a simple extension of the result. Such application requires additional experimentation and study. It is undoubtedly important that the results of laboratory experiments be tested out in real-life situations. Unless this is done the danger of "running dry" or "hitting a dead end" is always present. A continuous interplay between laboratory experiments and studies of real-life situations should provide proper perspective, for the results obtained should continually supply new hypotheses for building the theoretical structure and should represent progress in the solution of the problems of application and generalization.

Difficulties of Performing Laboratory Experiments

Laboratory experiments, however, do not represent an easy road to the collection of data for the resolution of theoretical problems. In social psychology they are typically difficult to do, and many dangers are present in their execution. It is extremely difficult to create in the laboratory forces strong enough for results to be measurable. In the most excellently done laboratory experiment, the strength to which different variables can be produced is extremely weak compared to the strength with which these variables exist and operate in real-life situations. One is able to obtain

results and to see clearly how these variables operate, in spite of this weakness, because of the increased control one has in the laboratory situation. But it is always possible, even probable, that the factors will be so weak that no differences between conditions experimentally created are apparent in spite of the increased control. Thus, in the setting up of a laboratory experiment, especial care must be taken to make the variables as strong as one possibly can. Unfortunately, one can determine whether or not one has succeeded only after the experiment is over. An exception to this generalization about the weakness of laboratory manipulation can be seen in Asch's use of the announced perceptions of group members (2). This involved, however, the use of seven confederates for a single experimental subject.

Related to the problem of the strength of forces in the laboratory situation is the difficulty of manipulating several variables simultaneously. In the complex field of research with which we are here concerned, it is frequently theoretically important to see the effect of the simultaneous operation of two or more variables. Unfortunately, however, the more variables the experimenter attempts to manipulate, the lower will be the strength of each variable. This is especially true if the manipulation of the variable is to be done by means of verbal instructions to the subjects. The result of this is, at least at the present stage of technical development, that the number of variables which it is possible to manipulate simultaneously in the laboratory is relatively restricted. This will undoubtedly become less true as more powerful techniques of manipulating variables in the laboratory are developed.

These difficulties have an important implication for the conclusions one can draw from the results of laboratory experiments. As in any study, it is possible that the experimenter is dealing with entirely irrelevant variables—that is, there may actually be no relationship among the variables that are being studied. Such a condition would result in negative results—that is, no differences between experimental and control groups. However, we should also find a lack of differences between experimental and control conditions if our experimental manipulations were not sufficiently strong to reveal measurable differences even though such differences really exist. Thus, negative results from a laboratory experiment can mean very little indeed. If we obtain positive results—that is,

demonstrably significant differences among conditions—we can be relatively certain concerning our interpretation and conclusion from the experiment. If, however, no differences emerge, we can generally reach no definitive conclusion unless we are quite certain that the manipulation of variables in the experiment was done successfully and adequately. At the present stage of technical development, it is seldom that we can be certain, in the absence of positive results, that our manipulations were adequate. Undoubtedly, as more and more experiments are done, good evidence will become available for believing that a certain manipulation is an adequate one, and then negative results can be interpreted as demonstrating no relationship. At the present time, however, it is all too easy to set up a laboratory experiment which, because of the ineffective manipulation of variables, will show no differences among conditions. It should be stressed again that, at the present stage of technical development, negative results perhaps reveal only the fact that the experiment was not set up carefully and that the experimenter's attempted manipulation of the variables was ineffective.

Keeping in mind these difficulties and the relationship which must exist between laboratory and field investigation, we shall now proceed to a more detailed examination of how laboratory experiments can be performed.

THE DESIGN OF LABORATORY EXPERIMENTS

The first and foremost requirement for a successful laboratory experiment is that the problem be stated in experimental terms. This means, essentially, that there must be a high degree of specificity and clarity in the statement of the problem and in the definition of the variables involved. The foregoing implies that before one can successfully do a laboratory experiment, one must already know quite a bit about the phenomena one is investigating.

The process of specifying and clarifying the statement of a problem so that it is amenable to experimental treatment is by no means a simple or easy one. Let us take an example to illustrate the kinds of problems which confront the experimenter at this stage. In a field study of transmission of a rumor in an organiza-

tion (4), it was observed that communication tended to be directed upward in the organizational hierarchy. This result was explained as depending upon forces acting on members to move upward in the organization; *i.e.*, the upward communication represented substitute movement on the part of the members.

Kelley (19) set out to perform a laboratory experiment to test this hypothesis more thoroughly. At this point the statement of his problem might have been "What direction does communication tend to take in a structured hierarchy?" This statement, however, is still much too general and vague for the purposes of an experiment. An attempt to think in terms of setting up an experiment makes it immediately clear that one must answer questions such as "What exactly is a hierarchy?" and "Exactly what kinds of communication are we talking about?" There are many aspects to what is customarily thought of as a hierarchical structure. Do superior levels in the hierarchy have power over subordinate levels and, if so, what kinds of power? Is each successive level upward in the hierarchy characterized by increased attractiveness of the work, or increased freedom of choice of what work to do, or increased importance of the work? For the purpose of setting up a laboratory experiment, the theory involved and the definition of hierarchy must be made more specific. Kelley chose to establish a hierarchy in the laboratory on the basis of the perceived importance of the job to the subjects, holding the actual attractiveness of the job and the exact work that was done constant for both levels in the hierarchy.

Let us now consider the question of what kind of communication would be expected to go upward in such a hierarchy. It was clear that a distinction had to be made between work-oriented communication, communication of criticism, communication of information, and communication which was irrelevant to the task. It was largely in the last category of communication content that the effect of substitute movement would be expected to appear. Consequently, the experiment was set up to allow and, in fact, to encourage communication of irrelevant content. The final problem in Kelley's experiment was phrased as "What is the direction of irrelevant communication content in a hierarchy based upon perceived differential importance of the task?" This statement was specific enough to permit the design of the actual experiment. This

process of clarifying the objectives of the experiment takes considerable time, although it may not take long to describe after it has once been done.

The difficulties of designing a laboratory experiment are by no means overcome when the problem has been specifically defined. There remain the major tasks of inventing measurement devices and techniques for manipulation of variables which will clearly measure and manipulate the variables which have been defined in the statement of the problem. No matter how specifically and clearly the concepts are defined in the statement of the problem, the laboratory experiment cannot be successful unless the measurement and the manipulation of variables actually relate to these defined concepts.

Thus, for example, in the Kelley (19) experiment mentioned above, it was necessary to develop techniques for producing a hierarchy as defined, while other variables, such as the type of work done, power, and attractiveness, would be controlled. The situation created had to be one in which irrelevant communication would occur. Adequate techniques for measuring the amount and direction of communication had to be developed. In the experiment, a two-level hierarchy was established. Each level did exactly the same kind of work, although each was under the impression that the other level was doing something different. High and low hierarchic perceptions were encouraged by the instructions to the subjects: one subgroup was told that its own job was the important one; the other subgroup was told that the job of the other level was the more important. Communication of irrelevant material was encouraged by having all communication carried on in writing and by injecting into the communication stream prepared fictitious notes which were irrelevant in their content, thus encouraging subjects to do such writing themselves. All notes were collected and kept, and thus analysis of the content of the communication, its direction, and amount was possible.

It is rarely safe to assume beforehand that the operations used to manipulate variables will be successful and will tie in directly with the concept the experimenter has in mind. It is a worth-while precaution to check on the success of the experimental manipulations. In the experiment by Kelley, the subjects were asked a number

of questions after the session was over to determine whether or not the manipulation of status in the hierarchy had been successful. It was found that, in terms of their reported perception of status and their desire to be in the other role, the manipulation had created a difference between the two levels. This difference was a relatively small one, however. Small differences in the results could be directly attributed to the small difference in perceived status. When the difference in perceived status was made larger by selecting out those subjects for whom the experimental manipulations were clearly successful, the results become much clearer and more conclusive. If there had been no check on the success of the experimental manipulation, such analysis would have been impossible. It would also have been impossible to attribute unequivocally the inconclusiveness in the results to the relative inadequacy of the experimental manipulation.

The problem of the adequacy of the manipulation of variables may be dealt with in part by preliminary studies. In almost any laboratory experiment, the initial design will have certain inadequacies which will become clear after a few trial experiments. Such preliminary runs are also important to provide practice for the investigator so that his behavior and his instructions become standardized by the time the regular experiments start.

THE EXECUTION OF LABORATORY EXPERIMENTS

Techniques of measurement, manipulation, or control of variables can be introduced at almost any stage in the process of a laboratory experiment. We shall attempt, in the following pages, to cover in detail most of the techniques which have been used fruitfully and to give examples of their successful use.

Decisions about Subjects for the Experiment

Decisions about the kinds of persons to be used as subjects, how they are to be recruited, and what they are to be led to expect before they come to the experiment provide important opportunities for the manipulation of variables.

Controlling the Composition of the Group

It is possible to arrange the composition of the group so as to control the number of friends in each group or to select subjects to ensure that all of the members of a group are strangers to one another at the beginning of the experiment. The decision concerning the composition of the group depends, of course, upon the purpose of the experiment and on the variables upon which the experimenter desires to focus his investigation. We shall give some examples of the introduction of an experimental control or manipulation at this stage of the procedure.

The experiment by Festinger (10) previously referred to had as its objective the determination of whether knowledge of religious affiliation in a mixed Catholic-Jewish group would affect the attitudes of members toward one another. It was assumed that these attitudes would be reflected by their votes in elections for officers of a club. It was decided to have groups meet in the laboratory and elect officers of a club into which they formed themselves. Half of the elections were to take place while no one in the group knew the religious affiliation of any one else; the other half of the elections were to take place after the religious affiliation of each member was publicly announced. It was obviously essential, for this procedure to be successful, that none of the six members of any group know one another. Contact was made with nine colleges in the Boston area and permission to recruit volunteers in each college was obtained. Experimental sessions were then scheduled so that in each group only one person from any one college was present. Thus, when the group met, the six members each came from a different college in the area and the chances of their knowing each other were quite low. In spite of all these precautions, however, one out of 13 groups had to be eliminated because two of the members did know each other, having gone to high school together. In the other 12 groups, all the members were complete strangers to one another.

Schachter (26), in an experiment designed to investigate the relationships between difference of opinion and rejection, also wanted his groups composed of strangers to minimize the effects of past history, such as established preferences or aversions, among members. Having strangers was important because he was partic-

ularly concerned with the effect of the experimental condition upon acceptance and rejection. He recruited volunteers from courses which were divided into small recitation sections. By scheduling, in any one group, only one person from any one recitation section, he was fairly successful in eliminating prior acquaintanceship.

In both the examples above, having strangers compose the group was a technique used to exercise additional control over the experimental situation. In experiments on the effects of discussion on opinions about matters of fact, Jenness (18) controlled the range of difference of opinion in the group by the assignment of subjects to given groups on the basis of their original estimates of the facts in question. French (16), in an experiment on the effects of frustration and fear, used the composition of the group as a means of manipulating a variable. He was concerned with the differential effects of frustration and fear upon organized and unorganized groups. For his unorganized groups he used subjects recruited at Harvard University who met together as a group for the first time in his laboratory. For his organized groups he used club members who had a long history of working together and engaging in activities as a group. The members of each organized group came to the laboratory together. This type of manipulation is, of course, a gross one, since an organized group is different in many ways from an unorganized one. The same type of manipulation of the composition of a group can, however, be used in any number of ways to produce fine or gross differences among conditions. Some of the earliest experiments with groups, for example, employed as their major variable the presence or absence of other persons (1). Whether the person worked alone or in a group of people or before an audience was found to affect his performance (8).

Duration of the Group's Existence

Before recruiting subjects, it is necessary to decide whether the experiment will be conducted in one meeting or whether the group will be required to continue for several sessions. Each of these procedures has advantages and disadvantages. If the experiment is to be performed in only one meeting, it is generally easier to obtain volunteers. If the experimenter is restricted to one session, however,

it may be more difficult to manipulate variables adequately. On the other hand, if the experimenter plans on more than one meeting per group, he must expect that a certain percentage of subjects will not return after the first meeting.

Designs which require the group to meet several times encounter another difficulty. Many uncontrolled factors may be introduced, since the subjects may contact one another outside the experiment and, in this way, materially change the situation between experimental meetings. The decision as to which of these two types of experimental designs to employ depends, again, upon the objectives of the experiment and on how these objectives can best be accomplished. A number of examples of each kind of experiment will be given to illustrate the advantages and difficulties.

Deutsch (9), in his study of the effects of competitive and cooperative situations on group problem-solving, felt that the full effects of the experimental variables would reveal themselves only if the group would have considerable experience working together under the prescribed conditions. He decided on six successive meetings of each group and, to accomplish this, persuaded the instructor of a course to give students credit for participating in his experiment. Under these conditions most subjects attended all six sessions. Such an arrangement is not usually possible, but it is generally necessary to have some means of ensuring that subjects will return when the group is to meet several times.

Schachter's (26) experiment on rejection of deviates used one meeting of each group. It was necessary, however, for the subjects to be under the impression that they were to continue to meet once a week for a considerable period of time. The experimenter recruited subjects by telling them about clubs that were being formed and giving them the opportunity to join one of the clubs. Subjects were told that by joining they were committing themselves to attend the first meeting. After the first meeting they would be able to decide for themselves whether or not they wanted to continue.

In an experiment on strength of attraction to groups, Libo (22) used the number of meetings which subjects attended as one of the major measures of the strength of their attraction to the group. He, too, gave subjects an opportunity to volunteer to join clubs which were to continue to meet every week. Subjects could decide,

after the first meeting, whether they wanted to continue their membership. Little pressure was applied to the subjects to return to subsequent meetings. The number of meetings actually attended was assumed to reflect their attraction to the group.

Starting the Manipulation of a Variable

It is possible, and sometimes necessary, to start the manipulation of an experimental variable at the time the subjects are recruited for the experiment. This can be done by providing various expectations for the subjects which will affect the attitudes with which they come to the experimental situation, or by collecting information which will later be used to manipulate a certain desired variable. We shall give some examples of the experimental manipulation of a variable which begins at the time of recruitment.

Several experiments (3, 14, 28) have varied attraction to the group experimentally by manipulating the degree to which the subjects expected they would like, and be congenial with, the other members of the group. At the time of recruiting, those who volunteered to be subjects were asked to answer a number of questions which concerned characteristics of themselves, characteristics which they liked in other people, and characteristics which they disliked in other people. No attention was actually paid to these data in setting up a group, but, because the subjects had provided such information, the experimenters were plausibly able to tell some groups that the members would like one another and be congenial and to tell others that they would not be very congenial. The results of such experiments showed that the manipulations were successful.

Schachter (26), in his experiment on the rejection of deviates, wanted to manipulate attraction to the group on the basis of interest in the activity in which the group was to engage. When the subjects were asked to join one of the clubs, each club was described in detail. Those who desired to join filled out an information sheet on which they were asked to give ratings of how interested they were in joining each of the available clubs. Some groups were composed of subjects who were highly interested in joining that specific club (high attraction to the group), whereas other groups were composed of persons who had indicated relatively low interest in

joining that specific club (low attraction to the group).¹ This manipulation of attraction to the group was also shown to be successful by the results and by answers which subjects made to questionnaires after the experiment.

Size of the Experimental Groups

No matter what techniques the experimenter employs, there will always be some subjects who, after having agreed to be at the laboratory at a certain time, will not appear. They may have forgotten, they may have changed their minds, or something may have happened which made it impossible for them to attend. In any event, the problem for the experimenter is the same. In designing a laboratory experiment in which human subjects are to be used, it is well either to design the experiment so that it may be conducted with a variable number of subjects or to make some provision to ensure the proper number of persons in each group. It is generally most desirable to allow for variation in the number of subjects. Thus, for example, an experiment may be designed so that it can be conducted with either five, six, or seven members in the group. If seven persons are then scheduled for each meeting, and if sufficient precautions are taken,² very few groups will be lost.

When a design requires a constant number of subjects in each group, there are a number of techniques to ensure the presence of the proper number. Festinger (10), in his experiment on the effects of knowledge of religious affiliation, felt it necessary to keep the size of the groups exactly constant at six subjects per group. Three of these were to be Jewish and three Catholic. This was essential because of the desire to have the group evenly divided between the two religions. Leeway in the number of subjects in each group would have produced deviations from an even division which might have introduced additional complexities. Before each experiment

¹ This is not strictly an experimental manipulation of a variable. Rather, it represents selection of subjects on the basis of some measure in order to create contrasting conditions.

² There are many factors which will affect the proportion of subjects who, having volunteered, actually come to the experiment. If, for example, volunteers are recruited from university classes, the more pressure applied upon them to participate, the lower the proportion of subjects who appear when scheduled (27).

each subject was written a letter stressing the importance of her coming to the experiment. On the day before the meeting, each subject was spoken to by telephone to make sure that she would be present. In spite of these efforts, only five subjects appeared in a number of groups. In most of these instances the subjects who had arrived agreed to wait while others who had volunteered were telephoned until an appropriate person was reached who agreed to come down immediately. By this procedure very few groups had to be discarded. In Pepitone's (25) experiment on group productivity, the situation was designed so that it was essential to have three subjects present in each group. The group was to work on a task which was divided into three parts, each of which had to be performed by one subject. The experimenter scheduled four subjects for each group. Occasionally only two subjects appeared and the group had to be canceled; most frequently three subjects appeared. When all four came, the last one was taken aside, the situation was explained to him, and he was allowed to observe the experiment in progress.

THE CONTENT AND FORM OF THE EXPERIMENTAL SITUATION

The investigator must make a number of decisions concerning how the situation is to be structured cognitively for the subjects, in what kinds of activities they will engage, and with what attitudes they come to the experiment.

"Real" or "Experimental" Situations

The experimental situation can vary from one which is frankly experimental to a situation which, for the subjects, is a "real" one. The pros and cons for the various possibilities within this range are by no means all clear. Good evidence is lacking concerning which types of experimental situations are superior for which purposes. We shall, however, discuss some of the considerations which might lead an experimenter to set up his groups in one or another manner.

To discuss these advantages and disadvantages we must explain somewhat farther the distinction between a situation which is

"real" for the subject and a situation which is "experimental" for him. All of the situations are, in a sense, "real" for the subject, and all of them, likewise, are experiments from the point of view of the investigator. Some examples from other fields of investigation may illustrate our point more clearly. If a psychologist does an experiment in discrimination learning, using rats as subjects, the situation is obviously an experimental one for the investigator. For the rat, however, it is undoubtedly a very real situation. The maze or discrimination box is a place where he works and gets fed. The basis of the "reality" of the experimental situation for the subject is somewhat less clear when humans are used as subjects. Thus, for example, in an experiment on level of aspiration the subject may come to the laboratory knowing he is to help in an experiment. He is given a series of tasks to perform and is asked, before each task, what he is going to try to score on the subsequent task. One may well ask, "In what sense is this situation a real one for the subject?" Certainly it is not "real" in the sense that it is a situation similar to those which the subject encounters in the ordinary course of events; on the other hand, it is certainly "real" in the sense that powerful motives are brought into play and strong forces are set up which act on the subject and determine his behavior in lawful ways. Thus, the situation in which one places the subject can be "real" for him in that it brings into play powerful forces, regardless of whether or not it is cognitively an experimental situation for him.

If the situation is cognitively a real one for the subject, it is probably easier to bring powerful forces into play. It may be more difficult to produce equally strong forces if the situation is cognitively experimental. In the latter case, the strength of the forces which can be brought into play depends largely upon the relations between the subject and the experimenter, the motivations which made the subject decide to volunteer for the experiment, and his desire to cooperate. These forces can, in the proper circumstances, be quite strong. It is much easier to create a laboratory situation which is cognitively experimental for the subjects. To create a cognitively "real" situation and still be able to control and manipulate variables successfully may require a great deal of subterfuge and much attention to technical details. If the subject sees through the subterfuge, the whole experiment may be invalidated.

We have, then, these relative advantages and disadvantages which the experimenter must consider when deciding whether to make the experimental situation cognitively experimental or cognitively real for the subject. If the experiment is cognitively real, it will be easier to make it motivationally strong. On the other hand, if the situation is cognitively experimental, it will be easier to set up with an adequate amount of control and precision. The examples below illustrate the kinds of decisions which have been made on this question.

Lippitt (23), in his experiment on the effects of the behavior of autocratic and democratic leaders, chose to make their experimental situation cognitively real for the subjects. To do this he organized school-age children into clubs which had their club rooms in the investigator's laboratory. The experimenter functioned as the adult leader of these clubs. In this role he was able to manipulate the desired variables. Because of the desire to maintain a cognitively real situation, the possible variations in the leader's behavior were also limited. The differences between conditions that were produced were rather gross. It is possible that the lack of control and precision in this experiment offset the advantages gained by having a cognitively real situation.

Schachter (26), in his experiment on rejection of deviates, also chose to have a cognitively real situation for the subjects because the major measures of rejection were to be obtained from verbal responses to questions. The investigator felt that these responses would have more validity if they were commitments to action on the part of the subject rather than answers to hypothetical questions. To obtain a cognitively real situation, he organized clubs of college students.

Once more a major difficulty was the restriction on the manipulation of variables. Manipulations had to be devised which were consistent with the notion of a bona fide club. To create groups with high and low cohesiveness, the investigator first ascertained the degree of interest of the subjects in each of two kinds of clubs and then manipulated the attraction to the group by composing some groups of persons who were all highly interested in the activity and other groups of persons who were only mildly interested. This type of manipulation of a variable by selection is probably not so satisfactory as other techniques would be. Because of the cognitively

real aspects of the situation, it was also not possible for the experimenter to engage in any further manipulation of variables while the meeting of the group was in progress. These problems, in this experiment, were satisfactorily solved by the use of paid participants, a technique which will be described later.

In an experiment on the effects of knowledge of religious affiliation Festinger (10) decided to use a cognitively experimental situation. This decision was made because it was obviously of importance to control the group session firmly and to carry on manipulations of variables while the session was in progress. The group consequently met with the knowledge that it was helping in an experiment. They were told to "imagine" that they were a club. There is no doubt that the forces in this situation were weaker than the forces which would have operated had the subjects actually been members of a club engaged in the same procedure. By virtue of the cognitively experimental aspects of the situation, however, this disadvantage of weaker motivation was counterbalanced by the precision of measurement and the control of extraneous variables.

The Choice of Activity for the Group

The choice of the activity in which the group, once assembled in the laboratory, is to engage is somewhat dependent upon the decision concerning the cognitive reality of the experiment. There is, of course, much leeway in the choice of activity, although it must be one which is consistent with the purposes of the experiments and does not conflict with the other experimental decisions which have been made. If the experimental situation is to be cognitively real, there are restrictions on the type of activity which can be employed. If the situation is to be cognitively experimental, there is much less limitation and the selection of an activity which is well suited to the experimental purposes is easier. The activity must be chosen to allow for the manipulation of the variables, the collection of the measures in which the investigator is interested, and the arousal of sufficiently strong forces so that the effects will be measurable. It is impossible, of course, to list all of the various activities in which laboratory groups may engage. We shall present a few examples of different kinds of activities which have been used and the reasons for their use.

Perhaps the most frequently employed group activity is discussion. Such an activity may be chosen when the purpose of the experiment is either to study the involvement of people in an activity, the amount of participation in an activity, or the communication or influence process that goes on in groups, or to provide a relatively interesting activity which will involve the subjects in order for the experiment to accomplish some other purpose in the meantime. Any topic which will be interesting to the subjects is suitable. The discussion may concern differences in opinion, as in the experiment by Back (3), it may be directed toward solving a problem, as in the experiment by Deutsch (9) or it may involve a sharing of experiences, as in the study of Festinger, Pepitone, and Newcomb (15).

When children are used as subjects, a play activity may frequently be appropriate. Thus, Thibaut (30), when he endeavored to create privileged and underprivileged subgroups, had one subgroup play an interesting and enjoyable game while the other subgroup took the role of helpers and servants to those who were actively engaged in having fun. Lippitt (23), in his experiment on autocratic and democratic leader behavior, used various games and craft activities which were appealing to school-age children.

It is also possible to use work situations as the activity for the group. Kelley (19) felt that a work situation would be more conducive to the establishment of a status hierarchy, so in order to create a two-level status hierarchy he used a work task in which the subjects had to arrange bricks according to a certain pattern. Pepitone (25), in an experiment on group productivity, used a work task which was constructed so that measures of production would be relatively easy to obtain.

These are but a few of the many possible examples of activities that can be prepared for a group. There is almost limitless room for the experimenter's ingenuity to create a situation which will be best for his experimental purpose.

The Orientation of the Subjects

Related to both the cognitive nature of the situation and the activity in which the group is to engage is the problem of what orientation to give the subjects in the experiment. It is highly desirable to have some plausible and understandable purpose for the

experiment which the investigator can communicate to the subjects and which they will accept. If this is not done, the subjects usually conjecture about it and make guesses as to the true purpose. If a plausible orientation is not given, this important aspect remains uncontrolled.

The orientation which the experimenter gives the subject at the beginning should be plausible and should remain plausible as the experiment progresses. It is usually important that this plausible orientation *not* reveal to the subject the true focus of the experiment. The true purpose of the experiment and the true focus of the investigator's interest can, and should, be revealed to the subjects at the conclusion of the experiment.

TECHNIQUES FOR THE CONTROL AND MANIPULATION OF VARIABLES

Since the basic purpose of a laboratory experiment is to achieve a simple situation in which certain variables can be well controlled while others can be varied at will, we shall attempt, in the present section, to be as detailed as possible. We shall illustrate not only the various techniques which have been developed for controlling and manipulating variables but also the kinds of variables which have been successfully controlled and manipulated in the laboratory.

Use of Pre-experimental Instructions

The most obvious technique for controlling or manipulating variables is the use of pre-experimental instructions to the subject. Such pre-experimental instructions vary greatly in their effectiveness. It is probably safe to say that instructions to the subjects will be successful in manipulating variables when these instructions are kept simple, are given emphatically, and are plausible in the sense of being integrally related to the experimental activity in which the subjects are to engage. The major dangers in the use of instructions as a device for manipulating variables are (1) the possible inattention of the subjects when the instructions are given and (2) the possible variability from subject to subject in interpretation of the instructions. Because of these difficulties, it is probably unde-

sirable to manipulate more than one variable at a time through the use of pre-experimental instructions. Instructions which attempt to manipulate several variables simultaneously are likely to become so complex and so long that they render the manipulation ineffective. We shall illustrate the problems involved in the use of instructions by giving examples of successful and unsuccessful attempts at manipulating variables in this manner.

Deutsch (9), in his experiment on competitive and cooperative groups, produced competitive or cooperative situations by differential instructions to the groups. In the competitive groups he told the subjects that all the members would be ranked according to their contributions in solving the problems given to the group and that their grades in the course would depend in part upon these rankings. It was explained that, thus, the one in that group who contributed most, irrespective of how the group as a whole performed, would get the highest grade and the one who contributed least would get the lowest grade. In the cooperative groups the experimenter told the subjects that their group was going to be compared with other groups, that everyone in the group would receive the same grade, and that this grade would be determined by how well the group as a whole did. These instructions were successful in creating the required conditions, and they provide a good example of how instructions can be integrated into the experiment. They were successful because they provided essential explanation of the situation to the subjects—they defined the goals for the subject and defined the manner in which these goals were to be reached.

Back (3), in his experiment comparing groups of high and low cohesiveness, wanted to vary the attraction to the group by using several kinds of motivation. In some groups he wanted to create in the members high or low attraction on the basis of personal liking for the other group members. To create high attraction, he told the subjects that, on the basis of the information they had written down when they volunteered, he had matched people in this group so that he was quite sure they would be congenial and like one another. To create low attraction he told subjects that, because of time-scheduling difficulties, he had been unable to match them very well but that he did not think they would dislike each other. In other groups, attraction to the group was made dependent upon

the personal goals that could be achieved through membership. This was done by informing the subjects that there was (or was not) a reward that would be given as a prize to each of the members in the best group.

These instructions were probably moderately successful. On the one hand, they were not integral to the experimental task. That is, the subjects could have done everything the experimenter required of them without these instructions ever having been given. The possibility of winning a reward or the likelihood that members would get along well with others in the group was, however, relevant to fairly important motives in the subjects. They probably were concerned about whether or not they would like the other persons and be liked by them. The possibility of a reward probably added to the motivation to do well in the eyes of the experimenter. The results of the experiment show that a difference between high and low attraction was created by means of these instructions.

In an experiment on the direction of communication in a group, Festinger and Thibaut (12) wanted to manipulate the subject's perception of the homogeneity or heterogeneity of the group. To create the perception of homogeneity, groups were told that the members had been carefully selected so that they were all in the same year in college and had equal interest in, and knowledge about, the problem they were to discuss. To create the perception of a heterogeneous group, they were told that great differences existed among them in their knowledge about, and interest in, the problem under discussion. The manipulation of the variable by these instructions was only mildly successful. Probably few of the subjects were much concerned with whether the group was homogeneous or heterogeneous. Although differences between these conditions were obtained in the results, these differences were by no means strong. It might be expected that a more adequate manipulation of these variables would have produced much larger differences between the conditions.

In an experiment by Festinger *et al.* (14), an attempt was made to manipulate three variables simultaneously, all by means of verbal instructions at the beginning of the experiment. The investigators were interested in the interaction among the variables of attraction to the group, perception of whether or not there were experts in the group, and perception of whether or not there was a correct

answer to the discussion problem. This attempt to manipulate all three variables by pre-experimental instruction was not very successful. The amount of instruction which had to be given to the subject and the complexity of the instructions rendered them rather ineffective. It probably would have been better to manipulate one of these variables by instructions and to have devised techniques for manipulating the other two in other ways. We shall discuss below such other techniques of manipulating and controlling variables.

Use of False Reporting

False reporting to the subjects of the results of votes or of sociometric choices and the like is another technique for control and manipulation of variables. Such false reporting must always be done in a manner which will make the report appear plausible. If sufficient care is used to ensure the acceptance of the report as true, this can be an effective means of manipulating some kinds of variables.

Festinger (10), in his experiment on the voting behavior of Catholics and Jews in mixed groups, used the technique of false reporting to the subjects to keep the situation identical for all groups. The members of the group voted for officers of the club in the following manner. There was first a nomination ballot to select two candidates for the election. The members of the group who received the most votes were to be the candidates in the final election. This nomination ballot was tabulated by the experimenter and, since the ballots were secret, it was simple for him to report falsely which two members had won the nominations. In this manner the experimenter was able to control which two persons were the candidates in each election. This experiment also employed paid participants (the use of which will be elaborated below) who were members of every group. By means of the false reporting of the results of the nomination ballot, the two candidates for each election in every group were two of the paid participants. One of the two candidates in each election identified herself as Jewish and the other identified herself as Catholic. Each election in each group was, thus, a standard situation.

In the experiment by Festinger *et al.* (14) in which an attempt

was made to manipulate simultaneously three variables by verbal instructions to the subjects, a fourth variable was manipulated successfully by means of false reporting to the subjects. The subjects were to have a discussion among themselves concerning an issue about which each of them had already formed an opinion. Before the discussion some subjects were given the impression that the group overwhelmingly *agreed* with their own opinion on the issue, whereas other subjects were given the impression that the group overwhelmingly *disagreed* with them. This was done in the following manner. Each subject wrote, on a slip of paper, his opinion on the issue which was to be discussed. Subjects were told that the experimenter would tabulate these and then give each person a tally which would show the opinion of each person in the group. Thus, knowing everyone's opinion, they would be able to proceed sensibly with their discussion. The tally which was handed to each of the subjects was entirely fictitious. Each of the subjects in whom the perception of group agreement was to be created was given a tally which showed all but one of the subjects agreeing very closely with him. Each of those in whom the perception of disagreement with the group was to be created was handed a tally sheet which showed everyone in the group at least two opinion steps removed from his own opinion. This false reporting proved successful in varying the degree of perceived agreement with the group.

We shall conclude the discussion of the technique of false reporting to subjects with an illustration of an unsuccessful attempt. Festinger and Hymovitch (13) attempted to create in subjects a feeling of rejection by the group. Four subjects, strangers to one another, met in the laboratory and were told that they were to work on a task which required cooperative effort, although the various parts of the task would be divided among them. They were first to have a brief discussion among themselves and get to know one another so that they could decide how they wanted to organize the task. They were told that people who liked one another worked more productively together. Consequently, if there was any one in the group that they disliked, it would be better to exclude that person from the group. After the discussion, the subjects were given ballots on which each could indicate whether he wanted to work together with all the others or wanted to eliminate a member from the group. If subjects chose the latter alternative, they wrote down

the name of the member they wanted to reject. Each subject was then taken to a separate room and was told that the experimenter would tell him the results of the ballot as soon as possible. Each subject was then privately told that the others had unanimously voted to reject him.

This false report to the subject was rarely successful. The overwhelming majority of the subjects refused to accept it and immediately suspected that the experimenter was not telling the truth. The reason for the failure were probably twofold. The experience with the others in the preliminary discussion did not provide grounds on the basis of which they could accept the reported rejection. Also, the false report was unpleasant enough so that the subjects did not want to accept it. Many subjects refused to accept the report even though they could not verbalize any reason for suspicion or disbelief. This technique had to be abandoned in this experiment.

Use of Paid Participants

The use of paid participants who are part of the experimental group and are accepted as such by the subjects is a powerful technique for the control and manipulation of variables. It is, however, a relatively expensive and tedious procedure. When paid participants are used, the details of their behavior must be exactly planned in advance and much time must be spent training and rehearsing them. We shall give some examples to illustrate the great variety of uses to which such paid participants may be put.

A relatively simple and effective use of paid participants to manipulate a variable is found in an experiment by Sherif (29). The same technique has been used by others for the same specific purpose (6). These experiments brought two persons together in the laboratory so that the degree to which the judgments of one would influence the judgments of the other might be investigated. The subjects were asked to judge the amount of movement of a point of light. This autokinetic effect (the light does not actually move) provided a rather ambiguous stimulus. These experiments used as one of the group members a paid participant who, by making a standard, prearranged series of judgments, was able to produce a standard situation for all subjects with specified differences between his judgments and the subjects' initial judgments.

Pepitone (24) reports an experiment in which he investigated the determinants of the perception of authority and approval in people. He was faced with the problem of how to provide a standard social situation for his subjects in which it would be meaningful to ask them for their perceptions of authority and approval. Using school-age children as his subjects, he let it be known in the school that, as part of a survey on interest in athletics, a three-man board would arrive in a few days to interview many of the students. Those who successfully answered the questions asked by the three-man board would win tickets to a college basketball game. The three-man board which came to the school and interviewed students individually consisted actually of three paid participants who had been trained by the experimenter. Scripts for each of the three had been carefully written so that each boy who was interviewed was asked exactly the same questions. The responses to the boys' answers were also standard for each of the conditions. In different conditions, however, the experimenter created authority differentials among the three board members and also differences among them in the extent to which they openly voiced approval of the boy who was being interviewed. The boy's perception of the relative authority and approval among the board members could be ascertained in an interview with each boy directly after his appearance before the three-man board. Thus, the experimental situation was effectively standardized.

Schachter (26), in his study of rejection of deviates, had three paid participants in each group. The topic for discussion was chosen so that all of the subjects would have opinions which very nearly agreed with one another. Paid participants were used to create various conditions of deviation from this group norm. One paid participant voiced an extremely deviant opinion and held to it throughout the discussion. Another paid participant voiced a deviate opinion at the outset but allowed himself to be influenced so that, in the end, he agreed with the other subjects. The third paid participant agreed at the beginning and continued to agree with the modal opinion in the group. Thus, standard conditions of deviation from the group norm were achieved and, by rotating the paid participants among the various roles from group to group, it was also possible to equate for personality factors. We must emphasize that these paid participants had been very carefully trained in how

to behave in the group and in what kinds of things they could and could not say.

In the study by Festinger (10) of the effect of knowledge of religious affiliation, four paid participants were members of every group which met. These paid participants were relied upon to control many variables and to create a standard situation. In the middle of the experiment, when everyone was identified according to her name and religious affiliation, two of these paid participants announced that they were Catholic and two announced that they were Jewish. The ones who said they were Jewish or Catholic were rotated from group to group so that actual religious affiliation and personality differences were equated among all the conditions. In this manner, many powerful variables, which would affect preferences for people, were controlled and the effects of knowledge of religious affiliation were permitted to emerge quite clearly.

The three foregoing examples of the use of paid participants in laboratory experiments hardly demonstrate adequately the possible range of uses to which this technique may be put. With sufficient ingenuity on the part of the experimenter and sufficient time in planning the behavior of the paid participants and in adequately training and rehearsing them, very powerful effects can be produced. There is ample evidence of the success of the control and manipulation of variables with the aid of paid participants.

Restriction of Behavior Possibilities

It is possible to exercise control over a situation and to manipulate variables by creating a situation which restricts the possibilities of behavior.

Festinger and Thibaut (12), in their experiment on the determinants of direction of communication, restricted the group to the use of written notes in carrying on their discussion. This decision was made for a number of reasons. If the discussion had been an oral one, the direction of communication (who spoke to whom) would have had to be recorded by observation of the group while the discussion was in progress. Such observation in fairly large groups is difficult and sometimes quite unreliable (see Chap. 9). By the use of written notes, a permanent record was immediately available. The exact time each note was written was recorded on it

before it was delivered to another group member, so that the whole communication process could be reconstructed in the analysis. Aside from these measurement problems, there were other reasons for restricting the discussion to written notes. In an oral discussion, the person who is talking may be primarily addressing one or two others in the group, but, whether he likes it or not, what he is saying is simultaneously heard by everyone. This introduces additional complexities. By limiting the communication process to written notes, with the further restriction that each note could be sent to only one person, the situation was kept simple and manageable. A further difficulty in using an oral discussion for the purposes of this experiment is the marked tendency for people to answer when remarks are addressed to them. This is fully demonstrated by the usually high correlation obtained between the number of times a person communicates to others and the number of times he is the recipient of communication (17). Since the experimenters were concerned primarily with other determinants of the direction of communication, this would have been a complicating factor. The further restriction that the written notes could not be signed avoided this complication. The recipient of a note did not know from whom it came. The pads of paper on which the subjects wrote their notes were marked so that later, in the analysis, the experimenter could tell who had written each note as well as to whom each note was addressed.

In his experiment on communication in a status hierarchy, Kelley (19) also restricted communication to written notes. Again there were a number of functions served by this restriction on the communication process. First, the experimenter intercepted all the notes written and thus had a detailed record of the communication process. Secondly, since all communication was by written notes, the experimenter could easily manipulate the communication process. Actually, none of the notes which the subjects wrote to one another was delivered. The notes which they received were fictitious ones designed to produce certain effects. In this manner a standard pattern of receiving communications from others was established for every group in all of the experimenter's conditions.

Restrictions on the behavior of the group can also be produced by an appropriate activity in which the group must engage. An activity can be chosen to eliminate certain complications, restrict

the range of behavior, or produce certain reactions in the subject.

French (16), in his experiment on the effects of frustration and fear on organized and unorganized groups, produced frustration in his groups by means of the activity in which they engaged. The groups were put to work on a task which was impossible to complete. The frustration engendered in this manner was unmistakable.

In his experiment on the relationship between influence and group cohesiveness, Back (3) wanted to produce a situation in which two subjects, meeting together, had different interpretations of, or opinions about, the same set of facts. Before they came together, each subject was given a set of three pictures and asked to write a story about them. Each of the subjects was actually given different pictures, which would force different interpretations. The differences between the sets of pictures, however, were so slight that none of the subjects ever suspected that he had seen different pictures. In this manner, by appropriate choice of activity, Back was able to ensure that, in every group, there would be a difference of opinion between the two subjects at the beginning of their discussion.

In experiments by Bavelas (5) and his colleagues (20) on the effectiveness of different patterns of communication in groups, a technique has been employed which is perhaps the most extreme example of restriction in a situation. In these studies the experimenters were concerned with determining which of a number of patterns of communication among members of a group would result in more effective problem-solving. To produce the different patterns of communication, the experimenters allowed some members to communicate to one another and prevented others from doing so. By this simple restriction, on which channels of communication were or were not available, various communication patterns were established. In these experiments the purposes of the investigators and the artificiality of the manipulation device were not hidden from the subjects. The restriction of the situation, however, was such that the subjects had to behave within it as well as they could. The results of these experiments show that the manipulation was successful. Such extreme and frank restriction of the situation would be appropriate, of course, only for a relatively selected range of problems.

In the foregoing discussion, we have by no means covered

exhaustively the various kinds of techniques for the control and the manipulation of variables. Those described are no more than a few examples of the wide variety of which an experimenter can avail himself. Many more possible techniques are likely to be developed in the near future. It should again be stressed that when one employs new techniques for manipulation of variables, or even some of those already developed, it is important to conduct preliminary experimentation to make sure that the manipulation is actually working.

OPPORTUNITIES FOR MEASUREMENT IN LABORATORY EXPERIMENTATION

Opportunities for collecting data in a laboratory experiment are present at all phases, from the recruiting of subjects until the end of the experimental sessions. There are, of course, some restrictions on what kinds of measurement can be employed at various phases in this process. These depend upon the design of the experiment and the way in which it is cognitively structured for the subjects. We shall point out some of the measurement possibilities at each of the stages of a laboratory experiment.

The first opportunity for measurement occurs before the experimental session takes place. Such measurement may be made at the time of recruiting subjects or when the subjects have assembled in the laboratory but before the experiment has begun. The exact time at which the measurement is done is immaterial and is generally selected for convenience. Such measurements, using a questionnaire or an interview, can have the following purposes: (1) to obtain some measure which will be compared to a similar one taken during or after the experiment; and (2) to enable the experimenter to control a variable by manipulating the composition of the group according to these measures.

In some experiments, it is essential for data to be collected before the experiment began. Thibaut (30), in his experiment on the cohesiveness of privileged and underprivileged subgroups, employed pre-experimental measurements to equate groups in the experiment and also to have a comparison between a pre-experimental and a postexperimental measure. The subjects were members

of already existing clubs. The investigator met the group at some designated place, usually their Y.M.C.A. or their club. He provided transportation for them to the experimental rooms. Before setting out for the laboratory, he asked them to answer a questionnaire concerning who their friends were among the other boys. He then brought them to the experimental rooms and was able to divide them into two subgroups so that each person had about as many of his friends within his own subgroup as in the other subgroup. After the experiment was concluded, the boys were again asked to answer the same sociometric questions. In this manner the investigator was able not only to equate his subgroups for amount of friendship within them but also to provide a basis for determining the effect of the experimental procedure on this variable.

Most of the possibilities for measurement occur, of course, during the actual progress of the experiment. One of the most frequently used measurement devices is observation of the group as it carries on its activities (dealt with in detail in Chap. 9). We shall discuss here some of the other kinds of data collection which are possible during the experiment.

The product of the activity in which the group engages is a major source of data. This product may take any of a variety of forms and may be analyzed in various ways by the investigator.

Kelley (19), in his experiment on communication in a status hierarchy, had his subjects arrange bricks in a certain pattern on the floor in accordance with instructions communicated to them. The actual product—that is, the exact pattern of bricks with which the group finished—was recorded by the experimenter and was used to obtain a measure of adequacy of production.

In his experiment on competitive and cooperative groups, Deutsch (9) had the subjects discuss, and write solutions to, various human-relations problems. He then analyzed these written products of the group discussion to obtain measures of the adequacy of the solution to the problem.

Closely related to such products are various records which the subject makes in the process of doing the required activity. Thus, in the Kelley (19) experiment and in the Festinger and Thibaut (12) experiment on direction of communication, the actual notes which the subjects wrote while carrying on the discussion were the main source of data.

Questionnaires and interviews may also be used during the course of the experiment. These may take the artificial form of questions interpolated into, and momentarily interrupting, the experiment or they may be disguised as election votes or expressions of opinion necessary to the conduct of the experiment.

Schachter (26), in his experiment on rejection of deviates, created a situation which was cognitively real to the subject. The groups were clubs which the subject had joined and which the subject expected would continue meeting periodically. It was fitting, consequently, to ask the subjects to elect committees to carry on various of the club functions and to vote on when and how often the club should meet. In this experiment, the data collection was seen by the subjects not as such but rather as part of their functioning as members of a club.

In the Festinger (10) experiment on mixed Catholic and Jewish groups, the major data were collected by holding elections for officers of a club. Here the situation was cognitively experimental for the subjects and the voting was undoubtedly seen as part of the experimental procedure. The results indicate it to have been an adequate method of data collection.

One can also collect a wide variety of data by questionnaires, interviews, or tests at the conclusion of the experimental session. The techniques of such data collection are discussed in Chapters 8 and 9.

SUMMARY

Laboratory experiments constitute a powerful technique for investigating relationships among variables. The essence of such experiments may be described as observing the effect on a dependent variable of the manipulation of an independent variable under controlled conditions. Such experiments, if well designed, can produce clear and unambiguous results which may add to a theoretical body of knowledge.

It is important to remember, however, that laboratory experimentation, as a technique for the development of an empirical body of knowledge, cannot exist by itself. Experiments in the laboratory must derive their direction from studies of real-life situations,

and results must continually be checked by studies of real-life situations. The laboratory experiment is a technique for basic and theoretical research and is not the goal of an empirical science.

We have, in this chapter, enumerated in some detail many techniques for designing laboratory experiments and for manipulating different kinds of variables in a variety of ways. Many of these techniques for the manipulation of variables involve deception, prevarication, misdirection of subject, and the like. As long as an investigator works with human subjects, it is impossible to overemphasize the necessity for keeping in mind the responsibilities to the subject and the ethics which the experimenter must follow. It is important, if such experimentation is to continue and is to be tolerated by the people who help in it, that the experimenter perform a service to the subjects in exchange for their help. In all laboratory experiments it should be a firm policy to give the subjects a full explanation at the conclusion of each experiment. This sometimes requires spending more time explaining and discussing matters with the group than it took to do the experiment. If it is done well, the subjects leave feeling that they have learned something and have not wasted their time. The subjects do not resent having been misdirected and deceived if they can see the reasons for the deceptions and understand the purposes.

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