AN EMPIRICAL STUDY OF JUDGMENT MAKING IN GROUPS USING QUALITATIVE CONTROLLED FEEDBACK

by

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ABSTRACT

This work gives an account of an empirical study on the assessment of judgments of individuals in a group. The phenomenon of judgment or decision making in groups appears in various contexts. However, we are interested in situations where each member of a group is required to give independently of other members of the group, his most informed and reasoned judgment on a controversial issue. Nonetheless, it is of interest to gain knowledge about the importance of various judgments about the issue, and also of the arguments (or reasons) put forward by the judges to support their judgments. Such situations of judgmentmaking raise methodological problems for collecting judgmental data, and methods, such as, face-to-face discussion or the Delphi method may not be appropriate. To circumvent this problem, a new method called 'Qualitative Controlled Feedback' (Q.C.F.) was developed by Press [13].

Our aim in the present work is to examine the workings of the method by its application to a real world situation. With this aim, judgments (and other data of interest) were collected, using a three-stage Q.C.F. survey, from a random sample group of Faculty and Staff members of the University of British Columbia on a question related to the issue of whether or not the University should build an Indoor Aquatic Center on the campus. The data was analysed from an exploratory viewpoint.

It was observed that qualitative controlled feedback creates a good interaction (in the sense of exchanging arguments and reasons) among the group members. Change in judgment occured as subjects went from one stage to another after having qualitative feedback of information. By comparing with a control group of subjects, it was also found that qualitative feedback was able to produce more rational judgments than without any feedback. The distributions of judgment obtained in this empirical study bear significant implications for decision making. The distributions were found to be bimodal and represented two opposing groups of thought. Other results involve regression analysis, transition probabilities of judgment change from one stage to another, analysis of judgment change behavior, importance of reasons, effect of non-response on judgment distributions and analysis of confidence in judgment. Finally, it was found that the method of Qualitative Controlled Feedback can be fruitfully applied to situations of practical interest.

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CHAPTER 1

INTRODUCTION

1 General Outline

This work gives an account of an empirical study on the assessment of judgments of individuals in a group. The phenomenon of judgmentmaking in groups appears in various contexts. However, we are interested in situations where each member of a group is required to give, independently of other members, his most informed and reasoned judgment on a controversial issue. The issue is controversial in the sense that there is no correct answer to the question of judgmentmaking. Nonetheless, it is of interest to gain knowledge about the importance of the various judgments and also of the arguments (or reasons) put forward by the judges to support their judgments. Such situations of judgmentmaking raise methodological problems for collecting judgments. We will discuss the problems in the following section. Our immediate question is: How to overcome the problems and collect judgmental data in situations as described above? An answer to this question has been given by Press [13] who has developed a method for collecting and analysing such data. This is the method of 'Qualitative Controlled Feedback'. The method has been described in Chapter 2.

Our aim in the present work is to examine the workings of the method by its application to a real world situation. With this aim, an empirical study had been undertaken whereby judgmental data was collected and analysed. The issue of judgmentmaking we selected for the purpose had originated in the University of British Columbia. The issue was whether or not the university should build an indoor aquatic center on the campus. Judgments, on a basic question of interest related to the issue, were collected from a

random sample of faculty and staff members of the university by using a three-stage qualitative controlled feedback survey. This work is a detailed account of the study and its findings.

2 Background

In this section we will review some material related to the psychology of judgmentmaking in groups and will outline the rationale behind developing the method of qualitative controlled feedback.

2.1 Some Basic Elements about Judgment(1)

The phenomenon of judgmentmaking may be described in terms of two sets of variables - stimulus variables and dependent variables. Stimulus variables are characteristics of stimulus objects or aspects of the stimulus situation calling for a judgment. For example, color, loudness, distance, attractiveness, etc. characteristics of objects may serve as stimulus variables in some situations of judgmentmaking. Four important dependent variables of judgment can be enumerated. They are::(1) the response by which the judgment is expressed or communicated, usually simply called judgment; (2) confidence or uncertainty of judgment; (3) the time taken by the judgment process; and (4) the difficulty of judgment.

Judgments may be classified into two broad categories - simple and complex - with respect to the nature of the stimulus variables. In case of simple judgments just one aspect or dimension of the stimulus object is to be judged and often the stimulus variable is clearly specified, and varies along a single dimension or continuuam. For example, judging loudness of voices is a simple judgment. On the other hand complex judgments

(1) For details see, for instance, [7], [8].

involve more than one dimension of the stimulus object and the stimulus variables may not be clearly specified. For example, in judging the importance of having either a hospital or a public recreation center in a city, the judge might consider such aspects as necessity, usefulness, and similar other characteristics of the two projects. These characteristics are not clearly defined and their number may vary from one judge to another.

In our present study of judgment, we are concerned with situations of complex judgmentmaking. We will be interested mainly in the first kind of dependent variable, that is, response of a subject on a question of making judgment; We have also collected data on the second variable, that is, confidence of judgment, at a later part of the study.

2.2 Group Judgment

It is important to realize the distinction between the terms 'judgment making in groups' and 'group judgment'. We use the former term to mean the task of making a judgment by an individual as a member of group, the other members of which are also engaged in similar tasks. Such groups are usually known as judgmentmaking groups or decisionmaking groups. On the other hand, by group judgment is meant a single judgment derived from the individual judgments of the group members. For example, the group may come to a consensus or the judgment of the majority may serve as the group judgment. Thus it must be emphasised that there is no fixed rule or criterion to derive the group judgment out of the individual judgments; the criterion may differ from one context to another.

In this study we are basically interested in seeing how better informed and reasoned judgments of the individual members of a group can be ob-

tained by using the method of qualitative controlled feedback. Once the judgments are obtained, it may be possible to derive group judgment from them by using some criterion.

2.3 The Rational behind the method of Qualitative Controlled Feedback

First we will review (1) the elements of the psychology of group processes, especially of face-to-face groups for judgment or decisionmaking, and (2) the Delphi method for forming group judgment.

Social psychologists have struggled for a long time to get an answer to the question: Which is better, the individual or the group? However, it was realized that the question was not quite meaningful; there are situations where individuals do better than groups and vice versa. The next question was: Under what conditions groups perform better? It has been found that the performance of a group depends, on the one hand, on the nature of the task, and on the other hand, on the interpersonal environment of the group [3]. In particular, it has been found that if the task involves intellectual activities in the sense that more ideas, views and alternatives need to be generated, the group performs better under certain conditions on the interpersonal environment. Thus, in situations of judgment or decisionmaking, where it is desired that a greater number of alternatives should be examined in the light of contrasting arguments and reasons, a group of judges should perform better subject to the condition: The interpersonal environment is such that it fosters independent thinking, free expression of ideas and views and the sense of respect in one member about other members' views. In other words, for a better performance of judgmentmaking groups, it is necessary that there should be a free interaction among the group members.

However, as Collins and Guetzkow [3] have shown, various obstacles in

the interpersonal environment stand in the way of free interaction among group members. The main sources of the obstacles are status hierarchy, personality styles, leadership styles and power of dominance. The impact of the obstacles may be that alternative views do not get representated, and also that undue weights are given, perhaps, to irrelevant factors. Effects of some other factors, such as, group cohesiveness, group norm and leadership on the performance of face-to-face decisionmaking groups has been examined by Janis [6]. He has found, after analysing the deliberations of actual world decisionmaking groups, that these factors may give rise to a phenomenon, he called, 'groupthink'. Groupthink is said to occur in a group if, in spite of their high intellectual ability, the group members refrain from critical thinking and manifest concurrence (or consensus) seeking behavior with an illusory optimism about the success of their decision. Group pressure is still another factor which inhibits free expression of views [1].

The objective of our above discussion was to show that, although, face-to-face discussion is the most common method for judgmentmaking in groups, it has many drawbacks; situations may arise when some other method may prove useful.

Delphi A different approach for soliciting judgment from the members of a group was initiated by Dalkey and Helmer [4] with a view to utilize expert judgment for forecasting future technological events. The method is named Delphi.(2) The idea behind the method is that of 'controlled feedback'.(2) Each member of a panel of experts are asked to give his judgment individually and independently on various aspects of future technolo-

(2) For a detailed definition see Chapter 2, page 8.

gical events. The judgments are given numerically and are collected by an intermediary. The intermediary then computes some summary measures, such as, mean, median, interquartile range etc. He, then, feeds back (i.e. gives information about) one or more of the measures, or perhaps, the entire distribution of judgments to each member individually(3). Each member is then asked again to give his judgment independently. Anonymity of the judges is preserved and this process of feedback and soliciting judgment is continued until convergence or consensus is reached.

With this basic principle, Delphi has been used in various ways and for a large number of applications.(4) . Although Delphi was used fruitfully in a number of situations for purposes of forecasting future events, it has been critisised as failing to meet standards of a methodology for social research.[14]. A principal objection is relating the idea of quantitative feedback. When quantitative measures, such as, mean is fed back, the panelists are psychologically persued to move their answer towards the given mean. This is because, if the panelist finds that his previous round answer is far away from the mean, he often feels that his answer is an outlier. Thus the panelists are artificially pressurized to move towards a consessus. It has also been argued that if, instead of forecasting future events, Delphi is applied to find a numerical answer to factual question, the answer produced by the consus of the judges may simply be wrong, that is, it may not be anywhere near the true answer.

In summary, while by using the controlled feedback approach Delphi attempts to avoid the various obstacles and their consequences (as discuss-

(3) This type of feedback is known as quantitative feedback.
(4) A list of these applications and studies is given by Linston and Turoff [10].

ed before in this section), by using a quantitative approach it produces obstacles to creating such interaction (e.g. exchange of alternative ideas) as desired by a judgmentmaking group (see first part of this section).

The problems of face-to-face discussion for forming judgment and also of the Delphi procedure lead to developing a new method that could overcome them (the problems). Such a method should, at least on principle, be able to provide an opportunity to the members of a group to form their judgments independently, and still come into interaction with other members of the group (e.g. by review of alternative arguments and reasons put forward by other members). It is for this objective that the method of qualitative controlled feedback has been developed.

3 Scope

In Chapter 2 the method of qualitative controlled feedback has been described and some statistical background useful for data analysis is presented. The various operational procedures, e.g. questionnaire preparation, data collection etc., related to planning and conducting a three-stage qualitative feedback survey are described in Chapter 3. Chapter 4 is devoted to data analysis. Finally, in Chapter 5, we summarise the main findings of the study, make recommendations for future applications, and suggest some further research directions.

CHAPTER 2

THE METHOD OF QUALITATIVE CONTROLLED FEEDBACK

The method can be described in two steps - first by defining 'controlled feedback' and then by defining 'qualitative controlled feedback'. We state these two steps as they appear in Press [13].

1 Controlled Feedback

A data collection protocol using a controlled feedback involves forming a random sample group of respondents and using the following procedure:

(1) Asking each group member to respond to questions privately and independently of all other respondents; he is specifically asked for an answer to each question, sometimes he is asked to provide justifying reasons for his answer;

(2) Collecting the answers (and possibly also, the reasons for the answers) from all group members (panelists), recording them, and then presenting (feeding back) some summary information about the group responses to each group member; each group member is then asked to respond to the same battery of questions again, without conferring with any other group members;

(3) Repeating the questioning and feedback process again, and again, until it stabilizes, in the sense that all panelists' responses are approximately unchanging from round to round. Thus, the process might terminate at group consensus, or at a point where there are several "judgment nuclei", representing several subgroups of hardened but differing positions.

In paragraph (2) above, it has been mentioned that the group members

are fed some summary information obtained from the previous round of questionning (and possibly collecting reasons). Here, two kinds of feedback can usually be considered - quantitative and qualitative. Quantitative feedback implies that some quantitative summary measures of information, such as, mean, median, mode, interquartile range, or possibly the whole distribution of responses are fed back. As an example, Delphi (Chapter 1) uses quantitative feedback.

2 Qualitative Controlled Feedback

A qualitative controlled feedback data collection protocol refers to a data collection procedure in which:

(1) Panelists are asked to give a response to a basic question of interest; in addition, panelists are asked to record justifying reasons (statements relating to their own values, in addition to what they believe to be facts) for the particular answers they are giving, to the question. The panelists are also asked for information about other explanatory (cue) variables about themselves.

(2) An intermediary then merges all of the reasons (eliminating replicated reasons that use differing wording), and forms a composite list of reasons;

(3) The composite of reasons is then presented (fed back) to each panelist (but no quantitative data, such as the group median or mean on the previous round, is fed back), and the group members are each asked to answer the same question again, and are asked again to provide justifying reasons for this round's response. They may then add to the composite, or delete some earlier given reasons, to form their individual current slate of reasons;

(4) The feedback process is now repeated again until the process

stabilizes. (That is, after a few rounds, panelists should no longer be able to create new reasons, and they should have hardened their positions on the basic question, since little new information will have appeared in the fed back composite of reasons).

3 Discussion

Although the basic principles have been stated above, it is worthwhile to discuss how one goes obout obtaining judgments using the method. Given an underlying population and an issue of judgmentmaking, a basic question relevant to the issue is prepared. An answer to this basic question is a judgment. To get a quantitative answer, the question may be framed in such a way that the answer can be chosen from a given scale. An intermediary(5) takes a random sample of individuals from the population to form a panel of respondents. The intermediary then solicits from each panelist, individually and independently, an answer to the basic question, and also his reasons for giving the answer, and possibly information on a set of respondent related cue variables(6). When this is done for all the members of the sample group, the first stage of data collection is over. The intermediary then prepares a composite list of reasons out of the reasons given by the panelists at the first stage. At the second stage, the composite list is presented to each panelist. Each panelist is then asked to answer the basic question again. However, when he answers the question, he is required to indicate which of the reasons in the composite list he would use to justify his own answer, and to provide new

(5) An intermediary is an individual or a group of individuals who designs and conducts the data collection process.

(6) Cuedvariables are explanatory variables in a regression sense, and relate to theodemographic, socioeconomic, and other sociopsychological background of the respondent.

reasons not contained in the list. He may delete some given previously by the panel (including his own). After the second stage is completed, the intermediary prepares a new composite list by including new reasons (given in the second stage) and dropping deleted ones (deleted in the second stage) and goes for the third stage. The process continues until the judgments stabilize, that is, until it is found that the changes in the panelists' responses are "small".

4 Objectives of the Study

Although the method of qualitative controlled feedback, as defined and discussed above, is conceptually promising and theoretically a much more sound technique for obtaining judgmental data, its worth can only be assessed by evaluating it in real world situations. It is only when the method is applied empirically that procedural problems can be identified, and subsequently, solutions can be sought and found. To find guidelines, so the method could be made operational, it was necessary to carry out a feasibility study. By studying feasibility we mean examining every aspect of the method in the light of an actual application. In particular, we have in mind the following questions:

(1) Is it possible to motivate people to take part in a multistage qualitative feedback survey?

(2) How actively do participants participate throughout the survey?

(3) Is it possible to create interaction among the participants through qualitative feedback?

(4) Do people change judgments from stage to stage?

We will seek answers to these and other questions in the course of our study.

5 Statistical Background[7]

In this section we present some statistical topics relevant to our data analysis. The first two subsections deal with regression models for response. Subsection 5.3 gives an outline of logistic regression which will be used for predicting nonresponse. Estimation of transition probabilities of reasons and importance of reasons are described in subsection 5.4, and finally a measure of round to round variation in response is defined in subsec. 5.5.

5.1 TAe Regression Model for the First Stage Response

We assume that the basic question of judgment can be answered numerically using a suitable scale. Let $Z_{i,1}$ denote the numerical response of respondent i to the basic question at the first stage, i = 1, 2, ..., N, N being the total number of respondents.

Let X_{ik} denote the value of the kth cue variable for respondent i, k = 1, 2, ..., r, where r is the number of cue variables. For the first stage responses, the usual multiple regression model is adopted. Then,

$$(Z_1|X) = X\beta + U_1,$$

$E(U_1) = 0$, $Var(U_1) =$
$E(U_1) = 0$, $Var(U_1) = \sigma^2 I_N$, where $Z_1 = (Z_{i,1})$ denotes an Nx1 vector of responses; $X = (X_{ik})$ denotes the Nxr matrix of cue variables; β denotes an rx1 vector of unknown regression coefficients; U_1 denotes an Nx1 vector of random disturbances associated with the first stage responses; and I_N denotes an identity matrix of order N.

We note that the assumption of uncorrelated disturbances is compatible with the fact that participants respond independently of each other at the first stage.

(7) Details of the statistical background are given in Press[13]

5.2 A Regression Model for the Response after Information Feedback[8]

Let $Z_{i,n}$ denote the response of the ith subject at stage n, n = 2, 3, ...,. We consider the regression of $Z_{i,n}$ on $Z_{i,n-1}$ which is given by

$$Z_{i,n} = \alpha_n + \beta_{n,n-1} Z_{i,n-1} + u_{i,n} ,$$

where α_n and $\beta_{n,n-1}$ are scalar constants and $u_{i,n}$ is a disturbance term.

For the error structure in the above model, we consider the fact that after information feedback, responses of the panelists are no longer uncorrelated. This is, because, at the second and subsequent stages, each panelist views the reasons given by the other panelists, and thus, is influenced by others in giving response. A correlation is, therefore, produced in the errors $u_{i,n}$. We also note that precisely the same information is fed back to each panelist on a given round. In addition, the protocol is such that the panelists are instructed not to communicate with one another. Thus, the correlation between the responses for any pair of panelists should be the same, on a given round; the correlation might change from round to round, however, since the feedback might change. For round n, $n \geq 2$, we therefore assume $E(u_{i,n}) = 0$; $Var(u_{i,n}) = \sigma^2_n$; $E(u_{i,n}\, u_{j,n}) = \lambda_n$, $i \neq j$. That is, in matrix form, if $u_n = (u_{i,n})$,

$$E(u_n) = 0,$$

$$Var(u_n) = (\sigma^2_n - \lambda_n)\, I_N + \lambda_n\, ee'$$

where e denotes an Nx1 vector of ones.

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(8) For a more general model see Press [13]

5.3 The Logistic Regression[9]

The logistic regression is useful when the dependent variable in a regression is dichotomous, indicating, for instance, the presence or absence of some attribute in an observation. Let Y denote the dependent variable, and let Y take values 1 and 0. Thus, for example, Y takes the value 1 if the attribute is present, and 0 if the attribute is absent.

Let p = Prob(Y = 1); then 1 - p = Prob(Y = 0). The equation for the logistic regression is then given by

$$p = \frac{1}{1 + e^{-a - b'x}}$$

where x is a nx1 vector of explanatory variables, b is a nx1 vector of constants, a is a scalar constant and the prime denotes transpose.

5.4 Importance of Reasons

As discussed before, at each stage participants give reasons supporting their answer to the basic question. The panelists evaluation of the importance of reasons on each stage is measured by $p_{\alpha n}$, the proportion of panelists who give reason α on stage n. It may also be of interest to estimate the importance of reasons at stage n+1.[10] Estimating the importance of reasons may be carried out according to the following scheme.

Let $Y_n(\alpha)$ be a random variable taking values 1 or 0 according to whether or not a given respondent gives reason α on stage n. Then the

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(9) See, for example, Nerlove and Press [11]

(10) The ultimate use of estimating the importance of reasons at the next future stage is to predict response at that stage (see Press [13])

transition probability, $\pi_{ij}(\alpha) = P[Y_n(\alpha) = i | Y_{n-1}(\alpha) = j]$ for $i,j = 0,1$. Here it is assumed that individuals tend to reassess their slate of reasons anew on each stage, merely on the basis of the composite list presented to them, and thus, the dependencies of the values of $Y_n(\alpha)$ on successive stages follows a one step Markov scheme. So the probability distribution of $Y_n(\alpha)$ depends only on stage n-1 and not on any earlier stages. For estimating the probabilities, let $n_{ij}(\alpha)$ denote the number of panelists who are in state i, at stage n, and who were in state j, at stage n-1, for reason α, $i,j = 0,1$. Then the maximum likelihood estimators of the $\pi_{ij}(\alpha)$ are:

$$\pi_{11}(\alpha) = \frac{n_{11}(\alpha)}{n_{11}(\alpha) + n_{01}(\alpha)},$$

$$\pi_{10}(\alpha) = \frac{n_{10}(\alpha)}{n_{10}(\alpha) + n_{00}(\alpha)}$$

$$\pi_{01}(\alpha) = \frac{n_{01}(\alpha)}{n_{01}(\alpha) + n_{11}(\alpha)}$$

$$\pi_{00}(\alpha) = \frac{n_{00}(\alpha)}{n_{00}(\alpha) + n_{10}(\alpha)}$$

We next note that

$$P[Y_{n+1}(\alpha) = 1] = \sum_{j=0}^{1} P[Y_{n+1}(\alpha) = 1 | Y_n(\alpha) = j]\, P[Y_n(\alpha) = j]$$

so that an estimator of the left hand side is

$$p_{\alpha,n+1} = \pi_{10}(\alpha)(1 - p_{\alpha,n}) + \pi_{11}(\alpha)\, p_{\alpha,n}.$$

This gives an estimate of the importance of reason α at stage n+1.

5.5 Measure of Round-to-Round Variation in Response

In order to measure the extent of variation in response from round to round, a quantity Q_n may be defined as follows:

$$Q_n = \frac{1}{N} \sum_{i=1}^{N} [z_{i,n} - z_{i,n-1}]^2$$

where $z_{i,n}$, $n = 2,3, \ldots$, is the response of the subject i at stage n. Thus Q_n can be calculated for $n = 2, 3, \ldots$. It can be seen that the value of Q_n depends on the extent of change in response from one stage to another; its value being zero if there is no change in response. Q_n can also be used as a stopping rule, that is, to decide how many times information should be fed back, and when should the process be brought to a halt. The notion is to stop iterating if subjects are not changing their position "much" from round to round. This means that the process should be stopped when Q_n has declined to a "small" value. How "small" is small enough must be determined subjectively.

CHAPTER 3

AN EMPIRICAL APPLICATION

1 The Application Situation

For applying the method of qualitative controlled feedback, the first task for us was to find an application situation; a situation where there was an issue of judgmentmaking with an underlying population of interest. Fortunately, at the time of initiating this research (June,1976), the University of British Columbia was starting construction of an indoor aquatic center on the campus. Construction of this center had been an issue of a good deal of controversy for more than five years within the university community (consisting of more than 25,000 students, faculty and staff). In spite of the involvement of such a relatively large population and a considerable amount of construction cost, no systematic effort was made (apart from two student referendums of yes-or-no type) to see what the community really felt, for example, about the importance of having the center. Furthermore, the university was not commited to construct the center, beyond a small initial preliminary construction stage, which could have made use of the site for many other purposes.

Apparently the university community was divided into two major sub-groups; one in favor of constructing the center, and the other against construction. A third group of neutral and uninformed people also existed. Also, it was quite natural to expect that the members of the community had something to say (reasons) as to why the center should or should not be constructed. As has been mentioned in the previous chapter, qualitative feedback aims at exploiting these individual nuclei of reasons by an inter-

acting process of feedback. Under these considerations, it was found that the method of qualitative feedback could be applied fruitfully to solicit judgments on a question which would be of interest to all members of the University community.

2 Background of the UBC Indoor Aquatic Center

It is well known by the denizens of the Vancouver/Seatle area that rain occurs very frequently and that forty inches per year is typical. For some reason however, the existing swimming pool at the University of British Columbia is outdoor, so that it is not used a large fraction of the time by most of the University community.

In early 1970, a recreation group of the university asserted the need for a covered swimming pool on campus, and proposed that the existing Empire pool be covered. The Alma Mater Society (AMS) of the university took the issue into their hands. In the subsequent years, in consideration of the relative cost and facilities, the idea of covering the Empire pool was rejected in favor of constructing a full scale indoor aquatic center. The AMS also proposed that a student levy of $5.00 per student, per year, be imposed to raise the share of student contribution towards construction of the center. Controversies among the students began as to whether or not the center should be built and the levy imposed. This led to a student referendum in October, 1972. About 4000 students participated in the referendum, and 67.3% voted in favor of constructing the center, and of imposing the proposed student levy. The AMS could not proceed with other aspects of the center until the Board of Governors approved the student levy in September, 1973. After this, while the AMS was busy with the planning and designing phase of the center, a new move

against student funding of the center started in September, 1974. This led to another referendum as to whether or not the students were still willing to pay the $5.00 fee. In this November, 1974 referendum about 6000 students participated of which 71 % voted in favor. Finally the decision to construct the first phase of the center was taken. The total cost of construction was estimated to be $4.5 million in 1974.

The proposed site (in front of the Student Union Building) was also a matter of debate in the community. Since the construction of the center at the site would destroy some beautiful trees and scenic beauty of the site, and also that the ground could be used for needed academic buildings, objections were raised against construction of the center. Apart from these issues, it was also a question of debate as to whether it was really worthwhile, with regard to the alternative needs of the university community, to have such alarge facility by spending a large amount of money that could be used for more demanding academic buildings (or other purposes). However, in view of the student referendums only, the decision to begin construction of the center was taken.

It was planned that the center be constructed in two stages. Although a ceremonial starting was marked in November, 1975, actual construction began in June, 1976. Finally, it was decided that if the center was to be completed, it would have to be financed by the University, Provincial and Federal Government grants, donations from Faculty and Staff of the University and the general public, and from contributions from Students. The center was designed to be used for a variety of recreational and academic purposes. But should construction really proceed beyond the initial stage?

3 Overall Plan of the Survey

Like other sample surveys, careful planning was necessary at the beginning. However, unlike the usual surveys, a feedback survey has the distinctive feature that it is not finished just by filling out a questionnaire only once; participants are to be followed up in subsequent stages with feedback of information (reasons). Thus, planning a feedback survey requires much more attention than in the usual ones. Planning is done keeping in mind the interrelated nature of the survey.

The overall planning may be described in terms of four broad actions: (1) specification of the underlying population, (2) selection of sampling scheme, (3) determining the number of stages and the sample size and (4) working out strategies for questionnaire design for each of the stages. These actions are discussed in the following subsections.

3.1 Population of Interest

We are interested in the judgment of the members of the University community on the general issue of whether or not the university should construct an indoor aquatic center on its campus. By its usual meaning, the community consists of students, faculty and staff members. However, due to the experimental nature of our survey we planned the population under study to consist of only faculty and staff; students were dropped for several reasons.

Students can be classified into two broad categories - "regular" and "irregular". The first category consists of the full-time graduate students and the undergraduates who register for the eight months period from September through April. Irregular students are the part-time students and intersession and summer session students. However, when we planned

the survey in June, 1976 (Intersession), a large part of the regular students were unavailable. Most of the Intersession and Summer Session students attend the university only for two months, and they are not involved in the the usual student affairs. Also the Intersession students may not be available to participate in all the stages of the survey, if it were to take more than two months, (which was likely to be the case, since the researcher carrying out the procedural aspects of the survey (the author of this thesis) was a full-time graduate student with many other responsibilities).

These considerations led us to decide that the population under investigation be limited to Faculty and Staff members of the University. We used the payroll list, prepared by the department of Finance of the University and published by the Data Processing Center, as our frame for drawing the sample. According to the June, 1976 statistics, a total of 2,194 Faculty and 2,825 Staff members were employed in the University, a total population size of 5,019.

3.2 Sampling Scheme

In view of the nature of the population it was decided, a priori, that a stratified random sample be drawn. The population consisted of two groups of people, Faculty and Staff, who were quite different with respect to type of job, educational background, and probably, but most importantly, with respect to their attitudes towards construction of the center. A Faculty member may be expected to prefer money spending on a project which is more of academic nature than on a project which is more of a recreational nature. A staff, on the other hand, may not be that much biased towards having an academic project. In short, on an average,

a staff may be expected to attach higher importance to the center than that of a Faculty member. These considerations lead us to choose a stratified random sample with two strata.

3.3 Number of Stages and Sample Size

Although, in principle, a feedback survey should be continued until responses of the participants stabilize, in this academic application, due to limitations of time, and the fact that clerical work had to be handled by the author only, and other factors, we fixed the number of stages beforehand, at three. Stabilization of judgment might or might not have occured within the three stages. However, it is expected that after a few rounds subjects are not likely to change their responses too much.

The question of how many stages is enough is related to determining the sample size. We were aware of the fact that at each stage of the survey, it could be expected that some nonresponse would occur. Thus, the number of participants (sample size) at the final stage was less than the same number at the first stage((about 63% response rate).

A relationship between the final stage sample size and the rates of nonresponse at different stages can be established. Let r_n be the nonresponse rate at stage n and let f_1 denote the sample size at the beginning of the first stage; then the number of subjects, f_k, who complete stage k is given by the integer part of the right hand side of the following equation:

$$f_k = f_1(1 - r_1)(1 - r_2) \ldots (1 - r_k)$$

where $0 \leq r_i \leq 1$ for $i = 1, 2, \ldots, k$. In particular, if $r_1 = r_2 = \ldots = r_k$

= r (say), then

$$f_k = f_1(1 - r)^k.$$

In our case, with three stages, we have k = 3. We also desired to end up with a final stage sample size, f_3, of at least 100. With a rather pessimistic outlook, we took f_1 to be 190.(11)

The next task was to allocate the sample size of 190 between the two strata of Faculty and Staff. With a view to ending up with approximately equal numbers from each group, and considering the fact that the Faculty members are more likely to move out of the university during summer (our first data collection period), we allocated a sample size of 105 to Faculty and 85 to Staff. When the actual sample was drawn, it was found that 9 of the Faculty members and 4 of the Staff members left the university and were not available for solicitation. Thus, finally we were able to solicit response from 81 Staff members and 96 Faculty members at the first stage, giving a revised first stage sample size of f_1= 177.

3.4 Strategy for Questionnaire Design

To maximize consistency in questionnaire design at various stages, we found it convenient to set up a general strategy for questionnaire design; the thinking behind this strategy was the following. Questionnaires of a feedback survey serve two purposes: one, to get desired information from the subject, and, two, to feed appropriate information back to the subject. In preparing questionnaires at each stage of the survey, one needs to be explicit about these two types of information. Once this

(11) In actual practice, as will be found latter, we ended up with an f_3 of 111 and r_1 = .17, r_2 = .19 and r_3 = .07.

has been done, the next task is to prepare questionnaire items for getting information and determine how to present the information we want to feed back. In summary, the following are the two steps we used in preparing questionnaires:

Step 1. Identify what information to 'get' and what information to feedback.

Step 2. Prepare questionnaire items to get information and work out a format for feeding information back.

In the rest of this chapter, we will describe questionnaire preparation with reference to these two steps.

4 First Stage

We have already discussed in the preceding section the background for starting the survey. Questionnaire preparation for the first stage is now described below.

4.1 Questionnaire Preparation

We follow the two steps mentioned in the last section.

Step 1. According to the methodology described in Chapter 2, we need the following information from each subject, independently:

(1) Numerical answer (or judgment) to a basic judgmental question,

(2) Reasons supporting the answer to the basic question, and

(3) Information on cue variables.

Also, the panelists need to be provided with the background information about the issue of judgmentmaking.

Step 2. First we discuss the formulation of the basic question and the questionnaire items on cue variables.

The Basic Question. The basic question is intimately related to the issue of judgmentmaking. In our case, the general issue was whether or not the university should build an indoor aquatic center. However, we are not interested in a 'yes' or 'no' type answer, as is usually done in voting. We are rather interested in a value judgment which may relate to such characteristics as 'importance','necessity', 'desirability', etc. Also, we need the question to be such that it can be answered numerically using a given scale. The characteristic we chose was 'importance'; and the basic question was: " How important (necessary) do you feel it is for the University of British Columbia to complete construction of an indoor aquatic center on the campus that would be available for use by students, faculty and staff and their families, and the general Vancouver community?"

Scale. For answering the above question numerically, a scale needed to be specified. A 9-point rating scale was designed to represent individual feelings about importance. The two extreme points of the scale were chosen to be 'Extremely Unimportant' and 'Extremely Important'; these two end points were assigned numerical values 0 and 100 respectively. The whole range between 0 and 100 was then partitioned by seven other points at equal intervals, the interval being 12.5. The scale points were: 0, 12.5, 25.0, 37.5, 50.0, 62.5, 75.0, 87.5 and 100. The next task was to assign verbal equivalents to the seven remaining points. First, the point 50.0 was chosen to be the neutral point, and thus was assigned 'indifferent or neutral'. The remaining six points were then assigned verbal statements in such a way that they conform to the equal numerical distance as much as possible. They are: 'Very Unimportant' (12.5), 'Moderately Unimportant' (25.0), 'Somewhat Unimportant' (37.5), [illegible] (62.5), and [illegible] Important

'Somewhat Important' (62.5), 'Moderately Important' (75.0), and 'Very Important' (87.5).

Selection of Cue Variables.[12] Considering the nature of the response variable (importance rating), the following cue variables were selected.[13] Selection was done on a subjective basis. Variables, such as, academic status, i.e., whether a participant is a faculty or staff member (4),[14] 'sex'(7), 'whether or not a participant knows how to swim' (9), 'whether or not the participant lives on campus'(10) are obviously relevant. In selecting some other variables, attention was given to pick up some psychological variables and variables related to usability of the center by a participant. In the first category are: 'whether or not the participant had already donated'(12), 'in case a panelist did not donate, whether or not he was willing to donate'(13) and 'how much annual fee a participant would be willing to pay for use of the center' (14). In the second category are: 'whether or not the participant's family members would use the center'(8) and 'frequency of use by the participant'(16). Two other variables are: 'whether or not the participant had a swimming pool near or in his residence'(15), and 'whether or not it takes the participant more than 30 minutes to commute to the campus'(11). Variables 4, 7, 8, 9, 10, 11, 12, 13, and 15 are dichotomous and participants were asked to check 'yes' or 'no'; variable 14 is quantitative. For variable 16 an ordered categorical scale was used with 4

(12) Some other cue variables were introduced in the second and third stages; they will be discussed in Sec. 5 and Sec. 6.

(13) Two questions related to the students were also added in the questionnaire. However students were latter excluded from the survey.

(14) These numbers in the parentheses are the corresponding item numbers in the first stage questionnaire (see Appendix A_1).

categories.

Information Feeding. As has been mentioned in Step 1, the only information we need to give is the background information about the issue of judgmentmaking, which, in our case, is related to the construction of the center. This was done by using a letter accompanying the questionnaire. The letter was also carefully composed to educate panelists about the entire process of the survey and its objectives, and also to give necessary instructions for filling out the questionnaire. In particular, it was emphasized in the letter that participants should fill out the questionnaire independently (without consulting with one another) and that they should give reasons for their answers.

Pilot Survey. After the preliminary questionnaire was prepared, a pilot survey was carried out for testing it. The respondent group consisted of 15 subjects from Faculty, Staff and Students with 5 in each category. The pilot survey brought out some problems with the preliminary questionnaire and demonstrated where modifications were needed; accordingly the questionnaire was revised.

4.2 Data Collection

Data collection was done by first contacting each subject in the sample group by telephone, and delivering the questionnaire personally. It was then left with the participant to fill out and send back by mail.[15] In the early part of data collection, we attempted a face-to-face method of administering the questionnaire; i.e., the participant was asked to complete the questionnaire in the presence of the inter-

(15) Since the respondents were all employees of the university they could use the campus mail without any postage.

viewer. However, it was soon found that respondents were demanding more and more that the questionnaire be left with them so they could fill it out according to their convenience and return by mail. The reason for this, according to the interviewer's experience, was that the respondents wanted more time to think about the reasons before they record them (reasons); since respondents were solicited during office hours, possibly, they did not want to divert their attention to something which needed some careful thinking.

At this point, it is worthwhile to mention two points - quality of response and rate of response. The issue of the relationship between quality of response and response time has been discussed by Sackman [14]. In our case, it has been observed that the respondents wanted not only sufficient time to think about answer to the basic question, and their supporting reasons, but also that the time should be according to their convenience (e.g. on weekends or lunch hours). If the respondents were pressed otherwise, the quality of response might be poor and also it could have an adverse effect on the response rate on subsequent stages. In view of the 'follow up' nature of our survey, one of the tasks of the first stage was also to motivate participants to take part in the latter stages of the survey. In consideration of these factors, it was decided that the questionnaires be delivered to the respondents in person and be left with them for completing and returning by mail.

A total of 147 (= 76 faculty + 71 staff) subjects participated in the first stage out of a total of 177 (= 96 faculty + 81 staff) solicited. The response rate was 83.05 percent.

5 Second Stage

5.1 Questionnaire preparation in the second stage involves certain things which were not encountered in the first stage; one of these is the preparation of a composite list of reasons. This list has to be prepared from the reasons the participants gave at the first stage.

Step 1. Each participant should again answer the basic question (already formulated in the first stage), and also give reasons supporting his answer. However, now a respondent should give reasons from a composite list (to be provided), and in addition, may give new reasons not contained in the list.

It may also be desirable to get information on some additional cue variables. Although, information on the cue variables should be asked at the first stage, in actual practice, it may happen that the investigator discovers some additional cue variables that were not included in the first stage, but which are deemed to be important. We picked up three additional cue variables. In our case, they were: 'age of the participant',[16] 'duration of membership of the participant with the university
university community', and 'category of job' (e.g. administrative, clerical, etc.) if the participant was a staff member.

Now we identify the information for feeding back. First, each participant should be given a composite list of reasons. Apart from

(16) In fact, age was included in the preliminary first stage questionnaire. However, it was observed in the pilot survey that many female respondents declined to state their age. Anticipating that this item might have adverse psychological effects on the particiپatiopation of females, the item was dropped from the revised first stage questionnaire.

that, we need to consider the issue of whether or not a panelist should be provided with the response (answer to the basic question) he gave at the first stage as well as the reasons he gave at that stage. This issue needs some examination.

First, if a participant is provided with his last stage's answer, and reasons, two things may happen: (1) on being reminded, he may develope a bias towards sticking to his original answer, and (2) he may develope a self-consciousness and still feel free to revise his original answer and reasons in the light of the new information contained in the composite list of reasons. Second, if the participants are not provided with their original answers and reasons, we may run into the problem of losing uniformity in the experiment, i.e., some of the participants might be able to recall their answers and reasons, while others may not; this would be likely to create a difference in behavior at the second stage.

Now, as has been mentioned before, the objective of qualitative controlled feedback is to provide panelists with maximum opportunity to share group information and thinking so that they can make a reasoned judgment (with minimal social pressure). On this basis, we decided that a panelist should be given the opportunity of reviewing his last stage's answer and reasons.

In summary, the information we wanted is: (1) answer to the basic question,aand (2) reasons from within the composite list or outside the composite list, and (3) information on cue variables. On the other hand, the information we needed to provide to the group includes: (1) a composite list of reasons, (2) the participant's own first stage response,

and (3) the participant's own first stage reasons.

Step 2. First we discuss preparation of the composite list of reasons.

Preparation of the Composite List. Let us, first, examine the general nature of the reasons given by the participants. Each subject was asked to write his own reasons. It was found that more than 90 percent of the respondents wrote their reasons. While many of them became precise, and apparently realized the objective of asking reasons, nonetheless, there were others whose reasons were not quite clear (at least to the investigator).. Also, reasons given by one panelist sometimes seemed the same as those given by another; a close examination revealed differences in meaning and emphasis. This inherent difference in the meaning of sentences made the task of making a single reason out of two or more, difficult.

Nonetheless, as is done in the case of enormous statistical data, it is necessary to process and summarise the verbal statements in order to make the information contained in them comprehensible to a respondent. This forces the investigator to make some kind of trade-off between dropping very minor details to reduce the number of conceptually distinct reasons to a minimum, and some loss of group information.

At this point, we must mention the phenomenon we observed of interpreting and answering a question with respect to different frames of reference, by different persons. This phenomenon was also observed by Campbell [2] and Speak [16]. They found from empirical research that people interpret the same question according to widely differing frames of reference.. Its existence, in our case, could be identified from the

reasons the panelists gave. First, let us look us at the basic question. The question asked the respondents for judgments about the importance of the center for the community. It was, therefore, expected that the reasons given by a participant should have also refered to the community as a whole. However, it was found that some of the participants (relatively few) gave reasons which may be termed as 'personal reasons'; for example, " I don't swim and will never use it", "I enjoy swimming and want to use it at lunch hour", etc. This indicates that the concerned participants interpreted the basic question from the viewpoint of importance to himself - the frame of reference for answering the question were different from what was expected.

Whereas questions may arise as to what to do with these reasons, the more basic question for us was: How to check against differing frames of reference, or interpreting the question differently, in subsequent stages? In order to keep the respondents from repeating the same phenomenon in the second, and subsequent, stages, we dropped the personal reasons from the composite list - an attempt towards a uniform frame of reference.

Before going on to discuss actual preparation of the composite list, we need to mention two other points. First, the number of reasons to be included in the list, and second, the number of words in the statement of a reason. It is possible to prepare a very exhastive list containing all points of views presented by the partipants; but, in that case the list may contain a very large number of reasons. A very long list of reasons may have an adverse psychological effect on the participants in that thay may feel discouraged to go through all the

reasons very carefully. For example, they may read only the first part of the list and then go to answer the basic question; this is likely to have an effect on the quality of response.(17)

The second point concerns the number of words in the statement of a reason. Salancik, et al [15] found, in the context of Delphi event statements, that people tend to interprete sentences in a variety of ways if the number of words in the sentence is both too few and too great; in the first case, because of insufficient constraints on interpretation and in the second case, there are too many elements to assimilate into a single interpretation.

Thus, a kind of balance has to be made so the number of reasons is not too large, and also the statement of a reason is not too big or short and is easy to have a single interpretation.

We, now, describe the particular technique we used in preparing the list. After studying each participant's slate of reasons very carefully, it was found that some specific 'points of view' could be identified in a participant's reasons. These 'points of views' were sorted out and noted down. It was observed that the 'points of views' could conveniently be put into one of the two broad categories, 'pro' and 'con'; 'pro' meaning 'in favor of having an aquatic center' and 'con' meaning 'against having such a center'.

The major points of view within the pro category were: 'year-round

(17) In order to see whether ordering of reasons has an effect on the answer, or reason-giving, randomised and nonrandomised lists were introduced in the third stage (see Sec. 6, Appendices A3 and A4 and Sec. 7 of Chapter 4)

swimming facility (with emphasis for winter)', 'need of the physical education department for training purposes', 'the center's social role as a mixing up media between university-people and the surrounding community', 'need for general recreation', 'the center's role for promoting standard of competitive swimming', and 'shortage of swimming facilities in Vancouver'. The points of view within the con reasons could be identified as: 'university is mainly an academic institution', 'priority of spending money on academic rather than recreational buildings', 'covering the existing pool', 'abundance of indoor and outdoor pools in the city', 'center's limited expected use to the community', 'large cost compared to limited use', 'plenty of recreational facilities on campus', 'alternative proposals for spending the money' and 'alternative for physical education department'.

These points of view need not be completely mutually exclusive; but, it is the task of the investigator to judge which point of view fits best to the reasons given by a certain participant. In doing this, some major details may have to be dropped. Once the points of views of each participant were identified, the next task was to sort out the statements from each reason's slate to different points of view groups. Care was taken to see that the overall arguments presented by a participant might not be distorted when doing this.

The final step was to compose a statement from the individual statements within a certain point of view group, such that it best represented all of them. Thus, corresponding to each point of view, we had a reason in the composite list. It can be seen in Appendix A2 that the reasons 1 through 8 are the pro reasons, while the reasons 9 through 17 are the con reasons.

Cue Variables. We have already discussed selection of cue variables in Step 1. The questionnaire item for age of the participant was prepared keeping in mind that the participants should not be required to write their exact age. Thus, they were asked to check one of five age groups.(18) A similar questionnaire item for the variable,'duration of membership in the UBC community' was also included in the questionnaire.

5.2 Data Collection

At the second stage, response was solicited only from those who participated in the first stage. The entire data collection was done by mail questionnaires using the university campus mail. Participants were informed beforehand that questionnaires were being mailed. Those who failed to return the questionnaire within a certain deadline, were reminded by telephone calls, or by reminding letters. It took about 8 weeks to complete the data collection.

In the second stage, 147 persons (=76 faculty + 71 staff) were solicited. A total of 119 response (= 58 faculty + 61 staff) were obtained. The overall response rate was 80.95 percent.

6 Third Stage

The general procedure for conducting the survey was the same as in the second stage. However, some new elements, such as, randomisation of the reasons in the composite list, and use of self confidence ratings for assessing confidence in judgment was made. We discuss them below.

(18) In contrast to our pilot survey it was found that at the second stage all of the female participants answered this item on age.

6.1 Questionnaire Preparation

Step 1. Apart from the answer to the basic question, reasons from a new composite list were needed from the participants. In addition, it was decided that information on a new cue variable, related to the location of the participant's residence, was needed, and information about the confidence in judgment of the participant should be asked. Information on confidence was sought to see whether one's self confidence in judgment increased after feedback.

As in the second stage, each participant needed to be provided with a new composite list, his second-stage response to the basic question, and the reasons he gave in the second stage.

Step 2. Preparation of the composite list at the third stage was much easier, since only a few new reasons were generated by a few subjects. There were 9 new reasons, generated during the second stage, each of which represented a specific point of view. These reasons were added to the second stage composite list of 17 reasons, which gave a total of 26 reasons in the third stage composite list. Next, in designing the format of the composite list, it was decided that two different formats be used - one with all of the "pro" reasons appearing at the first part of the list, followed by all the "con" reasons, and the other, with randomised ordering of reasons. The objective of doing this was to see whether the two procedures would produce any differences in response. In order that participants might recognize the new reasons, a '*' was attached to each of them. Participants were reminded of their last stage's reasons by checking in the list. (see Appendix A4)

Another point related to the list of reasons needs to be mentioned

here. Since a participant had no knowledge about the proportion of persons who gave a certain reason, it was anticipated that he might develope a tendency towards supposing that each reason was given by an equal proportion of persons. Since such a supposition might have an effect on his selecting reasons, it was decided that participants should be explicitly warned against such a supposition. In effect, an warning was included at the beginning of the questionnaire (see Appendix A3).

The only cue variable at this stage was "location of residence". For preparing the questionnaire item the Greater Vancouver Metropolitan Area was divided into 9 regions (including an "other" category), and respondents were asked to check the locality in which they lived.

Our last questionnaire item was "confidence rating". A 9-point rating scate was used for the purpose, and participants were asked to indicate on the scale their self confidence about the judgment they gave at the third stage.

6.2 Data Collection

In the third stage, only those subjects who completed the second stage were solicited. In view of the two types of questionnaires - with randomised and nonrandomised composite list of reasons - the entire group was divided into four subgroups on a random selection basis. These subgroups consisted of two subgroups of equal size from each of the groups faculty and staff. Out of the two subgroups from faculty, one was randomly picked for the randomised list, and the other for the nonrandomised list. In a similar way, the two subgroups of staff were also assigned to the two types of questionnaires.

Data collection was done through mail questionnaires in a similar way as was done in the second stage. The time taken to complete the data collection was about 8 weeks. A total number of 119 subjects (= 58 faculty + 61 staff) were solicited of which 111 responses (54 faculty + 57 staff) were obtained. The overall response rate was 93.28 percent.

7 The Control Group

We need to mention that a considerable amount of time (about 6 months) had passed in going from the first stage to the third stage. The first phase of the construction of the center was well in progress by this time. In addition, some other conditions might have changed; d due to which subjects felt in a different way (about the issue of judgmentmaking) than what they felt at the first stage of the survey. This change in the conditions of the experiment might have an effect on its results. As for example, it was found in the course of the survey, that a certain proportion of participants changed response from stage to stage; the question arises as to whether the change in response that occured was due to feedback of information (reasons), or simply due to the passage of time, or, possibly, due to both feedback and time. In order to resolve questions like this, a new group of subjects was selected and solicited. This group was used as a "Control Group".

The control group consisted of an independent group of people (who were not in the experimental group at any stage), selected randomly. This group was solicited at the same time as the third stage. However, in case of the control group, the first stage questionnaire (with some additional cue variables) was used (see Appendix A5). Thus, information

given to the control group was the same as that given to the experimental group at the first stage; there were no reasons fed back, however, as the control group was given only the first stage questionnaire.

A random sample of 110 subjects were selected for the control group and were solicited by using mail questionnaires; 89 responses were obtained which resulted in a response rate of 80.91 percent.

CHAPTER 4

DATA ANALYSIS

This chapter is devoted to the data analysis. In Section 1, response rates at different stages have been compared. Section 2 deals with the empirical judgment distributions; three hypotheses have been tested comparing the distributions. In Section 3, the phenomenon of judgment change from stage to stage is considered in detail. Section 4 is devoted to estimation of the regression models of response which were described in Chapter 2. In Section 5, we examine whether or not the dropouts of the survey are likely to have an effect on judgment distributions. We studied the behavior of participants with respect to reason-giving in Section 6. In Section 7, we examined whether ordering of the reasons in the composite list makes any difference on the part of the participants in giving judgments or reasons. Finally, the distributions of confidence ratings are compared in Section 8 to see whether feedback of information increases confidence in judgment.

1 Comparison of Response Rates

Table I, on the following page, gives the response rates at each stage of the survey and also for the control group. Rates for the two groups - faculty and staff - are shown separately. First, we compare the response rates at the first stage with that of the control group, and second, between the rates of the three stages of the experimental group. It is seen that the rate in the first stage is little higher than that of the control group. Recall that the first stage data collection was done by personally delivering the questionnaire to the

Table I. Response Rates

Groups	Stage	Number Solicited	No. of response	Response rates(%)
Faculty	1	96	76	79.17
	2	76	58	76.32
	3	58	54	93.10
	Control	55	46	83.64
Staff	1	81	71	87.65
	2	71	61	85.92
	3	61	57	93.44
	Control	55	43	78.18
Overall (Faculty & Staff Combined)	1	177	147	83.05
	2	147	119	80.95
	3	119	111	93.28
	Control	110	89	80.91

participants, and then by telephone follow ups, while the control group was done completely by mail questionnaires. It is our contention that the higher rate of response at the first stage has occured due to higher motivation to participate brought out by personal contact. Now, comparing the response rates of the experimental group, we find that whereas the rates at the first two stages are almost equal, the third stage rate differs from them by at least 10 percent. An explanation for this may be that participants who were highly motivated and prepared, completed the second stage, and most of them also completed the third stage; on the other hand, subjects who participated only reluctantly at the first stage, dropped out at the second stage. Thus, we may, in general, expect a hugher response rate at the third stage compared to the earlier two stages, in a three-stage survey. Such a conjecture seems reasonable for the time delays between stages that we experienced in this experiment. If interstage times were substantially reduced, the response rate pattern

would probably change also.

Finally, 62.71 percent of all the subjects who were in the sample at the beginning of the survey completed all the three stages of the survey.

2 The Empirical Judgment Distributions

In this section, we study the empirical distributions of judgment at the three stages of the experimental group, and also for the control group. These distributions are of fundamental importance in understanding the judgment structure of the group. They reveal various facts, e.g., whether or not there exist subgroups of differing judgment; if there are, how divergent the subgroups are in their judgments; and so on. Apart from comparing the distributions from their graphs, means and standard deviations (Subsections 1 and 2), we check three hypotheses of interest in Subsection 3.

2.1 Graphical Representations of the Judgment Distributions

Table II gives the distributions of judgment in relative frequencies for the three stages and the control group. Histograms of the distributions are given in Figures 1(a) through 3(c) and Fig. 4. In Figs. 5(a), 5(b) and 5(c) the superimposed, freehand drawn, frequency curves for the first, second the third stage are shown; they refer respectively to the combined group, Faculty and Staff. Finally, in Figures 6(a) and 6(b), superimposed curves of the first stage vs. the control, and the third stage vs. the control, respectively are shown. Note that no effort has been made to statistically smooth out the bumps in the frequency curves - they were just used for approximate descriptive

Table II. Empirical Judgment Distributions (in percent)*

Response (Judgment)	First Stage			Second Stage			Third Stage			Control		
	Faculty	Staff	Combined	Faculty	Staff	Combined	Faculty	Staff	Combined	Faculty	Staff	Combined
0	5.56	5.56	5.41	5.56	5.26	5.41	7.41	5.26	6.31	8.70	6.98	7.87
12.5	12.96	3.51	8.11	14.81	3.51	9.01	12.96	8.77	10.81	2.17	4.65	3.37
25.0	12.96	5.26	9.01	7.41	12.28	9.91	12.96	15.79	14.41	8.70	6.98	7.87
37.5	3.70	5.26	4.50	12.96	12.28	12.61	9.26	3.51	6.31	4.35	4.65	4.49
50.0	11.11	12.28	11.71	11.11	3.51	7.21	7.41	5.26	6.31	17.39	4.65	11.24
62.5	14.81	12.28	13.51	22.22	10.53	16.22	20.37	8.77	14.41	13.04	23.26	17.98
75.0	33.33	29.82	31.53	18.52	26.32	22.52	22.22	28.07	25.23	13.04	18.60	15.73
87.5	5.56	22.81	14.41	7.41	22.81	15.32	7.41	21.05	14.41	23.91	27.91	25.84
100.0	0	3.51	1.80	0	3.51	1.80	0	3.51	1.80	8.70	2.33	5.62

* Distributions in absolute frequencies are given in Appendix B.

comparisons.

Our first observation is that the distributions in each of the three stages are probably bimodal. While the empirical picture was a bit unclear at the beginning, bimodality emerged prominantly at the final stage, for each group. Thus, at the final stage, the participants became clearly divided into two distinct groups of thought - one with favorable opinion towards construction of the center, and clustering around 75 (moderately important); and the other with unfavorable opinion, and clustering around 25 (moderately unimportant). It is interesting to note that the groups cluster around points which are at an equal distance from the neutral point. While the modal ordinate at 75 decreased, from earlier values, at the third stage, the ordinate at 25 increased stage by stage (Figs. 1(a), 1(b) and 1(c)).

The phenomenon of bimodality in the distributions needs some careful examination. Let us suppose that the subjects were given only two options, 'yes' or 'no', to give their opinion about construction of the center. Under such circumstances, we would have expected, as is usually the case, the group to be divided into two major subgroups - one on the 'yes' side and the other on the 'no' side - and probably a relatively small group would refrain from giving any opinion, and would remain neutral. Thus, we would have observed the persons who gave ratings 0 through 37.5 to be on the 'no' side, and those with ratings 62.5 through 100 to be on the 'yes' side. In such a case, we would have no way to ascertain the extent of the extremity in the opinions of the two groups. However, now with a bimodal distribution we not only know the existence of the two opposing groups, but we also know that they cluster

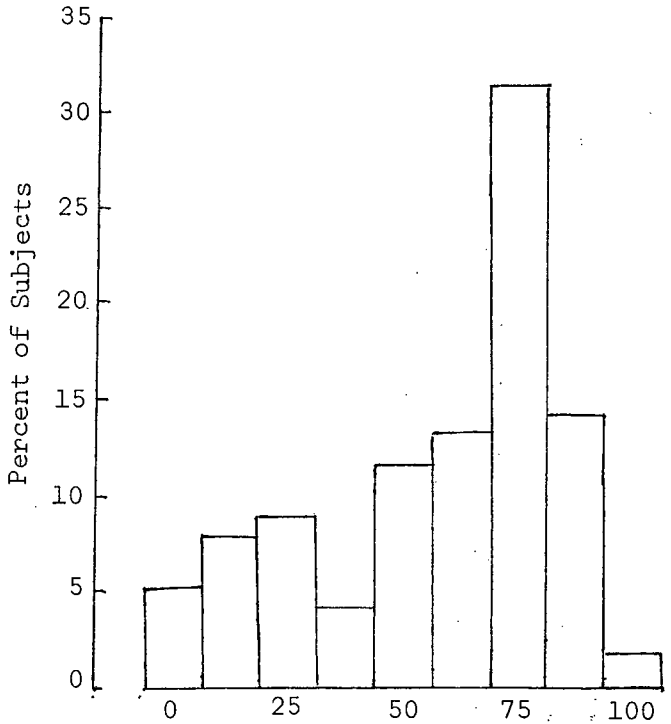

Fig.1(a) First Stage Distribution of Judgment of the Combined Group

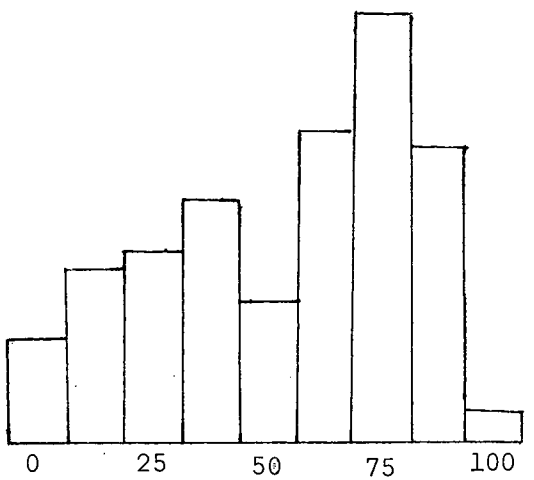

Fig.1(b) Second Stage Distribution of Judgment of the Combined Group

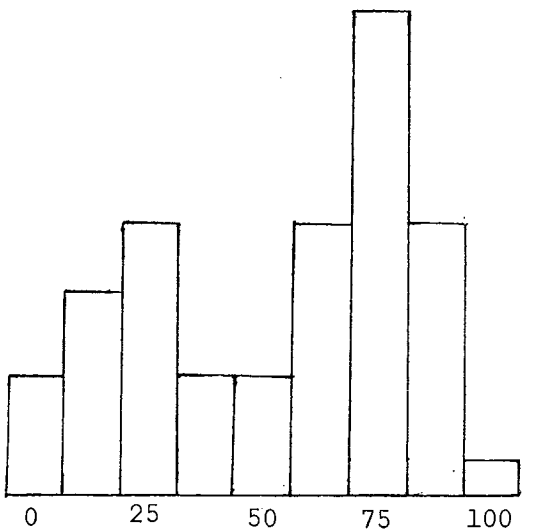

Fig.1(c) Third Stage Distribution of Judgment of the Combined Group

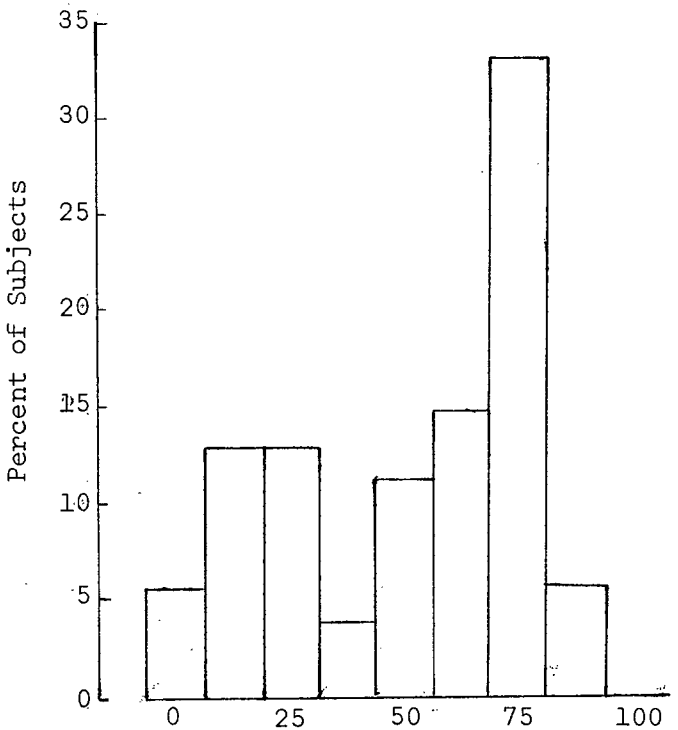

Fig.2(a) First Stage Distribution of Judgment of Faculty

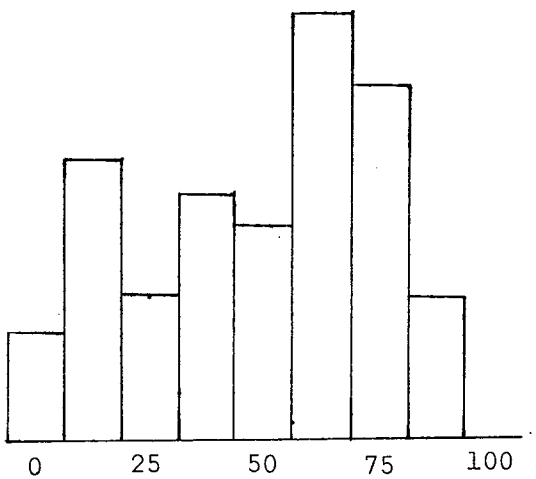

Fig.2(b) Second Stage Distribution of Judgment of Faculty

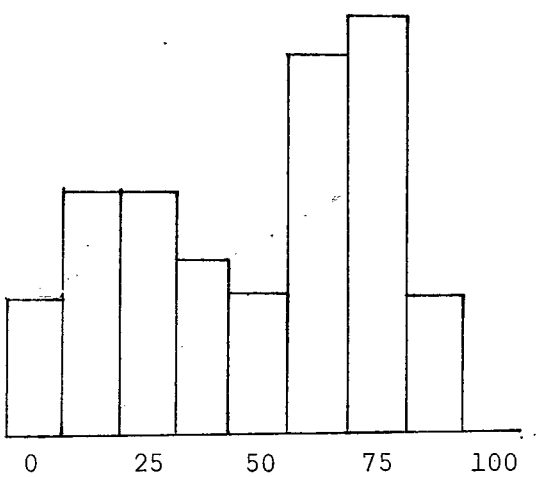

Fig.2(c) Third Stage Distribution of Judgment of Faculty

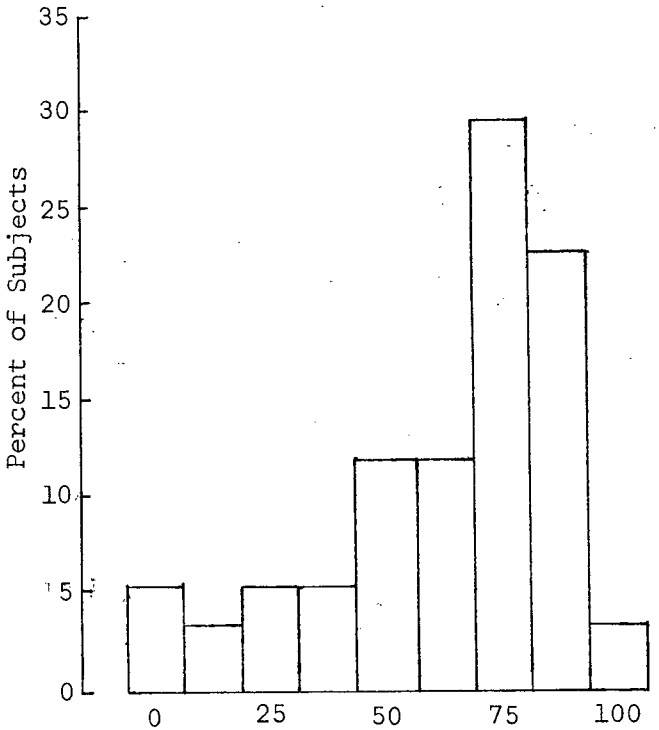

Fig.3(a) First Stage Distribution of Judgment of Staff

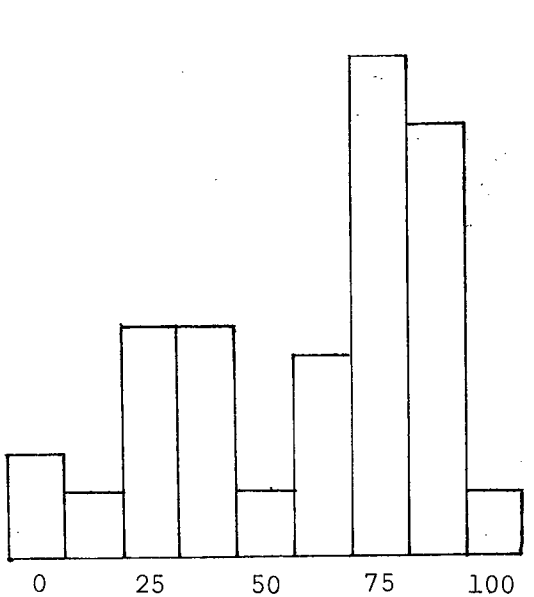

Fig.3(b) Second Stage Distribution of Judgment of Staff

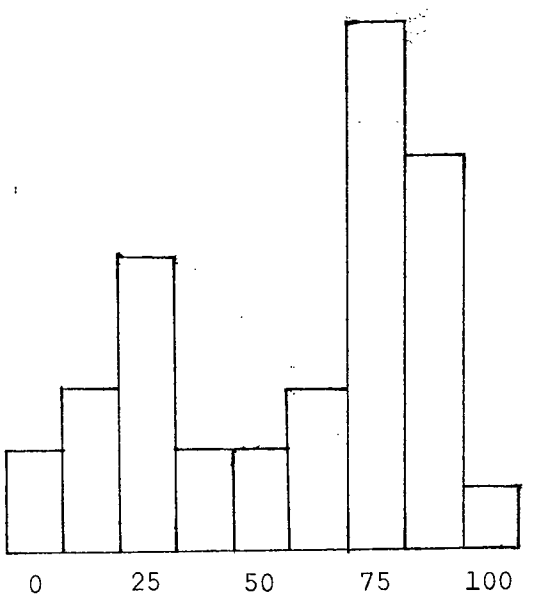

Fig.3(c) Third Stage Distribution of Judgment of Staff

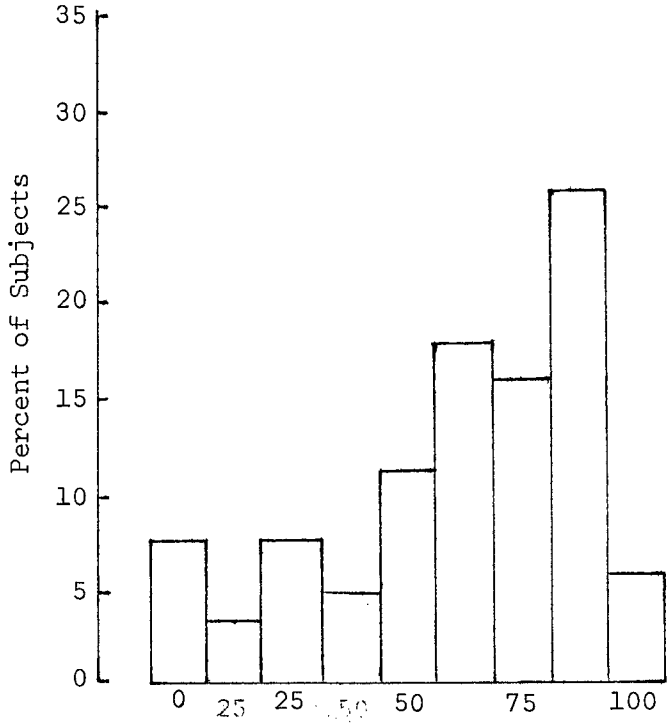

Fig. 4 Distribution of Judgment of the Control Group

around the judgment neuclei 'moderately important' and 'moderately unimportant'. If these judgment neuclei were 'very important' and 'very unimportant', the difference in opinion in the two groups would have increased (polarised). Thus, bimodality in the distributions have been useful not only in identifying the two opposing groupssbut also to get an idea as to the extent of their difference.

A comparison between the two groups - faculty and staff - reveals some minor differences when compared stage by stage. The bimodality character is prominent in faculty distributions from the first stage, whereas it is only in the second stage that the staff distributions appeared to become bimodal. The latter had undergone greater change from stage to stage, relative to that of faculty. Although the third stage distributions look similar, a careful examination reveals that the two

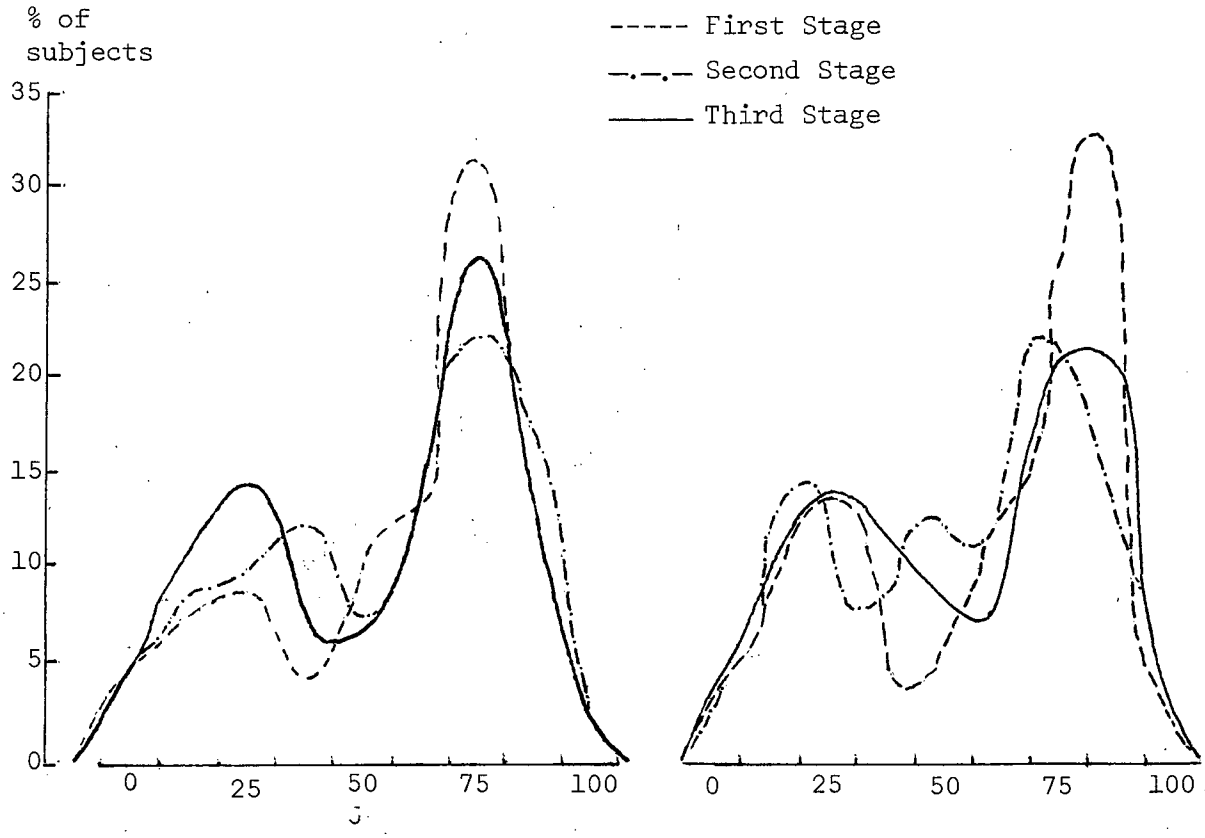

Fig.5(a) First, Second and Third Stage Distributions of Judgment of the Combined Group

Fig.5(b) First, Second and Third Stage Distributions of Judgment of Faculty

opponent subgroups in staff are more diverged than those of faculty.;

Now we look at the Figs. 6(a) and 6(b). The shape of the control group distribution is very much irregular and it is hard to find any good similarity between the frequency curves in each of the figures, except that the modes with the greatest ordinate are on the right side in both cases; but the modal values differ (75 in the experimental group and 87.5 in the control group). Thus, it seems from inspection of the graphs that both the first stage and the third stage distributions differ from the control group distribution.

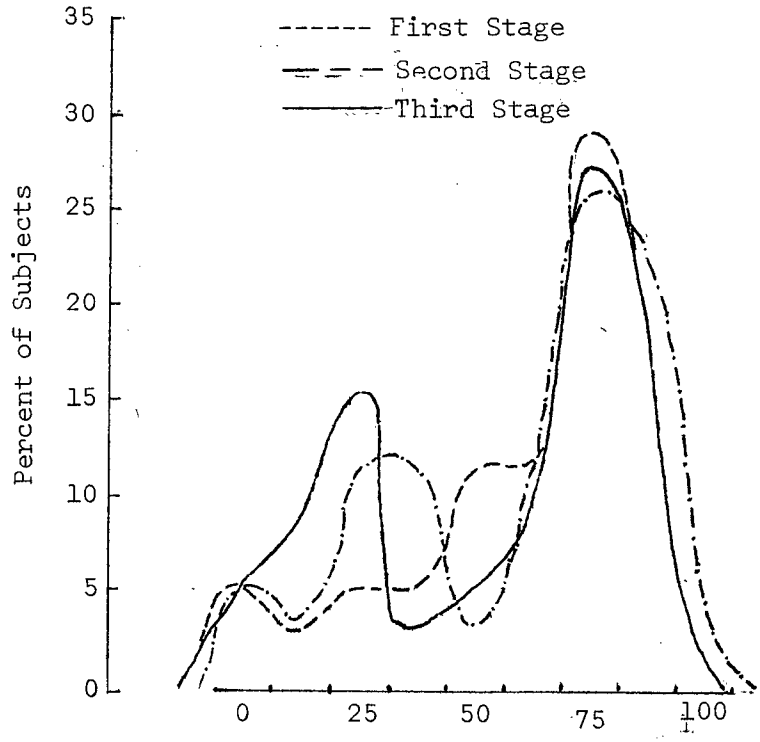

Fig.5(c) First, Second and Third Stage Distributions of Judgment of Staff

2.2 Means and Standard Deviations

The means and standard deviations of the various distributions are shown in Tables III and IV, respectively. Note that the means are not too meaningful since the distributions are bimodal. That is, although the means still denote average response, they do not reflect the point where most of the mass of this distribution lies. The shifts of the locations and heights of the modes are more reflective of distribution changes in this context. Nevertheless, we notice that the means decreased stage by stage for both the groups, and thus for the combined group. The mean for the staff is always larger than that for the faculty. The control group means are near the first stage means (except for faculty).

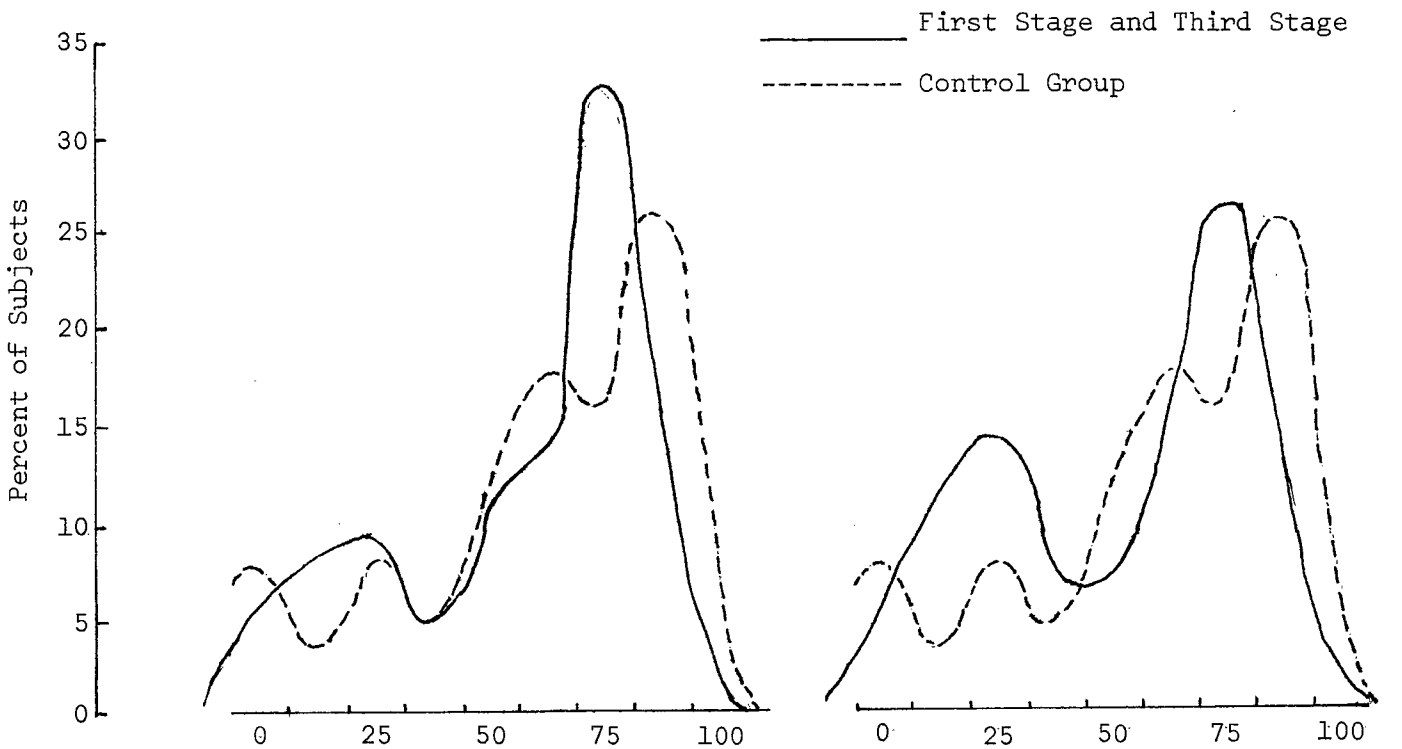

Fig. 6(a) First Stage and Control Group Didtributions

Fig. 6(b) Third Stage and Control Group Distributions

Table III. Means of Judgment Distributions

Groups	First Stage	Second Stage	Third Stage	Control
Faculty	50.93	48.38	46.53	60.33
Staff	63.38	59.61	57.46	61.63
Combined	57.32	54.15	52.14	60.96

Table IV. Standard Deviations of Judgment Distributions

Groups	First Stage	Second Stage	Third Stage	Control
Faculty	26.77	25.80	27.58	29.29
Staff	25.63	27.88	29.60	27.54
Combined	26.92	27.47	29.15	28.47

In contrast to the means, the standard deviations increased stage by stage, implying a monotone increase in polarisation of the two groups, due either to time effects or feedback effects. Since the third stage and control group standard deviations are comparable, it is not clear which effect may have generated the polarisation.

2.3 Tests of Three Hypotheses

In this subsection, we test three hypotheses comparing the judgment distributions of the experimental group at the the first stage and the third stage and of the control group. The hypotheses are:

H_{01} : The responses of the first stage experimental group and those of the control group came from the same population.

H_{A1} : The two groups of responses came from different populations.

H_{02} : The responses of the third stage experimental group and those of the control group came from the same population.

H_{A2} : The two group of responses came from different populations.

H_{03} : The responses of the first stage experimental group and those of the third stage (experimental group) came from the same population.

H_{A3} : The two groups of responses came from different populations.

Although each hypothesis has its individual implications, it is more informative, in our case, to examine the implications of the results jointly.

We use the standard chi-square test of goodness of fit for testing the hypotheses.(19)

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(19) Strictly speaking, the chi-square test is not applicable in testing H_{02} and H_{03}. The basic assumptions of the test are: (1) the two samples are independent (and thus the observations between them are necessarily uncorrelated), and (2) the observations within each sample are independent (and thus they are necessarily uncorrelated). However, in case of H_{02}, the second assumption is violated, since the observations obtained in the third stage are correlated. The correlation has been produced by the feedback of information in the sense that one participant's reasons have influenced another participant's response. In case of H_{03}, both the assumptions are violated, since, in addition to the above type of correlation, now the first stage responses are correlated with their counterparts at the third stage (the two sets being the responses of the same individuals at two occasions). However, due to lack of more appropriate tests at the present moment, we have used the chi-square test, hoping that the correlations may not turn out to be so serious as to upset the conclusions derived from the tests. For further

With 9 categories in each of the two multinomial populations, the chi-square statistic, in our case is given by

$$\chi^2 = \sum_{i=1}^{9}\sum_{j=1}^{2} \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

where f_{ij} = observed frequency in the (i,j)thecell,

e_{ij} = expected frequency in the (i,j)th cell,

Under the null hypothesis, the estimated value of e_{ij} is given by

$$e_{ij} = \frac{f_i\, f_j}{N}$$

where $f_i = \sum_{j=1}^{2} f_{ij}$, $f_j = \sum_{i=1}^{9} f_{ij}$ and $N = \sum_{i=1}^{9}\sum_{j=1}^{2} f_{ij}$

The chi-square has (9-1)(2-1)=8 degrees of freedom. While computing the chi-square, it was found, in each of the three cases, that some of the expected cell frequencies were small (less than 10). To make the test applicable, some of the cells were merged.[20] The results of the tests are:

Hypothesis	Computed chi-square (5 d.f.)	P-value[21]
H_{01}	10.93	0.053
H_{02}	10.87	0.054
H_{03}	3.17	0.674

---

discussion on this point see Chapter 5, Section 2.

(20) Computation of the expected cell frequencies are shown in Appendices D1, D2 and D3.

(21) P-value is the probability of exceeding the observed chi-square.

We reject H_{01} and H_{02} at the .05 significance level. H_{03} cannot be rejected.

Now let us examine the implications of the results. First we recall that the control group was solicited about 6 months latter than the first stage, and at a time when the construction of the center was well in progress; also some other conditions might have changed (e.g., arrival of winter and reduced concern about swimming). We also note that the responses of these two independent groups (first stage and control) were obtained using basically the same questionnaire, and without any feedback of information. Thus the two groups represented the general public feelings at two different times. A difference between the response distributions of these two groups may, therefore, be attributed to the effect of time.((In particular, it could be predicted that public attitude towards construction of the center would be more favorable when the construction was already well in progress). By rejecting H_{01}, we conclude that the two distributions are significantly different. Thus, the control group represented the time effect. On the other hand, acceptance of H_{03} implies that there is no significant difference between the first stage distribution and the third stage distribution (although the third stage was done at the same time as the control group). This implies that the third stage distribution did not have a significant time effect, (or in particular, that the third stage distribution was not affected significantly by the fact that construction of the center was in progress). This result is in conformity with the rejection of H_{02}, which shows that the third stage distribution is different from the control group distribution. Since the control group represented the time effect,(and that the control group and the third

stage were done simultaneously), the hypothesis, H_{02}, would not have been rejected had there been a time effect in the third stage distribution. The question arises: What is that which prevented the third stage experimental group from being effected by the time effect? The answer is 'Qualitative Feedback'.

Due to qualitative feedback, the subjects in the third stage experimental group were exposed to all the 'pros' and 'cons' about the issue of judgmentmaking. They were, thus, able to form their judgments on the basis of reasoned and rational thinking, and were not overwhelmed by the current developement of events (e.g. ongoing construction of the center). This demonstrates the usefulness of qualitative feedback in producing rational judgments.

Some further comments. It is important to realize that change in individual judgments from stage to stage does not imply a change in the judgment distribution. While individual judgments may change, the distribution of judgments may or may not change. This can be illustrated as follows: Consider any two response categories, say, 37.5 (somewhat unimportant) and 62.5 (somewhat important). Suppose n_1 and n_2, respectively, are the number of subjects in these two categories at the first stage; and suppose, at the second stage, one subject changes response from 37.5 to 62.5, and another from 62.5 to 37.5, and the frequencies in all the other categories remain fixed. We find that, although, a change in individual judgments has occured, the distributions of judgments hasenot changed. However, the converse is true, i.e., a change in the distribution implies a change in the individual judgments.

Thus, although we have found, by testing hypothesis comparing the first stage distribution with the third stage distribution, that the judgment distributions did not change significantly, we have no evidence about whether or not change in judgments has occured due to feedback of information. We will examine the issue of judgment change from stage to stage in the next section.

3 Analysis of Judgment Change

In this section we examine the pattern of change that occured in the subject's responses from stage to stage. First, we present a summary description of change for three broad categories in Table V, and then, with the help of a set of transition probabilities, we illustrate the pattern of change in detail.

The basic data tables that will be used in our discussion are shown in Appendices C1 and C2. They are, in fact, bivariate frequency tables. For example, the entry in the cell corresponding to column 5 and row 7 of Appendix C1 shows that 3 subjects who gave a response 62.5 (somewhat important) at the first stage changed their response to 37.5 (somewhat unimportant) at the second stage. Thus, the diagonal entries of the table show the number of subjects in various categories who did not change; the lower diagonal entries represent the number of subjects who changed to lower responses than their previous responses. The reverse is true for the upper diagonal entries. The row and column totals are the marginal distributions.

3.1 A Summary

Let us consider the three broad categories of response: 'less than

50', '50' and 'greater than 50'. All participants belonging to the first category gave responses on the 'unimportant' side of the of the scale; those in the second category were neutral; and those in the third category gave responses on the 'important' side of the scale. These are the three basic groups having opposite or neutral opinions. It is of interest to see how they behaved in changing opinions.

Some interesting features of response change can be observed from Table V. As can be seen from the last row, nearly 30% changed response at the second stage while the same rate is only about 21% at the third stage. From the same row we find that majority of subjects who changed response, changed to give a lower rating. We will see in Section 6 that the 'con' reasons were more "appealing" than the 'pro' reasons; thus it is quite reasonable to believe that as an effect of feedback of the 'con' reasons, on the average, the majority of participants changed their response to a lower direction. Now let us compare the three main categories. The first thing we notice is that the neutral respondents had undergone the greatest percentage of change in both the second and third stages (columns (9) and (10)). This means that the neutral subjects could be persuaded more to change judgment than those who had already committed. We also find that most neutral subjects (75% and 66.67%) who changed response, changed in the lower direction. This is also indicative of our earlier mentioned feedback effect of the 'con' reasons.

To see the extent of variation from round to round, Q_2 and Q_3, as defined in Chapter 2, were calculated. For the combined group, Q_n (n= 2, 3) is given by

Table V. Summary of Change in Response with respect to Three Broad Categories

Category of Response	Number of Subjects			No. changing to lower direction		No. changing to upper direction		% of subjects who changed response		% of subjects (out of those who changed) changing to lower direction		% of subjects (out of those who changed) changing to upper direction	
Stages	1	2	3	1,2	2,3	1,2	2,3	1,2	2,3	1,2	2,3	1,2	2,3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Less than 50(unimportant)impor	30	41	42	4	9	3	3	23.33	29.27	57.14	75.00	42.86	25.00
50(indifferent or neutral)	13	8	7	6	2	2	1	61.54	37.50	75.00	66.67	25.00	33.33
Greater than 50 (important)	68	62	60	16	13	2	5	26.47	12.90	88.89	37.50	11.11	62.50
Overall	111	111	111	26	14	7	9	29.72	20.72	78.79	60.87	21.21	39.13

Note(1): Computations of columns (9) through (14) are as follows: (9) = [((5)+(7)) - (2)]x100, (11) = [(5) - ((5) + (7))]x100, (10) = [((6)+(8)) - (3)]x100, (12) = [(6) - ((6) + (8))]x100, (13) = 100 - (11),and (14)= 100 - (12)

Note(2): Columns (6), (8), (10), (12) and (14) refer to change from the second stage to the third stage; columns (5), (7), (9), (11) and (13) refer to change from the first stage to the second stage.

$$Q_n = \frac{1}{111} \sum_{i=1}^{111} (z_{n,i} - z_{n-1,i})^2$$

where $z_{n,i}$ is the response of the ith subject at stage n, and i=1,..., 111. The computed values of the Q's are: Q_2 = 140.77 and Q_3 = 67.57. The variation in response in going from the second stage to the third stage is 48% of that in going from the first stage to the second stage. This shows that even in the third stage the responses were not quite stabilized.

3.2 Test of Hypothesis

It is also of interest to see if change in judgment by a subject in one stage is related to whether or not the participant changed judgment in the previous stage. To be precise, let us consider the hypothesis: H: Changing judgment in a given stage is not related to changing judgment in the previous stage. This hypothesis can be tested by using a 2x2 contingency table as shown below.

Table VI

Table VI. Classification of subjects with respect to judgment change in the Second and Third Stages

		SECOND STAGE		
		Changed	Did not change	Totals
THIRD STAGE	Changed	10	12	22
	Did not change	24	65	89
	Total	34	77	111

The hypothesis has been tested using the usual chi-square statistic for a 2x2 contingency table. The observed value of the chi-square

with (2-1)(2-1) = 1 degree of freedom is 2.03 (using the Yate's correction for continuity) which is exceeded with a probability of .15. We do not reject the hypothesis and conclude that change of judgment by a subject at one stage is not related to whether or not he changed judgment at the previous stage.

3.3 Transition Probabilities of Response

First, we will define the transition probabilities and explain their computations. Let z_n be the response of a subject at stage n (n = 1, 2, 3). Then the transition probability is simply the conditional probability, $p(z_n, z_{n-1}) = P[Z_n = z_n | Z_{n-1} = z_{n-1}]$ of giving response z_n (z_n = 0, 12.5, ..., 100) at stage n, given that the participant gave response z_{n-1} at stage n-1. Here we assume that the subject's response at the present stage depends only on his response at the previous satge.[22] The Maximum Likelihood estimate of $p(z_n, z_{n-1})$ is given by

$$\hat{p}(z_n,z_{n-1}) = \frac{f(z_n,z_{n-1})}{f(z_{n-1})}$$

where $f(z_n,z_{n-1})$ = number of subjects who gave response z_{n-1} at stage n-1 and z_n at stage n, and $f(z_{n-1})$ = total number of subjects who gave response z_{n-1} at stage n-1. Appendix C1 gives the values of $f(z_2,z_1)$ and $f(z_1)$, and Appendix C2 gives those of $f(z_3,z_2)$ and $f(z_2)$ for the combined group. The probabilities $\hat{p}(z_2,z_1)$ and $\hat{p}(z_3,z_2)$ are shown in Tables VII and VIII respectively. Note that according to our notation z_n and z_{n-1} correspond to column and row respectively.

(22) Recall that, while collecting data, each subject was reminded only his previous stage response.

Table VII. MLE* of Transition Probabilities
of Response from the First Stage
to the Second Stage

FIRST STAGE \ SECOND STAGE	0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0
0	1								
12.5		.78	.11			.11			
25.0		.30	.60	.10					
37.5			.20	.80					
50.0			.08	.38	.38	.08	.08		
62.5			.07	.20	.07	.66			
75.0			.03	.03	.06	.17	.65	.06	
87.5							.06	.94	
100.0									1

* Maximum Likelihood Estimates

We notice in both the tables that the largest probabilities occur in the diagonal cells, indicating that a subject is most likely not to change response. Starting from a diagonal cell as we move to the left or to the right, the probabilities decrease, the highest probability occuring in the adjacent left or adjacent right cell. Thus, when a subject changes response, it is most likely that he will move to one of the next response categories. We also notice that changes took place only in response categories 12.5 through 87.5; subjects in the extreme two categories did not change response in any of the stages.

4 Regression Analysis

We have described the regression models of response in Section 5 of Chapter 2. The models are estimated in this section. In Subsec. 4.1,

Table VIII. MLE* of Transition Probabilities of Response from the Second Stage to the Third Stage

SECOND STAGE	THIRD STAGE 0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0
0	1								
12.5	.100	.80	.10						
25.0		.09	.82	.09					
37.5		.14	.36	.43	.07				
50.0		.13	.13		.62	.12			
62.5						.83	.17		
75.0							.92	.08	
87.5					.06		.12	.82	
100.0									1

*Maximum Likelihood Estimates

the regression model of the first stage responses on the cue variables is estimated, and regression of Z_2 (second stage response) on Z_1(first stage response) and that of Z_3(third stage response) on Z_2 are estimated in Subsections 4.2 and 4.3 respectively.

4.1 Regression of Z_1 on the Cue Variables

In this regression, the dependent variable is the response at the first stage, which is measured by the numerical answer the subjects gave. Thus, the observed dependent variable has values 0, 12.5,..., 100. There are, in total, 16 cue variables of which 14 are 0-1 qualitative and the remaining two are quantitative. These variables are described below.

X_1 = 1 if the subject is a Faculty member

0 otherwise

X_2 = 1 if the subject is an administrative staff

0 otherwise

X_3 = 1 if the subject is a clerical staff

0 otherwise

X_4 = 1 if the subject is a male

0 if the subject is a female

X_5 = 1 if the subject's family would use the center

0 otherwise

X_6 = 1 if the subject knows how to swim

0 otherwise

X_7 = 1 if the subject already donated or was willing to donate towards funding of the center

0 otherwise

X_8 = 1 if there was a swimming pool in or near the residence of the subject

0 otherwise

X_9 = 1 if the subject would never use the center

0 otherwise

X_{10} = 1 if the subject would occasionally use the center

0 otherwise

X_{11} = 1 if the subject had been a member of University community for less than 5 years

0 otherwise (5 years or more)

X_{12} = 1 if the subject lived on the west side of the Granville street

0 otherwise

X_{13} = 1 if the subject lived on the east side of the Granville street or in the West End area

0 otherwise

X_{14} = 1 if the subject lived in West Vancouver, North Vancouver or in Richmond

0 otherwise

X_{15} = Age of the subject (measured as the mid-value of the age interval of the subject)

X_{16} = Amount of annual fee that the subject was willing to pay for use of the center

Data on these variables was available in the questionnaires for 111 subjects who participated in all the three stages. However, a complete set of observations on all the 17 variables (1 dependent + 16 explanatory) were available only for 96 subjects, the remaining 15 subjects had missing observations on either X_{15} or X_{16} or both. To make use of all the 111 data points, we have used a certain computer program which is designed to make good use of data sets with missing observations.(23)

The results of the regression are given in Table IX. It gives the parameter estimates, their estimated standard errors, the F-ratios and the probabilities of exceeding an observed F-value. In column 2, the parameter estimates are denoted by small case letters (corresponding to the variable names). The value of R^2, the coefficient of determination, is .38; only 38 percent of the observed variation was

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(23) The particular technique the program used is described in Appdx. E.

Table IX. Results of Regression of Z_1 on Cue Variables

Variables	Parameter Estimates	Standard Errors	F-Ratio	F-Probability
Constant	60.98	18.14		
X_1	b_1 = -12.01	6.46	3.46	0.06
X_2	b_2 = -15.15	11.18	1.84	0.175
X_3	b_3 = - 5.04	7.42	0.46	0.506
X_4	b_4 = - 0.77	5.69	0.02	0.862
X_5	b_5 = 1.60	5.65	0.08	0.769
X_6	b_6 = - 1.78	9.18	0.04	0.826
X_7	b_7 = 13.00	5.51	5.57	0.019
X_8	b_8 = 0.88	5.18	0.03	0.841
X_9	b_9 = -25.85	8.45	9335	0.003
X_{10}	b_{10}= - 7.19	6.76	1.13	0.290
X_{11}	b_{11}= 3.42	5.56	0 .38	0.548
X_{12}	b_{12}= -18.91	9.88	3.67	0.056
X_{13}	b_{13}= - 5.18	11.26	0.21	0.651
X_{14}	b_{14}= -10.13	10.65	0.90	0.347
X_{15}	b_{15}= 0.58	0.25	5.43	0.021
X_{16}	b_{16}= 0.05	00.07	0.43	0.519

d
due to the regression. However, under whatever variation has been explained, it is interesting to note the significance of some of the coefficients. We may consider the coefficients b_1, b_7, b_9, b_{12}, and b_{15} to be significant at p-values of .06, .02, .003, .056 and .02 respectively. A negative value of b_1 implies that the faculty, on the average, tended to assign lower ratings to the importance of the center. A posi-

tive value of b_7 means that those who already donated or were willing to donate, tended to assign higher ratings; this is what could be expected a priori. On the other hand, a negative value of b_9 implies that people who would not use the center at all gave low ratings on the average; this is also consistent with our usual expectations. However, a negative value of b_{12} is contrary to what could be expected. The variable X_{12} is 1 or 0 according to whether or not a subject lived on the west side of the Granville street and thus close to the new aquatic center. Since respondents living close to the center had greater opportunity to use it, they should assign higher rating, and thus, the sign of the coefficient should be positive. A positive value of b_{15}, although very small, implies that rating tended to increase with age.

4.2 Regression of Z_2 on Z_1

The regression model described in Chapter 2 is given by, for n=2,

$$Z_{i2} = \alpha_2 + \beta_{21} Z_{i1} + U_{i2}$$

where, Z_{i2} and Z_{i1} (i=1, 2, ..., 111) are the responses of the ith subject at the second and first stage respectively, α_2 and β_{21} are constants and U_{i2} is the errormtermowith $E(U_{i2}) = 0$, $Var(U_{i2}) = \sigma^2$ and $Cov(U_{i2}, U_{j2}) = \lambda$, $i \neq j$.

In view of the error structure, a simple least squares method of estimation will not be strictly applicable. However, for purposes of simplicity, and on the simplifying assumption that the correlation between the responses of two subjects might not be too large, we have used the ordinary least squares method to estimate the model.

The estimates of the coefficients and their estimated standard errors are:

	Estimates	Standard Errors	t-values	p-values
$\hat{\alpha}_2$	=0.92	2.54	0.36	0.70
$\hat{\beta}_{21}$	=0.93	0.04	23.00	less than .002

Thus β_{21} is highly significant and α_2 is not significant. The second stage response may be considered to be proportional to the first stage response. The value of R^2 is .83, so that the correlation between Z_1 and Z_2 is .92.

4.3 Regression of Z_3 on Z_2

Now we consider the regression of the third stage response on the second stage response. The regression equation is

$$Z_{i3} = \alpha_3 + \beta_{32} Z_{i2} + U_{i3}$$

where, as before, Z_{i2} and Z_{i3} are the responses of the ith subject ($i = 1, 2, \ldots, 111$) at the second and the third stage respectively, α_3 and β_{32} are constants, and U_{i3} is an error term with $E(U_{i3}) = 0$, $Var(U_{i3})=\sigma_3^2$, and $Cov(U_{i3},U_{j3}) = \lambda_3$. As in the previous regression, we again use the ordinary least squares method (assuming similar simplifying assumptions) to estimate the model. The results are:

	Estimates	Standard Errors	t-values	p-values
$\hat{\alpha}_3$	= -1.76	1.72	-1.02	0.28
$\hat{\beta}_{32}$	= 1.01	0.03	33.67	less than 0.002

Again the slope coefficient is highly significant and the intercept is not significant. The value of R^2 is 0.92 and thus R=0.96.

5 Analysis of Dropout Effect

It has been shown in Section 1 of this chapter that there were a certain proportion of nonresponses at every stage of the survey. The group consisted of three subgroups of people - (1) people who were in the sample but did not respond at the first stage; (2) people who participated at the first stage but dropped out at the second stage, and (3) people who participated at the first two stages but dropped out at the third stage. We will use the term 'dropout' to mean a nonrespondent of subgroups two and three.

In the previous sections, in studying various distributions and in other related analysis, we have used data of those 111 participants who participated in all the three stages of the survey. The distributions at the various stages are important and this is particularly true for the final stage distribution, since inference about group judgment and policy making would be based on it. It is, therefore, of interest to see whether or not the dropouts may have a serious effect on the final stage distribution. We will be interested to see whether there are good reasons, in view of the available information, in support of the proposition: The final stage distribution would have been different had there been no dropouts.

5.1 Comparison of First Stage Distributions: Dropout vs. Nondropout

As regards the dropouts, two kinds of information are available

to us - their first stage responses and information on their background cue variables. We will attempt to infer, from these two sources, about the validity of the proposition set up in the preceding paragraph.

Suppose that the first stage distribution of the dropouts differ significantly from that of the nondropouts; then we can reasonably conclude that if the dropouts had participated throughout, they would have contributed a distinctive pattern to the final stage distribution. This argument leads us to compare the first stage distribution of the dropouts with that of the nondropouts from the viewpoint of goodness of fit. Table X gives the two distributions in relative frequencies.

Table X. First Stage Distributions of Dropouts and Nondropouts

Response	% of Non-dropouts	% of Dropouts
00	5.41	2.78
12255	8.11	2.78
25500	9.9101	19.44
37.5	4.50	5.56
50.0	11.71	11.11
62.5	13.51	19.44
75.0	31.53	27.78
87.5	14.41	11.11
100.0	1.80	0

The freehand drawn frequency curves for the distributions are shown in Fig. 7(b). Fig. 7(a) gives the histogram of the distribution of the dropouts.

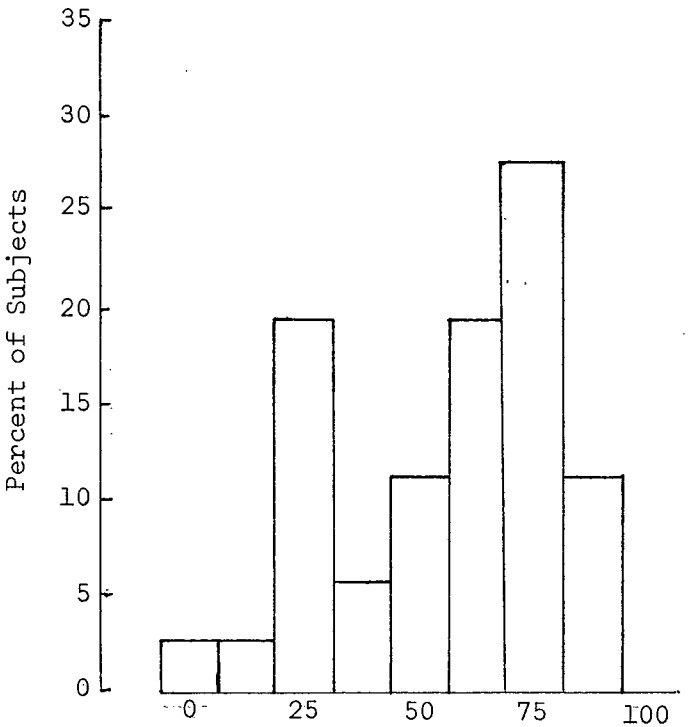


Fig. 7(a) First Stage Distribution of Response of Dropouts

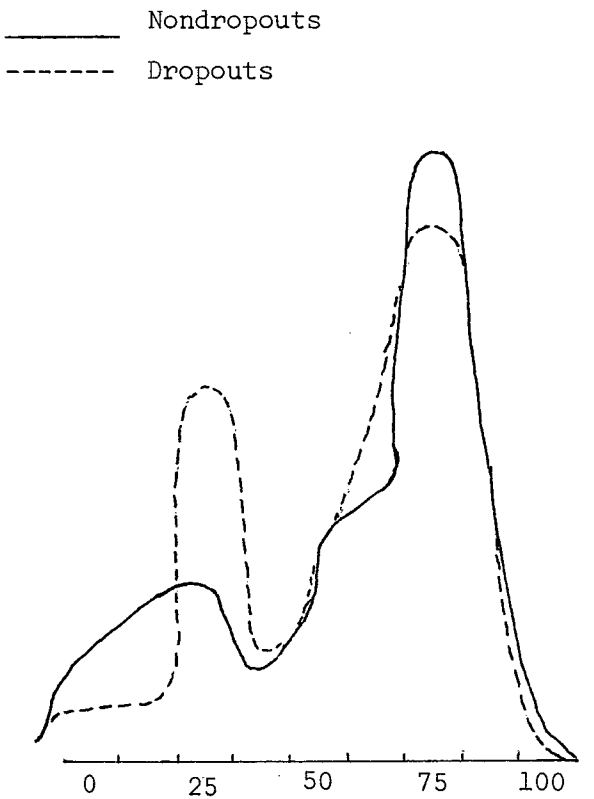


Fig. 7(b) First Stage Distributions of Response of the Dropouts and the Nondropouts

response of the dropouts. As can be seen in Fig. 7(b), both the distributions have the same modal values (with respect to both the modes) and also the troughs of the bimodal distributions are the same (at 37.5). The only dissimilarity of the curves occures on the left side (particularly for the extreme three categories). But the right side has a very good similarity. Considering the overall general pattern of the distributions we may assert that the shape of the distributions conform to each other fairly well. A chi-square with 3 degrees of freedom was also computed[24] for testing goodness of fit, the value of the statistic being 1.18. This value is far less than the theoretical .05 level value of 7.81. We may, therefore, conclude that so far the first stage responses are concerned, the dropouts do not come from a group very much different from the nondropouts.

5.2 Logistic Regression Analysis

It is also of interest to see whether or not the dropouts came from some particular classes with respect to their background cue variables. If the dropouts came from a section of the population with some particular background, it could be expected that they might have a typical response behavior; this, in turn, due to their nonparticipance, would carry an effect on the final stage distribution. For example, suppose as an extreme case, that most of the dropouts were Faculty members, then since, on the average, they gave lower ratings (as was found earlier) than the staff, we could expect that the final

(24) In computing the chi-square statistic, some response categories were merged to make the expected cell frequencies at least 5. The following are the revised 4 categories: (0, 12.5, 25.0), (37.5, 50), (62.5) and (75.0, 87.5, 100.0).

stage distribution would have larger proportion of people on the low rating response categories and the distribution would look different from what has been obtained.

Our arguments in the preceding paragraph lead us to enquire about the question: Is there any relationship between a person's being a dropout or a nondropout, and his background cue variables? To study this kind of relationship, we use the logistic regression model presented in Chapter 2.

Let Y be a random variable which takes the value 1, if the subject is a nondropout, and 0 if the subject is a dropout. Let p be the probability of being a nondropout, i.e., $p = P(Y = 1)$; then the logistic regression model is given by

$$p = \frac{1}{1 + e^{-a - b'x}}$$

where a is a scaler constant, b is a vector of constants, x is a vector of cue variables, and the prime denotes transpose.

In our case, observations on 10 cue variables were available;[25] they are the variables X_1, X_4, X_5, X_7, X_8, X_9, X_{10}, and X_{16} as defined in Sec. 4.1 of this chapter, and two other variables are X_{17} = response at the first stage,[26] and X_{18}, which takes the value 1 or 0

(25) Note that we do not have information on the cue variables (for t the dropouts) which were introduced at the second and third stage.
(26) X_{17} is the same as Z_1 of Section 4.

Table XI. Results of Logistic Regression for Non-response with 10 Cue Variables

Variables	Coefficient	Asymptotic Std. Error	Asymptotic t-Ratio	Asymptotic Significance
Constant	1.691	0.577	2.930	0.003
X_1	-0.350	0.282	1.244	0.213
X_4	-0.058	0.270	0.215	0.830
X_5	-0.133	0.288	0.462	0.644
X_7	-0.391	0.292	1.340	0.180
X_8	-0.166	0.235	0.704	0.481
X_9	-0.493	0.437	1.129	0.259
X_{10}	-0.107	0.351	0.304	0.761
X_{16}	0.015	0.012	1.268	0.205
X_{17}	-0.006	0.005	1.190	0.234
X_{18}	-0.149	0.296	0.505	0.614

according to whether or not a subject took more than half an hour to commute to the university campus. Data on all of these variables were available for 124 subjects. But excluding X_{16}, data on the remaining 9 cue variables were available for 145 subjects; there were 21 observations missing for X_{16}. Thus, in computing the parameters of the regression equation we used two approaches: (1) using 124 data points with 10 cue variables, and (2) using 145 data points with 9 cue variables. The Maximum Likelihood estimates of the parameters, asymptotic t-ratios and the asymptotic significance levels for the two approaches are shown in Tables XI and XII.

Table XII. Results of Logistic Regression for Nonresponse with 9 cue Variables

Variables	Coefficient	Asymptotic Std. Error	Asymptotic t-ratio	Asymptotic Significance
Constant	1.244	0.485	2.567	0.010
X_1	-0.326	0.253	1.291	0.197
X_4	0.074	0.247	0.299	0.765
X_5	0.111	0.247	0.448	0.654
X_7	-0.279	0.244	1.144	0.253
X_8	-0.075	0.214	0.350	0.726
X_9	-0.500	0.371	1.346	0.178
X_{10}	-0.274	0.331	0.829	0.407
X_{117}	0.000	0.005	0.023	0.982
X_{18}	-0.211	0.260	0.812	0.417
X				

It can be seen from the asymptotic significance levels in both the tables that none of the coefficients are significant. This implies that there is no relationship between the probability (1-p) of being a dropout and the cue variables; that is, knowing a subject's background variables, one cannot predict the probability of his being a dropout. This, on the other hand, implies that the dropouts were spread in an unpredictable way over the entire sample. However, we note that the constant term is significant (with significance levels .003 and .01 in Tables XI and XII respectively). This implies an overall probability of response (and hence nonresponse). This probability can be computed by setting all the b coefficients equal to zero and using an estimated value of a in the regression equation. Thus the probability of response is .84 (using a=1.691) and is .78 (using a=1.244).

From our above analysis we conclude that the dropouts do not form a distinctive group of people with respect to response behavior at the first stage and also with respect to their background. This leads us to say that there is no reason to believe that the response behavior of the dropouts would have been different from that of the nondropouts had the dropouts participated in the third stage.

6 Study of Reasons-giving Behavior

As has been stated before, the important aspect of qualitative feedback is that at each stage the subjects not only answer the basic question of judgmentmaking, but also, they give reasons supporting their answers. At the first stage, they write their own reasons individually and independently, and in subsequent stages they usually check reasons from a composite list; sometimes they also give new reasons not contained in the list.

The reasons generated by the participants should prove very useful to a decision maker to get insight about opinion, and in understanding the attitudes of the participants. It is worthwhile to examine and understand some basic features of the reason-giving behavior of the subjects. We have already discussed some aspects of this behavior in Chapter 2, where we have also discussed how the composite list was prepared. In this section we focus attention on several other things, such as, the distribution of the number of reasons given by the subjects, the transition probabilities of reasons, importance of reasons, andtthe subjetc's reason-giving behavior with respect to different response categories. In addition, we investigate whether there is any difference in behavior between groups with randomised and nonrandomised ordering of pro and con reasons (see Chapter 3).

6.1 Distribution of the Number of Reasons

Table XIII gives the distributions of the number of reasons, given by the subjects at the first, second and third stages. The means and standard deviations of the distributions are shown in Table XIV.

Table XIII. Distributions (in % of subjects) of the Number of Reasons for the First, Second and the Third Stage

N

Number of Reasons	First Stage	Second Stage	Third Stage
0	8.11	5.41	2.70
1	34.23	2.70	3.60
2	39.64	12.61	5.41
3	14.41	14.41	6.31
4	2.70	14.41	8.11
5	0.90	19.82	18.02
6	0	9.91	16.22
7	0	7.21	8.11
8	0	7.21	10.81
9	0	3.60	3.60
10	0	0.90	9.91
11	0	0.90	3.60
12	0	0.90	1.80
13	0	0	0.90
14	0	0	0
15	0	0	0
16	0	0	0.90

Table XIV. Means and Standard Deviations of the Distributions of the Number of Reasons

	First Stage	Second Stage	Third Stage
Mean	1.72	4.58	6.15
S.D.	0.96	2.46	3.02

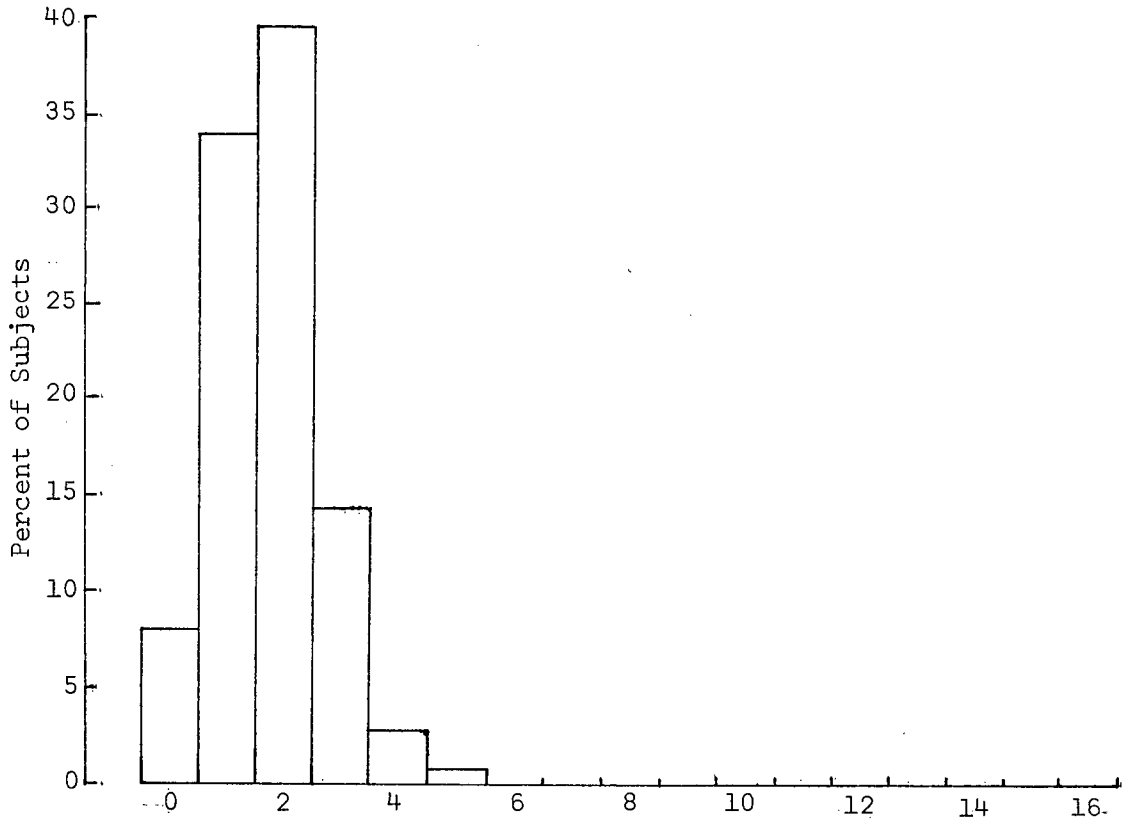


Fig. 8(a) Distribution of the Number of Reasons for the First Stage

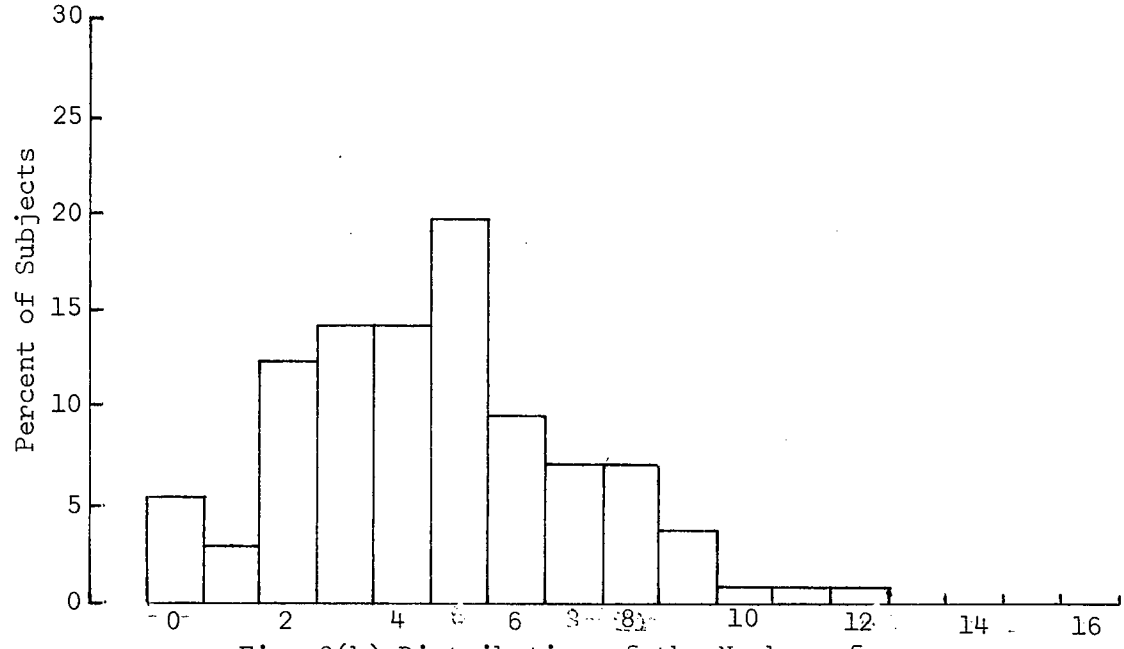


Fig. 8(b) Distribution of the Number of Reasons for the Second Stage

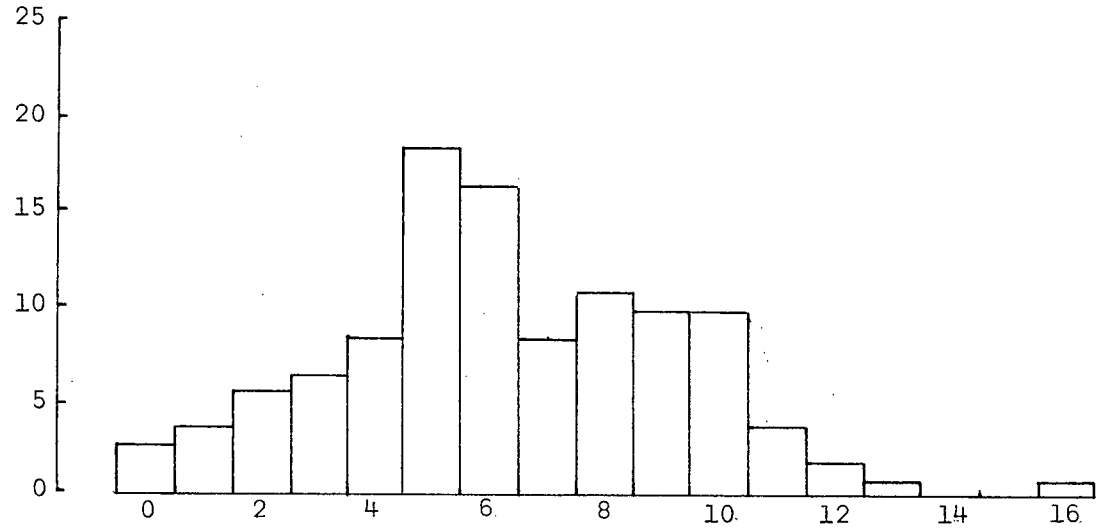


Fig. 8(c) Distribution of the Number of Reasons for the Third Stage

On the average, participants gave increasing numbers of reasons on successive stages, namely, 2, 5 and 6 reasons at the first, second and third stages, respectively. This tendency of giving an increasing number of reasons, on the average, may have some psychological implications. At the first stage, each subject had to write his reasons independently and thus he had to undergo a process of thinking and deliberation, which is not a very simple task for some people. Also, each subject had limited information. These factors might have resulted in giving only 2 reasons, on the average, at the first stage. On the other hand, in the second and third stages, subjects had only to check reasons they agreed with from a composite list. In doing this, we may expect, whenever a subject came accross a reason he agreed with and also which he could use to support his present judgment, he checked that

reason. Since he was supplied with a broad spectrum of reasons he could pick up a larger number of reasons than he gave at the previous stage.

The rate of increase in the average number of reasons is also noticeable. They are: 150% from the first to the second stage and only 20 % from the second to the third stage.(taking the averages to be 2, 5, and 6). This decreasing rate of increase is also compatible with the fact that at the later stages few new reasons were generated, and also, as will be seen later, that the new reasons carried less importance.

The standard deviations of the distributions also increased from stage to stage. It can be seen from the Figs. 8(a), 8(b) and 8(c) that the distributions tended to be skewed to the right.

6.2 Transition Probabilities of Reasons

From the second stage onward, a subject, while checking reasons from the composite list, sometimes added new reasons to his own previous stage slate of reasons, or dropped reasons from the slate. This phenomenon of adopting new reasons and abandoning old ones is somewhat similar to what happens in an ideal face-to-face interaction where, when faced with new arguments and reasons, participants often abandon their initial arguments and accept new ones or, perhaps, while still holding the original arguments, they pick some new reasons to strengthen their position. We will study this phenomenon within our new setting. Our analysis will be based mainly on the set of estimated transition probabilities of reasons. These probabilities are defined in Chapter 2. In estimating the probabilities, we have used data only of those 111 subjects who have completed all the three stages.

Table XV. Transition Probabilities of Reasons,** $\pi_{ij}(\alpha)$, corresponding to the First and Second Stages α ($i,j = 0, 1$)

α	1		2		3		4		5		6		7		8		9	
i \ j	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	.83	.20	.64	.27	.83	.30	.72	.17	.83	.13	.79	0	.90	*	.81	.33	.82	0
1	.17	.80	.36	.73	.17	.70	.28	.83	.17	.87	.21	1	.10	*	.19	.67	.18	1

α	10		11		12		13		14		15		16		17	
i \ j	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	.67	.14	.72	.25	.80	.08	.80	.33	.74	0	.92	.38	.76	.17	.88	0
1	.33	.86	.27	.75	.20	.92	.20	.67	.26	1	.08	.62	.24	.83	.12	1

** α denotes the serial number of a reason in the second stage questionnaire (Appendix A2).

* Probabilities in these cells could not be calculated since both the frequencies in these cells were 0s resulting in a marginal total of 0. This, rather, unfortunate situation occured because only one person who gave reason 7 at the first stage, dropped out at the second stage resulting in a 0 frequency in each of the two right cells.

Note again that in estimating the probabilities, we have used data only of those 111 subjects who have completed all the three stages.

Table XVI. Transition Probabilities of Reasons*, $\pi_{ij}(\alpha)$, corresponding to the Second and Third Stages (i,j = 0,1)

	α	1		2		3		4		5		6		7		8		9	
	j	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
i	0	.88	.11	.85	.03	.94	.13	.87	.08	.94	.17	.94	.12	.99	.18	.87	.09	.93	.09
	1	.12	.89	.15	.97	.06	.87	.13	.92	.06	.83	.06	.88	.01	.82	.13	.91	.07	.91

	α	10		11		12		13		14		15		16		17		18	
	j	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
i	0	.92	.06	.88	.17	.93	.19	.93	.28	.94	.18	.93	.23	.86	.09	.94	.21	.89	1
	1	.08	.94	.12	.83	.07	.81	.07	.72	.06	.82	.07	.77	.14	.91	.06	.79	.11	0

	α	19		20		21		22		23		24		25		26	
	j	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
i	0	.83	0	.93	0	.91	0	.89	0	.86	1	.79	0	.92	0	.85	0
	1	.17	1	.07	1	.09	1	.11	1	.14	0	.21	1	.08	1	.15	1

* The reasons in this table are numbered in such a way that Reasons Number 1 (i.e. $\alpha=1$) through 17 (i.e. $\alpha=17$) correspond to those in Table XV. To identify reasons in the randomised and nonrandomised composite lists of the third stage, Appendix F should be consulted.

The estimates of the probabilities, $\pi_{ij}(\alpha)$, (i,j=0,1) are shown in Tables XV and XVI. Each of these tables is again a set of 2x2 tables. For example, in Table XV, for reason number 3 (α=3), the probability is .7 that a subject who gave this reason at the first stage would again give it at the second stage, while the probability is only .17 that a subject who did not give the reason at the first stage would give it at the second stage.

In both the tables, the diagonal probabilities (diagonal entries of the 2x2 tables) are large compared to those of the off diagonals; it is more likely that a subject will repeat his last stage's reasons at the present stage. We also find in the left off-diagonal cells of Table XV , a probability ranging from .08 to .33, indicating that there was a substantial proportion of subjects who gave a reason at the second stage while they did not give it at the first stage. The corresponding probabilities in Table XVI, however, have another implication for Reasons 1 through 17. We note that these are the same reasons which were in the second stage composite list, while Reasons 18 through 26 were new additions in the third stage list. So each participant had the opportunity to see the Reasons 1 through 17 at the second stage, and if desired, they could give it then; thus, ideally the figures in the above mentioned cells should have been zero. However, the nonzero probabilities in these cells indicate that there was a certain proportion of people who did not give these reasons at the second stage, but gave them at the third stage. It is hard to explain this behavior, but it might have occured due to the time effect, or simply that the said subjects did not pay much attention to those reasons at the second stage.

6.3 Test of a Hypothesis

Now we focus our attention on an issue which is of methodological interest. We recall from Chapter 3 that at the second stage and thirds stages of the survey we reminded each participant of his previous stage response , and reasons, so he could make a conscious judgment. In particular, at the second stage, we gave each subject his own handwritten reasons he gave at the first stage. We asked him to check reasons from the composite list. This list was prepared from the reasons the participants gave at the first stage, and contained the reasons of each participant, maybe, in a slightly different form and composition.

The point of interest here is: whether or not a participant could recognize his reasons in the composite list. This is important, because the efficiency of the list depends partly on how effectively it can represent the reasons of the participants. If the list contains reasons much more distorted from what a certain participant gave, then he would not agree with them, and would not check off those reasons in the composite. However, if the list were effective, he would be able to recognize his own reasons. In that event two cases may occur - (1) the participant checks the reason if he still holds it , or (2) he does not check it, for he wants to abandon it. Now, only the investigator knows which reasons in the composite list were supposed to represent a given participant's reasons. Thus, if the particular participant checks those particular reasons, we know that he could recognize his reasons in the composite list. However, if he does not check them, we do not know whether or not he could recognize them.

We now proceed to formalise the situation into a hypothesis testing problem. We hypothesize: Subjects could recognize their reasons. Then, according to our discussion in the previous paragraph, and also due to the fact that about 70% of the participants did not change their reasons (See Section 2), in the second stage, we would expect that subjects should repeat their reasons and should be able to check reasons correctly. We note that this expected proportion is $\pi_{11}(\alpha)$, as defined in Chapter 2, for reason α(α= 1,2,...,17).

The problem of testing the above hypothesis may now be transformed into a statistical hypothesis testing problem as follows: We test a hypothesis $H_0(\alpha)$: $\pi_{11}(\alpha) = \pi^0_{11}(\alpha)$, independently for each α, where $\pi^0_{11}(\alpha)$ is a given hypothetical value of $\pi_{11}(\alpha)$. If $H_0(\alpha)$ is rejected, we conclude that reason α could not be recognized by participants.

Let $n(\alpha)$ be the number of subjects who gave reason α at the first stage. Each of these $n(\alpha)$ people were asked to check reasons independently at the second stage. We also assume that the probability of checking reason α is the same for everyone of them; this probability, in fact, is $\pi_{11}(\alpha)$. The $n(\alpha)$ subjects then form a set of independent trials; a success occurs if a subject checks Reason α. Thus for testing $H_0(\alpha)$ we can use the Binomial distribution.

We already have estimates of $\pi_{11}(\alpha)$ in Table XV. Next, we need to assign a numerical value of $\pi^0_{11}(\alpha)$ for each α(α=1,2,...,17). Since there is no reason to believe that $\pi_{11}(\alpha)$ would be different for different α, we will take the same value of $\pi^0_{11}(\alpha)$ for each α. On a subjective basis, we take the value to be .9, i.e., in the population 90% or more of the subjects recognized the reason and checked it. The

Table XVII. Results of Testing $H_0(\alpha)$

α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$n_{11}^0(\alpha)$	31	8	7	29	7	4	*	2	4	18	6	11	4	7	5	10	1
$n(\alpha)$	39	11	10	35	8	4	*	3	4	21	8	12	6	7	8	12	1
P-value	.037	.090	.070	.132	.570	1	*	.270	1	.352	.187	.718	.114	1	.038	.341	1

* Computations for Reasons 7 could not be carried out due to reasons explained in page 81.

Note: α stands for the serial number of reasons in the second stage questionnaire.

$n_{11}^0(\alpha)$ = number of subjects who gave reason α at both stages.

$n(\alpha)$ = number of subjects who gave the reason at the first stage.

P-value = $P(n_{11}(\alpha) \leq n_{11}^0(\alpha))$, where $n_{11}^0(\alpha)$ is the observed value of $n_{11}(\alpha)$ as defined above.

remaining 10% or less, we assume, consists of subjects who recognized the reason, but abandoned it. We have the hypothesis pairs:

$$H_0(\alpha): \pi_{11}(\alpha) = .9$$
$$H_A(\alpha): \pi_{11}(\alpha) < .9$$

for $\alpha = 1,2,\ldots,17$.

For each α, $H_0(\alpha)$ was tested separately using the Binomial distribution. The results of the tests are given in Table XVII. As can be seen from the P-values, we may reject only two hypotheses (corresponding to Reasons 1 and 15) out of 16 at a .05 significance level. We may conclude that the subjects could recognize their reasons in the composite list.

6.4 Study of Reasons-giving Behavior with respect to Category of Response

Tables XVIII, XIX and XX were compiled in order to examine how participants in different response categories differ in giving reasons. In each table, the reasons have been grouped into pro and con groupings. In numbering the reasons the same number has been used for a reason in all the tables. To identify the reasons in the randomised and nonrandomised lists of the third stage, Appendix F should be consulted, where the first row gives the numbers of reasons as appeared in Tables XVIII, XIX and XX.

We partition each table into six regions:

Region 1: All cells in categories 0 through 37.5 in pro reasons.

Region 2: All cells in categories 0 through 37.5 in con reasons.

[illegible] in categories 62.5 [illegible]

Region 3:All cells in categories 62.5 through 100 in pro reasons.

Region 4: All cells in categories 62.5 through 100 in con reasons.

Region 5: All cells in category 50 in pro reasons.

Region 6: All cells in category 50 in con reasons.

In all the tables, most cells in regions 2 and 3 are occupied and also the cell frequencies are large. This means that participants on the 'important' side gave mainly pro reasons and those on the 'unimportant' side gave mainly con reasons. This is what could be expected. However, it is interesting to notice that nonzero frequencies also occured in Regions 1 and 4; and consistently, in all the tables, frequencies have a larger value in Region 4 than those in Region 1. Region 4 represents subjects who gave con reasons, probably along with pro reasons, while giving an answer on the 'important' side; the reverse is true for subjects in Region 1. The con reasons seem to be more appealing in the sense that even when a suject gives a response on the important side of the scale, he cannot ignore the arguments presented in the con reasons. Also, if we look at Regions 5 and 6, we see that most of the neutral people gave con reasons. Another point to notice is that as the subjects deviated more and more from neutrality, they also tended to give fewer and fewer con reasons.

Importance of Reasons. Table XXl shows the importance of reasons as determined by the proportion of subjects (out of a total of 111) who gave a certain reason at the third stage. The reasons have been ranked in decreasing order of importance. Thus, the highest ranking reason was given by about 49% of the subjects (Reason 4) while the same per-

Table XVIII. Response vs. Reasons Classification**
(First Stage)

Response	Pro Reasons								Con Reasons									
Response	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	*
0										3	1	1		1		2		1
12.5								2	1	5	3	2	1	1	1	3		
25.0									1	3	2	22	1		2	3	1	1
37.5												33		1	2	1		
50.0		1								2	2	33	3	2	1	1		3
62.5	4	2	1	6	1					4			1	1	2	1		1
75.0	26	4	4	17	4	3		1	1	3				1		1		1
87.5	9	3	4	10	2	1												2
100.0		1	1		1													

* No reason given

** The reason numbers refer to the serial number of reasons in the second stage questionnaire, Appendix A2, page

Table IX. Response vs. Reasons Classification*
(Second Stage)

	Pro Reasons														Con Reasons										
Response	1	2	3	4	5	6	7	8	18	19	20	21	23	24	9	10	11	12	13	14	15	16	17	22	25	26	**
0															3	4	4	3	1	2	1	3	1				
12.5		2		1	1										5	9	4	3	3	6	1	5	2	1	1	1	
25.0	1			2	1										4	12	9	12	8	8	5	9	7				
37.5		1		3		1									3	8	8	9	5	10	3	6	2				
50.0	2	1		2				1							4	5	2		3	2	2	2					2
62.5	9	12	6	10	3	4	1	4					1		2	7	5	3	4	5		6	2				
75.0	16	16	6	18	11	11	3	7				1		1	2	4	3	1	1	1	1	3					3
87.5	14	10	11	13	7	10	6	8	1	1	1																1
100.0	1	2	1	1	1		1	2																			

* For identifying reasons in the randomised or nonrandomised lists (in Appendices A3 and A4), consult Appendix F.

** No reason given.

Table XX. Response vs. Reasons Classification*
(Third Stage)

	Pro Reasons														Con Reasons									
Response	1	2	3	4	5	6	7	8	18	19	20	21	23	24	9	10	11	12	13	14	15	16	17	22	25	26
0															4	5	4	4	1	3	2	5	2	2	2	1
12.5		1	1	2											6	12	8	7	5	10	2	5	3	4	4	5
25.0		1		1	1			1		1	1			3	8	16	11	12	9	7	6	12	6	5	2	4
37.5	1	1		1	1					1				2	3	2	5	3	2	4	5	4	2		1	4
50.0	3	2		1		2							1			4	3	1	2	4	1	3		1		
62.5	8	11	5	11	2	3	1	4	2	3	1		2	3	4	8	5	3	5	4		6	3			1
75.0	18	22	9	22	12	13	3	12	4	7	5	3	8	8	1	3	3					3		1		
87.5	14	13	10	14	7	10	5	13	5	6	2	6	4	6	1	1	1	1		1	1	1			1	2
100.0	2	2	1	2	2		1	1	1	1		2	1	2												
Total	46	53	26	54	25	28	10	31	12	19	9	11	16	24	27	51	40	31	24	33	17	42	16	13	10	17

* For identifying reasons in the randomised and nonrandomised lists(in Appendices A3 and A4) consult Appendix F.

centage for the lowest ranking reason (Reason 10) is only 9%. All the reasons have been arranged according to their ranks in Appendix H.

Let us consider the first five high ranking reasons. It can be seen that the reasons with ranks 1, 2 and 4 are pro reasons, while those with ranks 3 and 5 are con reasons. The reasons with ranks 1 and 4 reflect on the value the community places on swimming as a source of recreation and maintaining health and fitness. Since it rains very frequently during winter in Vancouver, the community feels the necessity of an indoor aquatic center. Now looking at the con reasons (ranks 3 and 5) we find contrasting arguments. Since, at the time of initiating construction of the center, the university was experiencing a financial shortage, the community also felt that the money could be spent for demanding academic purposes; various alternatives for spending the money were suggested. The reasons, thus, shows the rational for giving opposite judgments by the two subgroups (as haswbeen revealed by the judgment distributions).

7 Testing for the Effect of Ordering of Reasons in the Composite List

At the third stage of the survey, two types of composite lists of reasons were fed back - one with all the pro reasons appearing at the first part of the list followed by all the con reasons (this is the nonrandomised list), and the other randomised ordering of the reasons (this is the randomised list). Participants were divided into two equal subgroups by random selection. One of the subgroups were fed the nonrandomised list and the other the randomised one. Our objective was to

Table XXI. Importance Ranks of Reasons

Ranks	% of subjects	Ranks	% of subjects
1	48.64	11	23.42
2	47.74	12	22.52
3	45.95	13*	21.62
4	41.44	14	17.12
5	37.84	15**	15.32
6	36.04	16*	14.41
7	29.13	17	11.71
8*	27.93	18	10.81
9	25.23	19	9.91
10	24.32	20*	9.01
		21	8.11

* This rank coincides for two reasons

see whether or not there was any effect of ordering of pro and con reasons on response, and giving reasons. In doing this, first we will compare the response distributions of the two subgroups by using a chi-square test to see whether the distributions differ; then we compare, for each reason, the proportion of people in the two subgroups who gave the reason.

7.1 Comparision between Distributions

The response distributions of the two subgroups are shown in Table XXII. Because of small expected cell frequencies, some of the

Table XXII. Distributions of Subgroups with Randomised and Nonrandomised List

Response	Randomised List		Nonrandomised List	
	No. of Subjs.	% of Subjs.	No. of Subjs.	% of Subjs.
0	3	5.36	4	7.27
12.5	6	10.71	6	10.91
25.0	10	17.86	6	10.91
37.5	5	8.93	2	3.64
50.0	3	5.36	4	7.27
62.5	7	12.50	9	16.36
75.0	11	19.64	17	30.91
87.5	9	16.07	7	12.73
100.0	2	3.57	0	0
Total	56		55	

response categories were merged together. The 5 revised categories are (0,12.5), (25, 37.5), (50, 62.5), (75), and (87.5, 100). The computed value of the chi-square statistic is 4.75 with 4 d.f.; this is far below the 5% significance value of 9.49. We may conclude that, so far as the response distributions are concerned, we do not have evidence of differing response pattern in the two subgroups, or in other words, randomisation of ordering of the reasons does not have an effect on the response of a subject.

7.2 Comparison in terms of Reason-giving

Next we examine whether the two groups differ in giving reasons at the third stage. We will use data given in Appendix G. It gives, for

each reason, the number of subjects as well as proportion of subjects within a given subgroup. For example, 25% of the subjects with randomised list gave Reason 3 while the percentage is 21.82 in the non-randomised list group.

A contingency type analysis cannot be done with this table because a subject may give more than one reason and cannot be classified into one particular cell. The approach we will follow is to compare, for each reason, the two proportions in the two subgroups. To formulate the hypothesis, our argument is as follows: If there is no effect of randomisation then the two proportions for a given reason should be equal, i.e., the probability of giving a reason, whether the list is randomised or nonrandomised, is constant. In other words, the ordering of reasons does not have any effect on the probability of giving a reason. This is the basis for our null hypothesis. On the alternative side, supposing there is an effect of ordering, our contention is the following: Let a reason appear in the rth position in the nonrandomised list and in the (r+s)th position in the randomised list (s is nonnegative and r lies between 1 and 26), then the probability of giving the reason by a subject in the nonrandomised-list-group should be equal to or greater than that of the randomised-list-group according to whether or not not s=0. That is if a reason appears first in serial order in one list compared to the other list, then the chance of giving the reason by a subject in the first subgroup is higher; however, if the reason appears with the same serial number, the chance is equal.

Let us define the following for reason α (α=1,2,...,26).

i = serial number of the reason in the randomised list,

j = serial number of the reason in the nonrandomised list,

p_{1i} = proportion of subjects in the randomised-list-group who gave the reason, and

p_{2j} = proportion of subjects in the nonrandomised-list-group who gave the reason.

We set up the null and alternative hypotheses as follows.

$$H_0(\alpha): p_{1i} = p_{2j} \qquad (i,j = 1,2,\ldots,26)$$

$$H_1(\alpha): p_{1i} > p_{2j} \quad \text{if } i<j$$

$$H_1(\alpha): p_{1i} < p_{2j} \quad \text{if } i>j$$

$$H_1(\alpha): p_{1i} \neq p_{2j} \quad \text{if } i=j$$

For testing $H_o(\alpha)$, for each α separately, we use, in view of the large sample sizes, the normal approximation and the U statistic defined below.

$$U(\alpha) = \frac{\hat{p}_{1i} - \hat{p}_{2j}}{\hat{p}(\alpha)[1 - \hat{p}(\alpha)]\left(\frac{1}{56} + \frac{1}{55}\right)}$$

where $\hat{p}_{1i}$ and $\hat{p}_{2j}$ are the sample estimates of p_{1i} and p_{2j} respectively, and $\hat{p}(\alpha)$ is the overall proportion calculated from the entire group (see Appendix G). The numbers 56 and 55 are the sample sizes in the randomised and nonrandomised list subgroups respectively. Under the null hypothesis $U(\alpha)$ is distributed approximately as $N(0,1)$[27]

(27) Note that we are ignoring the fact that because of feedback from

Table XXIII. Computed Values of u(α)

α	1	2	3	4	5	6	7	8	9
i	25	10	4	26	20	18	21	17	8
j	1	2	3	4	5	6	7	8	17
u(α)	-1.62	-1.04	0.39	-1.23	0.18	-0.93	-0.03	1.42	0.17

α	10	11	12	13	14	15	16	17	18
i	23	22	9	16	24	6	3	13	1
j	25	24	18	22	26	16	15	20	13
u(α)	0.10	-0.87	0.15	-0.05	-0.67	0.75	0.32	0.22	-0.65

α	19	20	21	22	23	24	25	26
i	2	5	7	11	12	14	15	19
j	10	14	9	19	12	11	21	23
u(α)	0.21	-0.38	-0.35	0.85	0.50	3.37	0.63	0.22

Note: i denotes serial number of the reason α in the randomised list, and

j denotes serial number of the reason α in the nonrandomised list.

In view of the nature of our alternative hypothesis we reject the null hypothesis according to the following rule:

Case 1: $i < j$; reject $H_0(\alpha)$ if $u > u_{1-\delta}$

Case 2: $i > j$; reject $H_0(\alpha)$ if $u < u_{\delta}$

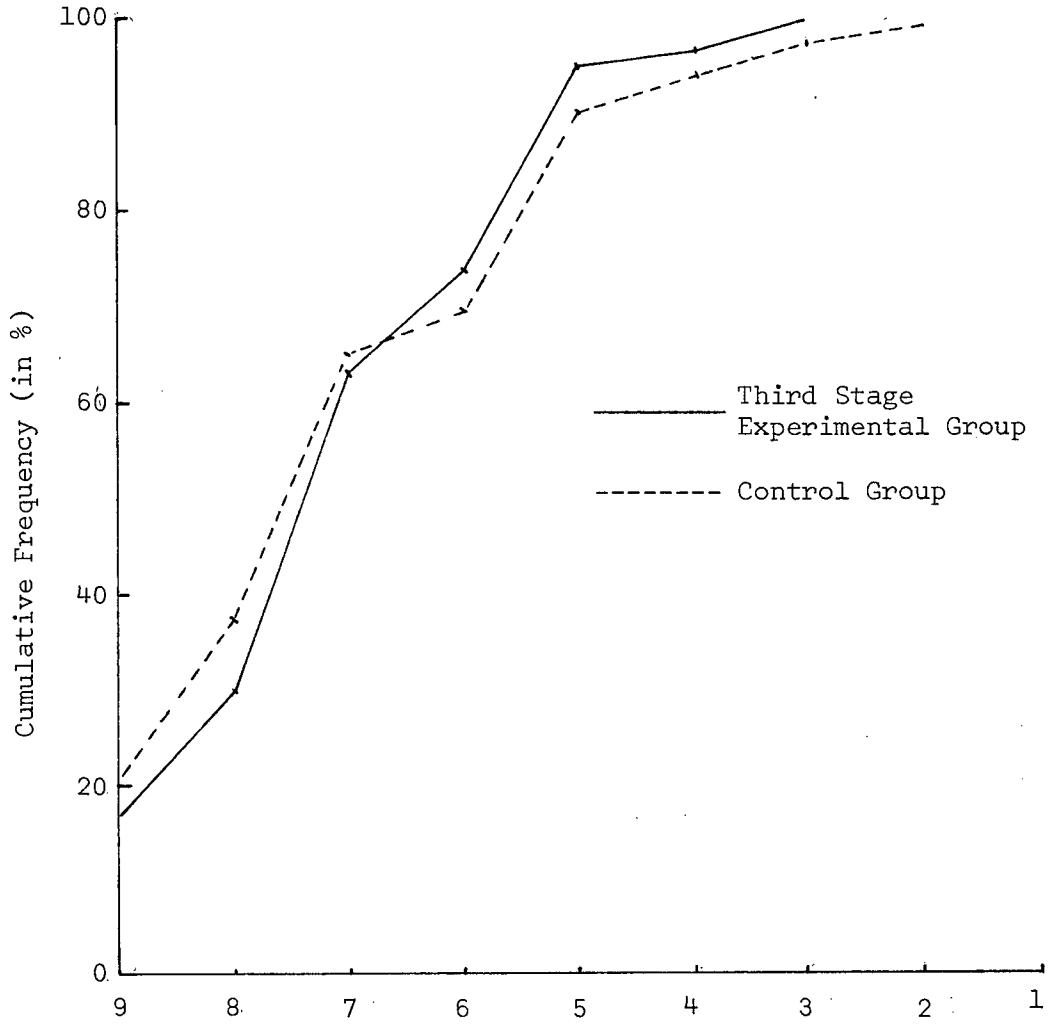
Case 3: $i = j$; reject $H_0(\alpha)$ if $|u| > u_{1-\delta/2}$

where u_k $(0 < k < 1)$ is the $(k \times 100)$ percentile point of the standard normal distribution. In particular, for $\delta = .05$, $u_{.95} = 1.64$ and $u_{.05} = -1.64$ and $u_{.975} = 1.96$. The computed values u of U are given in Table XXIII. We find that there are 16 reasons for which $i < j$, 9 reasons for which $i > j$ and one reason for which $i = j$. It can be seen from the values of u that none of the hypotheses can be rejected at the 5% signifecance level. We may conclude that there is no effect of ordering of reasons in the composite list on a subject's giving reason.

8 Distributions of Confidence Rating

To see whether information feedback increases confidence in one's judgment, each participant in the third stage as well as in the control group was asked to rate himself on the basis of his confidence in the judgment he gave by using a scale of confidence rating (see Appdx. A3, p. 145) The distributions of confidence ratings with cumulative percentages are shown in Table XXIV. For example, 95.28 percent of the subjects in the experimental group gave ratings 5 or more; the same percentage in the control group is 90.28. In Fig. 9, the cumulative percentages are shown

two earlier stages responses within each group are correlated (as well as between the two groups). We assume that this effect is small enough to be ignored.



GFig. 9 Cumulative Frequency Diagrams for the Third Stage and Control Group Distributions of Confidence Ratings

by broken line diagrams. Let (x,y) (using usual notation to denote a point) be a point on one of the curves; then y percent (approximately) of the subjects gave ratings x or more.

A chi-square was also computed for testing the goodness of fit between the distributions (after merging the first four categories into one). The value of the chi-square with with 5 d.f. is 3.5 and has a probability of .62 of being exceeded. We may conclude that the ratings for the two groups have come from the same population.

Table XXIV. Distributions of Confidence Ratings[28]

Ratings		Third Stage			Control		
		No. of Subjs.	% of Subjs.	Cumulative %	No. of Subjs.	% of Subjs	Cumulative %
(Not at all Confident)	1	0	0	100.00	1	1.15	100.00
	2	0	0	100.00	1	1.15	98.86
(Not quite Confident)	3	3	2.83	100.00	3	3.45	97.71
	4	2	1.89	97.17	3	3.45	94.26
(Quite Confident)	5	22	20.75	95.28	18	20.69	90.28
	6	12	11.32	74.53	4	4.60	70.12
(Very Confident)	7	35	33.02	63.21	25	28.74	65.52
	8	14	13.21	30.19	14	16.09	36.78
(Absolutely Confident)	9	18	16.98	16.98	18	20.69	20.69
Total		106			87		

The average ratings are also almost equal, being 6.75 for the control group and 6.77 for the third stage experimental group.

(28) 5 subjects in the third stage and 2 subjects in the control group did not give any ratings.

CHAPTER 5

CONCLUSION

In this final chapter we have three objectives in mind: We will review the main results and findings of the study, suggest some possible research directions and make certain recommendations so things can be done in a better way in future applications.

1 Summary of Findings

1.1 Verification of Methodological Issues

We raised four questions (in Chapter 2) relating to feasibility and methodological aspects of the qualitative controlled feedback method for obtaining judgmental data. First, we will review the findings of the study in relation to these objectives and then discuss some other results.

The first question asked was whether or not it was possible to motivate a group of people to participate in a multistage qualitative feedback survey. We give emphasis on the question of motivation because the success of a survey depends to a great extent on the motivation to participate on the part of the participants. Since qualitative feedback is a new method, and also due to operational considerations (e.g. writing or checking reasons) the survey demands more attention and involvement from the participants than in usual surveys, it is worthwhile to examine the issue of motivation to participate in such a survey.

However, in order to judge the extent of motivation we need to set up some criteria. In this, we note that motivation is an important factor which is highly related to the rate of response, although nonresponse may occure for other reasons also. Still it may be argued that unless there is a high motivation, a participant may not be willing to go through all the stages of the survey. We can, therefore, look at the response rates at different stages to get an idea about the extent of motivation.

We find (Table I) that 80% to more than 90% of the subjects participated at the different stages and also that about 63% of the people who were in the sample at the beginning of the survey, completed all the three stages. We also note that the survey was done mainly by mail questionnaires. Thus the rate of response may be considered rather high. This indicates that participants had a good motivation to participate. We conclude that it is possible to motivate people to participate in a multistage feedback survey. In actual application situations, where participants' judgments may be incorporated in decision-making, it can be expected that motivation would be high.

Our next question was: How actively do the participants participate? By this we mean, whether they take part in all the requirements of the survey; in particular, 'Do they write or check reasons?','Do they answer the basic question in the way the answer is wanted?'. We consider these questions, because, for example, if one participates in all the stages of the survey without giving any reason to support one's judgment, we say that he does not participate actively; and if

most participants do this, the survey is not likely to fulfill its purpose.

We found that almost all[29] the subjects who participated in at least one stage did not find it difficult to answer the basic question by using the rating scale provided. It was also found that, except for a small fraction (8%), all the participants gave at least one reason at the first stage; the average number of reasons being 2, 5 and 6 in the successive three stages. The cumulative number of reasons generated at the second stage was 26. These facts clearly show that the respondents were not only active in participation, but also, that they were enthusiastic in giving reasons and supporting answers.

Thus, from the viewpoint of both motivation and participation, the qualitative feedback survey can be successfully administered.

The other two ppoints are directly related to the successfulness of the method in creating an environment of a "group process". We have mentioned in Chapter 1 that the central element of group process is the process of interaction produced by interchange of arguments and reasons; and, that as a result of such interaction, a change in judgment may occure.

To see whether or not there was interaction, we must look into the reason-giving behavior of the participants, which we have analysed in Section 6 of Chapter 4. It was found that participants gave more and more reasons as they went from one stage to another, resulting in an

(29) There were only 2 subjects who said that the question was not quite meaningful to them.

increasing average number of reasons (2, 5 and 6). This tendency shows that as new reasons were introduced, a participant accepted some of them, so that a reason given by one participant convinced another participant. On the other hand, we also found that a certain proportion of participants (a maximum of 33% in the second stage, and 28% in the third stage) dropped their original reasons (we recall that each participant was reminded of his last stage's reasons), probably, because they found some more convincing reasons. This phenomenon is representative of the fact that an interchange of arguments and reasons took place among the participants; qualitative feedback was able to create the required interaction within the group.

Now that we know that there was an interaction, we examine whether change in judgment occured. It was found in Sec.3 of Chapter 4 that at the second and third stages, 30% and 21%, respectively, of the participants changed their judgments, and that more than 41% changed either in the second or in the third stage. That the majority of subjects did not change reasons is compatible with the fact that the majority of them did not change response (as was found earlier).

1.2 Substantive Findings

Apart from the above methodological verifications, two other important findings have emerged from our study. One of them has implications on the rationality of judgments, and the other is related to the character of judgment distributions and their implications on decisionmaking.

(a) Implications on the Rationality of Judgments

It has been mentioned in Chapter 1 (Subsection 2.3.3) that the rationale behind developing the method of qualitative controlled feedback (q.c.f.) is to give the members of a group as much opportunity as possible, so that they can generate and share a common pool of information and form (and express) their most reasoned judgments, on a controversial issue, independently (i.e. without being subject to pressures of social conformity, authoritarianism, transference of values and similar other coercive acts). Behind q.c.f. is, therefore, implicit the hypothesis that q.c.f. would produce the most rational judgments on the issue. A major result of our study lies with the evidence in support of the hypothesis. This evidence was demonstrated in Subsection 2.3 of Chapter 4 as a result of testing three hypotheses comparing the judgment distributions.

We have found that the experimental group which participated at all the three stages, almost stabilized their opinions about the issue, in a bimodal fashion, at the third stage, in spite of the fact that the public sentiment at that time (as measured by the control group distribution), was relatively in favor of the construction of the center. This is the evidence in support of the hypothesis. Let us explain this in the following way.

At the third stage of the study, the center had already been in the process of construction for quite a while. Based on some social psychological theories such as the cognitive dissonance theory (Festinger [5]), one can predict that people who originally were

opposed to the idea of constructing the center, would have gradually changed their attitude to a favorable one since the construction was already under way,whereas people who originally were in favor of the construction would remain so. Consequently, the overall opinion about this issue would be a favorable one. This prediction is actually verified by the result obtained from the control group. The result demonstrates that, at the time of the third stage, subjects in the control group, who represented the public feelings at that time, did have a more favorable attitude toward the construction of the center than the experimental group at the time of the first stage(Fig. 6(a)), which represented the public feelings at that time (first stage). The significant difference found between the third stage experimental group and the control group, however, indicates that subjects in the experimental group, at the time of the third stage, had not all changed their opinion toward the favorable direction. A Asignificant number of them had gone toward the opposite direction instead; i.e., they remained negative toward the issue. This finding implies that, by giving them both pro and con reasons, subjects in the experimental group, were not overwhelmed by the current developement of the issue and therefore, were allowed to make a decision more rationally than subjects in the control group.

(b) Implications for Decisionmaking

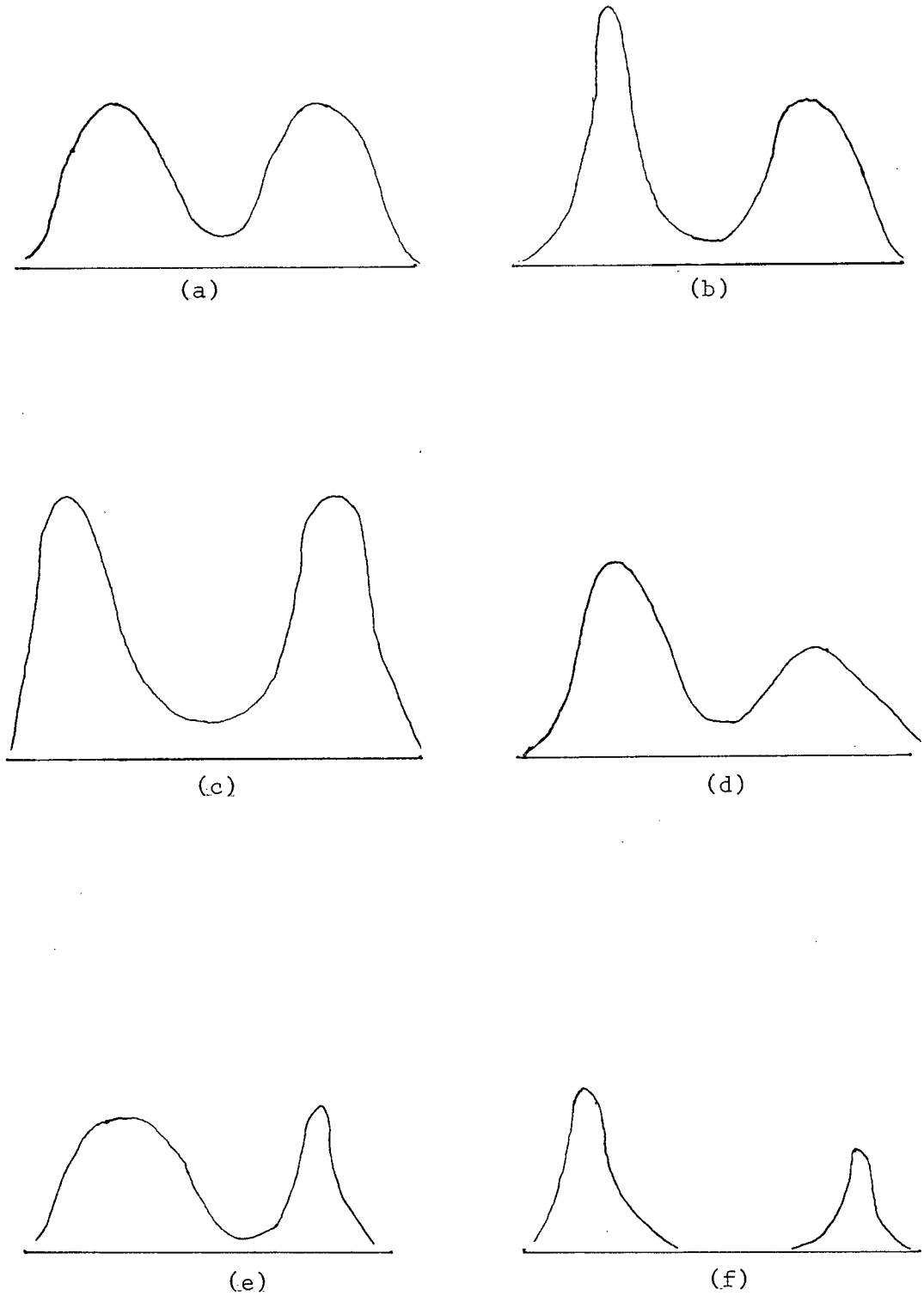
Another important finding of our study is related to the character of the judgment distributions. We have found that these distributions (see Section 2 of Chapter 4) are bimodal with troughs at the neutral point of the scale. This result suggests the hypothesis that when there

is a controversial issue of 'yes' or 'no' type, the judgment distribution becomes bimodal, indicating the two opposing groups. One important application of these distributions may lie in a decisionmaking context, where it is required to incorporate, in some way or other, the judgment of the group. In that case the distribution gives a clear idea about the extent to which the opposing groups differ in their judgments, and the strength of the individual groups.(30) These two ideas can be understood better by referring to the Figs.10(a) through 10(f).

In all of the distributions, we denote the group on the left as group 1 and the one on the right as group 2. In Figs. 10(a),(b) and (c) each of the groups contain equal proportion of individuals. Still, they differ with respect to the strength of the groups and the extent of difference between groups. In Figs. 10(a) and 10(b) the group members cluster around two judgment neuclei (the modal judgment) which are at a equal distance from the neutral position. However, in Fig. 10(b), group 1 is stronger in opinion than group 2, in the sense that members in group 1 are more united (as can be seen from the relatively sharp shape of the curve). On the other hand, in Fig. 10(a) the two groups are of equal strength. In Fig. 10(c), both the groups are equally strong, but group 1 holds a more extreme opinion than group 2. Now in

(30) We note that when the group is divided into two opposing groups, as in our case, it is not quite meaningful to talk about a single group judgment. In such situations, it is perhaps, more desirable to study the entire distribution (see discussion on group judgment in Subsection 3.2, Chapter 1).

Fig. 10. Some bimodal judgment distributions with opposing subgroups



Figs. 10(d), (e) and (f), the groups are disproportionate. In Figs. 10(d) and (e) the groups cluster at an equal distance while in Fig. 10(f) they cluster at an unequal distance from the neutral point. In Fig. 10(e), the smaller group holds a stronger opinion than the larger group.

Thus, by looking at the judgment distributions, it is possible to discern the difference between the groups, and accordingly assess risks before action is taken.(31)

2 Further Research Directions

Apart from the results in the previous section, another contribution of this empirical investigation is that it has also uncovered new areas of research, both in theoretical statistics and in applied social psychology. The research findings will not only increase the efficiency of the method but they are also of interest for their own sake.

2.1 Testing Goodness of Fit between two Populations with Correlated Observations

Let us consider two multinomial populations P_1 and P_2 with k categories in each. Samples of sizes n_1 and n_2 respectively are obtained from the two populations. For testing goodness of fit, a standard test is the chi-square test which assumes that the two samples

(31) In an actual decisionmaking situation it will also be helpful to look at the reasons as well as their weights (importance).

are independent of each other, and also, that the samples are randomly drawn from the respectively populations. This assumption, thus, implies, on the one hand, that the observations within a sample must be uncorrelated, and on the other hand, that there must not be any correlation between the observations in the two samples.

The assumptions in other standard tests of goodness of fit, such as, the Kolmogorov-Smirnov test, are even stricter. This test assumes not only the same assumptions as in the chi-square test, but also, that there must not be any ties among two or more observations, restricting the test from being applied to grouped data. Although a modified version of the Kolmogorov-Smirnov test for applying to grouped and discrete data has been developed by Pettitt and Stephens [12] for a single sample case, the independence assumptions are the same as those for the chi-square test.

The problem arises when the assumptions of zero correlation are violated by the observations, for instance, by observations obtained through qualitative feedback. Suppose data are obtained by applying such a protocol. Let $x_1, x_2, \ldots, x_N$ be the sample from the first stage, and $z_1, z_2, \ldots, z_N$ be the sample from the mth round, before grouping, where x_i and z_i are the responses of the ith participant. We notice first that x_i and z_i are correlated being the response of the same individual on two different occasions - before feedback and after feedback. Also the z_i's are correlated within themselves; this is because after feedback, one participant's reasons have influenced another's response. Thus a correlation among the z_i's is produced.

Existence of these two types of correlations contradicts the assumption of independence between samples and within samples. Thus, if it is required to test whether the first stage distribution is the same as that of the third stage distribution, strictly speaking, the usual tests described above are not applicable.

A more general situation occurs when there is also a correlation between the x_i's, for instance, when the x_i's are the responses at a stage latter than the first stage and earlier than the mth stage.

Now, when the observations are grouped, we may consider them to have come from two multinomial populations. The problem is then to test the goodness of fit between the two multinomial distributions. It is in this direction that a test may be developed that takes account of the correlation structure.

2.2 Goodness of Composite List

The composite list of reasons, used in qualitative controlled feedback, is the medium through which information is fed back. The success of getting a reasoned judgment, therefore, depends greatly on how the list is prepared, or, in other words, on the quality of the list. Many questions are related to the preparation of the list. Should only one person (as was done in our case) make the list? Should a group be formed so each member of the group prepares a list independently, and then sit together to form an anonymous list? or should they consult each other, face-to-face, and make the list? How should one proceed in making the list (i.e. in summarizing the statements

given by the panelists)? Can there be any difference in behavior due to composite lists prepared in different ways? Finally, what criteria should be followed to judge the quality of a composite list? Much empirical research is needed to get answers to the above questions. However, at this point, we will be interested only with the last question, i.e., 'What criteria should be followed to judge the quality of a composite list?'. In the following paragraphs we will suggest a criterion by which the quality of lists prepared by different approaches may be compared.

It is natural to assume that a good composite list of reasons must be representative of the arguments given by the participants. That is, the list should be able to reproduce the potential arguments raised by the participants. This means that, in a good composite list of reasons, if a reason is supposed to represent a certain participant's arguments, when presented to the said participant, he should be able to identify his argument in the same reason. On the basis of this principle, a test can be developed to see whether a list prepared by a certain procedure is good enough to represent the participants' reasons. The test is proposed below.

Let there be N subjects each of whom is asked to give his reasons supporting judgment on a controversial issue. A composite list containing reasons R_1, R_2, ..., R_h is prepared by using a certain method. Let R be the set $[R_1, R_2, \ldots, R_h]$ of all the reasons in the composite list and S_j be the set of reasons which is supposed to represent the jth subject's reasons ($j = 1,2,\ldots,N$); S_j contains k_j elements and $S_j \subset R$. We assume that S_j is an exhaustive set of reasons for subject j. S_j's

need not necessarily be mutually exclusive.

The list is presented to the jth subject without indicating which reasons are supposed to represent his arguments. He is then asked to check the reasons in the list he agrees with as representing his arguments. If it is found that he checks a reason in the set S_j, we say that a tie has occured. Let T_j $(0 \leq T_j \leq k_j)$ denote the number of ties for the jth subject. Define the statistic

$$T = T_1 + T_2 + \ldots + T_N$$

= Total number of ties for all subjects,

where $0 \leq T \leq K$, and $K = k_1 + k_2 + \ldots + k_N$. A high observed value of T will mean that a greater number of reasons given by panelists could be representated in the composite list. Thus, T can be used as a test statistic. The exact nature of T remains to be examined.

By using the above procedure, different methods for preparing composite lists can be compared.

3 Some Recommendations

In this section we make some recommendations designed to improver other applications of the qualitative controlled feedback procedure.

(1) If possible, a larger sample should be taken at the first stage. This is because most potential reasons are generated at the first stage; even if some of the participants do not give reasons supporting their judgments (as was observed in our case) many others will.

This will help in bringing out a variety of arguments about the issue. Also, even if a relatively high nonresponse occurs at subsequent stages, the large number of reasons generated at the first stage would serve the purpose of effective feedback of information.

(2) If possible, participants should be given the knowledge of the exact number of stages in which they would have to participate. This would greatly intensify the motivation to participate. Also the number of stages should be kept at a lower level, say 2, 3 or 4, in the case of a paper-and-pencil survey.

(3) For writing reasons participants should be encouraged to record the reasons by attaching serial numbers (e.g. 1, 2, 3 etc.). This can be accomplished by supplying each participant with a blank sheet of paper with serial numbers printed at reasonable spaces. This is likely to help to motivate participants to be precise in giving reasons.

(4) Information on all cue variables should be asked at the first stage. By so doing, more background information can be obtained about the dropouts at the subsequent stages, so that if necessary dropouts can be identified more effectively.

(5) In preparing the composite list, one of the following procedures may be adopted, although it is expected that the first of the two should produce a better list.

Procedure 1. A small group of people should be selected for preparing the list. Each of the group members prepares a list indepen-

dently, and without consulting the others. All the members then sit together with their lists and compare them. Finally they come up with a single composite list.

Procedure 2. As in Procedure 1, a group of individuals should be selected for preparing the list. The members should sit together and jointly review the reasons of the participants, and then prepare a list. In this case, before sitting together, the individual members may read the reasons independently.

4 Concluding Remarks

In conclusion, it may be said that the method of qualitative controlled feedback has been demonstrated to be a promising technique for judgmental data collection. If conducted according to the procedures outlined above, the method is likely to produce useful data for large populations under consideration.

It is reasonable to expect that, instead of a paper-and-pencil questionnaire survey, computers could be developed to collect judgments and reasons, and process reasons before feedback. This would drastically reduce the time required between stages, as well as provide an opportunity for a greater number of iterations.

Finally, we must mention that in our study we mainly focussed on the basic operational elements of the method, and attention was not given to derive group judgment, or to predict judgment. These are two broad areas where there is scope for further judgment research using qualitative feedback.

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APPENDIX A1. The First Stage Questionnaire

THE UNIVERSITY OF BRITISH COLUMBIA
2075 WESBROOK PLACE
VANCOUVER,B.C.,CANADA
V6T 1W5

FACULTY OF
COMMERCE AND BUSINESS ADMINISTRATION

Feb.-July,1976

Dear Sir/Madam:

May we ask your help in a research study we are conducting in the Faculty of Commerce which involves group decision making. We are trying to study the general process of how groups make decisions. We have developed theoretical statistical models which will predict the final decisions, when the information about the problem is presented in a certain way. We now need to test the theory, and that is where you come in. We need to collect real data regarding an actual decision. For this experiment involving group decision making, we have chosen an issue which is of interest to all of us: the new indoor swimming pool (aquatic center). You will be asked to provide a numerical answer to only one judgmental question relating to this swimming pool (there will also be some factual information requested), and you will be asked to provide reasons for your answer. The reasons are most important. We will gather all the reasons given by all respondents, and then come back to you and tell you everyone else's reasons (but we won't tell you the numerical answers they gave, not even the average number). We will then ask you the same basic question a second time, to see if other people's reasons will persuade you to change your answer. We

expect to do this three times. During the course of the experiment you are requested not to discuss your answers or reasons with any other panelists in our survey; if you do, it will invalidate the experiment. We will maintain this discipline with all panelists, and will keep all responses anonymous.

Equal numbers of students, Faculty, and Staff at U.B.C. have been selected randomly, as panelists. We will give you a nominal reward of one dollar for your trouble, if you help us complete the experiment (all three stages of being asked the same question). We wish to complete the whole process of data collection by the end of the Summer Session 1976.

To obtain fruitful results from our study we will need your full cooperation and hope you will be willing to give it.

Background for the Questionnaire

We would like to give you some background information about the aquatic center. The new aquatic center is now under its first phase of construction and is located in front of the Student Union Building. If sufficient additional funds are collected, construction will continue to the final stage. A brief history behind constructing the center is as follows.

In early 1970 a recreation group of the university stimulated the need for a covered swimming pool on campus, and proposed that the existing Empire pool be covered. In subsequent years the idea of covering

the existing outdoor pool was rejected in favor of a new full scale, aquatic center. The Alma Mater Society of U.B.C. took the issue in their hands. There, was, however, a good deal of controversy among the students about whether or not such an aquatic center should be built (in terms of whether the money to be spent might be used for "better" purposes). Finally, the issue was settled through two student referendums and the decision to construct the center was taken.

Regarding financing of the center, the students pledged to donate $925,000 (to be collected from a compulsory, annual fee of $5.00 from each student) towards a total estimated cost of $4.7 million. The current plan is that the remainder of the required funds will come from the University, Provincial and Federal Government grants, donations from Faculty, Staff, Alumni, and the community; the University will subsidize maintenance of the center. Additional costs for lockers, towels, laundry, etc. will probably be on an individual user basis.

The center will enable the University to provide recreational and training programs for both members of the academic community (students, faculty and staff), and the general public. Such programs might inclued general swimming for all, in addition to Learn-to-swim, Red Cross certification etc.

We invite you to complete the attached questionnaire.

For example, if you feel such an aquatic center is "Extremely Unimportant", put 0 in the box.

Now go on to Question B, for your reasons. Question C will request factual data.

B. To help persuade others in our survey, in the next two stages, about how important the center is, please enumerate any reasons you may have had for giving the answer to Question A. If you do not provide reasons, your answer will not persuade other respondents. If you have general comments on the questionnaire (not reasons for your answer) you may give them in Question 17, in C.

C. Please provide the following background data to help us in our evaluation. This information will be kept confidential and will not be used for any purpose other than this survey.

1. Name:

2. Address (where it is easiest to reach you during the day, on campus if Possible):

3. Telephone Number (on campus, if possible):

4. Status: Student Faculty Staff

5. If you checked "Student", are you working for a degree at U.B.C.?

6. Yes No

6. If you are a student, are you:

Undergraduate Graduate

7. Sex: Male Female

8. Would other members of your family use the center?

Yes No

9 Do you know how to swim? Yes No

10. Do you live on campus? Yes No

11. Using your usual means of transportation to commute to the campus, do you live more than thirty minutes away? Yes No

12. If you are a Staff member or a Faculty member, have you already donated $5.00 or more toward construction of the center?

Yes No

13. If you have not already donated, would you be willing to donate $5.00 or more toward construction of the center? (This questionnaire will <u>not</u> be used to ask you for a donation).

Yes No

14. How much annual fee would you be willing to pay for use (lockers, towels, etc.) of the aquatic center? (The current compulsory student fee of $5.00 for construction will probably not cover this).

Please write the amount in the box.

15. Do you have a swimming pool in your residence or near your residence (excluding the currently existing UBC outdoor pool).

Yes No

16. How frequently would you use an indoor aquatic center during the regular academic year, if there were one available on the campus? Please put your answer in the box:

0 - Not at all, 1 - Occasionally, 2 - Frequently,

3 - Very Frequently

17. Please use this space to give any general comments you may have on this questionnaire. If necessary, please use the reverse side of this page.

on the first stage and determine whether or not your original judgment regarding the importance of the proposed aquatic center is still valid. Perhaps in the light of some of the reasons by other group members your judgment has now changed; perhaps not. In any case, now re-answer the original importance question.

(2) In studying the composite list of reasons, check off those reasons which you feel you took into account in making your importance judgment on this round. If you feel there are some additional reasons relevant to your current judgment that are not listed in the composite, please add them to the list.

(3) Please also give some additional factual information which we neglected to request on the first stage.

We would like to give you an idea about how we prepared the composite list of reasons. First we carefully sorted out the reasons which showed very much the same kind of argument, and then we made a single reason out of them. In order to do this, sometimes we had to drop very minor details. We hope you will find the reasons you gave on the first stage in the composite list, even though these reasons may appear in a slightly different form from the way in which you gave them.

We would be very grateful if you would kindly take the trouble to fill out the attached questionnaire, and thus help us in carrying out our research study. Please send us back the completed questionnaire (including your first stage reasons sheet and the composite list) by campus mail, using the self addressed envelope. Thank you.

QUESTIONNAIRE ON GROUP DECISION MAKING USING CONTROLLED FEEDBACK

(Second Stage)

Please carefully read the composite list of reasons before answering Question A; they include your own original reasons. Check off the reasons which are relevant in determining your answer to the question. If you have any new reasons, please add them at the end of the composite list.

The Composite List of Reasons

1. The University area has a large population with no winter access to swimming. The Aquatic Center will meet this need of the university community; also the center can be used by the surrounding community.

2. As a major university in British Columbia UBC should possess adequate facilities in providing physical education and athletic training. The aquatic center can be used (as a lab) by the Physical Education Department in giving training in swimming and other aquatic sports.

3. The Aquatic Center will provide a good link between the University community and the general public; also, it will improve relationships between major subgroups within the University community (students, faculty and staff) which will lead to a better learning and working environment.

4. The aquatic center will be a good asset to the campus since it will provide a convenient facility for the use of the university students

and employees, and the nearby community, for swimming - an exercise good for recreation, health and fitness.

5. British Columbia, and in general Canada, should have the potential for first class competitive swimming, so that swimmers can show good performance in the Olympics. The center will improve quality of competitive swimming and other aquatic sports.

6. Existing facilities for year-round swimming in Vancouver are few in Number.

7. Use of the center for swim meets will be a good source of publicity for UBC.

8. Development of good facilities for the University is always important, whether recreational or otherwise.

9. As an academic institution it is not within the role of the University to provide recreational and athletic facilities on such a grandiose scale.

10. The present time is one of the severe financial stringency at this University. When a university is experiencing "hard times" to keep its essential academic functions running and improving, any money that can be used by the university should be spent on academic, rather than athletic, purposes.

11. A relatively inexpensive covering device for the existing Empire pool would be much more realistic in terms of expenses and need of the university (i.e.the needs of the students, faculty and staff).

12. A good number of outdoor pools (for example, pools in community centers) and some indoor pools (e.g. the Lord Byng High School pool, the English Bay pool) are available in the city; so there is little need for the community to have an additional new pool on this campus.

13. Since the proposed aquatic center would be located at a place far away from any sizeable residential community, it would not likely be used very effectively by the outside community.

14. A very small fraction of students, faculty and staff and (perhaps) community will use the center. The large cost involved for such a limited use is not justified.

15. Recreational facilities on the UBC campus are already plentiful and excellent, including one outdoor pool which meets the present needs.

16. The money could be spent on other, better, alternatives such as:

    (a) student housing;

    (b) audio-visual aids to class rooms;

    (c) better transportation, such as, a rapid transit system from Blanca to campus;

    (d) building a covered pool outside the campus;

    (e) providing improved medical facilities for university community members;

    (f) cultural programs;

    (g) a variety of recreational and athletic programs;

    (h) in updating women's status in the work force;

(i) staff salary;

(j) other projects.

17. If there is any need for a pool by the Physical Education Department for training purposes, during the 6 months period when the Empire pool cannot be used, that need could be met by the Lord Byng covered pool.

New Reasons

If you have any new reasons, please put them in the space below. Have you checked off your current set of reasons you will take into account in giving your "importance rating" on this stage?

Basic Question

Question A: How important (necessary) do you feel it is for the University of British Columbia to complete construction of an indoor aquatic center on the campus that would be available for use by students, faculty, staff, and their families, and the general Vancouver community.[Note: By "complete construction"wwe mean, how important is it to have an indoor aquatic center.]

Please give in this box [ ] the numerical rating which comes closest to corresponding with your own feelings, according to the following table:

Extremely Unimportant	0
Very Unimportant	12.5
Moderately Unimportant	25.0
Somewhat Unimportant	37.5
Indifferent or Neutral (don't care whether or not it gets built)	50.0
Somewhat Important	62.5
Moderately Important	75.0
Very Important	87.5
Extremely Important	100.0

Your answer (numerical rating) to Question A at the last stage was _____.

Question B. (Factual Information):

Please provide the following background information to help us in our evaluation. This information will be kept confidential and will not be used for any purpose other than this study.

1. Name:

2. Address (on campus):

3. Telephone Number (on campus, if possible):

4. Age: Below 25 [ ], 25 - 34[ ], 35 - 44 [ ], 45 - 54 [ ], 55 or more [ ].

5. How long have you been a member of the UBC community:
   Less than one year [ ],
   one to four years [ ],
   five or more years [ ]?

6. If you are a staff member, are you administrative [ ], clerical[ ], other [ ] ?

formed a composite of all the reasons given by all study participants. On Round Two, we showed you the composite of reasons and then asked you to answer the same question "A" again. We also asked you to give reasons for your numerical response on the second round (your reasons on the second round might or might not have been the same as those you gave on the first round).

We have now formed a composite of all of the Round Two reasons given by all participants. We want you to answer question "A" again (for the last time), after you study the composite of reasons, and again we want you to give reasons for your numerical response (your new reasons might or might not overlap with your reasons given on the two earlier rounds).

We are now asking you to do three things:

(1) Please study the third stage composite list of reasons, and then answer question "A" (your answer to question "A" on Round Two is provided as a reminder; we are also reminding you of the reasons you gave on round two).

(2) Please check off which reasons in the composite list which you now find as contributory towards your current response to question "A". If there are some new reasons you now have but which don't appear in the composite, please give them as well.

(3) Please answer the two subsidiary questions following question "A".

We hope to receive your completed questionnaire by February 25, 1977. If you would like to receive a copy of the summary report on this study, you may indicate that in the questionnaire.

Please return the entire questionnaire (you may retain this letter) by using the self-addressed envelope supplied. Upon receipt of your Round Three Questionnaire, we will send you a dollar, as promised earlier, as a token measure of our gratitude for your participation in the study.

Sincerely,

S.J. Press
Faculty of Commerce

M. W. Ali

Institute of Applied
Mathematics and Statistics
M

QUESTIONNAIRE ON GROUP DECISION MAKING USING CONTROLLED FEEDBACK

(Third Stage)

Instruction:

Please carefully read the following third stage composite list of reasons, before answering question "A". Check off the reasons which you think are relevant for your question "A"-answer by putting a "√" mark in the appropriate left hand box; we have placed checks in the right hand boxes corresponding to the reasons which you checked at the second stage. Note that the reasons with a "*" are the new reasons added by the panelists at the second stage. If you have any new reasons now, please add them at the end of the composite list.

Warning:

Note carefully that if a reason appears below it means only that the reason was given by one or more respondents; it may have been cited by most respondents, or it may have been cited by only one respondent.

COMPOSITE OF REASONS GENERATED BY THE PANEL DURING "ROUND TWO"

Check here if this reason is part of your current thinking

Reasons checked here were given by you on Round 2.

[ ] *1. Since it is not possible to cover the Empire pool, it is better to have a covered aquatic center. [ ]

[ ] *2. The existing Empire pool is well used by the community - one would expect the aquatic center to be used even more . [ ]

[ ] 3. The money could be spent on other, better, alternatives such as: [ ]

(a) student housing;

(b) audio-visual aids to classrooms;

(c) better transportation, such as a rapid transit system from Blanca to campus;

(d) building a covered pool outside the campus;

(e) providing improved medical facilities for university community members;

(f) cultural programs;

(g) a variety of recreational and athletic programs;

(h) in updating women's status in the work force;

(i) staff salary;

(j) other projects.

[ ] 4. The aquatic center will provide a good link between [ ]

the university community and the general public; also it will improve relationships among major subgroups within the University community (students, faculty, and staff) which will lead to a better learning and working environment. [ ]

[ ] *5. It is not certain that the Lord Byng pool will be available for our athletes, we should, therefore, have our own covered pool. [ ]

[ ] 6. Recreational facilities on the UBC campus are already plentiful and excellent, including one outdoor pool which meets the present needs. [ ]

[ ] *7. The center will be used in large part for academic and research purposes by a significant cross section of the university community. [ ]

[ ] 8. As an academic institution it is not within the role of the University to provide recreational and athletic facilities on such a grandiose scale. [ ]

[ ] 9. A good number of outdoor pools (for example, pools in community centers) and some indoor pools (e.g., the Lord Byng High School pool, The English Bay pool) are available in the city; so there is little need for the community to have an additional new pool on this campus. [ ]

[ ] 10. As a major university in British Columbia UBC should [ ]

possess adequate facilities in providing physical education and athletic training. The aquatic center can be used (as a lab) by the Physical Education Department in giving training in swimming and other aquatic sports. [ ]

[ ] *11. Instead of being a source of publicity it is suspected that the pool would create antipathy among the public, since what is being constructed is peripheral to the university's function. [ ]

[ ] *12. Since the University contribution is small enough compared to the total cost of the center, it is worthwhile to have an aquatic center on campus. [ ]

[ ] *13. If there is any need for a pool by the Physical Education Department for training purposes, during the 6 months period when the Empire pool cannot be used, that need could be met by the nearby Lord Byng covered pool. [ ]

[ ] *14. The center could become a source of revenue if used for competition and swimming exhibition. [ ]

[ ] *15. There are already too many "visitors" who are allowed to take up parking space that should be reserved for students, faculty and staff; the aquatic center, if accessible to outside visitors, will make the parking problem more acute. [ ]

[ ] 16. Since the proposed aquatic center would be located at a place far away from any sizeable residential community it would not likely be used very effectively by the outside community. [ ]

[ ] 17. Development of good facilities for the University is always important, whether recreational or otherwise. [ ]

[ ] 18. Existing facilities for year-round swimming in Vancouver are few in number. [ ]

[ ] *19. The University should obtain funds and complete the Asian Center before commiting itself to another building that it may not be able to complete due to insufficient funds. [ ]

[ ] 20. British Columbia, and in general Canada, should have the potential for first class competitive swimming so that swimmers can show good performance in the Olympics. The center will improve quality of competitive swimming and other aquatic sports. [ ]

[ ] 21. Use of the center for swim meets will be a good source of publicity for UBC. [ ]

[ ] 22. A relatively inexpensive covering device for the existing Empire pool would be much more realistic in terms of expenses and need of the University (i.e., the needs of the students, faculty and staff). [ ]

[ ] 23. The present time is one of severe financial stringency at this University. When a University is experiencing "hard times" to keep its essential academic functions running and improving, any money that can be spent by the University should be spent on academic, rather than athletic, purposes. [ ]

[ ] 24. A very small fraction of students, faculty and staff and (perhaps) community will use the center. The large cost involved for such a limited use is not justified. [ ]

[ ] 25. The University area has a large population with no winter access to swimming. The aquatic center will meet this need of the University community; also the center can be used by the surrounding community. [ ]

[ ] 26. The aquatic center will be a good asset to the campus since it will provide a convenient facility for the use of University students and employees, and the nearby community, for swimming - an exercise good for recreation, health and fitness. [ ]

New Reasons

If you have any new reasons, please put them in the space below. Have you checked off your current set of reasons you will take into account in giving your "importance rating" on this stage?

BASIC QUESTION

Question A. How important (necessary) do you feel it is for the University of British Columbia to complete construction of an indoor aquatic center on the campus that would be available for use by students, faculty, staff, and their families, and the general Vancouver community. (Note: By "complete construction" we mean, how important is it to have an indoor aquatic center).

Please give in this box [ ] the numerical rating which comes closest to corresponding with your own feelings, according to the following table:

Extremely Unimportant	0
Very Unimportant	12.5
Moderately Unimportant	25.0
Somewhat Unimportant	37.5
Indifferent or Neutral (don't care whether or not it gets built)	50.0
Somewhat Important	62.5
Moderately Important	75.0
Very Important	87.5
Extremely Important	100.0

Your answer (numerical rating) to Question A on the second stage was ----------.

If you place a check in this box you will receive a copy of a summary report of this study. [ ].

SUBSIDIARY QUESTIONS

Please provide the following subsidiary information which will be helpful to us in analysing the results.

Residence

1. Please indicate with a check in the appropriate box the location of your normal local residence in the Vancouver metropolitan area.

[ ] West side (West of Granville, on UBC side of Burrard Inlet, but in Vancouver).

[ ] East side (East of Granville, on UBC side of Burrard Inlet, but in Vancouver).

[ ] West Vancouver or North Vancouver.

[ ] West End (downtown area).

[ ] Burnaby or Coquitlam.

[ ] Richmond.

[ ] Surrey, New Westminister, Delta.

[ ] Other (please indicate location on the next line).

_____

Confidence Rating

2. Now that you have finished answering question "A", we would like to ask you to rate yourself, on the following scale, in terms of the degree of confidence you have in that your own answer to question "A" actually represents your true feelings about the issue.

   Please indicate the number below that best describes your confidence level in your answer to Question "A".

Not at all confident	1 2
Not quite confident	3 4
Quite confident	5 6
Very confident	7 8
Absolutely confident	9

APPENDIX A4. The Third Stage Questionnaire with Nonrandomised Composite List of Reasons.

We do not reproduce the questionnaire here, since this is the same as the questionnaire in APPENDIX A3 except that the ordering of the reasons in the nonrandomised composite list was different. The order in which the reasons appeared can be found in APPENDIX F. Note in that order that all the pro reasons appeared at the first part of the list followed by all the con reasons.

APPENDIX A5. The Questionnaire for the Control Group.

We do not reproduce the questionnaire here, since it is the same as the First Stage Questionnaire (items 5 and 6 dropped) in APPENDIX A1 with 3 additional items (item numbers 4, 5 and 6) from the Second Stage Questionnaire (APPENDIX A2) and two additional items (item numbers 1 and 2) from the Third Stage Questionnaire (APPENDIX A3)

Appendix B. Empirical Frequency Distributions of Response

Response	First Stage			Second Stage			Third Stage			Control		
	Faculty	Staff	Combined	Faculty	Staff	Combined	Faculty	Staff	Combined	Faculty	Staff	Combined
0	3	3	6	3	3	6	4	3	7	4	3	7
12.5	77	2	9	8	2	10	7	5	12	1	2	3
22500	7	3	10	4	7	11	7	9	16	4	3	7
37.5	2	3	5	7	7	14	5	2	7	2	2	4
50.0	6	7	13	6	2	8	4	3	7	8	2	10
62.5	8	7	15	12	6	18	11	5	16	6	10	16
75.0	18	17	35	10	15	25	12	16	28	6	8	14
87.5	3	13	16	4	13	17	4	12	16	11	12	23
100.0	0	2	2	0	2	2	0	2	2	4	1	5
Total	54	57	111	54	57	111	54	57	111	46	43	89

Appendix C1. Frequency Table showing change in response from the First Stage to the Second Stage (ejects)

FIRST STAGE \ SECOND STAGE	0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0	6									6
12.5		7	1			1				9
25.0		3	6	1						10
37.5			1	4						5
50.0			1	5	5	1	1			133
62.5			1	3	1	10				15
75.0			1	1	2	6	23	2		35
87.5							1	15		16
100.0									2	2
Total	6	10	11	14	8	18	25	17	2	111

Note: The entries of the table are $f(z_2,z_1)$ and the row totals are $f(z_1)$

Appendix C2. Frequency Table showing change in response from the Second Stage to the Third Stage the

SECOND STAGE	THIRD STAGE 0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0	6									6
12.5	1	8	1							10
25.0		1	9	1						11
37.5		2	5	6	1					14
50.0		1	1		5	1				8
62.5						15	3			18
75.0							23	2		25
87.5					1		2	14		17
100.0								1	2	2
Total	7	12	16	7	7	16	28	16		111

Note: The entries of the table are $f(z_3,z_2)$ and the row totals are $f(z_2)$.

Appendix C3. Frequency Table showing change in response from the First Stage to the Second Stage (Faculty)

FIRST STAGE	SECOND STAGE 0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0	3									3
12.5		6				1				7
25.0		2	4	1						7
37.5				2						2
50.0				2	3	1				6
62.5				2	1	5				8
75.0					2	5	10	11		18
87.5								3		3
100.0										0
Total	3	8	4	7	6	12	10	4		54

Appendix C4. Frequency Table showing change in response from the Second Stage to the Third Stage (Faculty)

SECOND STAGE	THIRD STAGE 0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0	3									3
12.5	1	6	1							8
25.0		1	3							4
37.5			2	5						7
50.0			1		4	1				6
62.5						10	2			12
75.0							9	1		10
87.5							1	3		4
100.0										0
Total	4	7	7	5	4	11	12	4	0	54

Appendix C5. Frequency Table showing change in response from the First Stage to the Second Stage (Staff)

FIRST STAGE	SECOND STAGE 0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0	3									3
12.5		1	1							2
25.0		1	2							3
37.5			1	2						3
50.0			1	3	2		1			7
62.5			1	1		5				7
75.0			1	1		1	13	1		17
87.5							1	12		13
100.0									2	2
Total	3	2	7	7	2	6	15	13	2	57

Appendix C6. Frequency Table showing change in response from the Second Stage to the Third Stage (Staff)

SECOND STAGE	THIRD STAGE										
	+	0	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	Total
0		3									3
12.5			2								2
225.0				6	1						7
37.5			2	3	1	1					7
50.0			1			1					2
62.5							5	1			6
75.0								14	1		15
87.5						1		1	11		13
100.0										2	2
Total		3	5	9	2	3	5	16	12	2	57

APPENDIX D1. Revised Expected Frequencies for the First Stage and the Control Group Distributions

Response Categories	First Stage		Control		Total
	Observed	Expected	Observed	Expected	
[0,12.5]	15	13.88	10	11.13	25
[25,37.5]	15	14.43	11	11.57	26
[50]	13	12.77	10	10.24	23
[62.5]	15	17.21	16	13.80	31
[75]	35	27.20	14	21.81	49
[87.5,100]	18	25.53	28	20.47	46
Total	111		89		200

APPENDIX D2. Revised Expected Frequencies for the Third Stage and Control Group Distributions

Response Categories	Third Stage		Control		Total
	Observed	Expected	Observed	Expected	
[0,12.5]	19	16.10	10	12.91	29
[25]	16	12.77	7	10.24	23
[37.5,50]	14	15.54	14	12.46	28
[62.5]	16	17.76	16	14.24	32
[75]	28	23.31	14	18.69	42
[87.5,100]	18	25.53	28	20.47	46
Total	111		89		200

APPENDIX D3. Revised Expected Frequencies for the First Stage and the Third Stage Distributions

Response Categories	First Stage		Third Stage		Total
	Observed	Expected	Observed	Expected	
[0,12.5]	15	17.0	19	17.0	34
[25]	10	13.0	16	13.0	26
[37.5,50]	18	16.0	14	16.0	32
[62.5]	15	15.5	16	15.5	31
[75]	35	31.5	28	31.5	63
[87.5,100]	18	18.0	18	18.0	36
Total	111		111		222

APPENDIX E. A Technique for Using Data Sets with Missing Observations in Regression

Let us consider a regression with 3 right hand variables X_1, X_2, and X_3 and suppose that 10 data points are available with some missing observations as shown below.

Y	X_1	X_2	X_3
Y_1	X_{11}		X_{31}
Y_2	X_{12}		X_{32}
Y_3	X_{13}	X_{23}	X_{33}
Y_4	X_{14}	X_{24}	X_{34}
Y_5	X_{15}	X_{25}	X_{35}
Y_6	X_{16}	X_{26}	X_{36}
Y_7	X_{17}	X_{27}	X_{37}
Y_8	X_{18}	X_{28}	X_{38}
Y_9		X_{29}	X_{39}
Y_{10}		$X_{2,10}$	$X_{3,10}$

To compute the vector of regression coefficients (b_1, b_2, b_3) we need to compute

$$\begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} = \begin{bmatrix} S(x_1^2) & S(x_1,x_2) & S(x_1,x_3) \\ S(x_2,x_1) & S(x_2^2) & S(x_2,x_3) \\ S(x_3,x_1) & S(x_3,x_2) & S(x_3^2) \end{bmatrix}^{-1} \begin{bmatrix} S(x_1,y) \\ S(x_2,y) \\ S(x_3,y) \end{bmatrix}$$

where S(.,.) stands for the sum of squares of deviations about average. Dividing each element in the matrices by n=10 we get the parameter estimates in terms of variances and covariances. This is usually done when we have a full set of observations.

According to the technique,however, when there are missing observations, as in the above example, we compute the variances and covariances using only the available observations. Thus,

$$\text{Var}(X_1) = \frac{1}{8} \sum_{i=1}^{8} (X_{1i} - \bar{X}_1)^2$$

$$\text{Var}(X_2) = \frac{1}{8} \sum_{i=3}^{10} (X_{2i} - \bar{X}_2)^2$$

$$\text{Var}(X_3) = \frac{1}{10} \sum_{i=1}^{10} (X_{3i} - \bar{X}_3)^2$$

$$\text{Cov}(X_1,X_2) = \frac{1}{6} \sum_{i=3}^{8} (X_{1i} - \bar{X}_1)(X_{2i} - \bar{X}_2)$$

$$\text{Cov}(X_1,X_3) = \frac{1}{8} \sum_{i=1}^{8} (X_{1i} - \bar{X}_1)(X_{3i} - \bar{X}_3)$$

$$\text{Cov}(X_2,X_3) = \frac{1}{8} \sum_{i=3}^{10} (X_{2i} - \bar{X}_2)(X_{3i} - \bar{X}_3)$$

and similarly for $\text{Cov}(Y,X_1)$, $\text{Cov}(Y,X_2)$ and $\text{Cov}(Y,X_3)$ may be computed. Finally the parameters can be obtained by using these variances and covariances.

APPENDIX F. Serial Number of Reasons in Tables XVI, XIX, XX, XXI and Appendix G and the corresponding Serial Numbers in Randomised and Non-randomised Lists.

Serial No. in Tables XVI,XIX, XX,XXI, & Appdx. G	Serial No. in Rando-misde List	Serial No. in Non-randomised List	Serial No. in Tables XVI,XIX, XX,XXI, & Appdx. G	Serial No. in Rando-misde lits	Serial No. in Nonran-domised List
1	25	1	14	24	26
2	10	2	15	6	16
3	4	3	16	3	15
4	26	4	17	13	20
5	20	5	18	1	13
6	18	6	19	2	10
7	21	7	20	5	14
8	17	8	21	7	9
9	8	17	22	11	19
10	23	25	23	12	12
11	22	24	24	14	11
12	9	18	25	15	21
13	16	22	26	19	23

APPENDIX G*. Proportion of Participants in the Randomised and and Nonrandomised List Groups who gave Reason α

α	1	2	3	4	5	6	7	8	9	10	11	12	13
x_{1i}	19	24	14	24	13	12	5	19	14	26	17	16	12
p_{1i}	.339	.429	.250	.429	.231	.214	.089	.339	.250	.464	.304	.286	.214
x_{2j}	27	29	12	30	12	16	5	12	13	25	21	15	12
p_{2j}	.491	.527	.218	.546	.218	.291	.091	.218	.236	.455	.382	.273	.218
p(α)	.414	.478	.324	.487	.225	.253	.090	.279	.243	.460	.342	.279	.216

Note: i = serial number of reason in the randomised list (see Appendix F).
j = serial number of reason in the nonrandomised list (see Appendix F).
x_{1i} = number of subjects in the randomised-list-group who gave reason i.
x_{2j} = number of subjects in the nonrandomised-list-group who gave reason j.

$$p_{1i} = \frac{x_{1i}}{56}, \quad p_{2j} = \frac{x_{2j}}{55}, \quad p(\alpha) = \frac{\text{Total number of subjects who gave reason } \alpha}{111}$$

* Appendix G is continued on the next page.

APPENDIX G (continued)*

α	14	15	16	17	18	19	20	21	22	23	24	25	26
x_{1i}	15	10	22	9	5	10	4	5	8	9	18	6	9
p_{1i}	.268	.179	.393	.161	.089	.179	.071	.089	.143	.161	.321	.107	.161
x_{2j}	18	7	20	8	7	9	5	6	5	7	6	4	8
p_{2j}	.327	.127	.364	.146	.127	.164	.091	.109	.091	.127	.109	.073	.146
$p(\alpha)$	.297	.153	.378	.153	.108	.171	.081	.099	.1171	.144	.216	.090	.153

* See notes in the previous page.

APPENDIX H. The List of Reasons Arranged according to Importance Ranks.

Importance Ranks

1. The Aquatic Center will be a good asset to the campus since it will provide a convenient facility for the use of the university students and employees, and the nearby community, for swimming - an exercise good for recreation, health and fitness.

2. As a major University in British Columbia UBC should possess adequate facilities in providing physical education and athletic training. The aquatic center can be used (as a lab) by the Physical Education Department in giving training in swimming and other aquatic sports.

3. The present time is one of severe financial stringency at this University. When a University is experiencing "hard times" to keep its its essential functions running and improving, any money that can be spent by the University should be spent on academic, rather than athletic purposes.

4. The University area has a large population with no winter access to swimming. The aquatic center will meet this need of the University community; also the center can be used by the surrounding community.

5. The money could be spent on other, better, alternatives such as:

   (a) student housing;

(b) audio visual aids to class rooms;

(c) better transportation; such as a rapid transit system from Blanca to campus;

(d) building a covered pool outside the campus;

(e) providing improved medical facilities for university community members;

(f) cultural programs;

(g) a variety of recreational and athletic programs;

(h) in updating women's status in the work force;

(i) staff salary;

(j) other projects.

6. A relatively inexpensive covering device for the existing Empire pool would be much more realistic in terms of expenses and need of the University (i.e. the needs of the students, faculty, and staff).

7. A very small fraction of students, faculty and staff and (perhaps) community will use the center. The large cost involved for such a limited use is not justified.

8. A good number of outdoor pools (for example, pools in community centers) and some indoor pools (e.g.the Lord Byng High School pool, the English Bay pool) are avaiable in the city; so there is little need for the community to have an additional new pool on this campus.

8. Development of good facilities for the University is always impor-

tant, whether recreational or otherwise.

9. Existing facilities for year-round swimming in Vancouver are few in number.

10. As an academic institution it is not within the role of the university to provide recreational and athletic facilities in such a grandiose scale.

11. The aquatic center will provide a good link between the University community and the general public; also, it will improve relations among major subgroups within the University community (students, faculty, staff) which will lead to better learning and working environment.

12. British Columbia, and in general Canada, should have the potential for first class competitive swimming, so that swimmers can show good performance in the Olympics. The center will improve quality of competitive swimming and other aquatic sports.

13. Since the proposed aquatic center would be located at a place far away from any sizeable residential community it would not likely be used very effectively by the outside community.

13. The center could become a source of revenue if used for competition and swimming exhibitions.

14. The existing Empire pool is well used by the community - one would expect the aquatic center to be used even more.

15. The University should obtain funds and complete the Asian Center before committing itself to another building that it may not be able to complete due to insufficient funds.

15. Recreational facilities on the UBC campus are already plentiful and excellent, including one outdoor pool which meets the present needs.

16. Since the University contribution is small enough compared to the total cost of the center, it is worthwhile to have an aquatic center on campus.

16. If there is any need for a pool by the Physical Education Department for training purposes, during the 6 months period when the Empire pool cannot be used, that need could be met by the nearby Lord Byng covered pool.

17. Instead of being a source of publicity it is suspected that the pool would create antipathy among the public, since what is being constructed is peripheral to the University's function.

18. Since it is not possible to cover the Empire pool, it is better to have a covered aquatic center.

19. The center will be used in lagge part for academic and research purposes by a significant cross section of the University community.

20. There are already too many visitors who are allowed to take up parking space that should be reserved for students, faculty and staff; the aquatic center, if accessible to outside visitors, will make the parking problem more acute

20. Use of the center for swim meets will be a good source of publicity for UBC.

21. It is not certain that the Lord Byng pool will be available for our athlets, we should, therefore, have our own covered pool.