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OBJECTIVE OF 1360

One of the ultimate objectives of the Bell System is to provide at reasonable cost a service that will at all times be satisfactory to the user. It follows that the ultimate criterion by which our work is to be judged is the degree of user satisfaction attained. Hence we of the Laboratories have always been concerned at some stage in our work with the problem of determining user preferences.

To this end preference studies are continually being made in different departments of the Laboratories. A recent example is the service trials on the #500 combined telephone set carried on by Mr. Martin's people. In all such cases, we are interested in determining the preference of telephone users for some new model B over some old model A. For our present purpose let us focus our attention on two aspects of this problem:

1. Selection of a sample of users.

2. Measurement of the preferences of the sample of users.

Within the past fifteen years a vast amount of work has been done on both of these problems by many different industries, market research organizations, academic institutions, and government agencies, including the Bureau of the Census and the Army and Navy. Within this period, there has developed an extensive literature on the mathematical theory of sampling applicable to such problems. Likewise considerable work has been done by all these different agencies on the problem of measuring preferences. However, I think it will be generally agreed by professional students in this field that the problem of measurement of preference is still in a very unsatisfactory state. One of the important contributions of the studies to date, however, is to show the importance of considering the statistical design of experiment.
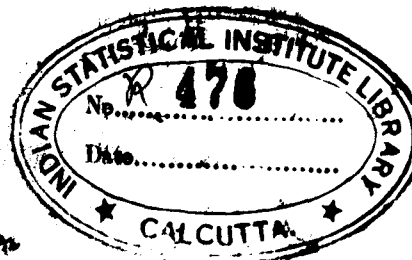
To illustrate what I have in mind let us assume that we are interested in determining the preference of users for some new model. Let us assume that we have solved the sampling problem and that we have a sample of n users. Also let us assume that in some way or other we have found that the new model is preferred at the moment by, let us say, 60% of the users in the sample. A bothersome question now is: <u>How stable is this preference</u>? If the characteristics of the telephone users of tomorrow were to be essentially the same as those of the telephone users of today, and if the physical and social conditions of tomorrow were to be essentially the same as today in the strict statistical sense, we could easily determine with considerable confidence the limits of fluctuation that might be expected in user preferences. This would be a simple problem in mathematical probability. Naturally, however, this is not the situation. Before we can hope to be able to predict with great assurance the trend in user preferences even in this simple example, a lot of additional fundamental information is needed. For example, we would like to know:

1. How to measure the intensity of a given user preference.

2. How a given user preference for a particular kind of telephone service or instrument is related to his other preferences and wants.

3. How a user's preference depends upon physiological, psychological, and experience factors.

4. How a user's preference depends upon the preferences of others.

5. What are the particular physical factors or qualities of telephone service or instrument that shape a given individual's preference - factors of which he is conscious and those of which he is not conscious.

To get at an answer to such questions it is obvious that we must not only measure the preferences of a sample of users at some time t but that we must study the variation in preference from time to time in this sample of users. In other words, it is doubtful that we can hope to attain our fundamental information about user preferences by a single spot check. Instead we must appeal to some type of controlled experiment where variations in preferences under different controllable conditions can be studied.

There is, however a more difficult problem in preference studies in which we of the Laboratories are interested, particularly those of us interested in long-range fundamental research programs designed to bring about radically new improvements in telephone services and equipment. Here we would like to know:

> How to find out all that we can about the user's potential interest in, and preference for, a novel and untried telephone system, instrument, or service, in order to decide whether or not to sponsor a research program to make this system, instrument, or service practicable.

For example, suppose that future developments were to make it possible to provide voice dialling and to enable us to get rid of the bell and the cord in the present telephone set, what would be the telephone user's likely reaction to such new developments. Presumably there is some radically new model X built along this line that would be most preferred by the telephone users. What kind of information can we get that will be most helpful in predicting the physical characteristics of this model X of the future?

> These are some of the problems to which Department 1360 is directing its attention. The broad objectives of this group include, among other things:

1. The organization of all available information about the sampling of users and the measurement of user preferences.

2. The development of improved methods for measuring preferences and for predicting the stability of these preferences.

3. The development of a basic theory of user preference as it applies to the field of communication, including a discussion of the necessary mathematical sampling theory.

I propose to discuss briefly our plan of attack on
the organization of available information and to describe one
experimental study that has been set up.

ORGANIZATION OF AVAILABLE INFORMATION

There are three principal sources of information:

1. Published books and articles,
2. The experience of groups within the Bell System
   in the measurement of preferences.
3. The vast amount of unpublished information and
   experience accumulated by outside agencies.

For example, books on consumer or market research, polling
opinions and attitudes, and certain psychological studies con-
tain information relevant to this problem but it would be an
almost superhuman task to sift the wheat from the chaff in much
of this literature. Undoubtedly the most valuable information
is the third source mentioned above, namely, unpublished exper-
ience of outside agencies. Strange as it may seem, this is
true even in respect to a lot of the mathematical discussion of
pertinent sampling theory, much of which was developed during
the last decade and has not yet been published.

You may be interested, therefore, in our plan of
attack on this problem of summarization. It is pretty obvious
that any feasible plan of attack must involve close liaison
with groups outside the company as well as within and must involve
the cooperation of many different people. The more formal aspects
of mathematical sampling theory pertinent to the measurement of
preferences has been arranged for by Shewhart as editor of the
Wiley Mathematical Statistics Series. Two books are being
written by four top-notch authors who have not only taken a lead
in developing the theory but also have access to most, if not
all, of the available information. One of these books will
shortly be published. Such formal mathematical theory, however,
is necessarily based on idealized assumptions and we need to
have a survey of how competitive sampling plans have worked in
practice. To this end the National Research Council, in cooper-
ation with the Social Science Research Council, largely at the
instigation of Shewhart, set up a committee in 1945 on the
Measurement of Opinions, Attitudes, and Consumer Wants. Through
funds secured by this committee to the tune of about $50,000, a
factual survey of the use of sampling in preference and similar
studies has been made under the direction of more than twenty
experts in the field and with the full and wholehearted

cooperation of the major outside agencies interested in such work. The report of this survey, running over 375 pages, will shortly be published. This committee, however, has gone further by securing the financial backing of a like sum for two other surveys dealing with special problems of design of experiment for preference studies.

When these books and reports are available, it will be a much simpler task to evaluate the older publications and we should in the course of a year or so have at our disposal not only an adequate survey of the available information of interest to us but also in the meanwhile we will have established close liaison for the discussion of methodological problems with leaders in this field in government, educational, and industrial organizations. This plan of attack is illustrated schematically in Fig. 1.

Fig. 1

PREFERENCE STUDY #1

Next I shall say a few words about our first experimental study of a preference problem.

Choice of Problem

In 1300 there are several long-range research projects under way that may result in radically new instruments and services that will directly touch the user such, for example, as the cordless telephone, hand-free telephone, and voice dialing. In each of these three instances we would like to know the characteristics of a model X that would be most satisfactory to the user.

We have arbitrarily chosen to consider the problem of finding such a model X of voice dialing for a particular group of individuals. This is a much more limited problem than finding the X for all potential users. We chose this particular problem not because of any immediate commercial interest in the answer but simply because it is an interesting practical example of the problem of measuring and predicting preference. If we can find out how to lick this problem, presumably we would be able to tackle in a much more rational manner any other problem of like character involving any specified group of people.

Given any group of users, it is conceivable that if we knew enough about them in terms of measurable physiological, psychological and experience factors, we could predict how they would react to a new model X under stated external conditions. In this first experiment, we are interested, among other things, in determining how some specific group react preference-wise individually and then collectively to a simulated voice dialing system. Then by using certain types of questions, supplemented now and later by certain quantitative measurements, we hope to uncover clues to some of the factors that predetermine this preference.

Choice of Group of Users

Keeping in mind that we are solely interested in the methodological problem of finding out why a given group reacts preference-wise as they do in a given situation, we have considerable freedom of choice of members of the group. Since, however, we are interested in studying the stability of preference, it is essential that we have a group who are willing to cooperate in a controlled experiment lasting some eight weeks and who later may be willing, if desirable, to submit to certain physiological and psychological tests. Under these conditions, it was decided to select a group of ten people in one way or another closely connected to, and interested in, the problem of voice dialing. Such a group meets the requirements and at the same time offers the advantages that any practical results coming out of this study may be of considerable help to them in their daily work.

The Experiment - 1st Stage

During the past three months a high speed manually operated system has been installed by Mr. Riesz with the cooperation of Mr. Beaumont of 3400, Mr. Whiteside of the Plant Department, Mrs. Carlson, our Chief Operator, and several engineers of the New Jersey Bell Telephone Company.

(Describe operation and point to a set on the stage)
(that the audience may try at the close of the meeting)

It is possible for us to vary at will certain characteristics of the system, should we find it desirable in the course of the experiment, to determine the effect of such changes on the user's preference.

The experiment was started on April 4th. The tentative schedule for the experiment is shown on Fig. 2

Fig. 2

At the beginning of the test each user was handed a sheet of
instructions and was asked to keep in mind the following question
during the first three weeks of the test:

> "If you had to make a lot of telephone calls, would you
> prefer the present finger dial system (FD) or the HSMO
> system?"

Each user was asked not to discuss the test with any other one
of the ten users, the object being to keep each user's reaction
unbiased by other users.

At the end of three weeks, the users are to be given
a week's experience with finger dialing. This is followed by
two weeks of voice dialing. At the end of the three, one, and
five weeks periods, each user is to be asked a specified list
of questions designed to elicit the user's preference at each
stage and the factors that have influenced this preference. Up
to this point the object is to find out not only the stability
of each user's preference but as much as possible about the
factors that predetermine this preference. At the end of this
six-week period, a conference of the ten users is to be called
and the results of the test thus far discussed with the users.
The members of the group are then to be given another two-week
period of voice dialing, at the end of which they will be
questionned to determine whether or not their preference has
been influenced through group reaction.

Naturally we plan to take account of all available
information in respect to the types of questions used and the
manner of asking them, a subject on which a vast amount of
work has been done by outside agencies.

A brush recorder is bridged across each line during
the time that the call is being placed so that we shall have
certain quantitative data in respect to the user's telephone
habits. The recorder, of course, is not on the line during a
conversation.

Out of a study of the results we hope to uncover,
as already indicated, not only the User's preference but also
some clues as to the factors that shape this preference. As-
suming that we are successful in this attempt, it is likely
that additional measurements may need to be made on each user
in order to get quantitative measures of such factors.