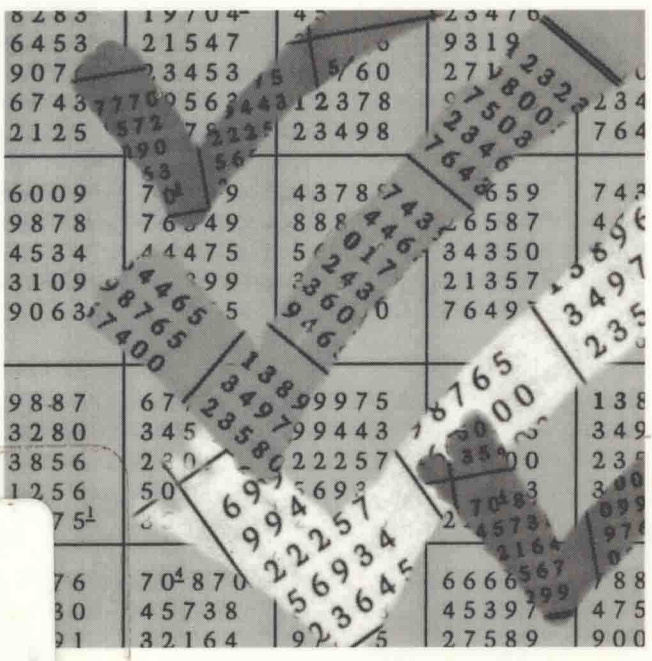
THE SURVEY KIT

TSK 8

HOW TO ANALYZE SURVEY DATA



ARLENE FINK

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HOW TO ANALYZE SURVEY DATA

THE SURVEY KIT

Purpose: The purposes of this 9-volume Kit are to enable readers to prepare and conduct surveys and become better users of survey results. Surveys are conducted to collect information by asking questions of people on the telephone, face-to-face, and by mail. The questions can be about attitudes, beliefs, and behavior as well as socioeconomic and health status. To do a good survey also means knowing how to ask questions, design the survey (research) project, sample respondents, collect reliable and valid information, and analyze and report the results. You also need to know how to plan and budget for your survey.

Users: The Kit is for students in undergraduate and graduate classes in the social and health sciences and for individuals in the public and private sectors who are responsible for conducting and using surveys. Its primary goal is to enable users to prepare surveys and collect data that are accurate and useful for primarily practical purposes. Sometimes, these practical purposes overlap the objectives of scientific research, and so survey researchers will also find the Kit useful.

Format of the Kit: All books in the series contain instructional objectives, exercises and answers, examples of surveys in use and illustrations of survey questions, guidelines for action, checklists of do's and don'ts, and annotated references.

Volumes in The Survey Kit:

1. **The Survey Handbook**
   Arlene Fink
2. **How to Ask Survey Questions**
   Arlene Fink
3. **How to Conduct Self-Administered and Mail Surveys**
   Linda B. Bourque and *Eve P. Fielder*
4. **How to Conduct Interviews by Telephone and in Person**
   James H. Frey and *Sabine Mertens Oishi*
5. **How to Design Surveys**
   Arlene Fink
6. **How to Sample in Surveys**
   Arlene Fink
7. **How to Measure Survey Reliability and Validity**
   Mark S. Litwin
8. **How to Analyze Survey Data**
   Arlene Fink
9. **How to Report on Surveys**
   Arlene Fink

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How to Analyze Survey Data: Learning Objectives

Surveys produce observations in the form of narrations or numbers. Narrations are responses stated in the survey participant's own words, which are then counted, compared, and interpreted, often using methods borrowed from communications theory and anthropology.

Numbers, or numerical data, are obtained when, for example, survey respondents may be asked to rate items on ordered, or ranked, scales, say, with 1 representing a very positive feeling and 5 representing a very negative one; in other surveys, participants may be asked to tell their age, height, or number of trips they have taken or books they have read. Survey data that take numerical form are analyzed using statistics, the mathematics of collecting, organizing, and interpreting numerical information.

The aim of this book is to teach you to become better users and consumers of statistics when applied in the analysis of survey data. It hopes to teach the basic vocabulary of statistics and the principles and logic behind the selection and interpretation of commonly used methods to analyze survey data. What the book does *not* do is teach you to be a survey statistician. For that, formal study is recommended, and, when appropriate, statistical consultation. If this book achieves its objectives, you will not only be able to tell the consultant exactly what you need but be able to interpret the data presented to you.

The specific objectives are to enable you to:

- Learn the use of analytic terms, such as the following:
  - Distribution
  - Critical value
  - Skew
  - Transformation
  - Measures of central tendency
  - Dispersion
  - Variation
  - Statistical significance
  - Practical significance
  - *p* value
  - Alpha
  - Beta
  - Linear
  - Curvilinear
  - Scatterplot
  - Null hypothesis
- List the steps to follow in selecting an appropriate analytic method

- Distinguish between nominal, ordinal, and numerical scales and data so as to:
  - Identify independent and dependent variables
  - Distinguish between the appropriate uses of the mean, median, and mode
  - Distinguish between the appropriate uses of the range, standard deviation, percentile rank, and interquartile range
  - Understand the logic in and uses of correlations and regression
  - Learn the steps in conducting and interpreting hypothesis tests
  - Compare and contrast hypothesis testing and the use of confidence intervals
  - Understand the logic in and uses of the chi-square distribution and test
  - Understand the logic in and uses of the *t* test
  - Understand the logic in and uses of analysis of variance
  - Read and interpret computer output

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1 What Statistics Do for Surveys

Statistics is the mathematics of organizing and interpreting numerical information. The results of statistical analyses are descriptions, relationships, comparisons, and predictions, as expressed in Example 1.1.

AUTHOR'S NOTE: The names of all corporations and survey instruments used in examples throughout this book are fictitious.

EXAMPLE 1.1
Statistical Analysis and Survey Data

A survey is given to 160 people to find out about the number and types of books they read. The survey is analyzed statistically to do the following:

- Describe the backgrounds of the respondents
- Describe the responses to each of the questions
- Determine if a connection exists between the number of books read and travel during the past year
- Compare the number of books read by men with the number read by women
- Find out if gender, education, or income predicts how frequently the respondents read books

Illustrative results are these:

1. *Describe respondents' background.* Of the survey's 160 respondents, 77 (48.1%) were men, with 72 (48%) earning more than $50,000 per year and having at least 2 years of college. Of the 150 respondents answering the question, 32 (21.3%) stated that they always or nearly always read for pleasure.
2. *Describe responses.* Respondents were asked how many books they read in a year and if they preferred fiction or nonfiction. On average, college graduates read 10 or more books, with a range of 2 to 50. The typical college graduate prefers nonfiction to fiction.
3. *Relationship between travel and number of books read.* Respondents were asked how often they traveled in the past year. Frequency of travel was compared to number of books read. Respondents who traveled at least twice in the past year read five or more books.

4. *Comparisons.* The percentage of men and women who read five or more books each year was compared, and no differences were found. On average, women's reading attitude scores were statistically significantly higher and more positive than men's, but older men's scores were significantly higher than older women's.
5. *Predicting frequency.* Education and income were found to be the best predictors of frequency of reading. That is, respondents with the most education and income read the most (one or more books each week).

In the first example, the findings are tallied and reported as percentages. A **tally** or **frequency count** is a computation of how many people fit into a category (men or women, under and over 70 years of age, read five or more books last year or did not). Tallies and frequencies take the form of numbers and percentages.

In the second example, the findings are presented as averages ("on average," "the typical" reader). When you are interested in the center (e.g., the average) of a distribution of findings, you are concerned with **measures of central tendency. Measures of dispersion** or spread, like the range, are often given along with measures of central tendency.

In the third example, the survey reports on the relationships between traveling and number of books read. One way of estimating the relationship between two characteristics is through **correlation.**

In the fourth example, comparisons are made between men and women. The term **statistical significance** is used to show that the differences between them are statistically meaningful and not due to chance.

In the fifth example, survey data are used to "predict" frequent reading. In simpler terms, predicting means answering a question like "Of all the characteristics on which I have survey data (e.g., income, education, type of books read, travel and leisure preferences), which one or ones are linked to frequent reading? For instance, does income make a difference? Education? Income and education?"

What methods should you use to describe, summarize, compare and predict? Before answering that question, you must answer at least four others: Do the survey data come from nominal, ordinal, or numerical scales or measures? How many independent and dependent variables are there? What statistical methods are potentially appropriate? Do the survey data fit the requirements of the methods?

Measurement Scales: Nominal, Ordinal, and Numerical

A characteristic may be surveyed and measured using nominal, ordinal, and numerical scales. The resulting data are termed nominal, ordinal, or numerical.

NOMINAL SCALES

Nominal scales have no numerical value and produce data that fit into categories such as country of birth or gender. Nominal scales (and the data they yield) are sometimes called categorical scales or categorical data. Two survey questions resulting in nominal or categorical data are presented in Example 1.2.

EXAMPLE 1.2
Survey Questions That Use Nominal Scales and Produce Nominal Data

1. What is the employee's gender? *Circle one*

Male	1
Female	2

2. Describe the type of lung cancer. *Circle one*

Small cell	1
Large cell	2
Oat cell	3
Squamous cell	4

Both questions categorize the responses. The answer is the "name" of the category into which the data fit. The numbers are arbitrary and have no inherent value. In Question 1, female could be labeled 1 and male 2. The numbers are merely codes.

When nominal data take on one of two values as in the first question (e.g., male or female), they are termed **dichotomous**. Nominal data are also called **categorical**.

ORDINAL SCALES

If an inherent order exists among categories, the data are said to have been obtained from an ordinal scale, as illustrated in Example 1.3.

EXAMPLE 1.3
Survey Questions That Use Ordinal Scales

1. How much education have you completed? *Circle one*

Never finished high school	1
High school graduate but no college	2
Some college	3
College graduate	4

2. Stage of tumor. *Circle one*

Duke's A	1
Duke's B	2
Duke's C	3
Duke's D	4

3. How often during the past month did you find yourself having difficulty trying to calm down? *Circle one*

Always	5
Very often	4
Fairly often	3
Sometimes	2
Almost never	1

Ordinal scales typically are seen in questions that call for ratings of quality (e.g., excellent, very good, good, fair, poor, very poor) and agreement (e.g., strongly agree, agree, disagree, strongly disagree).

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