Research Methods for Simple and Complex Systems

By David Alderoty © 2015

Chapter 6) Qualitative, Quantitative, and Mixed Methods, Observational Research, with Techniques for Recording Data

Over 1,700 words

To contact the author left click for a website communication form, or use:
David@TechForText.com

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Important Notes

The material in this chapter is focused on observational research, which does not involve experimental manipulation of the systems that are studied. However, all experimental research involves observations. Thus, many of the techniques and concepts presented in this section also apply to studies that involve experimentation.

Often, the term observational research is used in the social and psychological sciences, including marketing. In this e-book, the term observational research applies to any type of non-experimental research, including studies that involve astronomy, biology, chemistry, ecology, medicine, and physics.

Qualitative, Quantitative, and Mixed Methods, Observational Research

Introduction to Three Categories of Observational Research

Observational Research, can be placed in three broad categories, which are **qualitative** (does not involve numbers), **quantitative** (involves numbers), and **mixed methods**, which is a combination of both of the above. These three research strategies are all based on **observing** a **system**, and/or

examining samples that relate to the system. This is done with the goal of obtaining data that relates to the system, **without experimentally manipulating it.**

The word **system** in this definition represents anything the researcher is studying. The word **Observing** involves obtaining data that relate to the system, with the five human senses, and/or with equipment. The equipment can include rulers, scales, thermometers, microscopes, telescopes, cameras, oscilloscopes, seismographs, and any other device. **Examining samples** in the hard sciences, including biology, can involve laboratory evaluations, microscopic examinations, and other techniques that involve special instrumentation. In the social sciences, **Examining samples,** can involve evaluations of a representative sample of the population, with interviews, surveys, and other techniques.

What is Quantitative Observational Research?

Based on the way I am using the terminology **Quantitative observational research** is a non-experimental research method that involves numbers. The numbers might relate to quantity, size, mass, speed, frequency, chemical composition, correlation coefficients, averages, etc. When dealing with the simple systems of the hard sciences, the numbers might relate to measurements, and/or calculations with physics formulas. When dealing with the complex systems of the social and psychological

sciences, the numbers usually represent statistics, such as averages, and correlation coefficients.

There are instruments that display the data from observational research in the form of numbers, which are primarily used in the hard sciences. A few examples are scales, rulers, graduated cylinders, thermometers, barometers, anemometers, pH meters, pressure gauges, and galvanometers.

In the social sciences, quantitative data can be obtained from public records, and certain types of surveys. In psychology, various types of tests, such as IQ evaluations, can display results in the form of numbers.

Three **hypothetical examples** of **quantitative observational research** are presented below:

- Evaluating the correlation between financial resources, and the development of single-family households with children
- Measuring the mass, density, and/or charge of subatomic particles
- Evaluating the composition of a chemical, in terms of elements, and related quantities of each element

What is Qualitative Observational Research?

Based on the way I am using the terminology **qualitative observational research** is a non-experimental research method that does **not** involve numbers. The data obtained from this

research often involves written descriptions of observations, and related inferences, interpretations, and conclusions. In some cases, this may include videos, photographs, tape recordings, and any other data that does not involve numbers.

The descriptions and inferences that may be found in qualitative observational research might not represent highly precise scientific data. However, this type of research is especially useful for studies involving complex systems, **especially when the observations cannot be represented in terms of numbers**. For example, the results of observational studies of *behavior patterns*, *emotional responses, and cultural and social concepts, generally cannot be represented by numbers.*

Sometimes after carrying out qualitative observational research on a system, there are unanswered questions that relate to quantity or statistics. The technique described previously (**quantitative observational research**) can provide answers to such questions.

Mixed Methods Observational Research

The two observational research strategies described above can sometimes be combined, which I am calling: **mixed methods observational research.** This may involve data, results, and conclusions, comprised of numbers, coupled with descriptions,

photographs, sound recordings, videos, and other data, which may or may not involve numbers.

Techniques for Recording Data For Observational Research

Recording Observations, with Writing, NOT a Truly Scientific Technique, but Still Quite Useful

At the simplest level, observations can be recorded by taking notes while observing a system. The notes can be rewritten in an orderly fashion after completing the observations. This simple technique is often used in the social and psychological sciences. It may also be useful when observing the behavior of animals.

However, note taking while observing is **NOT a truly scientific technique**, because it involves **interpreting** observations into written language, which can be incomplete and/or incorrect. In addition, another individual observing the same system may provide a very different written account of what is taking place. This is most likely to happen when the systems under observation are complex, especially if they involve human beings.

During the process of observation, and note taking, ideally no inferences should be made, to ensure truly scientific results. However, if inferences are made at this point, they should be separated from the data that comprises the observations. For example, inferences can be placed in brackets, with the capitalized words INFERENCE. However, after observational data

is collected, the researcher might make related inferences, interpretations, and explain how the data supports and or refutes a hypothesis.

The accuracy of recording observations with note taking can be improved by using two or more observers that are watching the same system simultaneously. With this technique, the observers take notes independently of each other. After the observations have been completed, the notes from each observer are compared with the notes taken by the other observers. With this comparison, it may be possible to filter out, and/or correct biased interpretations, inferences that distort the data, and incomplete descriptions. However, this strategy is not a perfectly accurate or truly scientific method.

In spite of its limitations, note taking can be the ideal strategy to record observations that relate to practical problems. With the practical applications of informal observations, the note taking can involve written descriptions of the observations, as well as related inferences. Ideally, the notes should indicate which statements represent the observations, and which statements represent the inferences.

Examples are evaluations of hospital patients by medical personnel, assessments of employee performance by managers, observations carried out by inspectors, and law enforcement officials, or any type of practical observational evaluation. *Note taking is also useful for initial or preliminary assessments of a*

system, to determine if there is interesting phenomena taking place that will justify a formal observational research project.

Recording Observations with Photographic Equipment, and/or Tape Recorders

A precise and truly scientific technique of recording observations is to utilize photographic equipment, and/or tape recorders. Ideally, this can involve a video camera, with an audio recording mechanism.

At a simpler level, observations can be recorded with still cameras. This can be especially useful when the action takes place very rapidly, such as studying lightning strikes, or the wing movements of birds in flight.

Complex Equipment for Recording Observations, and Devices to Record Observations in Terms of Numbers

At a more complex level, observations can be recorded with specialized recording equipment, such as x-ray imaging devices, infrared cameras, and space satellites. Some devices record observations in terms of numbers and/or graphs, such as oscilloscopes, seismographs, electroencephalographs, cardiographs, etc. With the equipment in this category, the initial observations are essentially performed by electronic and/or photographic devices. Then the researcher examines, and evaluates the recorded data.

Some examples of sophisticated equipment that can be used to record observational data are presented below.

- High-speed video cameras, to record the movements of very fast objects, such as a bullet fired from a gun, or an explosion

- Time-lapse video cameras, to reveal very slow movements, such as the motion that plants make as they track the sun, and grow

- Robotic space satellites to photograph, and chemically analyze the atmosphere and surface of planets, such as the Mars rovers

- Underwater robotic devices, to obtain samples and videos of deep-sea animals, and rock formations

The Advantage of Recording Observations with Equipment

When observations are recorded with equipment, such as with video cameras, or tape recorders, there is a permanent record of the observations. The recorded observations can be evaluated and interpreted, by many individuals, including the general public, if it is published on the web. It is relatively easy to place videos, sound recordings, and other types of observational data on a publicly accessible website. This can result in corrective feedback, if there are any incorrect inferences, interpretations, or hypotheses derived from the observational data.

Another advantage of scientifically recorded data is it can be used for multiple research projects. Specifically, data that was recorded for one research project sometimes can be used for other research projects.

The Advantage of Recording Observational Data Photographically

When video cameras are used to record observations, special evaluations and enhancements of the video can reveal data that was not initially apparent. Special evaluations can involve examining the video multiple times, or in slow motion, or even frame-by-frame. It is also relatively easy to electronically enhance videos, and still photographs, which may reveal additional data. This can also involve magnifying portions of video frames, or photographs. Sometimes additional structures can be revealed in a video frame or photograph by electronically changing contrast and/or colors. This is especially useful for photomicrographs.

If videos or photographs are edited or modified in any way, ideally the original photographic material should be included with the edited versions. This is because the above can sometimes conceal or distort data, which may not be apparent to the researcher.

For Additional Information, or Alternative Points of View, On Video and Observational Research, see the Following Websites from other Authors

1) Google video search page: Using Video "observational research", **2)** Tech Tips: Using Video Management/ Analysis Technology in Qualitative Research J.A. Spiers, **3)** An introduction to using video for research, by Carey Jewitt, **4)** Methods to Improve Reliability of Video Recorded Behavioral Data, **5)** Image from International Space Station's new Window Observational Research Facility, **6)** Point of sale video observational research, **7)** Video: Visual Ethnography - Current Theory, **8)** Retail video observational research, **9**) Space Station Live: Window Observational Research Facility, NASA

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