



EMPERICAL RESEARCH METHOD: OSERVATION, INTERVIEW, QUESTIONNAIRE, SURVEY

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I. INTRODUCTION

Empirical

research is research using empirical evidence. It is a way of gaining knowledge by means of direct and indirect observation or experience. Empirical values such research more than other kinds. Empirical evidence (the record of one's direct observations or experiences) can be analyzed quantitatively or qualitatively. Quantifying the evidence or making sense of it in qualitative form, a researcher can answer empirical questions, which should be clearly defined and answerable with the evidence collected (usually called data). Research design varies by field and by the question being investigated. Many researchers combine qualitative and quantitative forms of analysis to better answer questions which cannot be studied in laboratory settings, particularly in the social sciences and in education.

In some fields, quantitative research may begin with a research question (e.g., "Does listening to vocal music during the learning of a word list have an effect on later memory for these words?") which is tested through experimentation. Usually, a researcher has a certain theory regarding the topic under investigation. Based on this theory, statements or hypotheses will be proposed (e.g., "Listening to vocal voice has

a negative effect on learning a word list."). From these hypotheses, predictions about specific events are derived (e.g., "People who study a word list while listening to vocal music will remember fewer words on a later memory test than people who study a word list in silence."). These predictions can then be tested with a suitable experiment. Depending on the outcomes of the experiment, the theory on which the hypotheses and predictions were based will be supported or not, or may need to be modified and then subjected to further testing.

TERMINOLOGY

The term empirical was originally used to refer to certain ancient Greek practitioners of medicine who rejected adherence to the dogmatic doctrines of the day, preferring instead to rely on the observation of phenomena as perceived in experience. Later empiricism referred to a theory of knowledge in philosophy which adheres to the principle that knowledge arises from experience and evidence gathered specifically using the senses. In scientific use, the term empirical refers to the gathering of data using only evidence that is observable by the senses or in some cases using calibrated scientific instruments. What early philosophers described as empiricist and empirical research have in common is the dependence on observable data to formulate and test theories and come to conclusions.

USAGE

The researcher attempts to describe accurately the interaction between the instrument (or the human senses) and the



entity being observed. If instrumentation is involved, the researcher is expected to calibrate his/her instrument by applying it to known standard objects and documenting the results before applying it to unknown objects. In other words, it describes the research that has not taken place before and their results.

In practice, the accumulation of evidence for or against any particular theory involves planned research designs for the collection of empirical data, and academic rigor plays a large part of judging the merits of research design. Several typologies for such designs have been suggested, one of the most popular of which comes from Campbell and Stanley. They are responsible for popularizing the widely cited distinction among pre-experimental, experimental, and quasi-experimental designs and are staunch advocates of the central role of randomized experiments in educational research.

The scientific method requires observations of nature to formulate and test hypotheses it consists of these steps:

1. Asking a question about a natural phenomenon
2. Making observations of the phenomenon
3. Hypothesizing an explanation for the phenomenon
4. Predicting logical, observable consequences of the hypothesis that have not yet been investigated
5. Testing the hypothesis' predictions by an experiment, observational study, field study, or simulation
6. Forming a conclusion from data gathered in the experiment, or making a revised/new hypothesis and repeating the process
7. Writing out a description of the method of observation and the results or conclusions reached
8. Review of the results by peers with experience researching the same phenomenon

Observations play a role in the second and fifth steps of the scientific method. However the need for reproducibility requires that observations by different observers can be comparable. Human sense impressions are subjective and qualitative, making them difficult to record or compare. The use of measurement developed to allow recording and comparison of observations made at different times and places, by different people. Measurement consists of using observation to compare the phenomenon being observed to a standard unit. The standard unit can be an artefact, process, or definition which can be

IV. OBSERVATION

Observation is the active acquisition of information from a primary source. In living beings, observation employs the senses. In science, observation can also involve the recording of data via the use of instruments. The term may also refer to any data collected during the scientific activity. Observations can be qualitative, that is, only the absence or presence of a property is noted, or quantitative if a numerical value is attached to the observed phenomenon by counting or measuring.



duplicated or shared by all observers. In measurement the number of standard units which is equal to the observation is counted. Measurement reduces an observation to a number which can be recorded, and two observations which result in the same number are equal within the resolution of the process.

Senses are limited, and are subject to errors in perception such as optical illusions. Scientific instruments were developed to magnify human powers of observation, such as weighing scales, clocks, telescopes, microscopes, thermometers, cameras, and tape recorders, and also translate into perceptible form events that are unobservable by human senses, such as indicator dyes, voltmeters, spectrometers, infrared cameras, oscilloscopes, interferometers, Geiger counters, and radio receivers.

One problem encountered throughout scientific fields is that the observation may affect the process being observed, resulting in a different outcome than if the process was unobserved. This is called the *observer effect*. For example, it is not normally possible to check the air pressure in an automobile tire without letting out some of the air, thereby changing the pressure. However, in most fields of science it is possible to reduce the effects of observation to insignificance by using better instruments.

Considered as a physical process itself, all forms of observation (human or instrumental) involve amplification and are thermodynamically irreversible processes, increasing entropy.

V. INTERVIEW

An **interview** is a conversation where questions are asked and answers are given. In common parlance, the word "interview" refers to a one-on-one conversation with one person acting in the role of the *interviewer* and the other in the role of the *interviewee*. The interviewer asks questions, the interviewee responds, with participants taking turns talking. Interviews usually involve a transfer of information from interviewee to interviewer, which is usually the primary purpose of the interview, although information transfers can happen in both directions simultaneously. One can contrast an interview which involves bi-directional communication with a one-way flow of information, such as a speech or oration.

Interviews usually take place face to face and in person, although modern communications technologies such as the Internet have enabled conversations to happen in which parties are separated geographically, such as with videoconferencing software, and of course telephone interviews can happen without visual contact. Interviews almost always involve spoken conversation between two or more parties, although in some instances a "conversation" can happen between two persons who type questions and answers back and forth. Interviews can range from unstructured or free-wheeling and open-ended conversations in which there is no predetermined plan with prearranged questions, to highly structured conversations in which specific questions occur in a specified order. They can follow diverse formats; for example, in a ladder interview, a respondent's answers typically guide



subsequent interviews, with the object being to explore a respondent's subconscious motives. Typically the interviewer has some way of recording the information that is gleaned from the interviewee, often by writing with a pencil and paper, sometimes transcribing with a video or audio recorder, depending on the context and extent of information and the length of the interview. Interviews have duration in time, in the sense that the interview has a beginning and an ending.

Interviews can happen in a wide variety of contexts:

- **Employment.** Interviews in an employment context are typically called job interviews which describe a formal consultation for the purpose of evaluating the qualifications of the interviewee for a specific position. Interviews are seen as a useful tool in assessing qualifications. A specific type of job interview is a case interview in which the applicant is presented with a question or task or challenge, and asked to resolve the situation. Sometimes to prepare for job interviews, candidates are treated to a mock interview as a training exercise to prepare the respondent to handle questions in the subsequent 'real' interview. Sometimes the interviews happen in several waves, with the first interview sometimes being called a *screening interview* which is a shorter length interview, followed by more in-depth interviews later on, usually by company personnel who can ultimately hire the applicant. Technology has enabled new possibilities for interviewing; for example, video phoning technology has enabled applicants to interview for jobs despite being in different cities or countries than the interviewer.

- **Psychology.** Psychologists use a variety of interviewing methods and techniques to try to understand and help their patients. In a psychiatric interview, a psychiatrist or psychologist or nurse asks a battery of questions to complete what is called a psychiatric assessment. Sometimes two people are interviewed by an interviewer, with one format being called couple interviews. Criminologists and detectives sometimes use cognitive interviews on eyewitnesses and victims to try to ascertain what can be recalled specifically from a crime scene, hopefully before the specific memories begin to fade in the mind.

In marketing research and academic research, interviews are used in a wide variety of ways. Interviews are often used in qualitative research in which firms try to understand how consumers think. Consumer research firms sometimes use computer-assisted telephone interviewing to randomly dial phone numbers to conduct highly structured telephone interviews, with scripted questions and responses entered directly into the computer.

- **Journalism and other media.** Typically, reporters covering a story in journalism conduct interviews over the phone and in person to gain information for subsequent publication. Reporters can interview political candidates on television shows. In a talk show, a radio or television "host" interviews one or more people, with the choice of topic usually being chosen by the host, sometimes for the purposes of entertainment, sometimes for informational purposes. Such interviews are often recorded and some of them can be released on an interview disc.



- **Other situations.** Sometimes college representatives or alumni conduct college interviews with prospective students as a way of assessing a student's suitability while offering the student a chance to learn more about a college. Some services specialize in coaching people for interviews. Government officials may conduct interviews with prospective foreign students before allowing them to study in the nation.

- ✧ preferences (e.g. political party)
- ✧ behaviours (e.g. food consumption)
- ✧ facts (e.g. gender)

Questionnaires with questions that are aggregated into either a scale or index include for instance questions that measure:

- latent traits
- attitudes (e.g. towards immigration)
- an index (e.g. Social Economic Status)

Usually, a questionnaire consists of a number of questions that the respondent has to answer in a set format. A distinction is made between open-ended and closed-ended questions. An open-ended question asks the respondent to formulate his own answer, whereas a closed-ended question has the respondent pick an answer from a given number of options. The response options for a closed-ended question should be exhaustive and mutually exclusive. Four types of response scales for closed-ended questions are distinguished:

- ✓ Dichotomous, where the respondent has two options
- ✓ Nominal-polychromous, where the respondent has more than two unordered options
- ✓ Ordinal-polychromous, where the respondent has more than two ordered options
- ✓ (Bounded)Continuous, where the respondent is presented with a continuous scale

A respondent's answer to an open-ended question is coded into a response scale afterwards. An example of an open-ended question is a question where the testier has to complete a sentence (sentence completion item)

In general, questions should flow logically from one to the next. To achieve the best response rates, questions should flow from the least sensitive to the most sensitive,

VI. QUESTIONNAIRE

A **questionnaire** is a research instrument consisting of a series of questions (or other types of prompts) for the purpose of gathering information from respondents. The questionnaire was invented by the Statistical Society of London in 1838.

Although questionnaires are often designed for statistical analysis of the responses, this is not always the case.

Questionnaires have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. However, such standardized answers may frustrate users. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and respond to them. Thus, for some demographic groups conducting a survey by questionnaire may not be concrete.

A distinction can be made between questionnaires with questions that measure separate variables, and questionnaires with questions that are aggregated into either a scale or index. Questionnaires with questions that measure separate variables could for instance include questions on:



from the factual and behavioural to the attitudinal, and from the more general to the more specific.

There typically is a flow that should be followed when constructing a questionnaire in regards to the order that the questions are asked. The order is as follows:

1. Screens
2. Warm-ups
3. Transitions
4. Skips
5. Difficult
6. Classification

Screens are used as a screening method to find out early whether or not someone should complete the questionnaire. **Warm-ups** are simple to answer, help capture interest in the survey, and may not even pertain to research objectives. **Transition** questions are used to make different areas flow well together. **Skips** include questions similar to "If yes, then answer question 3. If no, then continue to question 5." **Difficult** questions are towards the end because the respondent is in "response mode." Also, when completing an online questionnaire, the progress bars lets the respondent know that they are almost done so they are more willing to answer more difficult questions. **Classification** or demographic question should be at the end because typically they can feel like personal questions which will make respondents uncomfortable and not willing to finish survey.

While questionnaires are inexpensive, quick, and easy to analyze, often the questionnaire can have more problems than benefits. For example, unlike interviews, the people conducting the research may never know if

the respondent understood the question that was being asked. Also, because the questions are so specific to what the researchers are asking, the information gained can be minimal. Often, questionnaires such as the Myers-Briggs Type Indicator, give too few options to answer; respondents can answer either option but must choose only one response. Questionnaires also produce very low return rates, whether they are mail or online questionnaires. The other problem associated with return rates is that often the people who do return the questionnaire are those who have a really positive or a really negative viewpoint and want their opinion heard. The people who are most likely unbiased either way typically don't respond because it is not worth their time.

Some questionnaires have questions addressing the participant's gender. Seeing someone as male or female is something we all do unconsciously, we don't give much important to one's sex or gender as most people use the terms 'sex' and 'gender' interchangeably, unaware that they are not synonyms. Gender is a term to exemplify the attributes that a society or culture constitutes as masculine or feminine. Although your sex as male or female stands at a biological fact that is identical in any culture, what that specific sex means in reference to your gender role as a 'woman' or 'man' in society varies cross culturally according to what things are considered to be *masculine* or *feminine*. The survey question should really be what your sex is. Sex is traditionally split into two categories, which we typically don't have control over, you were either born a girl or born a boy and that's decided by nature. There's also the intersex population



which is disregarded in the North American society as a sex. Not many questionnaires have a box for people who fall under Intersex. These are some small things that can be misinterpreted or ignored in questionnaires.

More generally, one key concern with questionnaires is that there may contain quite large measurement errors. These errors can be random or systematic. Random errors are caused by unintended mistakes by respondents, interviewers and/or coders. Systematic error can occur if there is a systematic reaction of the respondents to the scale used to formulate the survey question. Thus, the exact formulation of a survey question and its scale are crucial, since they affect the level of measurement error. Different tools are available for the researchers to help them decide about this exact formulation of their questions, for instance estimating the quality of a question using MTMM experiments or predicting this quality using the Survey Quality Predictor software (SQP). This information about the quality can also be used in order to correct for measurement errors.

Further, if the questionnaires are not collected using sound sampling techniques, often the results can be non-representative of the population—as such a good sample is critical to getting representative results based on questionnaires.

associated collection techniques, such as questionnaire construction and methods for improving the number and accuracy of responses to surveys. Survey methodology includes instruments or procedures that ask one or more questions that may, or may not, be answered.

Statistical surveys are undertaken with a view towards making statistical inferences about the population being studied, and this depends strongly on the survey questions used. Polls about public opinion, public health surveys, market research surveys, government surveys and censuses are all examples of quantitative research that use contemporary survey methodology to answer questions about a population. Although censuses do not include a "sample," they do include other aspects of survey methodology, like questionnaires, interviewers, and nonresponsive follow-up techniques. Surveys provide important information for all kinds of public information and research fields,

e.g., marketing research, psychology, health professionals and sociology.

A single survey is made of at least a sample (or full population in the case of a census), a method of data collection (e.g., a questionnaire) and individual questions or items that become data that can be analyzed statistically. A single survey may focus on different types of topics such as preferences (e.g., for a presidential candidate), opinions (e.g., should abortion be legal?), behaviour (smoking and alcohol use), or factual information (e.g., income), depending on its purpose. Since survey research is almost always based on a sample of the population, the success of the research is dependent on

VII. SURVEY

A field of applied statistics of human research surveys, **survey methodology** studies the sampling of individual units from a population and the



the representativeness of the sample with respect to a target population of interest to the researcher. That target population can range from the general population of a given country to specific groups of people within that country, to a membership list of a professional organization, or list of students enrolled in a school system (see also sampling (statistics) and survey sampling). The persons replying to a survey are called respondents, and depending on the questions asked their answers may represent themselves as individuals, their households, employers, or other organization they represent.

- » Contact sampled individuals and collect data from those who are hard to reach (or reluctant to respond)
- » Evaluate and test questions.
- » Select the mode for posing questions and collecting responses.
- » Train and supervise interviewers (if they are involved).
- » Check data files for accuracy and internal consistency.
- » Adjust survey estimates to correct for identified errors.

Survey methodology as a scientific field seeks to identify principles about the sample design, data collection instruments, statistical adjustment of data, and data processing, and final data analysis that can create systematic and random survey errors. Survey errors are sometimes analyzed in connection with survey cost. Cost constraints are sometimes framed as, improving quality within cost constraints, or alternatively, reducing costs for a fixed level of quality. Survey methodology is both a scientific field and a profession, meaning that some professionals in the field focus on survey errors empirically and others design surveys to reduce them. For survey designers, the task involves making a large set of decisions about thousands of individual features of a survey in order to improve it.

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The most important methodological challenges of a survey methodologist include making decisions on how to:

- » Identify and select potential sample members.
