Research Methodology for PhDs

GBSB GLOBAL
BUSINESS SCHOOL

Session 11-1 Topics

- Specific Quantitative Methods:
  - -Single, Double, and Triple-Blind Studies
  - -Introduction to Fuzzy Logic

Bias in Research

A number of biases are present when a study is insufficiently blinded.

Participant-reported outcomes can be different if a participant is not blinded to their treatment.

Failure to blind researchers results in observer bias.

Unblinded data analysts may favor an analysis that supports their existing beliefs (confirmation bias).

These biases are typically the result of subconscious influences, and are present even when study participants believe they are not influenced by them

©https://en.wikipedia.org/wiki/Blinded_experiment

Problem Statement

Information may influence the participants of the experiment is withheld until after the experiment is complete.

Good blinding can reduce or eliminate experimental biases that arise from a participants' expectations, observer's effect on the participants, observer bias, confirmation bias, and other sources.

©https://en.wikipedia.org/wiki/Blinded_experiment

Example: Social Appreciated Behaviour

What a Blind Study Is (or Single-blinded)

In a blind or blinded experiment, information which may influence the participants of the experiment is withheld until after the experiment is complete.

Subject Researcher

Single-blinded

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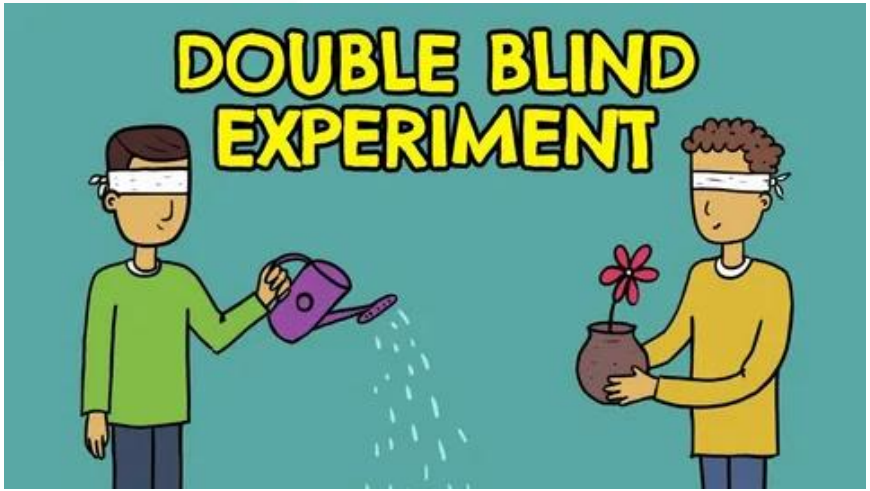
Double-Blinded Experiment

In double-blind experiments, the group assignment is hidden from both the participant and the person administering the experiment.

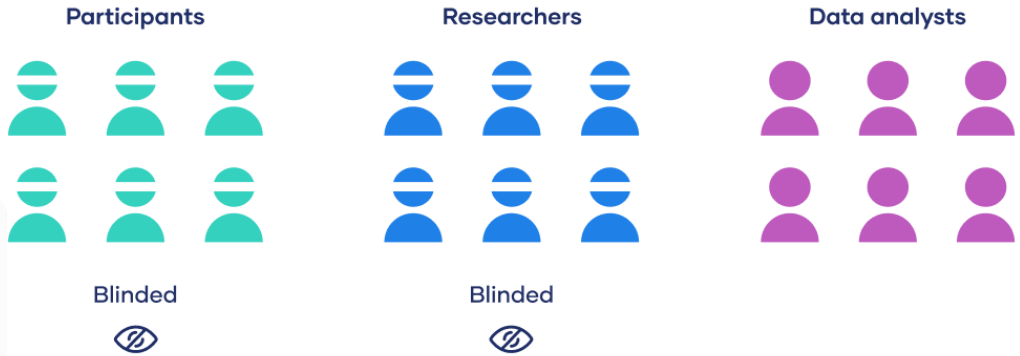


Double-blinded

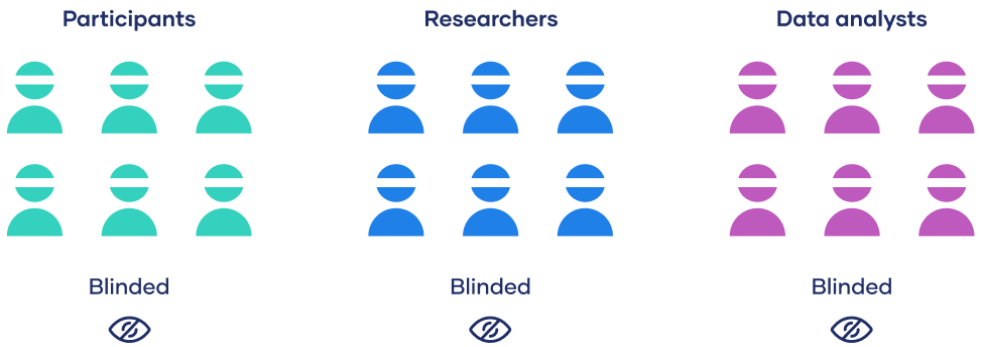
Example: Double-blind vaccine study
In the flu vaccine study that you are running, you have recruited several experimenters to administer your vaccine and measure the outcomes of your participants.
If these experimenters knew which vaccines were real and which were fake, they might accidentally reveal this information to the participants, thus influencing their behavior and indirectly the results.

They could even directly influence the results. For instance, if experimenters expect the vaccine to result in lower levels of flu symptoms, they might accidentally measure symptoms incorrectly, thus making the vaccine appear more effective than it really is.

To avoid this, you hide group assignments from both the participants and the experimenters giving the vaccines – a double-blind study.



Triple-Blinded Experiment



Example: Triple-blind vaccine study
In your vaccine study, you have also recruited assistants to analyze the data you gathered on flu infection rates. You decide to hide the group assignments from the participants, the people administering the experiment, and the people analyzing the data – a triple-blind study.
To achieve triple blinding, you assign each participant to group 1 or group 2, but do not inform the data analysts which number represents which group.

Importance of blinding

Blinding helps ensure a study's internal validity, or the extent to which you can be confident any link you find in your study is a true cause-and-effect relationship.

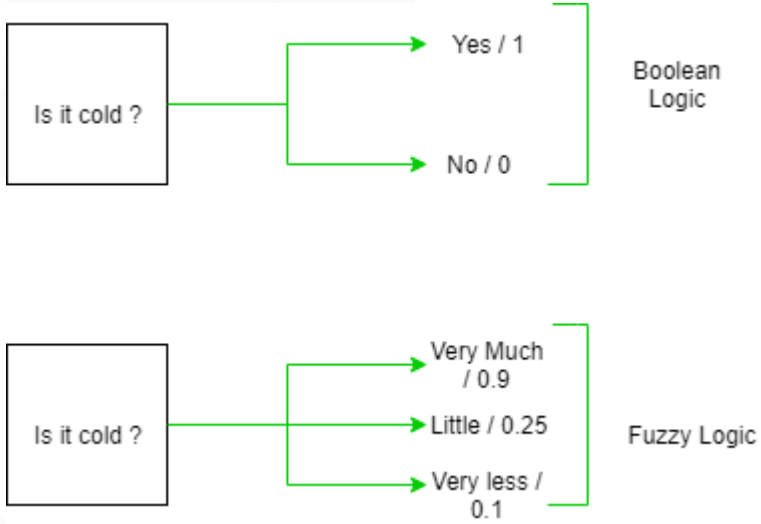
Since non-blinded studies can result in participants modifying their behavior or researchers finding effects that do not really exist, blinding is an important tool to avoid research bias in all types of scientific research.

Risk of unblinding

- Unblinding occurs when researchers have blinded participants or experimenters, but they become aware of who received which treatment before the experiment has ended.

Introduction to Fuzzy Logic. Problem statement

Fuzzy Logic is based on the idea that in many cases, the concept of true or false is too restrictive, and that there are many shades of gray in between. It allows for partial truths, where a statement can be partially true or false, rather than fully true or false.



https://www.geeksforgeeks.org/fuzzy-logic-introduction/

Introduction to Fuzzy Logic. History

Fuzzy logic is intended to model logical reasoning with vague or imprecise statements like “Petr is young (rich, tall, hungry, etc.)”. It refers to a family of many-valued logics, where the truth-values are interpreted as degrees of truth. The truth-value of a logically compound proposition, like “Carles is tall and Chris is rich”, is determined by the truth-value of its components. In other words, like in classical logic, one imposes truth-functionality.

Fuzzy logic emerged in the context of the theory of fuzzy sets, introduced by Lotfi Zadeh (1965). A fuzzy set assigns a degree of membership, typically a real number from the interval [0,1], to elements of a universe. Fuzzy logic arises by assigning degrees of truth to propositions. The standard set of truth-values (degrees) is the real unit interval [0,1], where 0 represents “totally false”, 1 represents “totally true”, and the other values refer to partial truth, i.e., intermediate degrees of truth.

Introduction to Fuzzy Logic. Example Wealthy Estimates

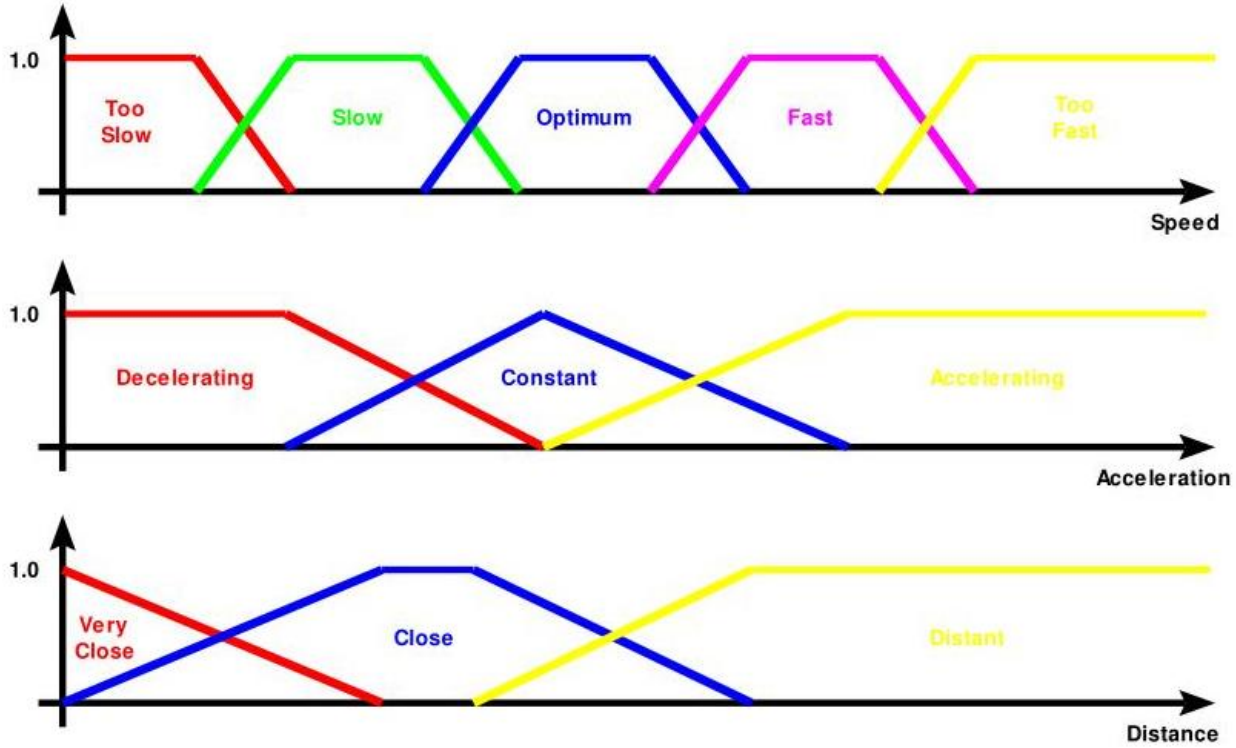
Level/ Annual Income, Eur	Poor	Middle Class	Rich
<8,000	1	0.05	0
8,001-12,000	0.8	0.1	0
12,001-20,000	0.4	0.5	0
20,001-50,000	0.1	0.6	0.05
50,001-100,000	0.01	0.8	0.25
100,001-500,000	0	0.9	0.1
>500,000	0	0.1	1

Introduction to Fuzzy Logic. Example Wealthy Estimates

10,000 Eur ϵ Poor AND 10,000 Eur ϵ Middle

60,000 Eur ϵ Poor AND 60,000 Eur ϵ Middle AND 60,000 Eur ϵ Rich

Introduction to Fuzzy Logic. Example Wealthy Estimates



Session 11-2 Topics

- Non-Standard and Complex Methods:
  - Longitudinal analysis
  - Participant-led diaries (written, blog, video)
  - Ethnography
  - Applying AI in research

Longitudinal analysis

In a longitudinal study, researchers repeatedly examine the same individuals to detect any changes that might occur over a period of time.

Longitudinal studies are a type of correlational research in which researchers observe and collect data on a number of variables without trying to influence those variables.

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Longitudinal studies can help researchers to distinguish between changes that happen as people get older, known as 'age effects', and generational differences that reflect the historical, economic and social context within which different cohorts grew up, known as 'cohort' or 'generational' effects.

Types of Longitudinal Analysis

In a retrospective study,

- collect data on events that have already happened.

In a prospective study,.

- choose a group of subjects and follow them over time, collecting data in real time

Types of Longitudinal Analysis

Panel study:	Cohort study:	Retrospective study:
• Sampling of a cross-section of individuals.	• Sampling of a group based on a specific event, such as birth, geographic location, or experience.	• Review of historical information such as medical records.

Challenges of Longitudinal Analysis

Preparing the data for longitudinal analysis usually requires merging together information from different data files.

Supporting relevance of data sources during long period

Participant-Led Diaries

A diary study is a user research method that involves asking a number of people to record their experiences relating to a particular subject over a defined period of time. It's a really useful tool for learning about user behaviour, providing you with a record of thoughts and actions in context.

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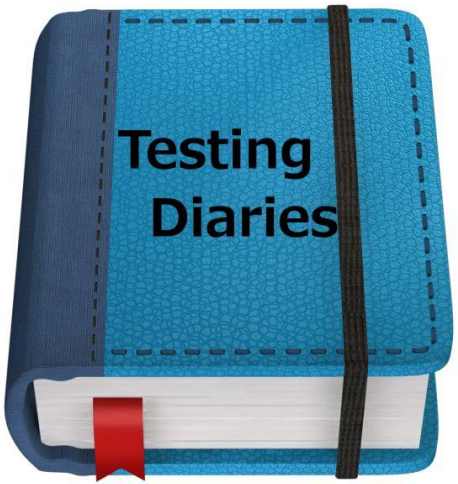

Basic Procedure for Performing a Diary Study

Recruiting Participants.	• Recruit participants for your target markets. Consider participants that represent current customers and potential ones, as their diary studies will have different viewpoints.
Providing basic instructions.	• Prepare some basic instructions that describe the Diary Study. You can use a paper or electronic format. You want them to keep their diary, all the way through to completion.
Scheduling Checkpoints.	• You will want to schedule checkpoints to keep the participants on task and to answer any questions.
Participants Return Their Diary.	• Participants return their diary for analysis. Verify the diary is complete before you move to the next step.
Analyzing the Dairy.	• You perform an analysis on the content. Look for common themes. Consider a mind map the data for each participant.
Following-up with Interviews & Surveys.	• Consider following-up diary studies with customer interviews to gain further clarity and analysis on the results. In addition, consider running an online survey to validate findings with a larger sample size.

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Tools for a Diary Study

- Paper
- E-mail
- Messengers (WhatsApp, others)
- Social nets (X, Instagram, Telegram, Reddit.,…)
- Diary software

Ethnography

Ethnographic research is probably the most familiar and applicable type of qualitative method.

In ethnography, you immerse yourself in the target participants' environment to understand the goals, cultures, challenges, motivations, and themes that emerge.

Ethnography has its roots in cultural anthropology where researchers immerse themselves within a culture, often for years! Rather than relying on interviews or surveys, you experience the environment first hand, and sometimes as a "participant observer."

For example, one way of uncovering the unmet needs of customers is to "follow them home" and observe them as they interact with the product. You don't come armed with any hypotheses to necessarily test; rather, you're looking to find out how a product is used.

Overt vs. covert ethnography

In an **overt** approach, the ethnographer openly states their intentions and acknowledges their role as a researcher to the members of the group being studied.

Covert means that the researcher does not tell participants about their research, and comes up with some other pretense for being there.

Narrative

The narrative approach weaves together a sequence of events, usually from just one or two individuals to form a cohesive story.

You conduct in-depth interviews, read documents, and look for themes; in other words, how does an individual story illustrate the larger life influences that created it.

Often interviews are conducted over weeks, months, or even years, but the final narrative doesn't need to be in chronological order.

Rather it can be presented as a story (or narrative) with themes, and can reconcile conflicting stories and highlight tensions and challenges which can be opportunities for innovation.

For example, a narrative approach can be an appropriate method for building a persona. While a persona should be built using a mix of methods—including segmentation analysis from surveys—in-depth interviews with individuals in an identified persona can provide the details that help describe the culture, whether it's a person living with Multiple Sclerosis, a prospective student applying for college, or a working mom.

Active vs. passive observation

An active role involves trying to fully integrate, carrying out tasks and participating in activities like any other member of the community.

- Active participation may encourage the group to feel more comfortable with the ethnographer's presence…
- …but runs the risk of disrupting the regular functioning of the community.

A passive role is one in which the ethnographer stands back from the activities of others, behaving as a more distant observer and not involving themselves in the community's activities.

- Passive observation allows more space for careful observation and note-taking…
- …but group members may behave unnaturally due to feeling they are being observed by an outsider.

AI in Research

Artificial intelligence (AI) is revolutionising academic writing by managing complex ideas and extensive information.

A systematic review of 24 studies from major databases since 2019 highlights AI's impact on academic writing and research.

AI enhances academic writing in six areas: idea generation, content structuring, literature synthesis, data management, editing, and ethical compliance.

ChatGPT demonstrates significant potential in academic writing, though challenges in academic integrity and AI-human balance persist.

AI is transforming academic practices, necessitating broader integration and ethical use in research.

Future recommendations include ongoing AI research in academia, emphasizing training, ethical usage, and transparent integration in workflows.

LLM vs SLM vs MLM Models

LLM – large language models, are based on more than 20 bln. Parameters

SLM – Small Language models include 0.5-20 bln. Parameters

MLM – micro-language models include less parameters

Selection Criteria

Fine-tuning	Inference
• helps adapt a pre-trained language model to a specific task or dataset to ensure the quality of its outputs and general abilities match your expectations.	• calls a fine-tuned language model to generate responses to user input.

AI Research Tools

Perplexity

- AI chatbot designed to deliver concise, reliable, up-to-date answers drawing on a variety of high quality sources, including scholarly sources. Includes an interactive search mode that asks you clarifying questions to guide the AI search process and find the best answer for you. Also offers a list of related questions and references.

Consensus

- A search engine that uses AI to search over 200 million scientific papers from Semantic Scholar and deliver reliable, evidence-based answers tied to actual studies. It also provides summaries of the top articles it analyzes, making it easier to understand complex research.

Elicit

- AI search assistant for researchers and academics that helps conduct literature reviews by identifying relevant research papers on a topic and summarizing key points.

AI Tools for Researchers

Scite

- AI platform that helps researchers find and understand research articles through Smart Citations. scite uses access to full-text articles and its deep learning model to tell you how many times an article was cited and context of the citation (i.e., whether the article provides supporting or contrasting evidence).

Research Rabbit

- Described as “Spotify of research”, users can create collections of academic papers that the software can learn from to give them relevant recommendations. It also visualizes scholarly networks in graphs, so it’s possible follow the work of specific authors or topics.

Scholarcy

- AI summarization tool that reads your research articles, reports, and book chapters and extracts key information to create a summary flashcard identifying study participants, data analyses, main findings, and limitations.

AI Tools for Researchers

ChatPDF

- AI chatbot designed to help researchers read, analyze, and extract answers from research papers. Simply upload a file and ChatPDF will generate a short summary of the paper and provide examples of questions it can answer based on the full text.

Semantic Scholar

- Free, AI-powered research tool for scientific literature. Semantic Scholar helps researchers understand a paper at a glance by extracting meaning and identifying connections from within papers. Indexes over 200 million academic papers sourced from publisher partnerships, data providers, and web crawls.

Iris.ai

- AI tool designed to aid researchers in scientific discoveries. The service uses natural language processing and machine learning algorithms to comprehend the context of a research project and suggest pertinent literature. It helps navigate and find data sources without relying on specific keywords, making it significantly more efficient than traditional search engines.

AI Tools for Researchers

Scispace

- AI-driven platform for exploring, understanding, and publishing research papers. It offers a comprehensive searchable database of over 270 million papers, authors, topics, journals, and conferences. It also provides a variety of features such as a manuscript editor, citation generator, plagiarism checker, and an AI copilot to summarize any research paper.

Paper Digest

- AI-based article summarization service that aims to help researchers quickly grasp the core ideas of a paper and help them decide whether it is worth reading.

You.com

- A search engine built on artificial intelligence that provides users with a customized search experience while keeping their data 100% private.

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