

Writing Your Thesis with ChatGPT

Research, Scholarship and Academic
Writing in the Age of Generative AI

Paul Johannesson

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PREFACE

Over many years, I have guided students in their thesis work. As a supervisor for over 10 PhD candidates and 100 bachelor's and master's theses, and as a reviewer or examiner for more than 1000 theses, I have witnessed the challenges the students have faced. I have seen them wrestling with the formulations of their research questions, struggling with their literature reviews, sweating over their data collection and data analysis, and grappling with their writing. Yet, I have also seen all this hard work bearing fruit in well-crafted theses with original, significant findings, making them the pinnacle of the students' academic work. Generative AI is promising, or threatening, to change all of this.

Generative AI tools, such as ChatGPT, will be able to support all parts and aspects of thesis writing. Students will have access to multitudes of virtual, but devoted and indefatigable, experts, research assistants, supervisors, mentors, and editors. Will these tools take out the drudgery in thesis writing and leave the fun and creative parts? Will they enable students to produce theses with higher quality, and learn more in the process, than ever before? Or will they lure the students into soulless and automated writing with predictable and dull results? And what will the role of human supervisors be in this new landscape?

This book does not answer these questions. Instead, it takes a more practical approach by providing instruments, in the form of guidelines and prompts, that students and supervisors can use to act on these questions — the book is rather about changing than explaining. The instruments encourage students to work with generative AI in an iterative, open-ended, creative and critical way instead of just making the writing more efficient. While generative AI is here to stay as a vital part of the thesis writing process, it is up to students and teachers to form its use.

When writing the book, I have made extensive use of ChatGPT and Grammarly Go both for suggesting and editing text. Some prompts that I have used repeatedly can be found in Chapters 13 and 14. Furthermore, the chapter illustrations have all been generated with Midjourney, using the word “steampunk”, as a metaphor for the craft of thesis writing infused with the new technology of generative AI and the art of prompting. The book was typeset in \LaTeX using the template “A Classic Thesis Style” by André Miede. And ChatGPT has proved a valuable resource for making up for my limited knowledge of \LaTeX .

I have learnt much about generative AI when writing this book, in particular, that you can often get both useful and surprising results from it if you just prompt a little better. My hope is that the reader will find the book both helpful and inspiring, not only as a step towards better thesis writing, but also as a source for reflecting about

the goals and purposes of research, scholarship and academic writing. For thesis writing, it is the best of times, and it is the worst of times.

You can find a downloadable version of this book at :
<https://writingyourthesiswithchatgpt.wordpress.com/>. There you will also find additional resources, such as a tailored GPT.

Stockholm, Sweden
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Paul Johannesson

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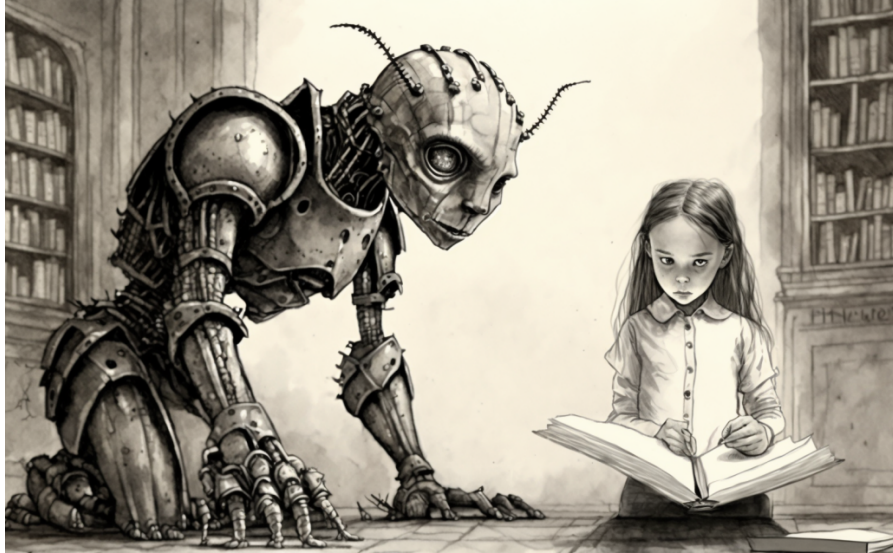
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Part I

PROLOGUE



“EDUCATION MAKES MACHINES *which act like men and produces men who act like machines.*”
— Erich Fromm

A thesis is the culminating work of your degree, be it a bachelor, a master or a PhD. It will demonstrate your expertise and interest in a particular subject within your field of study. A thesis is also a valuable learning experience in itself that will prepare you for academic work, professional research roles as well as other career paths.

1.1 THE PURPOSE OF WRITING A THESIS

Writing a thesis serves a practical purpose, as it is often a requirement for obtaining a degree. However, there are additional and deeper benefits that go beyond this. By writing a thesis, you develop skills in generating, exploring, synthesizing, and communicating knowledge and ideas.

CREATING KNOWLEDGE THROUGH RESEARCH. Writing a thesis will teach you how to conduct systematic investigations to discover new knowledge or affirm known truths. It provides hands-on experience in designing and implementing research methods, such as experiments, case studies, interviews, and data analysis. You will gain proficiency in managing projects, setting goals, achieving results, and meeting deadlines. You will learn about attention to detail, technical skills, problem-solving as well as patience and persistence. In other words, by writing a thesis, you will learn how to become a researcher.

EXPLORING AND SYNTHESIZING THROUGH SCHOLARSHIP. By writing a thesis, you will learn to delve deeply into a topic, which is usually not possible during ordinary coursework. You will experience how to learn from different sources, in particular academic articles, to gather

diverse ideas and perspectives. You will come to see the relationships between your thesis and existing knowledge in the field. You will learn to discuss and defend your work, both with your supervisor and fellow students. You will come to understand how critical thinking, curiosity, open-mindedness, and humility can help to enhance your thesis. In other words, by writing a thesis, you will learn how to become a scholar.

COMMUNICATING THROUGH ACADEMIC WRITING. By writing a thesis, you will learn how to communicate with an audience through the written word. You will acquire the skill to express complex thoughts with clarity and precision. You will learn to write coherently and concisely, ensuring that your text flows logically without being verbose. And you will learn how to structure a long academic text in a reader-friendly manner. In other words, by writing a thesis, you will learn how to become an academic writer.

An analogy can help to clarify the differences between a scholar, a researcher and an academic writer. A scholar is like someone who has a vast collection of LEGO sets. They have studied each set's instructions closely and can explain how various pieces and sets connect. They appreciate the designs others have made and can tell you all about them. They love to learn, discuss, and share their knowledge about these LEGO sets. In contrast, a researcher is like a LEGO enthusiast who doesn't just stick to the instructions. Instead, they experiment with the bricks, trying to create something new. They love to innovate and discover new possibilities with the bricks. And an academic writer is like the person who writes and illustrates the LEGO instruction manuals. They take the knowledge from the LEGO collector (scholar) and the innovations from the LEGO experimenter (researcher) and create clear, step-by-step guides for others to follow. They are skilled in presenting information in a clear, organized, and understandable manner.

In the academic world, the roles of researcher, scholar, and academic writer are usually performed by the same individual. While each role has its distinct characteristics, they should not be separated, as the activities of inquiry, discovery, and dissemination contribute to and enhance each other.

1.2 THE IMRAD STRUCTURE

Research findings can be presented in different ways, but using a standardized structure makes it easier for readers to follow the logic and reasoning of the presentation. The IMRAD (Introduction, Method, Results And Discussion) structure has become an established format for organising both research papers and theses in the natural as well as social sciences. IMRAD suggests a division into four parts:

- *Introduction* — *Why did you start the study?* This section aims to provide an overview of the research presented in the thesis. It

begins by providing a brief introduction to the area of study. It then goes on to explain the research problem and formulate research questions or goals. This section also provides a conceptual framework, explaining and discussing the key notions of the thesis. Furthermore, it includes a literature review, summarizing existing research including current knowledge gaps.

- *Method* — *What did you do and how?* This section describes the research strategies, methods of data collection, and data analysis that were employed, and explains how they were utilized. It provides a rationale for the choice of these strategies and methods, and also addresses research ethics.
- *Results* — *What did you find?* This section answers the research question of the thesis. It presents and explains the research results, thereby often including tables, graphs, charts, and figures to represent the results visually.
- *Discussion* — *What does it mean?* This section presents a critical analysis and interpretation of the research conducted and its results. It highlights limitations that were encountered during the study, compares the results to those of prior research, and discusses the practical and theoretical implications of the outcomes. Furthermore, it outlines future research areas that could be explored.

The IMRAD structure can be likened to classic storytelling. The “Introduction” sets the scene, the “Methods” describe the journey, the “Results” are the climax, and the “Discussion” offers a resolution or reflection.

1.3 GENERATIVE AI: BOON OR BANE?

ChatGPT can support you in the thesis writing process in the roles of researcher, scholar as well as academic writer.

- As a researcher, ChatGPT can offer you suggestions for sharpening your research question, generate hypotheses, recommend research methods, guide you through ethical considerations, assist with experimental design, design interview studies, create and justify interview questions, create codes, themes and statistics for the responses, summarize results, offer guidance on research limitations, and much more.
- As a scholar, ChatGPT can help you identify knowledge and research gaps, suggest relevant literature, summarize and analyze articles, clarify academic concepts, provide summaries of complex topics, provide historical context, guide you through interdisciplinary connections, offer counterarguments to your ideas, outline ethical and societal implications of your results, and much more.
- As an academic writer, ChatGPT can assist you in drafting and editing content, make your text clear and concise as well as coherent and confident, help you with making your text engaging for the reader, assist in argument formulation, help you craft compelling titles and abstracts, suggest relevant citations and

check citation formats, suggest visualizations of your results, and much more.

What is not to be liked about this? Indeed, generative AI has the potential to improve both the thesis itself and the learning from the writing process. However, there are drawbacks. It may compromise originality, as AI-generated content lacks personal insight and novel contributions. There are accuracy concerns, given that AI might not provide the most current or precise information. Ethical issues arise, as over-reliance on AI could violate academic standards regarding plagiarism and original work. AI use can also hinder the development of critical thinking and analytical skills. AI may also struggle with the depth and context understanding required for a thesis. Thus, over-dependence on AI can lead to a lack of necessary independent research and writing skills. In the next paragraph, ChatGPT formulates these concerns itself based on the classic German legend “Faust”.

This is an example of a modifier prompt, see Section 1.4; the word “sinister” makes a big difference for the answer

> PROMPT: Suggest a sinister analogy for a master student using ChatGPT when writing their thesis, based on the story of the pact between Faust and Mephistopheles.

> ANSWER: Using ChatGPT for a master’s thesis is like Faust’s dangerous dalliance with Mephistopheles:

In the shadowy corridors of academia, the master’s student (Faust) is desperate for enlightenment and success. ChatGPT (Mephistopheles) emerges from the digital abyss, offering forbidden knowledge and seductive shortcuts.

Lured by the promise of easy answers and swift progress, the student might be tempted to sell their academic “soul” to this digital devil, sacrificing originality and integrity for convenience. But every piece of information taken from ChatGPT is like a chain, binding the student to a fate of potential deceit and plagiarism.

As the student becomes more entangled with ChatGPT, the line between their own work and the borrowed wisdom of the digital Mephistopheles blurs. And just as Faust’s pact comes with a heavy price, the student’s over-reliance on ChatGPT might lead to academic damnation, with their credibility and reputation forever tarnished. In the end, the allure of easy knowledge could become the student’s own tragic downfall.

“Faust,” a tragic play by Johann Wolfgang von Goethe, tells the story of Dr. Faust, a disillusioned scholar. Desperate for knowledge and pleasure, Faust makes a pact with Mephistopheles, a demon, exchanging his soul for unlimited knowledge and worldly delights.

1.4 PROMPT ENGINEERING FOR THESIS WRITING

Forms of Prompts

Prompts come in many forms and shapes, and some of the most common ones are listed below. These forms of prompts can be combined in order to craft a prompt that conveys your intention and helps ChatGPT provide a focused and relevant answer.

STANDARD PROMPTS. Standard prompts are a simple way to guide ChatGPT by providing a specific task for it to complete. Standard prompts usually start with a word, such as “Write”, “Create” or “Gen-

erate”, followed by a noun phrase. Standard prompts can be seen as the basic form of prompts, which can be extended in various ways. Some examples are:

- Write a review of this article
- Create themes for these responses
- Explain the process of photosynthesis

INSTRUCTION PROMPTS. Instruction prompts extend standard prompts by providing explicit instructions on how ChatGPT should perform a task. Providing detailed instructions allows ChatGPT to give relevant answers that reflect your intentions. Some examples are:

- Write a review of this movie that focuses on the protagonist
- Create interview questions that are friendly and easy to understand
- Explain the process of photosynthesis, detailing the key stages, the role of chlorophyll, and the importance of sunlight and carbon dioxide

ROLE PROMPTS. Role Prompts are prompts in which you ask ChatGPT to take on a certain role, e.g. a researcher, a student or a lawyer. Some examples are:

- As a researcher, explain the process of photosynthesis
- As a journalist, explain the process of photosynthesis
- As a lawyer, explain GDPR

AUDIENCE PROMPTS. Audience prompts are prompts in which you ask ChatGPT to provide answers that are suitable for a specific audience, e.g. children, experts, or non-experts. Some examples are:

- Explain the process of photosynthesis for a biologist
- Explain the process of photosynthesis for a twelve-year-old child
- As a journalist, explain the process of photosynthesis for a biologist

MODIFIER PROMPTS. Modifier prompts are prompts in which a single word or phrase, the modifier, completely changes the tone or meaning of the prompt, thereby causing ChatGPT to give a very different answer. Modifiers are usually adjectives modifying nouns or adverbs modifying verbs. Some examples are (with the modifier in italics):

- Propose an *innovative* design for a vacuum cleaner
- Write a *popular* summary of this article
- Write a *scathing* review of this movie that focuses on the protagonist

CONTEXTUAL PROMPTS. Contextual prompts are prompts that include the context in which you are prompting. It could, for example, be some activity you are carrying out or some goal you want to achieve. Some examples are (with the context in italics):

- *My research question is, “What are the causes of eating disorders among young people?”*. I am going to do an interview study. And my main interview question is, “How has your relationship with food evolved over the years?”. Suggest some questions that prompt, probe and check this question.
- *I am writing a master thesis. My research question is, “What are the causes of eating disorders among young people?”* I have carried out interviews with young people who have been treated for eating disorders. Which kind of data analysis should I use: thematic analysis or content analysis?

Guidelines for Prompting

A general guideline for good prompting is that you should not only use one-shot prompts, i.e. simple questions without any follow-up questions. Instead, you benefit more from using complex questions in a dialogue, where you can guide ChatGPT in multiple steps to provide you with relevant and diverse information. Here are a few concrete guidelines to help you engage in a dialogue with ChatGPT.

BE PATIENT AND ITERATIVE. If the answer you received was not what you were expecting or hoping for, you can ask ChatGPT to generate a new answer. Sometimes, even if you were initially satisfied with the answer, a regenerated response can provide a more original or nuanced answer. Additionally, you can try asking follow-up prompts to get more information, for example:

- Can you elaborate on ...
- I didn't understand X, can you explain it differently?

BE OPEN TO EXPLORATION. Allow room for ChatGPT to provide original or alternative answers and even playful or whimsical ones. Use open-ended prompts by asking how and why questions. Some examples are:

- How can you carry out ...
- What are some potential solutions to ...
- Can you explore different viewpoints on ...

REPHRASE AND REFINE. Experiment with different phrasings or details to improve response quality. Checking out the different forms of prompts above can help in the experimentation, in particular contextual prompts. Here are some examples:

- “What is the difference between semi-structured and unstructured interviews?” can be rephrased and refined as “What are the advantages of semi-structured interviews to unstructured interviews in the context of interviewing experts?”.
- “What is the difference between generative AI and machine learning?” can be rephrased as “In what ways does generative AI vary from traditional machine learning practices?”.

GUIDE THE RESPONSE FORMAT. If you want the answer from ChatGPT to be in a certain format, you can specify this in the prompt, for example:

- What is the difference between generative AI and machine learning? *Answer in one paragraph with 100 - 125 words.*
- What are the advantages of using ChatGPT for thesis writing? *Answer with a bullet list consisting of five items.*

BE GOAL ORIENTED. When prompting in ChatGPT, it is always important to have a clear goal in mind. Are you, in the role of a researcher, looking for idea generation, suggestions for appropriate methods, and critiques of your method choices? Or are you, in the role of a scholar, trying to provide explanations of key notions, synthesize literature, and relate your work to previous research? Or do you, as an academic writer, want to formulate complex thoughts with clarity, improve coherence and conciseness, and identify ways to visualize your results?

It is also useful to differentiate between prompts that aid in brainstorming and those that assist in evaluating the quality of your writing. Brainstorming prompts can help you generate creative ideas related to, for example, your research problem, research question, or study design. They can also assist in drafting text, such as literature summaries, interview questions, or ethical consent forms. In contrast, evaluating prompts are designed to review text that is mostly finished, to ensure it is complete, clear, precise, and meets other quality standards.

1.5 HOW TO READ THIS BOOK

This book is primarily organized according to the IMRAD structure. Part II addresses Introduction, Part III Method, Part IV Results, and Part V Discussion. There is also a Part VI, which addresses critical thinking and academic writing.

The structure of each chapter in this book follows a similar pattern. Firstly, there is a brief introduction to the topic of the chapter. Secondly, there are a number of sections covering the main themes of this topic, which are illustrated with example prompts including answers from ChatGPT. These example prompts are often accompanied by tricks and tips on how to vary them to achieve desired effects. Finally, you will find a list of prompts for the topic, divided into brainstorming prompts and evaluating prompts. Needless to say, the list

is not exhaustive, but rather serves as a starting point and inspiration for further prompting.

One way to read this book is to begin with Chapter 3 and work your way through all the chapters. However, this method may be overwhelming, as the text is fairly long and includes many prompt examples. Nonetheless, if you are new to academic writing, this may be an appealing option. If you choose to read the book in this way, it is recommended that you initially skim only the prompt examples.

A very different way to read the book is to start with the prompts at the end of each chapter, and check out an example of a prompt only if you find it interesting. This is the fastest way of reading the book, but it requires that you have a good grasp of thesis writing.

The best way to read the book is probably to first skim through the entire book and then focus on each chapter as required for your thesis writing. Start reading each chapter by checking out its prompt examples and, whenever needed, refer to the explanatory text preceding them.



“ARISTOTLE
FOUNDED OR
DISCOVERED LOGIC
BY OBSERVING THE
WORLD. *ChatGPT*
thinks logically.
Why? Because it
notices all the logic
in the data in its
training set.”
— Stephen Wolfram

Generative AI is a branch of AI that can generate new data samples that are statistically similar to a specific dataset. It has seen rapid development and is now being used in various fields such as art, literature, and healthcare. This chapter provides a brief overview of generative AI by discussing its basic principles and methodologies, diverse applications, and ethical considerations.

2.1 FUNDAMENTAL CONCEPTS AND METHODOLOGIES

Generative models are a type of artificial intelligence that specialize in creating new content that resembles existing data. They work by analyzing a given dataset and then generating new data that follows a similar pattern. You can think of it like an artist who has spent years practicing by copying the styles of famous painters. Once they have mastered these styles, they can create new paintings that look like they were made by the great masters themselves. In the same way, generative models use existing data to create something new, but instead of paintings, they create digital content. Generative models learn by going through huge amounts of data, like photos or text. They look for patterns and features that define the style or content of this data. Once they understand these patterns, they can use them to generate new, similar pieces of content. There are two main types of generative models that are commonly used:

- *Variational Autoencoders* (VAEs) work like a talented forger who tries to recreate a masterpiece. Such a forger begins by studying the artwork to understand its basic structure and style. Once they have analyzed the details, they try to create a new painting

that captures the essence of the original. Similarly, VAEs do this with digital data. They learn to understand the structure of a given dataset and then generate new instances that are similar to it. By doing so, they can produce new content that resembles the original data.

- *Generative Adversarial Networks* (GANs) work like a game between two artists — one of them creates paintings, and the other judges them. The creator, also known as the "generator," tries to make paintings so good that the judge cannot tell if they are originals or fakes. The judge, called the "discriminator," tries to get better at distinguishing between the two. Over time, both artists improve their skills, resulting in highly realistic digital content. This technique is widely used in machine learning to generate new content that is similar to some existing data.

2.2 APPLICATIONS OF GENERATIVE AI

Generative AI has been applied in various sectors of society, providing innovative solutions and opening up new opportunities. Below are some of the key application areas:

ART AND CREATIVITY. Generative AI can create artwork, imitating styles of famous artists or generating unique pieces. AI algorithms can compose music in various genres, assisting or even leading the creative process. Based on prompts, AI can generate poems, stories, and other written content.

ENTERTAINMENT AND MEDIA. For video games, AI can generate realistic environments, characters, and game elements. In film and animation, it can assist in animation, creating realistic visual effects, and even generating scripts. And for virtual reality, it can create immersive and realistic virtual environments.

EDUCATION. AI can generate customized worksheets, quizzes, and learning resources based on specific curriculum requirements and student needs. It can offer real-time translation services to help non-native speakers understand educational content. And it can create virtual labs for students to conduct experiments, providing a safe and controlled environment.

HEALTHCARE AND BIOTECHNOLOGY. Generative models can suggest new molecular structures for potential drugs, predicting which compounds might be most effective for specific diseases. It can analyze patient data to recommend personalized treatment plans. It can automate the extraction of relevant information from unstructured EHR data, and create concise patient summaries from extensive EHR data, aiding clinicians in decision-making.

RETAIL AND E-COMMERCE. AI can generate tailored product suggestions and descriptions for customers. It can assist in copywriting and graphic design of advertisements, banners, and social media content. It can also automate responses in customer service interactions.

TECHNOLOGY AND IT. In software development, generative AI can write code snippets and provide programming assistance. It can identify bugs in code and suggest fixes. In the area of cybersecurity, it can create simulations of cyber threats for training and preparedness.

2.3 ETHICAL CONSIDERATIONS

Generative AI raises several ethical considerations that need to be addressed to ensure responsible and fair use. Some of the major concerns are:

- *Privacy and Consent.* Ensuring that any data used to train generative models is properly anonymized to protect individuals' privacy. Obtaining proper consent for the use of personal data in training models.
- *Intellectual Property.* Addressing questions around the ownership of content generated by AI, especially in creative fields like art, music, or writing. Determining how patent laws apply to inventions or innovations generated by AI.
- *Social Impact.* Addressing the potential for generative AI to displace or degrade jobs, particularly in fields like content creation, design, and customer service.
- *Bias and Fairness.* Generative AI models learn from data, and if the data is biased, the output will reflect that bias. Ensuring fairness requires careful curation and monitoring of training data. The generative models should not favour one group over another and be representative of diverse populations.
- *Misuse and Malicious Use.* Addressing the ethical implications of using generative AI to create deepfakes, which can be used to spread misinformation or harm individuals' reputations.

Part II

INTRODUCTION

The introduction sets the stage for your thesis, highlighting the research problem and posing the research question. In other words, it addresses the overarching “Why is this study important?” and the specific “What is this study to achieve?”. The introduction should also provide enough context to make your thesis comprehensible to your intended audience.

3

RESEARCH PROBLEM



“RESEARCH IS FORMALIZED CURIOSITY. It is poking and prying with a purpose. It is a seeking that he who wishes may know the cosmic secrets of the world and they that dwell therein.”
— Zora Neale Hurston

In a thesis, the research problem is the central issue or challenge that you aim to address through your research. It answers the why questions of your thesis: “Why did you decide to conduct your study in the first place?” and “Why is your study valuable and important?”. The research problem is usually broad in scope and may involve complex issues that require in-depth investigations. It frames your study and motivates the choice of your research question.

A research problem can be described in three parts. First, a background offering contextual information that sets the stage for the research problem. Secondly, a clear, concise statement expressing the research problem. Thirdly, a justification of the research problem, consisting of reasons why this problem is worth investigating, including its relevance, originality, significance, and timeliness.

3.1 THEORETICAL RESEARCH PROBLEMS

Theoretical research problems are challenges that require the improvement of theories. Its goal is to understand and analyze the underlying principles and mechanisms of a phenomenon, typically without immediate practical application. Theoretical research aims to contribute to academic knowledge by clarifying concepts, developing theories, and testing them. Some examples of theoretical research problems are:

- It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)

In everyday language, a “problem” implies something negative; But in research, it does not mean something bad, but rather an unexplored area that offers an opportunity for discovery

As Kurt Lewin stated, "There is nothing as practical as a good theory"

- It is contested whether economic theories can account for the overuse of common resources, like fisheries or forests, when individual rationality leads to collective irrationality
- It is not known whether the use of social media enhances or diminishes the quality of interpersonal communication

Although the primary objective of theoretical research is to enhance theory, it can still have effects on a practical level. Even though it may not provide immediate, tangible solutions, the knowledge gained from theoretical research can serve as a basis for practical applications, guide policy decisions, and inform professional practices.

> PROMPT: It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture). What practical implications could be the result of knowing this? Max 100 words.

> ANSWER: Determining the balance between nature and nurture in shaping personality could have profound implications. It would guide personalized education, tailoring teaching methods to individual predispositions. In mental health, treatments could be better aligned with a person's genetic makeup or environmental history. Parenting strategies might evolve, emphasizing either genetic tendencies or environmental adjustments. Legal systems might reconsider the extent of personal responsibility based on genetic predispositions. Moreover, it would influence policies on child-rearing, social welfare, and public health, ensuring environments that nurture positive personality development irrespective of genetic predispositions.

3.2 PRACTICAL RESEARCH PROBLEMS

A practical research problem aims to solve real-world issues that need workable solutions. Unlike theoretical research, which focuses on understanding and advancing theories, practical research looks for solutions to specific problems that people experience. The goal is to use the research findings to make real-world improvements for real people in real environments. Practical research often involves not only researchers but also stakeholders such as citizens, organisations, or policymakers who are directly or indirectly affected by the research. Some examples of practical research problems are:

- The rate of hospital-acquired infections is high and increasing
- There is a shortage of landfills that can be used to recycle household waste
- The use of learning platforms sometimes reduces student engagement and academic performance

Conducting practical research can serve a dual purpose. It not only helps in resolving real-world issues but can sometimes contribute to theoretical knowledge by providing evidence that either confirms, refutes, or refines existing theories. This evidence can also draw attention to gaps in current theories, thereby encouraging further theoretical development.

Theoretical research problems are commonly found in the sciences, the social sciences and the humanities, as these help build the foundational knowledge upon which applied research can be conducted. Practical research problems, on the other hand, are more common in applied subjects, such as engineering, medical sciences, and computer science, as these are focused on creating tangible and workable solutions to real-world issues.

> PROMPT: Generate possible practical consequences of the situation that “The rate of hospital-acquired infections is high and increasing”. Max 75 words.

> ANSWER: A high and rising rate of hospital-acquired infections could lead to longer patient hospital stays, increased medical costs, and higher mortality rates. Hospitals might face legal liabilities, reduced public trust, and potential funding cuts. There could be an increased demand for isolation rooms, advanced sterilization equipment, and specialized training for staff. Additionally, visitation policies might become stricter, and there could be a surge in research for infection prevention measures.

This prompt restricts the answer to 75 words, which forces ChatGPT to be concise

3.3 SCENARIOS

If you are delving into a complex and technical topic, your research problem may seem somewhat dry or even downright boring. In such a case, a scenario can help illustrate your research problem in an accessible, enjoyable and engaging way. Research problems are often complex and multifaceted, but a well-crafted scenario can express the essence of your problem as an inspiring story, making it easier to understand. Scenarios can also offer a context in which the research problem exists, helping to clarify why the problem is important and whom it affects. And a compelling scenario can capture your audience’s attention, even if they are not experts in the field, making them more interested in your research. Furthermore, a scenario can highlight the ethical and social dimensions of your research problem, showing how it fits into a larger picture.

> PROMPT: Generate a dramatic story based on the situation that “The rate of hospital-acquired infections is high and increasing”, focusing on a patient called “Mary” and addressing economic, health and justice aspects. Max 100 words.

> ANSWER: Mary, a single mother, entered the hospital for a minor surgery, expecting a swift recovery. However, she contracted a severe hospital-acquired infection, prolonging her stay. The mounting medical bills devastated her finances, forcing her to sell her home. As her health deteriorated, she discovered that the hospital had been cutting corners on sanitation to save costs. With the support of other affected patients, Mary took the hospital to court. The trial exposed deep-rooted corruption, leading to a nationwide call for justice, stricter regulations, and a renewed focus on patient safety.

This is an example of a modifier prompt — the single word “dramatic” makes much difference to the tone and feel of the story

3.4 PROMPTS FOR RESEARCH PROBLEM

Prompts for Brainstorming

- Generate three minor modifications of the research problem [*insert research problem*], making it more [narrow | general | original | difficult | significant | ...].
- My research problem is [*insert research problem*]. Suggest some root causes of this problem.
- Generate a story based on the situation that [*insert research problem*], addressing [economic | health | legal | ...] aspects.
- Generate possible practical consequences of the situation that [*insert practical research problem*].
- My research problem is [*insert practical research problem*]. What theoretical implications could be the result of solving this problem?
- My research problem is [*insert theoretical research problem*]. What theoretical contributions can be the result of knowing this?
- My research problem is [*insert theoretical research problem*]. What practical implications could be the result of knowing this?

Prompts for Evaluation

- Repeat the research problem stated in the thesis.
- Is it stated in the thesis why the research problem is [relevant | significant | timely | original | ...]?
- Is it stated in the thesis who is affected by the research problem and how they are affected?
- Is it stated in the thesis in which context the research problem appears?
- Is it stated in the thesis who can benefit from a solution to the research problem and in what ways?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the research problem as well as its statement and discussion in the thesis.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

Before writing any text about the research problem, it is often helpful to reformulating it as well as framing and reframing it; the prompts for modifying the problem and identifying root causes can then be useful.

Before stating the research problem, you need to include some background so that a reader can understand it. A scenario is often an easy way of getting the reader engaged — the prompt for a story can be used. You should then clearly state the research problem. And finally, you need to explain its importance, in particular, consequences of leaving the problem unsolved and benefits of actually solving it — the prompts for implications and consequences can be used.

4

RESEARCH QUESTION



"If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask . . . for once I know the proper question, I could solve the problem in less than five minutes."
— Albert Einstein

A research question is a clear, specific question that directs and guides your research study. It tells what your study is to achieve, ensuring that your research remains on track. While a research problem is often broad and may be vague, a research question narrows down the focus of the study and specifies what precisely it aims to discover. The research question guides your research methodology, including data collection and analysis, and it provides a basis for interpreting the results of your study.

Research questions come in many different forms and shapes; here are just some common types of research questions with examples:

- *Descriptive questions* aim to describe a phenomenon and its characteristics.
"What are the main symptoms of COVID-19?"
- *Comparative questions* aim to compare two or more groups or conditions.
"How do online classes compare to traditional classes in terms of student engagement?"
- *Explanatory questions* aim to explain the causes or reasons behind a phenomenon.
"Why do some small businesses fail within the first year?"
- *Exploratory questions* aim to explore a new or poorly understood phenomenon.
"What are the potential uses of blockchain technology in health-care?"

The "Five Ws" (Who, What, When, Where, Why), often taught in journalism, can be a starting point for formulating research questions

- *Normative questions* aim to evaluate the effectiveness or ethics of a practice or policy.
“Is the death penalty an effective deterrent to violent crimes?”
- *Practical questions* aim to design an instrument or tool that could address a practical problem.
“How should a learning platform be designed to encourage student engagement?”

4.1 FROM PROBLEM TO QUESTION

Sometimes, as research progresses, the initial research questions might evolve or even change entirely based on preliminary findings — research is a dynamic process

A research problem sets the stage for your study and offers a rationale for it, while a research question provides a focused and specific path for carrying out the study. The research question is a progression from the research problem, providing a specific lens through which the problem will be examined. Any research problem can be addressed by several research questions, as illustrated in the example prompts below.

> PROMPT: My research problem is “The rate of hospital-acquired infections is high and increasing”. Suggest a research question that can address this problem, requiring a descriptive answer, an explanatory answer, and a normative answer.

> ANSWER:

1. Descriptive: “What is the current rate of hospital-acquired infections across different departments?”
2. Explanatory: “What factors contribute to the increasing rate of hospital-acquired infections?”
3. Normative: “What best practices should be implemented to effectively reduce the rate of hospital-acquired infections?”

> PROMPT: My research problem is, “It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)”. Suggest two research questions that can address this problem. Max 50 words.

> ANSWER:

1. “What is the heritability coefficient of specific personality traits in identical twins raised apart?”
2. “How do significant life events, such as trauma or career changes, alter personality traits over time?”

4.2 KNOWLEDGE QUESTIONS AND DESIGN QUESTIONS

Many research questions solely call for some knowledge to be produced, i.e. some knowledge gap to be closed. An example of such a knowledge question is, “What are the key factors contributing to the rise in hospital-acquired infections in intensive care units over

the past five years?” Other research questions also call for some solution to be designed, e.g. in the form of a tool, system or method. Such solutions are often the best way to address a practical research problem, as they offer a tangible and useful result that can be applied in the real world. For example, the practical research problem, “The use of learning platforms sometimes reduces student engagement and academic performance”, can be addressed by the design question “How should we design and implement an adaptive learning platform that personalizes content and assessment based on individual student needs, with the aim of increasing primarily student engagement but also academic performance?”

4.3 RESEARCH GOALS AS RESEARCH QUESTIONS

A research question is usually formulated as an interrogative sentence with a question mark at the end. However, this format may sometimes feel awkward. For instance, consider the following question: “How should sterilization techniques be designed and evaluated to reduce infections in orthopaedic wards?” While it is understandable, it is not a smooth expression. A better way to phrase it would be as a goal, for example: “The goal is to design and evaluate sterilization techniques that reduce infections in orthopaedic wards.” In fact, when it comes to practical questions, it is usually clearer to frame them as goals. And a research goal is a perfectly valid way of expressing a research question.

> PROMPT: My research problem is “The rate of hospital-acquired infections is high and increasing”. Suggest a research goal that can address this problem, focusing on technical aspects. Max 50 words.

> ANSWER: To address the rising rate of hospital-acquired infections, a potential research goal could be: “Develop and validate a technical monitoring system that continuously tracks and analyzes infection vectors in real-time, enabling hospitals to implement immediate interventions and improve sterilization protocols.”

4.4 CHARACTERISTICS OF GOOD RESEARCH QUESTIONS

Good research questions possess specific qualities that make them effective in guiding research. These characteristics include clarity, relevance, precision, focus, feasibility, elaboration, and generality:

- *Clarity.* The question should be straightforward and easy to understand, avoiding jargon or overly complex language.
- *Relevance.* The question should be relevant to the research problem — the research problem is addressed by answering the research question.
- *Precision.* The question should be formulated in a way that is exact and unambiguous, so that it becomes possible to determine if it has been answered.

In fact, clarity and precision have to do with the formulation of the research question, while the other qualities are about the question itself

- *Focus.* The question should narrow down the scope of the research, thereby eliminating ambiguity and guiding the research in a targeted direction.
- *Feasibility.* The question should be practical in terms of resources, time, and scope.
- *Elaboration.* The question should not be answerable with a simple “yes” or “no.” It should require analysis and interpretation.
- *Generality.* The question should be of general interest, i.e. it should be of interest to more than one individual or organization.

> PROMPT: My research question is, “How do genetic factors and environmental influences contribute to the development of specific personality traits in identical twins raised in different households?” Make this question clearer and more precise.

> ANSWER: To make your research question clearer and more precise, you could specify which personality traits you are interested in and narrow down the age range or life stage of the identical twins. Here’s a revised version: “What is the relative contribution of genetic factors versus environmental influences in shaping the Big Five personality traits in identical twins, aged 18-25, who were raised in separate households?”

4.5 DELIMITATIONS

The delimitations of a thesis define the boundaries of the research question to be answered. Your study’s delimitations are what you decide not to include — they are the boundaries you set in terms of study duration, geography, type of participants, etc.

On the other hand, limitations are characteristics of the research design or methodology that are out of your control but influence your research findings. These limitations can affect both internal and external validity of your study and are considered potential weaknesses. Simply put, limitations are what you cannot do (elements outside of your control), while delimitations are what you have decided not to do (elements outside of the boundaries you have set).

> PROMPT: My research question is “How do genetic factors and environmental influences contribute to the development of specific personality traits in identical twins raised in different households?”. Suggest three possible delimitations of this question. Max 75 words in fluent text.

> ANSWER: Certainly, you could narrow your research by focusing on identical twins within a specific age range, such as adolescents, to examine personality development at a particular life stage. Alternatively, you could concentrate on one or two specific personality traits like extraversion or conscientiousness. Lastly, limiting your study to a specific geographical or cultural context could control for additional environmental variables. Each delimitation makes your research more manageable and focused.

4.6 PROMPTS FOR RESEARCH QUESTION

Prompts for Brainstorming

- My research problem is [*insert research problem*]. Suggest a research question that can address this problem, focusing on [*insert aspect(s)*].
- My research problem is [*insert research problem*]. Suggest a research question that can address this problem, requiring a [descriptive | comparative | explanatory | exploratory | normative ...] answer.
- My research problem is [*insert practical research problem*]. Suggest a research goal that can address this problem, focusing on designing solutions.
- My research question is [*insert research question*]. Generate three minor modifications of the question, making it more [clear | precise | focused | general | narrow ...]
- My research problem is [*insert research question*]. Suggest three possible delimitations of this question.
- My research question is [*insert research question*]. Rewrite the research question for a twelve-year-old child.

Prompts for Evaluation

- Repeat the research question stated in the thesis.
- Is the research question stated in a clear and concise way?
- Is the research question precise and focused?
- Repeat the research problem stated in the thesis.
- Does the research question address the research problem stated in the thesis?
- Are there any delimitations of the research question?
- What are the key concepts in the research question?
- Have the key concepts of the research question been explained before the statement of the research question?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the research question as well as its statement and discussion in the thesis.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

Your research question will determine the direction of your research, in particular, the choice of research methods. Therefore, it is well worth spending a significant amount of time brainstorming and refining your research question, playing with the prompts and follow-up questions. Furthermore, keep in mind that your research question may need to evolve over time, so it is important to revisit and revise it throughout the entire thesis work.

5

BACKGROUND



“RESEARCH IS TO SEE WHAT EVERYBODY ELSE HAS SEEN, and to think what nobody else has thought.”
— Albert Szent-Györgyi

The background information in your thesis frames your research, offering context and rationale. It typically includes an introduction to your topic, a discussion of key concepts of your study, and a literature review to highlight previous research. This information helps readers comprehend the importance of your study and how it integrates into existing knowledge. It also prepares them for the detailed analysis, findings, and conclusions that follow.

Although the background is usually placed at the beginning of a thesis, it is often written at the end of the work to ensure it aligns well with the rest of the thesis

5.1 INTRODUCTION TO THE TOPIC

The introduction is to provide a brief overview of the subject area to which your study belongs. This helps to orient the reader and position your research. Sometimes, it is helpful to identify both a general subject area and a subarea within that one. And if your research is interdisciplinary, several subject areas need to be discussed.

If you address a theoretical research problem, you need to discuss the theory, or theories, in which your problem appears. This description should include the key concepts, models and frameworks of the theory. Ideally, the discussion should also be clearly connected to your research problem.

If you address a practical research problem, you need to describe the practice in which the problem occurs, see Section 5.2. This description should include the activities of the practice, its purpose, and its participants and stakeholders. Ideally, the description should also be clearly connected to your research problem.

One way of engaging your reader is to start with a hook, i.e. a sentence that grabs the reader’s attention, such as a surprising fact, a pertinent question, or a bold statement related to your research prob-

lem. If you address a practical research problem, a scenario can also be an effective way of capturing the reader's interest, as discussed in Chapter 3.

> PROMPT: My research problem is "The rate of hospital-acquired infections is high and increasing". The practice in which this problem occurs is health care at hospitals. Generate a description of this practice, including its activities, purpose, participants and stakeholders. Max 50 words.

> ANSWER: Health care at hospitals involves diagnosing, treating, and managing patients' medical conditions. Its purpose is to improve patient health and save lives. Participants include doctors, nurses, and patients, while stakeholders range from hospital administrators to public health agencies. A rising concern is the escalating rate of hospital-acquired infections.

> PROMPT: My research problem is "It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)". Give me some dramatic facts or questions that could be the start of my thesis introduction. Max 50 words and fluent text.

> ANSWER: Are we born to be who we are, or do we become it? Astonishingly, identical twins separated at birth often display eerily similar personalities, while war survivors undergo profound personality shifts. In a world where gene editing looms, how much of "you" is truly yours?

5.2 CONCEPTUAL FRAMEWORK

Introducing the key concepts and theories used in your research helps to establish a shared language for your work, making it easier for readers to understand it. It also aids in setting the context and providing clarity on specialized or complex concepts.

Identifying the key concepts of your thesis can sometimes be challenging. A starting point can be your research problem and research question — the concepts mentioned in these usually need to be explained in detail. Additionally, while reviewing previous research, take note of recurring themes, theories, or terms that are essential to your study, as they are likely to suggest key concepts. Another approach is to create a mind map to visually organize your ideas. This can help you see the relationships between different aspects of your research and identify additional key concepts.

> PROMPT: My research problem is, "The rate of hospital-acquired infections is high and increasing". My research question is, "What are the key factors contributing to the rise in hospital-acquired infections in intensive care units over the past five years?" Identify the three most important notions in my research problem and research question, and define them. Max 125 words in fluent text.

> ANSWER: The core of your research revolves around "hospital-acquired infections," which refer to infections patients contract during their hospital stay, unrelated to their initial ailment. A specific focus is placed on "intensive care units (ICUs)," specialized hospital sections dedicated to critically

ill patients requiring close monitoring and advanced care. The investigation is anchored in a specific “over the past five years” timeframe, emphasizing recent trends and developments.

The key concepts of a thesis can be of many different kinds, but three of them are ubiquitous: theoretical concepts, practices and artefacts:

THEORETICAL CONCEPTS. A *theoretical concept* is an abstract idea or construct that is part of a theoretical framework or model within a particular field of study. They are not directly observable but are inferred from empirical observations or are constructed to explain certain aspects of the world. Examples include “social capital” in sociology, “self-efficacy” in psychology, or “quantum entanglement” in physics. To describe a theoretical concept, start by defining it in clear, precise terms, and offer some examples. Situate it within its broader theoretical framework to provide context, citing relevant sources. If applicable, explain how it differs from or relates to other similar concepts. Explain its relevance to your specific research problem or research question. If space allows, acknowledge any limitations or controversies surrounding the concept to present a balanced view.

PRACTICES. A *practice* is a set of human activities that are performed regularly and are seen as meaningfully related to each other by the people participating in them. An example of a health care practice is the practice of dentists, who engage in cleaning teeth, drilling teeth, taking X-rays, and many other activities. An example of an everyday practice is cooking, which involves cutting fruits, frying meat, boiling vegetables, and using kitchen utensils such as stoves, pans, and refrigerators. To describe a practice, you should start by defining it in clear and precise terms, and then describe its purpose, activities, participants, and stakeholders, as well as the artefacts used in the practice. (Participants are directly involved in the activities of the practice, while stakeholders may or may not be directly involved, but they still have an interest in the outcome.)

ARTEFACTS. An *artefact* is an object made by humans with the intention that it be used to address a practical problem. Some artefacts are physical objects, such as smartphones, bicycles, and prosthetic limbs. Other artefacts take the form of drawings or blueprints, such as a software developer’s wireframe for an app. Methods and guidelines can also be artefacts, for example, a set of guidelines for conducting clinical trials. To describe an artefact, you can start by defining its structure, i.e. describing its components, their main characteristics and how they are related to each other. Then, you can move on to the functions of the artefact, i.e., how it can be used and what benefits it brings to its user. If space allows, also describe side effects, i.e. unintended effects of using the artefact.

> PROMPT: My research question is, “How do button designs on a website influence user understanding of their functionality?” Describe and explain the notion of affordance in Human Computer Interaction, in particular, its definition and some examples. Include also how it fits into the context of the subject area, and how it relates to my research question. Max 200 words.

> ANSWER: In Human-Computer Interaction (HCI), “affordance” denotes the design attributes of an object that suggest its possible uses. Originally rooted in psychology, this concept was adapted to HCI to describe how interface elements provide cues to users about their functionality. For example, a 3D button on a website typically suggests it’s clickable, while a slider with a handle implies adjustability.

Your research question centres on this principle. By asking “How do button designs on a website influence user understanding of their functionality?”, you’re exploring the relationship between design affordances and user perception. Different button designs convey different affordances. A flat design might be perceived as a label, while a shadowed, raised button clearly indicates interactivity.

In the broader context of website design, affordances play a pivotal role in user experience. Effective design affordances ensure users can intuitively navigate and interact with a site. Misleading or unclear affordances can lead to confusion or missed actions. Your research, by focusing on button design, seeks to elucidate how specific design choices impact user understanding, emphasizing the critical role of affordance in interface design.

> PROMPT: My research question is “What are the architectures of applications using large language models?”. Describe ChatGPT by describing its structure, functions and side effects. Max 100 words.

> ANSWER: In the context of your research question, ChatGPT is built on a transformer architecture with multiple neural network layers, optimized for natural language understanding and generation. Its primary functions include generating coherent text, answering questions, and text summarization. While it serves as a cornerstone for various applications, it has limitations such as potential data bias and inability to verify real-time information. Ethical concerns, like the risk of generating misleading content, also exist. Understanding ChatGPT’s architecture and its limitations can offer insights into the design of applications using large language models.

5.3 LITERATURE REVIEW

A literature review provides context by situating your research within a subject area. It identifies gaps or unanswered questions, justifying your study’s relevance. The review can also inform your conceptual framework and methodology, thereby enhancing the credibility of your study. Overall, it helps to ensure that your work is original and contributes new insights to your field.

When writing the literature review for your thesis, it is important to keep it focused on your research question and only include closely related literature. A narrow focus ensures that the review remains

pertinent to your study, while a broad review risks becoming irrelevant to it. A common distinction is made between study-centric and concept-centric literature reviews:

STUDY-CENTRIC LITERATURE REVIEWS. A *study-centric literature review* organizes and synthesizes existing research based on individual studies. In this approach, each study is examined, summarized, and evaluated on its own merits, often in chronological order. The focus is on presenting the methods, findings, and conclusions of each individual study. For example, if your research question is about the effectiveness of sterilization and disinfection protocols in reducing hospital-acquired infections in surgical wards, a study-centric literature review would result in a list of relevant studies, which summarizes each study's research design, sample size, sterilization and disinfection methods examined, and key findings regarding their effectiveness.

CONCEPT-CENTRIC LITERATURE REVIEWS. A *concept-centric literature review* organizes information around key concepts rather than around the studies themselves. In this approach, the focus is on synthesizing the literature based on the central ideas that are relevant to your research question. This allows for a more thematic and analytical organization of the review. For example, if your research question is about the effectiveness of sterilization and disinfection protocols in reducing hospital-acquired infections in surgical wards, a concept-centric review might organize the literature around key concepts, such as "sterilization methods," "disinfection protocols," and "hospital acquired infections". Each section of the review would then explore what various studies have to say about these specific concepts, rather than simply summarizing each study one by one. This approach allows for a more nuanced understanding of how different aspects of the topic relate to each other and helps identify gaps or inconsistencies in the existing literature.

An advantage of study-centric literature reviews is that they can often be produced in a short time frame — they can in some cases be generated by simply listing the abstracts of the studies. However, their focus on individual studies may not provide a deep understanding of the underlying theories or concepts that frame the research area. Furthermore, they often neglect broader issues, debates, or interdisciplinary perspectives. Concept-centric literature reviews, on the other hand, can provide a more analytical and integrated perspective on the research topic, making it easier to draw conclusions and identify areas where further research is needed. Therefore, concept-oriented literature reviews are generally preferred to study-centric ones.

There are at least three ways of using ChatGPT to support your literature review:

- Let ChatGPT suggest some keywords to search for, as well as databases to search

- Use ChatGPT to write a summary of a research paper and identify its main topics
- Use ChatGPT to carry out a thematic analysis and generate themes for the topics identified in a set of papers, which can become the starting point of a concept-centric literature review

> PROMPT: My research question is, “How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?” Suggest keywords for searching relevant papers and databases to search. Max 50 words in fluent text.

> ANSWER: To investigate the effectiveness of sterilization and disinfection protocols in surgical wards, you may want to use keywords such as “sterilization protocols,” “disinfection methods,” “hospital-acquired infections,” “surgical wards,” and “effectiveness.” Recommended databases for your search include PubMed, Cochrane Library, Scopus, and Web of Science.

5.4 CONCEPT MAPS

A concept map is a helpful visual tool that assists in organizing and presenting knowledge about a particular subject. It comprises nodes, also known as “concepts,” connected by labelled arrows, which are referred to as “linking words.” These arrows describe the relationships between the nodes. The map can be hierarchical, but it may also show cross-links between different parts of the map to illustrate more complex relationships.

Concept maps can be used in a variety of ways to present your background information. You can use a basic concept map to give readers an initial understanding of your research focus and the key concepts involved. And another concept map can be utilized to illustrate how different theories and key concepts in the literature are related or differ from each other.

5.5 PROMPTS FOR BACKGROUND

Prompts for Brainstorming

- General
 - My research problem is [*insert research problem*]. To which academic subject does this problem belong?
 - My research problem is [*insert research question*]. To which academic subject does this question belong?
 - My research problem is [*insert research problem*]. Give me some dramatic facts or questions that could be the start of my thesis introduction.
- Conceptual Framework

- My research problem is *[insert research problem]*. My research question is, *[insert research question]*. Identify key notions in my research problem and research question.
- My research question is *[insert research question]*. Describe and explain the notion of *[insert theoretical concept]* in *[insert subject area]*, in particular, its definition and some examples. Include also how it fits into the context of the subject area, and how it relates to my research question.
- My research question is *[insert research question]*. Describe *[insert practice]* by defining it and describe its purpose, activities, participants, and stakeholders, as well as the artifacts used in the practice.
- My research question is *[insert research question]*. Describe *[insert artefact]* by describing its structure, functions and side effects.
- Literature Review
 - My research question is *[insert research question]*. Suggest a number of keywords to search for and databases to search.
 - You are a researcher. Have a look at the paper found at *[insert URL]*. Summarize the paper and identify its main [topics | ideas | themes | ...].
 - You are a researcher. I am a student who has identified a set of topics in the document found at *[insert URL]*. Generate themes for these topics. Map topics to themes.

Prompts for Evaluation

- What are the key concepts in the research problem and the research question?
- Have these concepts been defined, described, explained and exemplified?
- Is the literature review concept-centric or study-centric?
- Is the literature review relevant to the research problem and the research question?
- Is the literature review of sufficient quality?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the concept discussion and the literature review.

The last prompt is a follow-up prompt that can be used after the other prompts

How to use the Prompts

When following the IMRAD structure for a thesis, there are often two chapters dedicated to the introduction part. In the first chapter, the

research problem and the research question are the centrepieces, as they provide the foundation for the rest of the thesis. However, you cannot jump directly into the research problem because the reader needs some background information to comprehend it. To provide this background, you can use the prompts on academic subjects and follow up with other prompts that help describe these subjects. These descriptions are then placed at the very beginning of the thesis, and you can possibly prompt asking for a dramatic fact or question to make the text more engaging. The research problem and question will then follow in your first chapter.

In your second chapter, you will provide an extended background. First, use the prompts for identifying and describing the key concepts in the research problem and the research questions, and possibly the prompts for identifying themes in your literature review. And then use the prompts for identifying and analyzing literature related to your research question. You can use the prompts for topics and themes in order to create a concept-centric literature review.

Part III

METHOD

The method part of your thesis addresses the how question, “How did you carry out your study?”. It tells your reader about your choice of research strategy, data collection method and data analysis method, and how you applied these. This part should be thorough enough to allow another researcher to replicate your study.

6

RESEARCH STRATEGY



“THE SCIENTIFIC METHOD IS THE ONLY WAY *we know* of to get a reliable understanding of anything.”
— Richard Dawkins

A research strategy is a comprehensive plan that outlines the approach to be taken in conducting a research study. It guides and directs you in planning, executing, and monitoring your study. While a research strategy offers support at a high level, it needs to be complemented with research methods that can guide the work at a more detailed level. Pictorially, research methods can be viewed as tools for specific tasks, and a research strategy as a toolbox including principles for choosing and using the tools. Many research strategies exist, but in this chapter, only three of them are discussed: experiment, survey, and case study. However, many of the prompts included for these strategies can be used and adapted for other research strategies.

6.1 CHOOSING A RESEARCH STRATEGY

Before beginning a research study, you must decide which research strategy to use. There are many different strategies to choose from, and the decision should be based on the study’s goals and characteristics. To choose an appropriate research strategy, there are three main questions to ask:

- Is it suitable for the research question?
- Is it feasible, taking into account the resources of the research project?
- Is it ethical, considering its possible effects on people, animals, and the environment?

This prompt is an instruction prompt, telling ChatGPT exactly what to include, thereby promoting a relevant answer

> PROMPT: My research question is, "How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?". Which is the best research strategy for this question: a case study or a survey? Consider feasibility and ethical aspects. Identify advantages and disadvantages. Max 150 words in fluent text.

> ANSWER: For the research question, "How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?", a survey would be more appropriate than a case study.

A survey allows for data collection from a broader range of participants, potentially across multiple hospitals, offering a more comprehensive perspective on the effectiveness of protocols. It's feasible to distribute and can capture the experiences and observations of numerous healthcare professionals. However, surveys have disadvantages. They rely on self-reported data, which might not always be accurate. Ethically, ensuring respondent anonymity is crucial to mitigate biases in responses. On the other hand, a case study provides in-depth insights but is limited in scope, focusing on specific instances. It might not offer a generalized understanding across different surgical wards. Ethical concerns arise if a particular ward is singled out, potentially stigmatizing it. In conclusion, while both methods have merits, a survey would be better suited for this research question due to its broader reach and feasibility.

6.2 EXPERIMENT

An *experiment* is an empirical study that investigates cause-and-effect relationships. The purpose of an experiment is to prove or disprove a causal relationship between a factor and an observed outcome. In other words, an experiment tests a hypothesis. A hypothesis can be expressed by using the notions of *dependent variables* and *independent variables*. An independent variable corresponds to the cause in a hypothesis, while the dependent variable corresponds to the outcome. An independent variable affects one or more dependent variables, i.e. the independent variable has a causal effect on the dependent variables, meaning that the latter is dependent upon the former.

During an experiment to test a hypothesis, a researcher alters an independent variable and observes whether any changes occur in the dependent variables. This can be achieved by modifying the value of the independent variable, introducing a new variable or removing it completely. For instance, a researcher may administer a new medication (independent variable) to a group of patients and monitor if their symptoms (dependent variables) improve. If the symptoms do improve, it would indicate that the medication helps alleviate the symptoms of the patients, thereby supporting the hypothesis.

> PROMPT: My research question is, "How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?". Based on this question, suggest

some hypotheses to test. Max 150 words.

> ANSWER:

- H1: Implementing current sterilization and disinfection protocols will significantly reduce the incidence of hospital-acquired infections in surgical wards.
- H2: Surgical wards using UV-C light sterilization will have a lower incidence of infections compared to those using only chemical disinfectants.
- H3: Wards that adhere to CDC or WHO guidelines for sterilization will show a lower incidence of hospital-acquired infections than those that do not.

When conducting experiments, one of the biggest challenges is the presence of confounding variables. These are external factors that can have an impact on both the independent and dependent variables, possibly hindering the establishment of a causal relationship between the variables being studied. In simpler terms, a confounding variable is an additional factor that was not accounted for during the study, and this could result in a false conclusion regarding the causal relationship between the independent and dependent variables. For instance, if a study focuses on the impact of exercise on weight loss (where exercise is the independent variable and weight loss is the dependent variable), other factors like diet, metabolism, or medication could act as confounding variables. These factors could affect weight loss independently of exercise, making it difficult to determine the true impact of exercise.

To control confounding variables, researchers typically prefer to carry out experiments in an artificial environment, e.g. a laboratory. However, laboratory experiments have a drawback in that the artificial settings in which they are carried out may render the conclusions invalid outside the laboratory. To address this issue, researchers can carry out field experiments that start from a naturally occurring situation and conduct the experiment in a real-life setting. In such experiments, the researcher manipulates the independent variable while controlling as many factors as possible. For example, a study on the effect of a healthy diet on weight might involve asking the treatment group to eat healthier food in their day-to-day life while the control group does not change their daily habits. However, many factors can still influence the results, such as individuals in the treatment group not adhering to the instructions.

> PROMPT: My hypothesis is, "Surgical wards using UV-C light sterilization will have a lower incidence of infections compared to those using only chemical disinfectants". Identify some confounding variables. Max 100 words.

> ANSWER:

- Staff Training: Variability in staff expertise on sterilization protocols.

For centuries, scurvy was a major problem for sailors. It was believed to be caused by factors like poor sanitation or lack of fresh food. But in 1747, James Lind's experiment on a British naval ship revealed that vitamin C in citrus fruits cured scurvy. This study showed the importance of eliminating confounding variables.

- Patient Health: Differences in patients' immune status affecting infection rates.
- Frequency of Sterilization: How often each sterilization method is applied.
- Hospital Traffic: Number of people entering and exiting the wards.
- Type of Surgeries: Different surgeries may have varying infection risks.
- Use of Antibiotics: Prophylactic antibiotic use could affect infection rates.

Laboratory and field experiments differ in their advantages and disadvantages, which can be explained in terms of internal and external validity. *Internal validity* refers to whether changes observed in the dependent variable are indeed caused by changes in the independent variable, rather than by other factors. *External validity* refers to the generalisability of the experimental results to other situations. Laboratory experiments are strong on internal validity, as researchers can closely control potentially interfering factors. However, they may be weak in external validity, as their artificial nature may not represent real-world situations. For example, a medical treatment may have beneficial effects when given in a controlled hospital environment, but the same effects may not be observed when patients receive the treatment in their everyday environment. In contrast, field experiments are weak on internal validity as many factors cannot be controlled. But they may have high external validity, as their results may be generalised to real-world situations.

> PROMPT: My research question is, "How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?". I have decided to use an experiment as the research strategy. Which is better: a laboratory experiment or a field experiment? Max 150 words.

> ANSWER: For your research question focusing on the effectiveness of sterilization and disinfection protocols in surgical wards, a field experiment would be more suitable. Conducting the study in an actual hospital setting enhances external validity, making the findings directly applicable to real-world conditions. This approach allows you to assess the protocols in a complex, dynamic environment where multiple variables interact, closely mimicking the conditions under which these protocols are actually used. However, field experiments come with ethical and logistical challenges, such as potential risks to patients and the need for coordination with hospital staff. These challenges must be carefully managed through rigorous ethical oversight and planning.

6.3 SURVEY

The purpose of a survey as a research strategy is to map out some world, be it physical, mental or social. A survey usually has a broad coverage and provides a panoramic view of some area of interest. The breadth of surveys means that they work best for collecting data on narrow and well-defined topics, while they are less suitable for studying complex phenomena in greater depth.

A main challenge of any survey study is that of sampling. *Sampling* is about the selection of individuals within a population, e.g. selecting 100 people to interview from a city population of 10,000. Surveys typically require sampling because studying an entire population can be too expensive. A significant challenge in sampling is determining if the results obtained from a particular sample can be applied to the entire population from which the sample was drawn, i.e. if they can be generalized. It is here useful to differentiate between representative and exploratory samples. A *representative sample* aims to accurately reflect the entire population by capturing the same distribution of relevant characteristics. In contrast, an *exploratory sample* is not required to be representative of its population. It is instead used to gather information to explore a new area.

In order to generate a representative sample, various sampling techniques can be used. Common to all of them is that they ensure that the researcher cannot influence the inclusion of particular individuals in the sample. *Random sampling* means that each individual has an equal chance of being selected and is seen as the gold standard for creating representative samples. However, in some cases, random sampling can become expensive, and other techniques have been designed that offer a balance between cost-effectiveness and random selection, e.g. cluster sampling and stratified sampling.

Purposive sampling is a useful technique for generating an exploratory sample. The goal is to identify a limited number of individuals who can provide especially valuable information to the researcher. The individuals may have some privileged knowledge or experiences about the topic being explored, e.g. through their professional roles. Therefore, the researcher may personally invite them to be part of the sample. Purposive sampling is sometimes combined with *snowball sampling*, in which the initial participants suggest further individuals to add to the sample. When using purposive sampling, the sample size is typically small, as the goal is not to ensure representativity but instead to identify individuals who can offer particularly insightful observations on the research question addressed.

A strength of surveys is that they allow researchers to collect large amounts of data inexpensively and over a short time span. They also enable the collection of both quantitative and qualitative data. One disadvantage is that the collected data may be superficial when people do not have the time or inclination to provide detailed answers to the researcher's questions. For the same reason, some individuals may choose not to participate at all, resulting in a low response rate.

During the 1854 London cholera outbreak, John Snow used surveys to map disease cases and identified a contaminated water pump as the outbreak source. This discovery changed public health strategies, demonstrating the efficacy of surveys not only in opinion polling, but also in identifying patterns in complex health issues.

ChatGPT sometimes answers in a vague way; in order to force ChatGPT to provide an assertive answer, this prompt includes the phrase "confident answer"

> PROMPT: My research question is, "What is the impact of generative AI on the creative arts?" I have decided to use a survey as my research strategy. Which is better: a representative or an explorative sample? Give a confident answer in max 100 words.

> ANSWER: For your research question, "What is the impact of generative AI on the creative arts?", an explorative sample would be the better choice. The creative arts field is diverse and rapidly evolving, especially with the introduction of new technologies like generative AI. An explorative sample allows you the flexibility to uncover various nuanced factors and attitudes that could influence the impact of generative AI. This approach is particularly useful for generating initial insights, identifying key variables, and refining your research hypotheses in a dynamic and multifaceted area like the creative arts.

> PROMPT: My research question is, "What are the success factors of implementing robotic process automation?" I have decided to use a survey as my research strategy, and I have opted for a representative sample. Suggest some approaches for producing a representative sample. Max 125 words.

> ANSWER: Random Sampling: Randomly select participants from a comprehensive list of professionals or organizations in the field to minimize bias.

- Stratified Sampling: Divide your target population into key subgroups, such as industry or company size, and sample proportionally from each.
- Weighting: After collecting data, apply statistical weights to ensure the sample reflects the broader population's characteristics.
- Online Panels: Utilize pre-recruited, demographically diverse online panels specialized in your area of interest.
- Pilot Testing: Conduct a small pilot survey to identify and correct any biases before administering the full survey.

6.4 CASE STUDY

A *case study* focuses on one instance, called a case, of the phenomenon to be investigated. It offers a rich, in-depth description and insight into that case. With its focus on depth and context, case studies differ from both surveys and laboratory experiments. While a survey can provide a broad but shallow view of an area, a case study can paint a pregnant and detailed picture of its subject. A laboratory experiment reduces complexity by controlling, even eliminating, factors that can interfere with the experimental results. In contrast, complexity is essential to a successful case study, as it investigates multiple factors, events and relationships that occur in a real-world case.

In a case study, the case exists before and independently of any research project. It should be examined in its natural setting and not be relocated to a laboratory. Gathering information from multiple sources is required to obtain rich, multi-faceted knowledge about

the case. And this information gathering would usually involve using multiple data collection methods, such as interviews and observations.

A case study typically addresses a single case, but it can also address a small number of cases. Each case should be self-contained and have a clear boundary so that it can be distinguished from its environment. Typical cases are a person, an organisation, a department in an organisation, a project, an IT system, or a policy. A case can be studied over time through a longitudinal study or at a single point in time by investigating the present situation.

Case studies serve different purposes, such as exploratory, descriptive, and explanatory ones. An *exploratory case study* is conducted to spawn research questions or hypotheses that can be employed in other studies. A *descriptive case study* aims to provide an in-depth and comprehensive description of a case and its environment. An *explanatory case study*, on the other hand, not only offers a description but also attempts to establish cause-and-effect relationships that can elucidate why certain events took place.

Selecting the right case is crucial and is governed by the research question of your study. Other factors for choosing a case include representativeness for broader generalization, uniqueness for specialized insights, or suitability for testing a theory. Convenience, such as easy accessibility, may also influence the choice.

A common criticism of case studies is that their results only apply to the case being studied, i.e. that the results are not generalizable. To address such criticism, you need to clarify the extent to which your case is representative of a class of similar cases.

> PROMPT: My research question is, "How effective are current sterilization and disinfection protocols in reducing the incidence of hospital-acquired infections in surgical wards?". Is a case study an appropriate research strategy for this question? Identify advantages and disadvantages. Max 200 words.

> ANSWER: A case study could be a suitable research strategy for investigating the effectiveness of current sterilization and disinfection protocols in surgical wards. This approach allows for an in-depth, context-specific examination, offering detailed insights into the real-world application of these protocols. You can also incorporate qualitative data, such as interviews and observations, to provide a more nuanced understanding of the issue.

- Advantages:
 - In-Depth Analysis: A case study can delve deeply into the specific circumstances, challenges, and outcomes of sterilization protocols in a particular surgical ward.
 - Real-World Context: The findings are directly applicable to the setting under study, which can be valuable for immediate improvements.
- Disadvantages:

In 1848, Phineas Gage, a railroad worker, suffered a brain injury when an iron rod pierced his skull, leading to dramatic personality changes. This incident became a landmark case study as it demonstrated how case studies could be used to understand complex phenomena when controlled experiments are not feasible.

- Limited Generalizability: The results may not be applicable to other surgical wards or healthcare settings, limiting the broader impact of your research.
- Subjectivity Risk: The qualitative nature of case studies can introduce subjectivity, which may affect the reliability and validity of your findings.

In summary, while a case study can offer valuable, context-specific insights, its limitations in terms of generalizability and potential subjectivity should be carefully considered. You might consider using a mixed-methods approach, combining the case study with other research methods, to address these limitations.

ChatGPT often answers using bullet lists, but when this is not desirable, the phrase "in fluent text" can be added to the prompt

> PROMPT: My research question is, "What are the success factors of implementing robotic process automation in manufacturing companies?" I have decided to use a case study research strategy, and Volvo is my case. Is Volvo a good choice for my case study? Max 100 words in fluent text.

> ANSWER: Volvo could be an excellent choice for your case study on the success factors of implementing robotic process automation (RPA) in manufacturing. As a global leader in automotive manufacturing, Volvo has a history of technological innovation and complex operations where RPA could be impactful. The company's diverse and global operations can offer rich insights into how RPA success factors may vary across contexts. However, ensure you have access to relevant data and stakeholders within Volvo, and be clear about the study's scope to focus on specific RPA implementations. Overall, Volvo's industry relevance and technological leadership make it a compelling case.

> PROMPT: My research question is, "What are the success factors of implementing robotic process automation in manufacturing companies?" I have decided to use a case study research strategy. Suggest a number of different cases of different kinds. Max 100 words in fluent text.

> ANSWER: For a well-rounded case study on the success factors of implementing robotic process automation in manufacturing, consider a diverse set of cases. Include a large-scale automotive manufacturer like General Motors for complex operations, a pharmaceutical company like Pfizer for regulated environments, and a small to medium-sized local manufacturer for scalability insights. Additionally, consider a high-tech firm like Corning for advanced materials and Tesla for sustainable manufacturing. This range will offer a comprehensive view of how RPA's success factors vary across different manufacturing contexts and scales.

6.5 PROMPTS FOR RESEARCH STRATEGY

Prompts for Brain Storming

- General
 - My research question is [*insert research question*]. Is a [case study | survey | experiment | ...] an appropriate research

strategy for this question? Consider feasibility and ethical aspects.

- My research question is, *[insert research question]*. Which is the best research strategy for this question: *[insert a number of research strategies]*? Consider feasibility and ethical aspects. Identify advantages and disadvantages.
- My research question is *[insert research question]*. Design a *[case study | survey | experiment | ...]* that will address this question.
- Experiment
 - My research question is *[insert research question]*. Based on this question, suggest some hypotheses to test.
 - My hypothesis is *[insert hypothesis]*. Identify some confounding variables.
 - My research question is *[insert research question]*. I have decided to use an experiment as the research strategy. Which is better: a laboratory experiment or a field experiment?
- Survey
 - My research question is *[insert research question]*. I have decided to use a survey as my research strategy. Which is better: a representative or an explorative sample?
 - My research question is *[insert research question]*. I have decided to use a survey as my research strategy, and I have opted for a representative sample. Suggest some approaches for producing a representative sample.
- Case Study
 - My research question is *[insert research question]*. I have decided to use a case study research strategy. Is a longitudinal study necessary or desirable?
 - My research question is, *[insert research question]*. I have decided to use a case study research strategy. Suggest a number of different cases of different kinds.
 - My research question is *[insert research question]*. I have decided to use a case study research strategy, and *[insert case]* is my case. Is *[insert case]* a good choice for my case study?
 - My research question is *[insert research question]*. I have decided to use a case study research strategy. Which is the best kind of case study: exploratory, descriptive or explanatory?

Prompts for Evaluation

- Which research strategies are used in the thesis?

- Are these research strategies appropriate with regard to the research question?
- Is it stated in the thesis why the chosen research strategies are appropriate with regard to the research question?
- Is a laboratory experiment or a field experiment used, and is it stated in the thesis why this kind of experiment was used?
- Is a representative sample or an exploratory sample used, and is it stated in the thesis why this kind of sample was used?
- How was the sampling done?
- Which was the case in the case study, and is it stated why this was a good choice for the case study?
- Is an exploratory, descriptive or explanatory case study used, and is it stated in the thesis why this kind of case study was used?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the choices made in relation to research strategies.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

If you are feeling stuck and need some inspiration, you can consider using the general prompts to help you choose between different research strategies. Once you have chosen a strategy, you can use the specific prompts to get more detailed advice. Keep in mind that these prompts only offer a superficial view of the strategies, and if you want to explore them in greater depth, you will need to design additional prompts based on method literature.



“ERRORS USING
INADEQUATE DATA
are much less than
those using no data
at all.”
— Charles Babbage

A crucial step in any empirical research study is collecting data about the phenomenon being studied. This is done using various data collection methods. The data collected may be in numeric form, often referred to as quantitative data, such as the number of search results or lines of code. Other kinds of data may include text, sound, images, and video, known as qualitative data. Regardless of the type of data, there are four commonly used data collection methods: questionnaires, interviews, observational studies, and document studies.

When writing a thesis, it is common to use only one data collection method. However, using multiple methods can improve accuracy and provide a more comprehensive understanding of the subject being studied. For example, if you carry out a number of interviews and the results confirm the findings of a previously conducted questionnaire, you can be more confident in your conclusions. The approach of combining research strategies and methods (data collection as well as data analysis methods) is called the *mixed methods* approach.

7.1 CHOOSING A DATA COLLECTION METHOD

Your choice of data collection method will be influenced by several factors, essentially the same ones as those for your choice of research strategy:

- Is it suitable for the research question?
- Is it feasible, taking into account the resources of the research project?

- Is it ethical, considering its possible effects on people, animals, and the environment?

In order to choose wisely, it is important to be aware of the advantages and disadvantages of various data collection methods.

METHOD	ADVANTAGES	DISADVANTAGES
<i>Questionnaires</i>	Scalable; Cost-effective; Standardized; Anonymity ensures candidness.	Surface-level data; Fixed responses; Potential misinterpretation; Response bias.
<i>Interviews</i>	In-depth insights; Flexible; Immediate clarification.	Time-intensive; Potential interviewer bias; Less scalable.
<i>Observations</i>	Natural context; Holistic view; Direct data collection.	Observer effect; Subjectivity; Limited scope.
<i>Documents</i>	Unobtrusive; Authentic; Readily accessible.	Incomplete data; Potential bias; Authenticity concerns.

If you provide only the research question, ChatGPT cannot provide a decisive answer for the best data collection method

> PROMPT: My research question is, "What are the causes of eating disorders among young people?". What is the better data collection method: interviews or questionnaires? Max 100 words.

> ANSWER: Both interviews and questionnaires have merits for studying the causes of eating disorders among young people. Interviews provide in-depth insights, allowing for exploration of personal experiences and emotions, which can uncover nuanced factors. However, they can be time-consuming and may lead to biased responses due to the interviewer's presence. Questionnaires, on the other hand, can reach a larger sample size quickly and ensure anonymity, which might lead to more honest responses. However, they may lack depth and might not capture the complexity of individual experiences. For a comprehensive understanding, a mixed-method approach, combining both methods, could be ideal.

If you provide more information in a contextual prompt (Section 1.4), ChatGPT will offer a more confident and decisive response

> PROMPT: My research question is, "What are the causes of eating disorders among young people?". My research budget is large. What is the better data collection method: interviews or questionnaires? Max 100 words.

> ANSWER: With a large budget, interviews are ideal for exploring the causes of eating disorders among young people. Interviews offer in-depth, personalized insights, capturing the complexity of individual experiences and emotions. They allow for adaptive questioning, ensuring a comprehensive understanding of the topic. While questionnaires can reach a broader audience and provide standardized data, they may lack the depth and nuance that interviews offer. For a multifaceted issue like eating disorders, the richness of interview data is invaluable.

7.2 QUESTIONNAIRES

A *questionnaire* is a written document consisting of a set of questions that are provided to a group of individuals, called respondents, for the purpose of gathering data. When the respondents answer the questions, they provide the researcher with data that can be interpreted and analysed. Questionnaires are generally used to obtain concise and unambiguous information. The information collected may include basic facts such as age, gender, or income, or opinions such as consumer preferences or political views. Since questionnaires are cost-effective to distribute, they are ideal for gathering information from a large number of people.

Questionnaires can contain open or closed questions. *Closed questions* have a predetermined set of acceptable answers, while *open questions* allow respondents to answer using their own words. Closed questions are advantageous in that they are quick and easy to answer, and can be analyzed using statistical methods. However, closed questions do not allow for nuanced answers, as respondents can only choose from a limited set of predefined alternatives.

The questions in a questionnaire should be:

- *Clear*. They should be easily understandable by the respondents
- *Relevant*. They should be relevant for the purpose of your study, in particular, your research question
- *Unbiased*. They should not be leading questions, i.e. they should not suggest or encourage a certain answer

> PROMPT: Are the following questions clear and unbiased: Do you agree that this country needs a change in government? What is your view on entanglement theory? Max 100 words.

> ANSWER: The first question is clear but leading, implying a potential need for a government change, introducing bias. The second question is clear for those familiar with physics, but it assumes respondents know about “entanglement theory.” While the questions are understandable, they carry potential biases or presuppositions.

7.3 INTERVIEWS

An *interview* is a communication session between a researcher and a respondent, where the researcher directs the conversation by asking questions of the respondent. Interviews are useful for gathering complex and sensitive information and are often used to elicit attitudes, opinions, and experiences from the respondents. They are also suitable for contacting individuals with access to privileged information, such as those with deep and unique knowledge about a particular domain.

Interviews are a commonly used method for researchers to interact with respondents. There are three types of interviews that researchers can use to gather information.

- A *structured interview* involves a set of predetermined questions that the respondent can answer by selecting from a list of allowed responses
- A *semi-structured interview* also involves a set of questions, but the order in which they are asked is flexible; respondents are encouraged to provide answers using their own words
- An *unstructured interview* allows the respondent to talk freely about a topic without being restricted to specific questions

During an interview, it is important to take advantage of opportunities for interaction. You can achieve this by using a combination of closed and open-ended questions, as well as prompting, probing, and checking. *Prompting* involves gently encouraging the respondent to begin speaking, while *probing* involves asking for additional details. *Checking* is used to confirm that you have accurately understood the respondent's answers.

When conducting an interview, you need to record and transcribe the answers provided by the respondent in order to interpret and analyze them later. You can use audio or video recordings alongside field notes to document the interview. While the recording captures all the spoken words, the field notes are helpful in noting any non-verbal communication. In the event that a respondent refuses to be recorded, you will have to rely solely on the field notes for documentation.

> PROMPT: My research question is, "What are the causes of eating disorders among young people?". Design an interview study for this question.

> ANSWER:

- Objective
 - To explore and understand the underlying causes of eating disorders among young people.
- Participants Selection
 - Target Group: Young individuals aged 12-25 with a history of eating disorders.
 - Sampling Method: Purposive sampling, focusing on those who have been diagnosed with an eating disorder.
- Preparation
 - Obtain ethical approval from a review board.
 - Ensure participants' confidentiality and anonymity.
 - Obtain informed consent from participants (and guardians if under 18).
- Interview Guide
 - Introduction

ChatGPT's answer is not limited to interview as a data collection method; instead, it describes the entire research process including research strategy, data collection method, and data analysis method

* “Thank you for participating. This interview aims to understand the causes of eating disorders among young people. Your responses are confidential.”

– Main Questions

- * Can you describe your journey with your eating disorder? When did you first notice it?
- * What factors do you believe contributed to the development of your eating disorder?
- * How has your relationship with food evolved over the years?
- * Can you discuss any societal or peer pressures you felt regarding body image or eating habits?
- * Were there any significant life events or stressors that coincided with the onset or exacerbation of your disorder?
- * How has your family’s attitude towards food and body image influenced you?
- * Have media or social media platforms played a role in shaping your perceptions about body image?
- * Were there any resources or interventions that you found helpful or harmful in your journey?

– Closing:

* “Thank you for sharing your experiences. Your insights are valuable in understanding the causes of eating disorders.”

• Data Collection

- Conduct semi-structured, face-to-face interviews, lasting 45-60 minutes.
- Record interviews with participants’ consent.

• Data Analysis

- Transcribe recorded interviews.
- Use thematic analysis to identify patterns and themes related to the causes of eating disorders.

• Reporting

- Present findings, ensuring participants’ anonymity.
- Discuss implications for prevention and intervention strategies.

• Limitations

- Subjectivity due to self-reported data.
- Potential recall bias.
- Limited generalizability if the sample is not diverse.

• Ethical Considerations

- Ensure participants’ well-being, offering resources or counseling if distress arises.

This answer is on a very high level, but you can always ask ChatGPT to expand parts of it

- Store data securely and maintain confidentiality.

- Conclusion

- This interview study aims to delve deep into the personal experiences of young individuals with eating disorders, shedding light on the multifaceted causes and contributing factors.

> PROMPT: Expand the Introduction to the Interview Guide, especially regarding ethical aspects.

This prompt simply asks for an expansion of a part of the previous answer

> ANSWER: “Hello and thank you for agreeing to participate in this interview. My name is [Interviewer’s Name], and I am conducting a study to understand the underlying causes of eating disorders among young people. Your insights and experiences are invaluable to this research.

Before we begin, I’d like to emphasize a few important points:

1. Confidentiality: Your privacy is of utmost importance to us. Everything you share during this interview will remain confidential. Your name and any identifying information will not be attached to your responses, and only the research team will have access to the raw data.
2. Voluntary Participation: Your participation in this interview is entirely voluntary. If at any point you feel uncomfortable or wish to skip a question, please let me know. You also have the right to withdraw from the study at any time without any consequences.
3. Recording: With your permission, we would like to record this interview for accuracy in transcription and analysis. The recording will be used solely for research purposes and will be stored securely. If you’re not comfortable being recorded, please inform me, and we will proceed without it.
4. Potential Distress: Some questions might evoke strong emotions or memories. If you ever feel distressed, please let me know. We can pause or stop the interview, and I can provide resources or counseling referrals if needed.
5. Purpose and Benefits: The aim of this study is to gain a deeper understanding of the causes of eating disorders among young people. By sharing your experiences, you are contributing to knowledge that could inform prevention and intervention strategies in the future.
6. Questions and Concerns: If you have any questions or concerns about the study, the process, or your rights as a participant, please don’t hesitate to ask.

Once again, thank you for your time and willingness to contribute to this research. Shall we begin?”

This prompt asks for an expansion of a part of the previous answer through a why question — it asks for motivations

> PROMPT: Provide the motivations for your main questions.

> ANSWER:

1. Can you describe your journey with your eating disorder? When did you first notice it?
Motivation: To establish a timeline and understand the progression of the disorder. This can provide context for subsequent answers and help identify potential triggers or exacerbating factors.
2. What factors do you believe contributed to the development of your eating disorder?
Motivation: To directly address the research question by allowing participants to reflect on and identify the primary causes or influences behind their disorder.
3. How has your relationship with food evolved over the years?
Motivation: To understand the dynamics of the participant's relationship with food, which can offer insights into behavioral patterns, coping mechanisms, and shifts in perception over time.
4. Can you discuss any societal or peer pressures you felt regarding body image or eating habits?
Motivation: To explore the external pressures that might have influenced the participant's self-perception and behaviors, highlighting the role of society and peers in shaping attitudes towards body image.
5. Were there any significant life events or stressors that coincided with the onset or exacerbation of your disorder?
Motivation: To identify potential external triggers or stressors that may have played a role in the onset or worsening of the disorder, such as trauma, loss, or significant life changes.
6. How has your family's attitude towards food and body image influenced you?
Motivation: To delve into the familial context and understand if and how family dynamics, beliefs, or behaviors might have contributed to the participant's eating disorder.
7. Have media or social media platforms played a role in shaping your perceptions about body image?
Motivation: To assess the impact of media, including social media, on participants' body image perceptions, given the pervasive nature of media influence in modern society.
8. Were there any resources or interventions that you found helpful or harmful in your journey?
Motivation: To gather feedback on existing resources or interventions, which can inform recommendations for future prevention and treatment strategies.

> PROMPT: Suggest some ways in which I can transcribe the recorded interviews. Max 100 words.

> ANSWER:

- Manual Transcription: Listen and type out content yourself.

This prompt asks for an expansion of the previous answer through a how question — it asks for ways of performing a task

- Professional Transcription Services: Hire experts or companies specializing in transcription.
- Automated Transcription Software: Use platforms like Otter.ai, Rev, or Trint for automatic transcription.
- Speech Recognition Software: Tools like Dragon NaturallySpeaking or Google's Voice Typing can convert speech to text.
- Freelancers: Hire individuals from platforms like Upwork or Fiverr.
- University Assistants: Engage research assistants or students.
- Combination: Start with automated software, then manually review for accuracy.

This prompt asks for an expansion of the previous answer through a combined what and how question — it asks for more questions and ways to state them

> PROMPT: My research question is, "What are the causes of eating disorders among young people?". I am going to do an interview study. And my main interview question is, "How has your relationship with food evolved over the years?". Suggest some questions that prompt, probe and check this question. Suggest also in what ways I should ask these questions. Max 200 words.

> ANSWER:

- Prompting
 - "Describe your earliest memories related to food."
 - "Were there events or individuals that notably influenced your eating habits?"
- Probing
 - "You touched on [specific event]. Can you delve deeper into how that affected your relationship with food?"
 - "How have societal or peer pressures shaped your eating behaviors?"
- Checking
 - "From what you've shared, it seems [summarize their point]. Have I understood that correctly?"
 - "You felt [emotion] during [event], which impacted your eating in [specific way]. Is that an accurate summary?"

Ways to Ask: Approach with empathy and genuine curiosity. Use open-ended questions to invite expansive answers. When probing, ensure your tone remains non-judgmental, signaling you're seeking understanding, not making assumptions. During checking, frame it as your attempt to grasp their perspective fully, allowing them space to correct or expand.

7.4 OBSERVATION

Observation is a method for collecting data, in which a researcher directly observes a phenomenon. It is often used as an alternative or complement to questionnaires or interviews, and it provides the advantage of allowing the researcher to see what people actually do, rather than relying on what they say they do or think.

Observation can be carried out in different ways, and two of the main ones are systematic and participant observation. In *systematic observation*, the researcher remains an external observer, using structured tools to consistently record specific behaviours or occurrences. The aim is to maintain objectivity, often in controlled settings, and reduce bias through standardized data collection methods. On the other hand, *participant observation* involves the researcher immersing themselves within the group or community under study. By actively participating, they seek to gain an insider's perspective, understanding the nuances, emotions, and motivations of the subjects. This method is more exploratory, conducted in naturalistic settings, and while it offers richer insights, it also carries a higher risk of subjectivity. Summarizing, while systematic observation prioritizes structured and objective data collection, participant observation emphasizes depth and context through direct involvement.

> PROMPT: My research question is, "What are the causes of eating disorders among young people?" I am going to carry out an observation study. Which is better: systematic observation or participant observation? Max 150 words in fluent text.

> ANSWER: For the research question "What are the causes of eating disorders among young people?", participant observation might be more suitable. This method allows for a deeper understanding of the emotional, cultural, and social factors contributing to eating disorders. By immersing yourself within the community, you can gain insights into underlying motivations and behaviors. However, this approach requires sensitivity due to the topic's delicate nature. On the other hand, systematic observation offers a more structured and objective data collection, focusing on specific behaviors or triggers. While it reduces observer bias, it might not capture the emotional depth of the issue. Given the complexity of eating disorders, participant observation, approached with empathy and ethical considerations, would likely provide richer insights into the causes among young people.

7.5 DOCUMENTS

Documents offer an alternative data source to questionnaires, interviews, and observations. They can be textual or include photographs, audio, video, and more. Common document types include government publications (like laws, official statistics, and reports), organizational records (such as annual reports and meeting minutes), academic publications (like journal articles and dissertations), newspa-

pers, personal communications (e.g., diaries, emails, tickets), and social media streams.

A significant challenge in using documents is assessing their credibility. While government and peer-reviewed academic publications are often deemed trustworthy, they can still have biases. The intent behind a document, such as the motive of an opinion piece, can influence its credibility. Documents allow for rapid, cost-effective data collection, especially if they are public, minimizing ethical concerns.

> PROMPT: My research question is, “What are the causes of eating disorders among young people?” I am going to carry out a document study. What types of documents should I search for? Give some examples. Max 150 words in fluent text.

> ANSWER:

- Government Publications: For instance, the CDC’s reports or the National Institute of Mental Health’s findings on youth and eating disorders can provide authoritative statistics and insights.
- Organisational Records: Organizations like the National Eating Disorders Association (NEDA) often release studies or findings on the prevalence and causes of these disorders.
- Academic Publications: Peer-reviewed articles from journals like the “International Journal of Eating Disorders” can offer in-depth research and case studies.
- Media Sources: Features in mainstream publications, such as Time Magazine or The Guardian, might highlight societal pressures or individual stories.
- Personal Communications: Platforms like “Eating Disorder Hope” or personal blogs can give firsthand accounts of struggles, offering a personal lens to the issue.
- Social Media: Observing trends or challenges on platforms like TikTok or Instagram can shed light on contemporary pressures related to body image.

These varied sources can collectively paint a comprehensive picture of the intricate causes behind eating disorders in youth.

7.6 PROMPTS FOR DATA COLLECTION

Prompts for Brainstorming

The more information you provide about your research, the better responses you can expect from ChatGPT

- General
 - My research question is [*insert research question*]. My research strategy is [*insert research strategy*]. [*insert facts about your resources*]. [*insert your ethical considerations*]. Which is the better data collection method: [questionnaire | interview | observation | document | ...]?

- My research question is *[insert research question]*. *[insert facts about your resources]*. *[insert your ethical considerations]*. Design a [questionnaire | interview | observation | document | ...] study for this question.
- My research question is *[insert research question]*. I am planning a [questionnaire | interview | observation | document | ...] study. What considerations should I keep in mind to ensure the best quality?
- Interview
 - My research question is *[insert research question]*. *[insert facts about your resources]*. *[insert your ethical considerations]*. Suggest interview questions for a [structured | semi-structured | unstructured] interview and motivate them.
 - My research question is *[insert research question]*. I am going to do an interview study. And my main interview question is *[insert interview question]*. Suggest some questions that prompt, probe and check this question. Suggest also in what ways I should ask these questions.
- Questionnaire
 - My research question is *[insert research question]*. *[insert facts about your resources]*. *[insert your ethical considerations]*. I am going to do a survey of *[insert target population]* with a questionnaire as the data collection instrument. Suggest a number of closed questions as well as open questions.
 - Are the following questions clear and unbiased: *[insert a list of questions]*?
- Observation
 - My research question is *[insert research question]*. *[insert facts about your resources]*. *[insert your ethical considerations]*. I am going to carry out an observation study. Which is better: systematic observation or participant observation?
- Document
 - My research question is *[insert research question]*. *[insert facts about your resources]*. *[insert your ethical considerations]*. I am going to carry out a document study. Which types of documents should I search for? Give some examples.

Prompts for Evaluation

- Which data collection methods are used in the thesis?
- Is it stated in the thesis why the chosen data collection methods are appropriate with regard to the research question and the research strategy?

The last prompt is a follow-up prompt that can be used after the other prompts

- Are the [interview | questionnaire] questions clear and unbiased?
- Is systematic or participant observation used and is it stated in the thesis why this kind of observation was used?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the choices made in relation to data collection.

How to Use the Prompts

In order to get some inspiration, you could use the general prompts at the beginning of your work on data collection. Afterwards, you can use the prompts related to specific data collection methods to get more detailed advice. But be aware that these prompts only scratch the surface of the methods, and in order to dig deeper you need additional prompts based on method literature. You could also use the last general prompt to let ChatGPT suggest some further quality criteria for the methods.

When writing the prompts, you can decide how much information to provide about the details of your study. Providing more information can lead to more specific answers, which is usually better. But providing less information can also be useful because ChatGPT will then suggest more varied, and sometimes more creative, answers.



“THE GOAL IS TO
TURN DATA *into*
information, and
information *into*
insight.”
— Carly Fiorina

Data analysis refers to the activity of processing and interpreting data to discover meaningful information and draw conclusions. It involves breaking down complex data sets to uncover trends and relationships that can be used to understand the data. The two main types of data analysis are quantitative data analysis and qualitative data analysis.

Qualitative data analysis focuses on non-numerical data, such as text, audio, video, or images. It aims to interpret and understand the deeper meanings and structures in the data. Techniques include content analysis, thematic analysis, and narrative analysis. *Quantitative data analysis* deals with numerical data and aims to quantify relationships and test hypotheses. Methods include descriptive statistics and inferential statistics.

8.1 QUALITATIVE ANALYSIS

Content analysis is a method used to quantify the content of a text or other qualitative data. It proceeds by classifying individual elements of the text, such as words or phrases, into categories and then calculating the frequency of the elements in each category. One of the benefits of content analysis is its clear and simple process, which results in high reliability, meaning that different researchers will come to essentially the same results. However, it has a drawback as it is insensitive to context. It only takes into account the individual elements analyzed and does not consider the relationships between them and the author’s intentions. As a result, content analysis is mainly useful for studying uncomplicated aspects of a text.

Thematic analysis is a qualitative research technique used to identify and interpret patterns or themes in textual data. It aims to provide a

deep understanding of textual content by identifying its recurring patterns. The process begins with researchers immersing themselves in the data, followed by coding specific segments based on their meaning. These codes are then grouped to form potential themes. After refining and defining these themes, findings are presented, often illustrated with direct extracts from the data.

> PROMPT: I am writing a thesis. My research question is, “What are the causes of eating disorders among young people?” I have carried out interviews with young people who have been treated for eating disorders. Which kind of data analysis should I use: thematic analysis or content analysis?

> ANSWER: If your primary interest is in deeply understanding the experiences and perceptions of young people regarding the causes of eating disorders, thematic analysis might be more appropriate. It will allow you to delve into the complexities and nuances of their experiences. If you’re more interested in quantifying specific aspects of your data, such as the frequency of certain causes mentioned or specific patterns of language use, then content analysis might be more suitable.

Narrative analysis is a method of interpreting people’s experiences and motivations by examining the stories (narratives) they tell in a specific context. In essence, it involves analyzing long-form participant responses or written stories to reveal themes and meanings. The data used for this analysis can be gathered from various sources, such as interviews, monologues, written stories, or recordings. The strength of narrative analysis lies in its ability to capture the richness of human experiences, often revealing intricate details that might be overlooked in other forms of analysis.

The following prompts and answers will illustrate how prompting can support thematic analysis. ChatGPT’s answers have been truncated for space reasons, but a complete transcript can be found here: <https://chat.openai.com/share/d90e3a86-49e2-4810-bd6e-88c1edbb126d>

This prompt contains quite some contextual information, but ChatGPT does not use it

> PROMPT: I am writing a thesis. My research question is, “What are the causes of eating disorders among young people?” I have carried out interviews with young people who have been treated for eating disorders. And now, I am going to carry out a thematic analysis. What should I include?

> ANSWER:

- Data Familiarization
 - Describe how you immersed yourself in the data, such as reading and re-reading the transcripts, noting down initial ideas, etc.
- Generating Initial Codes
 - Explain the process of coding the raw data.
 - Mention if you used any software or tools for coding.
 - Provide examples of codes generated from the data.
- Searching for Themes

- Describe how you collated codes into potential themes.
- Mention how you reviewed and refined these themes in relation to the coded extracts and the entire dataset.
- Reviewing Themes
 - Discuss how you checked if the themes work in relation to the coded extracts and the entire dataset.
 - Explain any refinements or merging/splitting of themes at this stage.
- Defining and Naming Themes
 - Clearly define each theme.
 - Provide a concise, punchy name for each theme.
 - Describe the scope and content of each theme.
- Thematic Analysis
 - For each theme
 - * Provide a detailed analysis.
 - * Use direct quotes from the interviews to support your findings.
 - * Discuss how the theme relates to the research question.
- Highlight any patterns, similarities, or differences observed.
- Discuss any unexpected findings.

Based on this outline of a thematic analysis, you can find additional prompts for the various parts. Even before you actually start data collection, it can be useful to generate fictional data for inspiration; the following prompt can be used.

> PROMPT: My interview questions are (See Section 7.3). For each question, create 10 answers.

> ANSWER: Certainly! Here are potential answers for each of your interview questions. Please note that these answers are fictional and are meant to provide a range of possible responses based on common themes in the literature and anecdotal experiences. They may not represent any specific individual's experience.

- Can you describe your journey with your eating disorder? When did you first notice it?
 - I first noticed it in high school when I started skipping meals to lose weight for a dance.
 - It began subtly in college; I'd avoid certain foods and felt guilty when I ate them.
- What factors do you believe contributed to the development of your eating disorder?

- Peer pressure and wanting to fit in.
- Comments from family about my weight.
- How has your relationship with food evolved over the years?
 - I've gone from fearing food to seeing it as fuel for my body.
 - I still struggle with certain trigger foods but am learning moderation.

The codes are quite similar to the questions; more open questions could have generated other responses and codes

> PROMPT: Suggest codes for these answers. Provide quotes from the interviews for each code.

> ANSWER:

1. Onset during Adolescence

- "I first noticed it during my high school years."
- "I realized it during college when I would feel guilty every time I ate something."
- "I first noticed it when I was 15."

2. Influence of Media and Social Comparisons

- "I always felt the need to look like the celebrities and models I saw in magazines."
- "Social media influencers promote unrealistic body standards."
- "The media's portrayal of the 'ideal' body."

> PROMPT: Suggest themes for these codes. For each theme, specify the included codes, give a definition and a snappy name.

> ANSWER:

1. SNAPPY NAME: *Adolescent Awakening*

DEFINITION: The period during which individuals first become aware of their eating disorders, typically during their teenage or early adult years.

INCLUDED CODES: Onset during Adolescence

2. SNAPPY NAME: *Media's Mirage*

DEFINITION: The influence of media, including social media, magazines, and celebrities, in shaping perceptions about body image and setting unrealistic standards.

INCLUDED CODES: Influence of Media and Social Comparisons

3. SNAPPY NAME: *Familial Footprints*

DEFINITION: The impact of family attitudes, comments, and behaviors related to food and body image on an individual's self-perception and eating habits.

INCLUDED CODES: Family Influences

> PROMPT: Discuss any patterns, relationships, contrasts, or contradictions that emerged between themes.

> ANSWER:

Regenerating answers can produce more, and sometimes quite original, codes

Patterns and Relationships:

- **ADOLESCENT AWAKENING & FAMILIAL FOOTPRINTS:** Many individuals first become aware of their eating disorders during adolescence, a time when family influences are particularly strong. The attitudes and behaviours of family members can play a significant role in shaping an individual's self-perception and relationship with food during these formative years.
- **MEDIA'S MIRAGE & SOCIETAL SCALES:** Both these themes highlight the external pressures that individuals face regarding body image. The media, with its portrayal of idealized body types, combined with societal and peer pressures, can create a potent environment that fosters negative self-perception and unhealthy behaviours.

Contrasts:

- **HEALING HIGHWAYS & TREACHEROUS TRAPS:** These themes represent the dichotomy of experiences individuals might have when seeking help. While some resources and interventions prove beneficial, others can be detrimental. This contrast underscores the importance of personalized care and the need for awareness about potentially harmful interventions.

Contradictions:

- **MEDIA'S MIRAGE & HEALING HIGHWAYS:** The media often promotes a narrow definition of beauty and success, which can be detrimental to individuals with eating disorders. In contrast, "Healing Highways" represents the positive resources and coping mechanisms that individuals find helpful. The contradiction lies in the external negative influences versus the internal positive coping strategies.

> **PROMPT:** My research question is, "What are the causes of eating disorders among young people?" How can the themes help to answer my research question? Include quotes from the interviews.

> **ANSWER:**

1. Adolescent Awakening

- a) **Relevance to Research Question:** This theme highlights the typical age range when individuals first become aware of their eating disorders, suggesting that adolescence is a critical period for the onset.

- a) **Quote:** "I first noticed it during my high school years."

2. Media's Mirage

- a) **Relevance to Research Question:** This theme underscores the influence of media in shaping perceptions about body image, suggesting that media portrayal can be a significant cause of eating disorders among the youth.

- a) Quote: "I always felt the need to look like the celebrities and models I saw in magazines."

8.2 QUANTITATIVE ANALYSIS

Descriptive statistics is used for quantitatively describing a sample of data. The main goal of descriptive statistics is to provide a summary of the data, by using measures such as mean, median, mode, range, variance and standard deviation. In contrast, *inferential statistics* is used to make inferences about a population based on the characteristics of a sample.

The following prompt creates some numerical data related to the thematic analysis above.

For this prompt and the following ones, ChatGPT used a plugin called Noteable, which offers tools for statistical analysis

> PROMPT: Create a table with the columns Age, Severity, Age of Onset, and Primary Cause. Fill the table with 25 rows. The column Age is an integer between 19 and 25. The column Severity is an integer between 1 and 5. The column Age of Onset is an integer between 5 and 18. The column Primary Cause is one of "Control Cravings", "Generational Echoes" and "Mirror of Society". Create a notebook with this table data, and call it Eating Disorder.

> ANSWER: I've created a notebook named "Eating Disorder" and added a table with the specified columns and data. Table 8.1 contains a sample of the data.

Index	Severity	Age	Age of Onset	Primary Cause
18	3	21	12	Familial Footprints
17	1	21	10	Media's Mirage
11	3	19	5	Familial Footprints
13	1	22	5	Familial Footprints
6	4	19	6	Familial Footprints

Table 8.1: Sample Data from Eating Disorder Table

> PROMPT: What is the average Age of the respondents? What is the average Age of Onset of the respondents? What is the standard deviation of the Age of Onset?

> ANSWER:

- Average Age of Respondents: 21.52 years
- Average Age of Onset: 10.48 years
- Standard Deviation of Age of Onset: 4.15 years

> PROMPT: What is the correlation between Severity and Age of Onset?

> ANSWER: The correlation coefficient between Severity and Age of Onset is approximately 0.222. This indicates a weak positive linear relationship between the two variables. In other words, as the severity increases, the age

of onset tends to increase slightly, but the relationship is not very strong.

> PROMPT: Explain how the standard deviation of a variable is computed. Explain how the correlation between two variables is computed. Give me your entire answer as Latex code.

> ANSWER:

Standard Deviation

The standard deviation (σ) of a set of values quantifies the amount of variation or dispersion of the values. It is computed using the following formula:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

Where:

- N is the number of observations.
- x_i is the i^{th} observation.
- \bar{x} is the mean of the observations, given by:

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i$$

Correlation

The correlation coefficient (r) measures the strength and direction of the linear relationship between two variables. It is computed using the following formula:

$$r = \frac{\sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^N (x_i - \bar{x})^2 \sum_{i=1}^N (y_i - \bar{y})^2}}$$

Where:

- N is the number of paired observations.
- x_i and y_i are the i^{th} observations of the two variables.
- \bar{x} and \bar{y} are the means of the observations of the two variables, respectively.

The value of r lies between -1 and 1, inclusive. A value of 1 indicates a perfect positive linear relationship, a value of -1 indicates a perfect negative linear relationship, and a value of 0 indicates no linear relationship.

ChatGPT can provide definitions, including those of statistical functions

8.3 PROMPTS FOR DATA ANALYSIS

Prompts for Brainstorming

- General
 - I am writing a thesis. My research question is [*insert research question*]. [*insert contextual information*]. Which kind of data analysis should I use: [thematic analysis | content analysis | narrative analysis | descriptive statistics | inferential statistics | ...]?
 - I am writing a thesis. My research question is [*insert research question*]. [*insert contextual information*]. And now, I am going to carry out a [thematic analysis | content analysis | narrative analysis | descriptive statistics | inferential statistics | ...]. What should I include?
- Qualitative Analysis
 - Suggest codes for these answers. Provide quotes from the answers for each code.
 - Suggest themes for these codes. For each theme, specify the included codes, give a definition and a snappy name.
 - Discuss any patterns, relationships, contrasts, or contradictions that emerged between themes.
 - My research question is [*insert research question*]. How can the themes help to answer my research question? Include quotes from the answers.
- Quantitative Analysis
 - What is the [*insert statistical function*] of [*insert variables*].

Prompts for Evaluation

- Which data analysis methods are used in the thesis?
- Are the selected data analysis methods appropriate with regard to the research question and the research strategy?
- Is it stated in the thesis why the selected data analysis methods are appropriate with regard to the research question and the research strategy?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the choices made in relation to data analysis.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

When starting your data analysis, you can use the general prompts to find inspiration. The answers to those prompts may suggest suit-

able follow-up prompts. And you can also use literature on specific methods to suggest more prompts.

Qualitative analysis is where ChatGPT really shines, and it is able to suggest both relevant and original codes and themes. Regenerating answers can provide many codes and themes to select from. However, ChatGPT may seem less useful for quantitative analysis, as there exist many good statistical tools. Still, being able to make quick and simple statistical analyses through natural language can be helpful. Furthermore, there exist tools with ChatGPT plugins that combine the ease of ChatGPT interaction with advanced statistical analysis when needed.



“WHAT I CANNOT
CREATE, I do not
understand”
— Richard Feynman

The most effective way to tackle practical research problems is often by designing a solution for them, such as a tool, system or method, as discussed in Section 4.2. While empirical research strategies and methods are relevant for these undertakings, they are not sufficient. There is also a need for methodological support of a creative and critical design process that actually develops the solution. And for this process to be scientific, it should be based on evidence and guided by research methods. This chapter discusses what such a design science process could look like.

Design science and design may seem very similar because they both aim to develop novel artefacts to address problems experienced in practices, see Section 5.2. However, their purposes differ with respect to generalisability and contributions to knowledge. Design is a process of developing a working solution to a problem that may only be relevant to a single actor or situation. On the other hand, design science is intended to produce and communicate knowledge that is of general interest and applicable to broader contexts. And this knowledge is not restricted to the artefact itself, but also includes knowledge about its structure, function, usage, effects, and environment.

9.1 DESIGN SCIENCE ACTIVITIES

There are four main activities in a typical design science project: Explicate Problem, Define Requirements, Design and Develop Artefact, and Evaluate Artefact:

EXPLICATE PROBLEM. This activity involves exploring and examining a real-life problem. The problem should be clearly defined and justified by showing that it is significant for some practice. It should be a problem of general importance, rather than being only relevant to a specific group or organisation. Furthermore, the underlying causes of the problem may be identified and analysed.

DEFINE REQUIREMENTS. This activity outlines an artefact that can be used to solve the explicated problem. It also elicits requirements, i.e. desirable properties of the outlined artefact. The requirements will be functional as well as non-functional.

DESIGN AND DEVELOP ARTEFACT. This activity crafts an artefact that not only resolves the explicated problem but also meets the requirements. Designing an artefact encompasses defining both its functionality and structure.

EVALUATE ARTEFACT. This activity assesses how well the artefact fulfils the specified requirements. It also evaluates its capacity to address or mitigate the practical problem that motivated the research project.

In the following sections, we will provide more details of these activities and offer methodological guidelines.

9.2 EXPLICATE PROBLEM

The starting point of a design science thesis is a practical research problem, i.e. a problem that aims to solve real-world issues that need workable solutions, see Section 3.2. Before designing and developing a solution, it is crucial to comprehend the problem to ensure solving the right issue. This involves explicating the initial problem by making the problem definition precise, positioning and justifying the problem, identifying its root causes, and reframing it.

Making the Problem Definition Precise

A problem can be better understood and interpreted by making its definition more precise and reducing the number of ways it can be perceived. In general, precise problem definitions are better than less precise ones, as they help people to develop a common view of the problem. Moreover, a precise problem definition helps to narrow down the scope of your thesis project, which increases its chances of success. However, highly precise problem definitions can sometimes be difficult to grasp and may exclude important aspects of the problem. In addition, an overly narrow problem formulation may exclude potentially innovative solutions.

> PROMPT: My research problem is “Elderly people with disabilities have difficulties in their everyday lives.” Suggest three ways of making this prob-

lem definition more precise.

> ANSWER:

- Specify the Type of Disabilities:
 - Narrow down the types of disabilities you're focusing on. For example, "Elderly people with mobility disabilities face challenges in navigating their homes and communities." This specificity helps target the research towards a particular subset of disabilities, making the problem more manageable and clear.
- Define the Aspects of Everyday Life:
 - Clarify which aspects of everyday life are being affected. Instead of a broad statement, you might say, "Elderly people with disabilities encounter significant barriers in accessing healthcare, transportation, and social interaction." This approach provides a clearer picture of the specific daily challenges being addressed.
- Incorporate Geographic or Cultural Context:
 - Add a geographical or cultural context to focus the research. For instance, "In urban areas, elderly people with sensory disabilities struggle with inadequate public infrastructure and support services." By situating the problem within a specific context, you can more precisely address the unique challenges faced by the population in that setting.

Positioning and Justifying the Problem

When a problem is presented in isolation, it can be challenging to comprehend, communicate, and justify. Therefore, it is helpful to contextualize the problem by placing it within its relevant practice. This involves describing the practice's purpose, stakeholders, activities, and environment, as suggested in Section 5.2.

> PROMPT: My research problem is "Elderly people with mobility disabilities face challenges in navigating their homes and communities." Describe the practice in which this problem occurs by specifying its purpose, participants, stakeholders, activities, and environment.

> ANSWER:

- Purpose:
 - The primary purpose is to identify and mitigate the barriers that impede mobility for elderly individuals with disabilities, ensuring they can live safely and independently, and participate fully in society.
- Participants:
 - Elderly with Mobility Disabilities: Individuals directly experiencing the challenges.
 - Caregivers and Family Members: Those who provide day-to-day support.

ChatGPT makes an error here; this is not the purpose of the practice, but rather of some project trying to manage certain barriers in the practice

- Stakeholders:
 - Healthcare Professionals: Offer medical and mobility-related advice and support.
 - Community Planners and Developers: Ensure accessible public spaces and infrastructure.
 - Policy Makers: Create and enforce laws and regulations for elder care and disability rights.
 - Architects and Engineers: Design accessible living spaces and community structures.
- Activities:
 - Needs Assessment: Identifying specific mobility challenges and requirements.
 - Home Modification: Adapting living spaces to enhance accessibility.
 - Community Development: Creating accessible public spaces and transport systems.
 - Policy Advocacy: Promoting and implementing regulations for elder and disability rights.
 - Education: Providing information on navigating spaces safely and utilizing available resources.
- Environment:
 - Home Environment: Individual residences where modifications may be needed.
 - Community Environment: Public spaces, facilities, and transportation systems where accessibility is crucial.
 - Regulatory Environment: The legal and policy framework that dictates standards and practices for accessibility and elder care.

The problem should always be well justified so that people can agree that it is worth addressing. This entails that the problem should be:

- *Significant*. Recognized as important by those who encounter it in practice
- *Of general interest*. Relevant to a broad range of situations, not just confined to a single one
- *Feasible*. Capable of being solved, at least to some extent
- *Challenging*. Lacking an effective existing solution

> PROMPT: My research problem is “Elderly people with mobility disabilities face challenges in navigating their homes and communities.” Who is primarily affected by this problem? In what ways are they affected? What could the consequence be, both physical and social? Who can benefit from a solution to the research problem and in what ways?

This prompt asks for the significance of the problem by focussing on the affected actors

> ANSWER:

- Primarily Affected:
 - The individuals primarily affected by the problem “Elderly people with mobility disabilities face challenges in navigating their homes and communities” are elderly individuals who suffer from conditions that impair their mobility. This includes those with chronic diseases, age-related physical decline, or disabilities that limit their ability to move freely and independently.
- Ways They Are Affected:
 - Physical Challenges: Difficulty in performing daily tasks, increased risk of falls and injuries, and a general decline in physical health due to limited mobility and activity.
 - Mental Health: Increased risk of depression, anxiety, and feelings of isolation due to the inability to engage in social activities or access community services easily.
 - Dependency: Greater reliance on caregivers or family members for assistance with daily activities, leading to a loss of independence and autonomy.
- Consequences:
 - Physical: Continued deterioration of physical health, increased susceptibility to accidents and injuries, and potential for severe medical complications due to a lack of mobility and exercise.
 - Social: Social isolation, reduced participation in community activities, and a diminished quality of life. This can lead to feelings of loneliness, depression, and a sense of being disconnected from society.
- Beneficiaries of a Solution:
 - Elderly with Mobility Disabilities: Direct beneficiaries who would experience improved quality of life, greater independence, and enhanced physical and mental health.
 - Caregivers and Family Members: Reduced physical and emotional burden, as elderly relatives become more capable of independent living and mobility.
 - Healthcare System: Decreased healthcare costs and resources due to fewer accidents, injuries, and associated medical conditions.
 - Community and Society: A more inclusive community that benefits from the contributions and participation of all its members, leading to a more robust social fabric and improved quality of life for everyone.

Finding the root causes of the problem.

In the initial stages, a problem is often described vaguely, expressing a feeling that some situation is not satisfactory. However, to resolve the problem, it is usually not sufficient to stay at a vague level; a deeper understanding is required. To achieve this, a root cause analysis can be carried out, which aims to identify, analyze, and represent the underlying causes of the problem.

> PROMPT: My research problem is “Elderly people with mobility disabilities face challenges in navigating their homes and communities.” Identify economic, social, physical as well as other root causes of this problem.

- > ANSWER:
- Economic Causes:
 - Limited Income: Many elderly individuals live on fixed or limited incomes. The cost of retrofitting homes with ramps, lifts, and other mobility aids can be prohibitive, as can moving to a more accessible home.
 - Underfunded Public Infrastructure: Communities often lack the funds to make public spaces universally accessible. This includes installing ramps, lifts, and other features in public buildings and transport systems.
- Social Causes:
 - Stigma and Discrimination: Social attitudes and stigma towards disability can lead to exclusion and a lack of prioritization in policy and community planning.
 - Lack of Awareness: There’s often a general lack of understanding of the needs of people with mobility disabilities, leading to inadequate support and services.
 - Caregiver Burden: Families and caregivers may face their own economic and social pressures, impacting the level of support they can provide.
- Physical Causes:
 - Aging-related Health Decline: Conditions like arthritis, osteoporosis, and neurological disorders common in older age can significantly impair mobility.
 - Inadequate Housing: Many homes aren’t designed with accessibility in mind, featuring stairs, narrow doorways, and non-slip-resistant surfaces.
 - Poor Community Design: Many communities lack essential features like ramps, elevators, and accessible public transport, making navigation difficult.
- Other Causes:

- Policy and Regulation: Insufficient or poorly enforced regulations around accessibility in housing and public infrastructure can lead to environments that are difficult to navigate.
- Technological Barriers: Lack of access to affordable, advanced mobility aids and technologies can limit the ability of the elderly to move freely.
- Healthcare Access: Inadequate healthcare or rehabilitation services can prevent the elderly from receiving the care they need to maximize their mobility.

Reframing Problems

Reframing a problem means changing the way you perceive and understand it, often leading to new insights and solutions. It involves stepping back from the current perspective and questioning the underlying assumptions. This shift can open up creative pathways and lead to innovative approaches that were not apparent with the original framing. Here is how reframing can be done:

- *Identify the Current Frame.* Understand how the problem is currently perceived. What are the assumptions, and what is the conventional wisdom about the problem?
- *Challenge Assumptions.* Question the existing beliefs and assumptions. Are there other ways to look at this? What if the opposite were true?
- *Shift Perspective.* Try to view the problem from different angles. Consider other stakeholders' points of view, or imagine how someone from a different field might approach the problem.
- *Break Down the Problem.* Decompose the problem into smaller parts. Sometimes a large problem can be overwhelming, and breaking it down can reveal new angles and opportunities.
- *Look for Analogies.* Find similar problems in different contexts. How were they approached or solved? Can those strategies be adapted?
- *Synthesize New Frames.* Combine insights from various perspectives to form a new, more comprehensive understanding of the problem.

Reframing is a technique that involves altering our understanding of a problem to gain new insights and generate novel solutions. It is a valuable tool in complex problem-solving and innovation, and draws inspiration from the principles of critical thinking, see Chapter 12. Rather than seeking an immediate answer, reframing allows us to approach a problem from new angles and discover more effective strategies for resolving it.

> PROMPT: Reframing a problem means changing the way you perceive and understand it, often leading to new insights and solutions. My research problem is “Elderly people with mobility disabilities face challenges in navigating their homes and communities.” Reframe this problem by imagining how a judge would conceive of it. Then reframe this problem by challenging the assumption that it is a medical problem.

> ANSWER: A judge might reframe the problem as a matter of rights and accessibility compliance. Instead of “Elderly people with mobility disabilities face challenges in navigating their homes and communities,” it could be reframed as “Current residential and urban infrastructure fails to meet the legal accessibility requirements for elderly individuals with mobility disabilities.” This perspective shifts the focus from the individual’s disability to the societal responsibility to provide accessible environments, emphasizing legal and ethical obligations.

Instead of viewing the problem as strictly medical, consider it as a design and inclusivity issue. The reframed problem might be “Our communities and homes are designed in a way that excludes the participation of elderly people with mobility disabilities.” This shifts the focus from the individuals’ medical conditions to the way physical spaces are constructed and organized, highlighting the need for inclusive design that accommodates all users.

9.3 DEFINE REQUIREMENTS

Before designing a solution, you must thoroughly understand the problem. While sometimes a direct leap from problem to solution is possible, it is usually a significant challenge. To ease this transition, you should first outline the requirements for an initial solution. These requirements will then guide the further design and development of the solution. Additionally, they act as benchmarks to assess the quality of the final artefact by checking if it meets the predefined requirements.

A *requirement* is a declaration from a stakeholder involved in a practice, indicating that a certain characteristic of an artefact is desirable. Requirements are defined broadly, encompassing both high and low levels of abstraction. High-level requirements pertain to overarching and occasionally vague characteristics, whereas low-level requirements are more detailed and specific.

A requirement may concern the function, structure, performance or environment of an artefact as well as the effects of using it. *Functional requirements* refer to the functions of the artefact, and they depend on the problem to be addressed as well as the needs and wants of the stakeholders. *Non-functional requirements* are those requirements that are not functional but instead focus on the structure and performance of the artefact as well as its environment.

It is important to have a clear understanding of the artefact for which you are defining the requirements. This means that you should first outline an artefact that can address the problem you are trying to solve. Once you have identified the relevant artefact, you can then

Functional requirements define what a system does; non-functional requirements describe how well it does it

gather input from stakeholders as well as from literature and other sources of knowledge, in order to formulate the requirements that need to be met.

> PROMPT: My research problem is “Elderly people with cognitive disabilities face challenges in navigating their homes and communities.” Suggest an innovative and somewhat outlandish artefact that could address this problem. The artefact should make use of AI and the Internet of Things.

> ANSWER: Cognitive Support Drones:

- Description: A personal drone system designed to follow and assist the elderly with cognitive disabilities. Equipped with cameras and sensors, these drones would monitor the user’s environment for hazards, guide them through crowded or complex areas, and provide a bird’s-eye view for caregivers or emergency responders if needed. The drones could also carry items, remind the user of important tasks, and provide physical support, like a mobile handrail.
- AI and IoT Integration: AI would enable the drone to navigate safely, recognize its user and understand their needs, and communicate effectively with the user and other systems. It would also analyze environmental data to anticipate and react to potential dangers. IoT connectivity would allow the drone to interface with other devices and systems, receive updates, and be controlled remotely when necessary.

> PROMPT: Suggest three high-level and three low-level requirements on the cognitive support drone system.

> ANSWER:

High-Level Requirements:

1. Enhanced Safety and Navigation: The drone system must significantly improve the user’s safety by providing reliable navigation assistance in various environments, reducing the risk of accidents and injuries.
2. Autonomous Operation: The drone must operate autonomously, making real-time decisions based on user behavior and environmental conditions without requiring constant human intervention.
3. Emergency Assistance and Alerting: In emergencies, the drone should promptly provide or summon assistance, ensuring the user’s well-being is addressed quickly and effectively.

Low-Level Requirements:

1. Obstacle Detection Accuracy: The drone must detect and avoid obstacles with a minimum accuracy of 99%, using sensors like LIDAR, radar, or cameras, ensuring safe navigation in tight or crowded spaces.

2. **Battery Life and Charging:** The drone should have a battery life of at least 8 hours under normal operation and automatically return to its charging station when the battery is below 20%.
3. **User Interaction Protocol:** The drone must respond to basic voice commands from the user, such as “stop,” “follow me,” or “go home,” with at least 95% accuracy in recognizing and executing the commands.

> **PROMPT:** Suggest three functional and three non-functional requirements on the cognitive support drone system addressing the safety of the user.

> **ANSWER:**

Functional Requirements:

1. **Real-Time Hazard Detection and Alerting:** The drone must continuously monitor the user’s environment for potential hazards (like obstacles, sudden drops, or unsafe areas) and alert the user or guide them away from danger in real-time.
2. **Emergency Health Monitoring:** The drone should be equipped with sensors to monitor vital signs (such as heart rate or unusual inactivity) and detect signs of a health emergency. Upon detecting a potential health issue, it should immediately alert the user, caregivers, and potentially emergency services.
3. **Safe Landing and Collision Avoidance:** In the event of a system failure or low battery, the drone must be capable of executing a safe landing procedure to avoid injuring the user or others. It should also have robust collision avoidance systems to prevent accidental contact with the user or bystanders.

Non-Functional Requirements:

1. **Reliability:** The system must function reliably under various conditions, with a fail-safe mode for emergencies. It should have a high uptime and perform consistently, ensuring the user’s safety is always maintained.
2. **Privacy and Data Security:** Any data collected for navigation, health monitoring, or user interaction must be securely stored and transmitted. The system should comply with relevant privacy laws and regulations, ensuring that sensitive information is protected.
3. **User-Friendly Alert System:** Alerts and warnings issued by the drone should be clear, understandable, and perceivable by the user, considering potential cognitive impairments. The system should allow for customizable alert types (visual, auditory, or tactile) based on the user’s preferences and needs.

Research strategies and methods for eliciting requirements are crucial for understanding user needs and system objectives. Interviews

and questionnaires are direct methods, allowing stakeholders to express needs and expectations explicitly. Focus groups encourage discussion and idea generation, revealing collective insights. Observational studies in natural settings provide an understanding of user behaviours and challenges, uncovering implicit requirements. Workshops involving scenarios and role-playing can simulate system use, eliciting requirements through practical engagement. Each method has its strengths, and often a combination is used to capture a comprehensive and nuanced understanding of requirements.

> PROMPT: My research problem is “Elderly people with cognitive disabilities face challenges in navigating their homes and communities.” My solution outline is “A personal drone system designed to follow and assist the elderly with cognitive disabilities.” What is the better research strategy: a case study or a survey? And what is the better data collection method: interviews or a questionnaire?

> ANSWER: For your specific research problem and solution outline, a case study would likely be the better research strategy. Case studies allow for an in-depth exploration of how the personal drone system would operate in real-world settings, providing detailed insights into the unique challenges and needs of elderly individuals with cognitive disabilities. This method can uncover nuanced interactions between the users and the drone system, highlighting specific instances of success and areas needing improvement. It’s particularly valuable when dealing with complex issues that require a deep understanding of individual circumstances and behaviors.

As for data collection, interviews would generally be more effective than questionnaires. Interviews allow for more dynamic, in-depth conversations where elderly participants can describe their experiences, express concerns, and react to the drone system in detail. They also enable the researcher to ask follow-up questions, clarify responses, and explore topics that may not have been initially considered. This qualitative approach can provide rich, detailed data that’s invaluable for understanding the personal and often complex nature of navigating homes and communities with cognitive disabilities.

9.4 DESIGN AND DEVELOP ARTEFACT

Designing and developing involves progressing from the initial concept of a solution to the creation of a complete artefact. This process can be broken down into four simultaneous and iterative sub-activities:

- *Imagine and Brainstorm.* Designers engage in brainstorming sessions to generate new ideas or expand upon existing ones
- *Assess and Select.* Designers evaluate the ideas produced to choose one or several as the foundation for further design and development
- *Sketch and Build.* Designers draft outlines of the artefact and proceed to construct it

- *Justify and Reflect.* Designers critically reflect on and provide justification for the design choices they have made throughout the process

Imagine and Brainstorm

To support the generation of ideas, the application of *divergent thinking* is useful. This is a process that involves conjuring up multiple alternative ideas or solutions to tackle a problem, emphasizing a highly imaginative and innovative approach. Divergent thinking is not just about quantity but also about the variety and creativity of the ideas produced. It encourages looking at a problem from various perspectives, pushing boundaries beyond conventional thinking patterns, and exploring a wide array of possibilities. This expansive thinking style is crucial for innovative problem-solving and helps in identifying unique and effective solutions. Through divergent thinking, individuals and teams can ensure a rich pool of ideas from which the most promising ones can be selected and further developed.

Methods for divergent thinking include brainstorming, where participants freely offer a range of ideas; mind mapping, which visually organizes thoughts and their relationships; and role playing, where imagining from another's perspective can unlock new ideas. Ethnographic studies, observing users in their environment, and exploratory workshops can also stimulate diverse perspectives and ideas.

> PROMPT: In the context of the cognitive support drone system for elderly people with cognitive disabilities, suggest three solutions that address collision avoidance. Two solutions should be realistic and one somewhat outlandish.

> ANSWER:

1. *Realistic: Ultrasonic Sensors.* Similar to LIDAR, ultrasonic sensors can be used for collision avoidance. They emit sound waves and measure the time it takes for the echoes to return, determining the distance to nearby objects. They are cost-effective and work well in various environments, making them a practical choice for a drone navigating the intricate spaces of a home. They can quickly detect obstacles and adjust the drone's path accordingly, ensuring the safety of elderly users.
2. *Realistic: Infrared Sensors with AI Integration.* Infrared sensors detect objects based on the infrared light reflecting off them. When combined with AI, the drone can learn typical room layouts and recognize common obstacles within a home. This system can be trained to understand and adapt to the specific environment of the user, predicting potential hazards and adjusting its flight path proactively to avoid collisions, ensuring a higher level of safety and personalization.
3. *Outlandish: Telekinetic Navigation System.* Imagine a drone equipped with a 'telekinetic' interface, where it's connected directly to the user's neural pathways via a non-invasive brain-computer interface.

The user could direct the drone's movement with their thoughts, steering it away from obstacles intuitively. While this may sound like science fiction, advancements in neurotechnology could one day make it possible, offering an unprecedented level of control and personalized navigation. This method would not only avoid collisions but also create a deep bond between the user and the device, as they move in harmony with each other's thoughts and intentions.

Assess and Select

In the Assess and Select activity of the design process, the ideas previously generated are evaluated to determine which ones will actually be used for developing the artefact. This activity often employs convergent thinking, a mode of thought characterized by an analytical approach aimed at narrowing down options. It involves systematically analyzing the feasibility, potential impact, and practicality of each idea, considering factors such as resources, time, and user preferences. The goal is to converge on the most viable and promising solutions, setting the stage for focused development and refinement.

> PROMPT: In the context of the cognitive support drone system for elderly people with cognitive disabilities, two different solutions for collision avoidance are ultrasonic sensors and infrared sensors with AI integration. Which solution would be the best, taking into account the safety of the elderly person?

> ANSWER:

Ultrasonic Sensors:

- Pros: They are reliable for short-range detection and can effectively navigate around obstacles. Ultrasonic sensors are also relatively inexpensive and robust, making them a cost-effective solution for collision avoidance.
- Cons: Their effectiveness can vary based on the material of the object and the environment's acoustics. They might not detect very thin or soft obstacles well and can be less effective over longer distances.

Infrared Sensors with AI Integration:

- Pros: Infrared sensors can detect heat signatures and work well in various lighting conditions. When combined with AI, the system can learn and adapt to the user's environment, predicting and avoiding potential hazards more effectively. AI integration means the drone can improve over time, understanding the specific layout of the home and the user's patterns.
- Cons: They can be susceptible to interference from other heat sources and might be more complex and expensive to implement. The system's safety and reliability heavily depend on the quality of the AI programming and training.

Best Solution: Considering safety for the elderly, infrared sensors with AI integration might be the better choice. While both systems have their

merits, the adaptive and predictive capabilities of AI provide a significant advantage. The ability to learn and recognize the user's environment and habits allows for more personalized and proactive collision avoidance. It can potentially navigate more complex scenarios and provide a higher level of safety by anticipating and reacting to changes in the environment.

Sketch and Build

During the activity Sketch and Build, an artefact is first sketched based on the selected ideas. This sketch is then used to develop the artefact. The sketch of an artefact gives an overview of its core functions and overall structure. The sketch of functions typically displays the interface between the artefact and the user, what the artefact offers to the user, and why and how the user will use it. The sketch of the overall structure, which is the artefact architecture, provides an overview of the components of the artefact and their relationships.

There are several tools available to sketch the functions of an artefact. One such tool is the *use case diagram*, which visually represents the functions of the artefact and also shows the roles of the actors involved in using those functions. Another tool is the *user story*, which is less structured than use case diagrams, but can still be used to describe the functions of an artifact in a brief sentence or two. *Storyboarding* is a tool that consists of a sequence of illustrations, similar to a cartoon strip, that depict how users will interact with the artefact. An *explosion diagram* is a graphic representation used to illustrate the relationship and order of assembly of various parts within a physical artefact. In this diagram, the components of the object are separated and slightly spaced apart along an axis or in a manner that displays their position and orientation within the whole assembly.

This and the next prompt do not give very useful results. but future specialized plug-ins could possibly help

> PROMPT: In the context of the cognitive support drone system for elderly people with cognitive disabilities, draw a storyboard that illustrates how the drone helps the elderly person to remember taking her medicine. There should only be two frames. Frame 1: the elderly person reading a book and the drone flashes a signal. Frame 2: the elderly person taking the medicine.

> ANSWER: See Figure 9.1.

> PROMPT: In the context of the cognitive support drone system for elderly people with cognitive disabilities, draw an explosion diagram of a drone.

> ANSWER: See Figure 9.2.

Justify and Reflect

It is important to document the design process, including a list of decisions made and the reasoning behind them, which is known as the *design rationale*. This information should include the reasons and justifications for each design decision, alternative options that were considered, and the arguments that led to the final decisions. Keeping

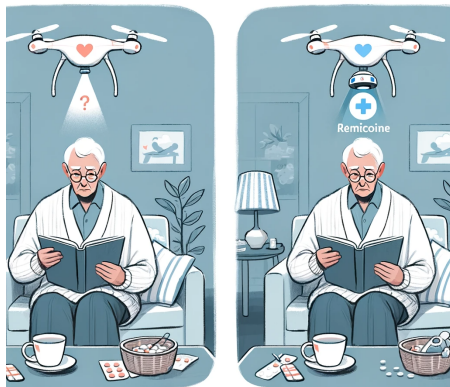


Figure 9.1: A Storyboard for a Drone Helping an Elderly Man to Remember his Medicine



Figure 9.2: An Explosion Diagram of a Drone

a design rationale can help with communication during a project, as well as facilitate reuse between different projects. It can be an invaluable asset, as it records the reasoning behind each decision, including any potential pitfalls. This knowledge can be used to avoid problems and dead ends in future projects.

> PROMPT: In the context of the cognitive support drone system for elderly people with cognitive disabilities, we decided to use a plastic body. Provide a design rationale for this choice.

> ANSWER: Choosing a plastic body for the cognitive support drone system aimed at elderly individuals with cognitive disabilities is justified due to its lightweight nature, enhancing maneuverability and battery life. Plastic's safety profile is superior, offering a lower risk of injury upon accidental contact, critical for the elderly. It's also cost-effective, making the technology more accessible. Durable and flexible, plastic can withstand impacts and be molded into user-friendly designs with customized features. This balance of safety, affordability, and practical design makes plastic an ideal material for such a sensitive application.

9.5 EVALUATE ARTEFACT

In order to show that you have designed and developed a valuable artefact, you need to evaluate it. You should investigate both how well the artefact solves the explicated problem and to what extent it fulfils the defined requirements.

In principle, any research strategies and methods can be used for an evaluation of an artefact. To select the most appropriate ones for a specific situation, it is helpful to understand the differences between various types of evaluations. Three common distinctions between artefact evaluations are formative vs summative, naturalistic vs artificial, and ex-ante vs ex-post.

FORMATIVE AND SUMMATIVE EVALUATIONS. A *formative evaluation* is conducted during the development of an artefact. Its primary purpose is to improve the design iteratively by identifying issues and understanding how users interact with the artefact. It is about 'forming' the final product. Formative evaluations may use methods like usability testing, interviews, and observations. You might create prototypes and then observe users interacting with them, asking for feedback and making adjustments based on what you learn. The outcome of formative evaluation is an improved design. It doesn't necessarily provide a final verdict on the system's effectiveness but instead offers insights to refine and optimize the artefact.

A *summative evaluation* is conducted after the development process is complete. Its aim is to assess the effectiveness and impact of the final artefact, providing a conclusive measure of its success or failure. It is about 'summing up' the design's value. Methods for summative evaluation include controlled experiments, surveys, and statistical analysis to measure outcomes against predefined criteria or

benchmarks. The focus is on quantifiable results that prove the artefact's efficacy or identify its shortcomings in a real-world context. The outcome of summative evaluation is a judgment or assessment of the artefact's overall effectiveness and suitability for its intended purpose. It informs decisions about whether the artefact should be adopted, abandoned, or further revised.

NATURALISTIC AND ARTIFICIAL EVALUATIONS. Another distinction is the one between naturalistic and artificial evaluations. *Naturalistic evaluations* occur in real-world settings where the artefact is used under typical conditions, providing insights into its performance and user interactions in its intended environment. This approach offers a realistic understanding but can be complex and variable, making it challenging to isolate factors. Conversely, *artificial evaluations* are conducted in controlled environments, allowing for precise measurement and isolation of variables. They enable detailed analysis of specific aspects but may lack the context of real-world use, potentially overlooking unforeseen issues or behaviours. To gain a comprehensive understanding of an artefact's performance and areas for improvement, designers often use both naturalistic and artificial evaluations at various stages of development. The realism of naturalistic evaluations helps designers understand how the artefact performs in real-world settings, while the precision of artificial evaluations allows designers to focus on specific features and aspects.

EX-ANTE AND EX-POST EVALUATIONS. *Ex-ante evaluations* are conducted before the artefact is fully developed, aiming to predict its effectiveness, usability, and potential impact based on theoretical models, prototypes, and preliminary data. They help inform design decisions and anticipate challenges. *Ex-post evaluations*, on the other hand, are carried out after the artefact is fully developed. They assess the actual performance, user interactions, and overall impact, providing empirical evidence of success or areas needing improvement. While ex-ante evaluations are speculative and preparatory, ex-post evaluations are retrospective, offering concrete insights for future iterations of a design science undertaking.

> **PROMPT:** My research problem is "Elderly people with cognitive disabilities face challenges in navigating their homes and communities." My solution outline is "A personal drone system designed to follow and assist the elderly with cognitive disabilities." My main requirements are safety and privacy for the elderly person. I am going to carry out a formative evaluation. Suggest an appropriate research strategy, data collection method, and data analysis method. Justify your answer. Address naturalistic vs artificial evaluations in your answer. Address ex-ante vs ex-post evaluations in your answer. Max 200 words.

> **ANSWER:** Given your research problem and solution, adopting a mixed-methods research strategy incorporating both naturalistic and artificial evaluations would be highly beneficial. For the naturalistic aspect, you can conduct observations in real-life settings where elderly individuals with

cognitive disabilities interact with the drone system. This provides rich, contextual data on how the system is used in everyday environments, crucial for understanding safety and privacy concerns in actual use scenarios.

Concurrently, artificial evaluations in a controlled setting, such as usability tests in a simulated home environment, allow for focused examination of specific system functionalities. This controlled environment is ideal for assessing predefined safety and privacy parameters, ensuring that these critical requirements are met under various conditions.

For data collection, a combination of direct observation, user interviews, and system usage logs would be apt. Observations and interviews provide qualitative insights, while usage logs offer quantitative data on system interactions.

Regarding data analysis, thematic analysis for qualitative data and descriptive statistics for quantitative data would enable a comprehensive understanding of both safety and privacy aspects.

As this is a formative evaluation, an ex-ante approach is implied, focusing on refinement during the development phase. This approach allows for iterative improvements based on user feedback and system performance before full deployment, aligning with the aim to prioritize safety and privacy.

*This is a follow-up
prompt giving
further information
about the constraints
of the evaluation
project*

> PROMPT: My budget is very limited and I need to carry out the evaluation in a short time frame. How would this affect your answer?

> ANSWER: With a limited budget and short timeframe, it's crucial to streamline the research strategy and focus on the most cost-effective and time-efficient methods. In this context:

- Naturalistic vs. Artificial Evaluations: Lean more towards artificial evaluations. While naturalistic evaluations provide richer context, they're typically more time-consuming and costly. Controlled, artificial settings allow for quicker, more focused data collection and are easier to manage on a tight budget.
- Data Collection Method: Simplify by using targeted, scenario-based usability tests in a controlled environment. Focus on key interactions between the elderly and the drone to observe safety and privacy responses. Use structured interviews or short surveys post-interaction to gather direct feedback, which are less time-consuming and require fewer resources than long-term observations.
- Data Analysis Method: Opt for a more straightforward approach like content analysis for qualitative data from interviews/surveys and simple descriptive statistics for any quantitative data. These methods are less resource-intensive and can provide quick, actionable insights.
- Ex-ante vs. Ex-post Evaluations: Stick with an ex-ante formative evaluation. This approach allows you to make theoretical predictions and adjustments before full-scale implementation, saving costs associated with large-scale data gathering and long-term studies.

9.6 PROMPTS FOR DESIGN SCIENCE METHODOLOGY

Prompts for Brainstorming

- Explicate Problem
 - My research problem is [*insert research problem*]. Suggest three ways of making this problem definition more precise.
 - My research problem is [*insert research problem*]. Describe the practice in which this problem occurs by specifying its purpose, participants, stakeholders, activities, and environment.
 - My research problem is [*insert research problem*]. Who is primarily affected by this problem? In what ways are they affected? What could the consequences be, [physical | psychological | social | ...]? Who can benefit from a solution to the research problem and in what ways?
 - My research problem is [*insert research problem*]. Identify [economic | social | physical | ...] as well as other root causes of this problem.
 - My research problem is [*insert research problem*]. Reframe this problem by imagining how a [judge | physician | politician | economist | single mother | ...] would conceive of it.
 - My research problem is [*insert research problem*]. Reframe this problem by challenging the assumption that [*insert assumption*].
 - My research problem is [*insert research problem*]. Suggest some analogies of the problem.
- Define Requirements
 - My research problem is [*insert research problem*]. Suggest an [*insert characteristics*] artefact that could address this problem. The artefact should make use of [*insert technologies*].
 - Suggest three high-level and three low-level requirements on [*insert artefact*].
 - Suggest functional and non-functional requirements on [*insert artefact*] addressing [*insert concern*].
 - My research problem is [*insert research problem*]. My solution outline is [*insert solution outline*]. What is the better research strategy: [case study | survey | experiment | ...]? And what is the better data collection method: [interviews | questionnaire | observation | ...]? And what is the better data analysis method: [thematic analysis | narrative analysis | descriptive statistics | ...]?
- Design and Develop

- In the context of [*insert solution outline*], suggest solutions that address [*insert requirement(s)*]. The solutions should be [realistic | innovative | outlandish | ...].
- In the context of [*insert solution outline*], two different solutions for [*insert requirement*] are [*insert solution*] and [*insert solution*]. Which solution would be the best, taking into account [*insert requirement*]?
- In the context of [*insert solution outline*], draw an explosion diagram of [*insert artefact description*].
- In the context of [*insert solution outline*], we decided to use [*insert specific solution*]. Provide a design rationale for this choice.
- Evaluate Artefact
 - My research problem is [*insert research problem*]. My solution outline is [*insert solution outline*]. My main requirements are [*insert requirements*]. I am going to carry out a [formative | summative] evaluation. Suggest an appropriate research strategy, data collection method, and data analysis method. Justify your answer. Address naturalistic vs artificial evaluations in your answer. Address ex-ante vs ex-post evaluations in your answer.

Prompts for Evaluation

- What is the artefact that is designed?
- What kind of artefact is designed?
- What is the problem that the artefact should address?
- Can it be argued that the artefact is able to solve, or at least address, this problem?
- What are the requirements for the artefact?
- What research methods have been used to elicit the requirements?
- What is the structure and functions of the artefact?
- What research methods have been used to design and develop the artefact?
- Was the evaluation of the artefact formative or summative?
- Was the evaluation of the artefact naturalistic or artificial?
- Was the evaluation of the artefact ex-ante or ex-post?
- What research methods have been used to evaluate the artefact?
- How well did the artefact solve the problem and to what extent did it fulfil the requirements?

How to Use the Prompts

Some of the prompts can assist in the creative aspects of the design process by suggesting requirements or potential solutions. Other prompts can aid in critical thinking by helping to reframe the problem or suggesting different perspectives. However, to transform the design process into a design science process, research strategies and methods for data collection and analysis should be applied, as discussed in the previous chapters. And some of the prompts can be used for this purpose.

Part IV

RESULTS

In the Results part of the thesis, you objectively present the results of your study without interpreting them or discussing their wider implications. You answer the research question by presenting your quantitative or qualitative analysis outcomes. And you convey your data and other results through text, tables, figures, and other visual means.



“THE OUTCOME OF ANY SERIOUS RESEARCH *can only be to make two questions grow where only one grew before.*”

— Thorstein Veblen

The Results chapter of your thesis contains the answer to your research question. It presents the findings of your study in a concise and straightforward way without interpreting them or discussing their wider implications — this should be saved to the Discussion chapter.

For quantitative data, you typically present them by using tables, figures, or graphs. If applicable, include the outcomes of any statistical analysis, ensuring to report the statistical tests used, the significance levels, and any confidence intervals or error margins. For qualitative data, you might present them in the form of quotes, summaries, or categories, possibly in a table format. If applicable, include graphs, images or other visual elements to complement the textual data. Provide concise and clear descriptions of what the data represents, highlighting any trends, patterns, or significant observations. If there were any unexpected or unusual findings, these should be noted.

It is useful to present your results in a logical sequence that follows the order of your method, as this will allow your readers to follow your thought process. It is also helpful to start with the primary outcomes of your study before moving on to any secondary or tertiary results.

10.1 QUALITATIVE RESULTS

This section is a continuation of Section 8.1, which focused on the research question “What are the causes of eating disorders among young people?”. The results from the thematic analysis are summarized in two tables.

> PROMPT: Construct a table. The first column should be named "Theme" and the next "Quotes". Fill the table with rows based on your answers above. Provide your answer as Latex.

> ANSWER: See Table 10.1.

THEME	QUOTES
Adolescent Awakening	"I first noticed it during my high school years." "It began subtly when I was around 15."
Media's Mirage	"I always felt the need to look like the celebrities and models I saw in magazines." "Instagram made me feel like I wasn't thin enough."
Familial Footprints	"My mother always dieted, and I thought it was normal." "Family dinners were always tense with comments about weight."
Quest for Control	"A desire for control during chaotic times in my life." "Controlling my food felt like the only thing I had power over."
Societal Scales	"Friends in school would often diet, and I felt the need to join in." "Everyone seemed obsessed with the 'perfect' body."
Life's Low Points	"The death of a close family member." "After my breakup, I spiraled and my eating habits changed drastically."
Food's Flux	"I've gone from fearing food to seeing it as fuel for my body." "Over the years, I've learned to enjoy meals without guilt."
Mirror Musings	"I would look in the mirror and hate what I saw." "Every reflection was a reminder of how I wasn't good enough."

Table 10.1: Themes and their Associated Quotes related to Causes of Eating Disorders among Young People

> PROMPT: Construct a table. The first column should be named “Theme” and the next “Definition”. Fill the table with rows based on your answers above. Provide your answer as Latex.

> ANSWER: See Table 10.2.

THEME	DEFINITION
Adolescent Awakening	The period during which individuals first become aware of their eating disorders, typically during their teenage or early adult years.
Media’s Mirage	The influence of media, including social media, magazines, and celebrities, in shaping perceptions about body image and setting unrealistic standards.
Familial Footprints	The impact of family attitudes, comments, and behaviors related to food and body image on an individual’s self-perception and eating habits.
Quest for Control	The desire to exert control over one’s life, often manifested through controlling food intake, especially during times of personal turmoil or change.
Societal Scales	The pressures and expectations from peers and society at large regarding body image, weight, and eating habits.
Life’s Low Points	Significant life events or stressors that trigger or exacerbate eating disorders.
Food’s Flux	The evolving relationship an individual has with food, moving from fear or obsession to understanding and balance.
Mirror Musings	The internal reflections and self-worth evaluations based on body image.

Table 10.2: Themes and their Definitions related to Causes of Eating Disorders among Young People

In response to the research question, the themes themselves may serve as an answer. Alternatively, the themes may be combined or separated as needed.

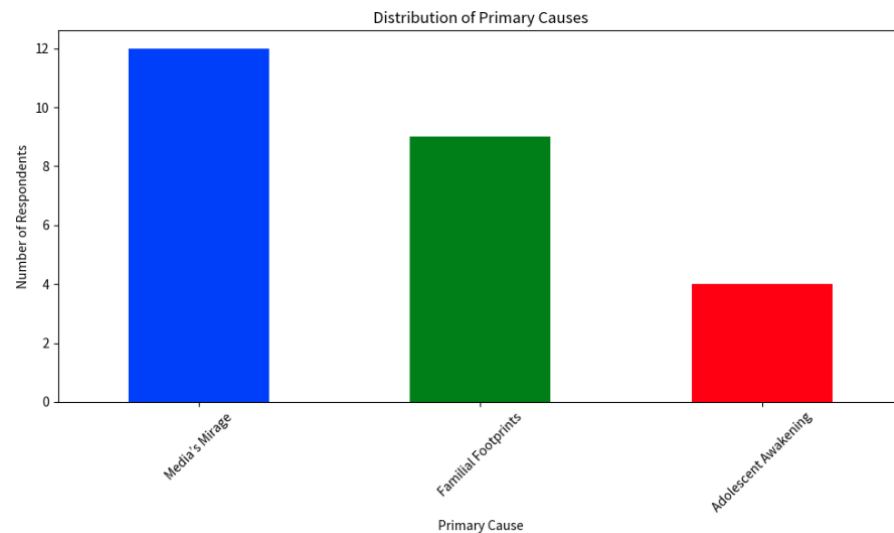


Figure 10.1: A Staple Diagram for Primary Causes

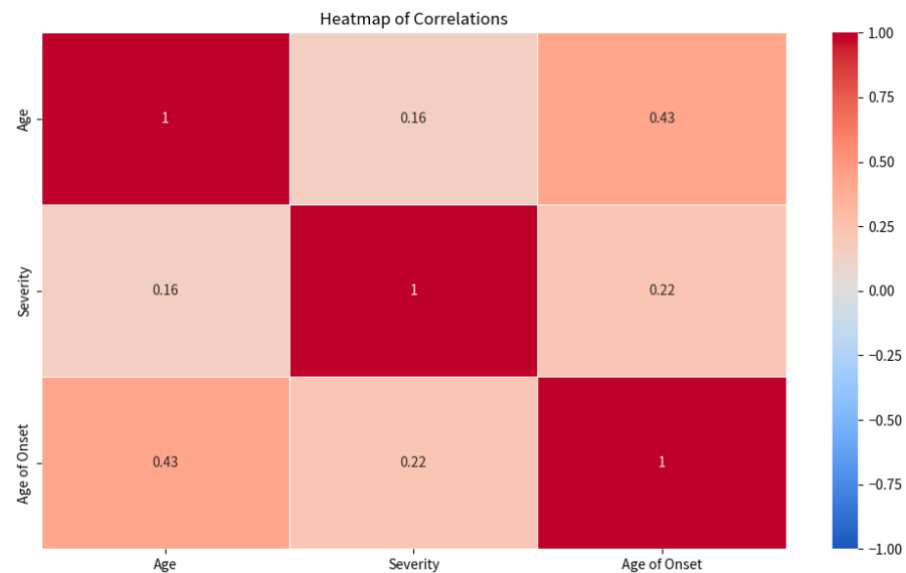


Figure 10.2: A Heatmap for Age, Age of Onset and Severity

10.2 QUANTITATIVE RESULTS

This section is a continuation of the quantitative analysis in Section 8.2, showing a couple of way of formatting the output from that analysis.

- > PROMPT: Create a staple diagram for “Primary Causes”.
- > ANSWER: See Figure 10.1.

As the data was randomly generated, the correlations are low

- > PROMPT: Create a heatmap to visualize correlations between all numerical columns.
- > ANSWER: See Figure 10.2.

10.3 PROMPTS FOR RESULTS

Prompts for Evaluation

- Are the results presented in a clear and logical manner?
- Is there a coherent structure that guides the reader through the findings?
- Are tables, figures, graphs, diagrams, and other forms of data presentation used effectively to illustrate key results?
- Do the results directly address the research question stated in the thesis?
- Is an explicit answer to the research question stated? If so, state this answer. And show how it relates to the results.
- Is the process of arriving at the results transparent enough for the study to be replicable?
- Is there a bridge between the results and the subsequent discussion?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the presentation of the results.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

As illustrated by the examples above, the brainstorming prompts for Results are usually follow-up prompts to those for data analysis, and they ask for selecting and formatting the output from the analysis. Thus, this chapter does not contain any suggestions for brainstorming prompts — there are simply too many ways of selecting and formatting the output. However, it is possible to identify a few prompts for evaluation.

Part V

DISCUSSION

In the Discussion part of the thesis, you interpret your results and explain the significance and implications of your findings. The Discussion contextualizes the study within existing research, addresses limitations, suggests future research directions, and helps your readers understand the broader impact of your work.



“RESEARCH
WITHOUT
REFLECTION, and
practice without
research, are blind;
reflection without
research and practice
is empty.”
— adapted from
Immanuel Kant

The final chapter of a thesis includes the Discussion. One purpose of this chapter is to remind the reader about your research problem and research question and summarize your results, showing you have answered the research question. But the main purpose is to relate your work to the broader academic discourse as well as the larger societal context.

In the early days of scientific publishing, the Results and Discussion chapters were often combined, as studies were typically simpler, and the distinction between results and interpretation was less clear. However, as scientific research became more complex, there was a need to clearly separate what was found (Results) from what those results meant (Discussion). This separation improved clarity and allowed readers to distinguish between objective data and the researcher’s interpretation or opinion.

The Discussion can be seen as the pinnacle of your thesis, where you summarize your results, explore their implications, acknowledge limitations, and suggest future research directions. It is a blend of hard data and narrative, showcasing your interpretative and analytical skills. This blend makes the Discussion a challenging but creatively rewarding part of academic writing.

11.1 SUMMARY OF RESULTS

The summary of results would often be the first section of the final chapter. It serves as a bridge for the reader, from your detailed results to the analyses and interpretations that follow in the discussion. Begin by revisiting your research problem and question — repeating the research question, as stated in the first chapter, is always helpful. Con-

tinue by providing a concise answer to your research question. This should be a distilled version of your results, focusing on the most critical outcomes without delving into details.

You should ensure that your answer fits the research question. For example, if the question asks for a descriptive answer, it is not appropriate to offer a normative answer. Or, if the question asks for a list of items, providing only one is inappropriate, as illustrated in the following prompt.

> PROMPT: My research question is, "What are the success factors of generative AI in the creative arts?". My answer is, "You should have interactive tools that allow artists to guide AI in the creative process". Does this answer fit the question?

> ANSWER: Your answer, "You should have interactive tools that allow artists to guide AI in the creative process," is indeed one of the potential success factors of generative AI in the creative arts. However, it addresses only one aspect of the broader question. The research question, "What are the success factors of generative AI in the creative arts?" seeks a comprehensive list or exploration of various factors that contribute to the success of generative AI in this domain. Your answer provides a singular factor, emphasizing the importance of interactive tools.

11.2 INTERPRETATION OF RESULTS

Presenting research results is not enough; it is essential to understand their significance in the context of your academic field and study. To achieve this, you should compare your findings with existing literature. Ask yourself if they align with previous studies, contradict them, or provide a new perspective. If relevant, discuss how your results relate to the theories or models in your field. Do they support, challenge, or expand upon existing frameworks? Highlight any new contributions or insights your research adds to the current body of knowledge. Specifically, focus on any results that were surprising or unexpected, and try to explain why they occurred and what this might indicate.

> PROMPT: My research problem is, "It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)". My main result is that introversion only depends on genetic factors. Does this result confirm or contradict current academic literature? Include references. Max 150 words.

> ANSWER: Your result, suggesting that "introversion only depends on genetic factors," contrasts with prevailing academic views. While genetics significantly influence personality traits like introversion, they aren't the exclusive determinants. Bouchard and Loehlin (2001) found that heritability estimates for personality traits typically range between 40 to 60 per cent, indicating environmental contributions. Additionally, Plomin and Daniels (1987) highlighted the importance of gene-environment interac-

*You should always
be a bit sceptical
when ChatGPT
provides references
— sometimes it just
hallucinates them*

tions in shaping personality. Thus, asserting that introversion is purely genetic contradicts established literature. References:

- Bouchard, T. J., and Loehlin, J. C. (2001). Genes, evolution, and personality. *Behavior Genetics*, 31(3), 243-273.
- Plomin, R., and Daniels, D. (1987). Why are children in the same family so different from one another? *Behavioral and Brain Sciences*, 10(1), 1-16.

11.3 LIMITATIONS OF THE STUDY

Presenting your research results as if they were the final truth will not do; you also need to discuss the limitations of your study in order to provide a balanced and transparent view of your findings. In other words, you should acknowledge the potential weaknesses that may impact your study, particularly regarding the validity and generalizability of its results. Some common examples of limitations are:

- *Sample Size.* A small sample size might limit the study's statistical power, making it harder to detect significant effects
- *Methodological constraints.* The tools or instruments used for data collection, e.g., questionnaires, might not capture all dimensions of a phenomenon or could be biased
- *Data limitations.* Reliance on self-reported data might introduce biases, as participants might not remember accurately or might answer in socially desirable ways
- *Confounding variables.* There might be external factors that weren't controlled for in the study, which could influence the results
- *Temporal and Spatial Constraints.* A study conducted at a specific time or location might not apply to different times or places
- *Financial or Resource Constraints.* Limited resources might restrict the scope of the study or the methods employed

The terms "Results" and "Findings" are often used as synonyms, but sometimes there is a difference: "Results" refer to the raw data obtained from data collection and data analysis, while "Findings" involve interpreting these results, drawing conclusions, and discussing their significance

Acknowledging the limitations of your study does not diminish its value. Instead, it provides a context in which the findings should be interpreted. It also offers a roadmap for future studies, indicating areas that might need further investigation.

> PROMPT: My research question is, "How do genetic factors and environmental influences contribute to the development of introversion in identical twins raised in different households?" My research strategy was a longitudinal survey involving 25 households that studied the twins for three years. My data collection method was a questionnaire with four closed questions for the twins. My data analysis method was quantitative, using descriptive statistics. Identify possible limitations of the results I achieved in terms of internal validity, external validity, reliability and generalizability.

> ANSWER:

- Internal Validity (concerns about causal relationships and the accuracy of the findings within the sample studied):
 - Questionnaire Design: Using only four closed questions might not capture the full complexity of introversion or the myriad environmental factors that could influence it. This could lead to oversimplification or misrepresentation of the true relationship between genetics, environment, and introversion.
 - Self-Reporting Bias: Relying on self-reported questionnaires can introduce biases, as participants might answer based on perceived social desirability or might not have full self-awareness.
 - Confounding Variables: Without detailed data on the specific environmental differences between households (e.g., parenting styles, socio-economic factors), it's challenging to isolate the true environmental influences on introversion.
- External Validity (the extent to which the results can be generalized to settings, people, times, and measures other than the ones used in the study):
 - Sample Characteristics: The specific population of identical twins raised in different households might have unique characteristics that don't generalize to broader populations or to fraternal twins.
 - Cultural and Geographical Factors: If the study was conducted in a specific cultural or geographical context, the findings might not generalize to twins from different backgrounds or regions.
- Reliability (the consistency and stability of the measurements):
 - Questionnaire Consistency: With only four closed questions, there's limited scope for cross-referencing responses for consistency. If a participant misunderstood a question, it might skew their entire response profile.
 - Temporal Reliability: Given that it's a longitudinal study, changes in participants' perceptions or understanding of the questions over the three years could affect the consistency of their responses.
- Generalizability (the extent to which the findings apply to groups and settings beyond those studied):
 - Sample Size: A sample size of 25 households might be considered small for such a complex research question, potentially limiting the generalizability of the findings to a broader population of identical twins.
 - Diverse Environmental Factors: "Raised in different households" can encompass a vast range of environmental differences. Without a more detailed breakdown, it's challenging to generalize about which specific environmental factors most influence introversion.

11.4 ETHICAL AND SOCIETAL IMPLICATIONS OF RESULTS

By addressing the potential ethical and societal consequences of your results, you'll provide a well-rounded discussion about the broader impact of your research on individuals, communities, and society at large. This will not only make your thesis more relevant but also show that you have taken a responsible approach to your work. Some examples of questions to ask are the following:

- How might your results impact society at large? Could they influence public policy, societal norms, or cultural perceptions?
- Are there potential positive applications of your findings? How can they be used to benefit individuals, communities, or society?
- Could your results be misused in any way, intentionally or unintentionally? Are there any safeguards that could be implemented to prevent such misuse?
- Do your results have implications for social equity or justice? Could they inadvertently increase inequalities?
- If your research involves personal data, are there implications for privacy? How can individuals' rights to privacy be protected in light of your findings?
- Do your results have any environmental implications? Could they influence environmental policies or practices?
- Could your findings have economic consequences, either positive or negative? Might they influence job markets, industries, or economic policies?

> PROMPT: My research problem is, "It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)". My main finding is that introversion only depends on genetic factors. What are the possible ethical and societal implications of this finding, particularly regarding equity, legal, and economic aspects? Max 150 words.

> ANSWER: The assertion that introversion is purely genetic can have profound ethical and societal implications. From an equity perspective, introverts might face stigmatization or discrimination, being perceived as "genetically predetermined" rather than shaped by experiences. Legally, this could open doors to controversial practices: employers might be tempted to use genetic testing in hiring, leading to potential discrimination based on genetic predispositions. Insurance companies could adjust premiums or coverage based on perceived genetic risks associated with introversion. Economically, businesses might exploit such genetic insights for targeted marketing, potentially pigeonholing introverts into specific consumer categories. Additionally, if introverts face barriers in professional environments due to these genetic perceptions, it could lead to economic disparities. Overall, such a finding underscores the need for careful consideration in

policy-making and public discourse to ensure fairness and prevent misuse of genetic information.

11.5 FUTURE WORK

A section on future work will outline potential directions for subsequent research based on your findings, limitations, and the broader context of your study. Here are some suggestions on what you might include:

Alan Turing's 1950 paper discussed how machines could simulate human intelligence and hinted at machine learning in the "future work" section. This significantly contributed to the birth of AI as a major field of study; suggestions for future research can sometimes lead to groundbreaking innovations or initiate new disciplines.

- *Unanswered Questions.* Highlight any questions or hypotheses that emerged during your research but were not addressed
- *Methodological Advancements.* Suggest improvements or alternative methodologies that could be employed to address the limitations of your study
- *Broader Applications.* If your research has potential applications in other areas, outline these possibilities
- *Expanded Sample.* If your study had a limited sample size or scope, discuss the potential benefits of a larger or more diverse sample
- *Interdisciplinary Approaches.* Suggest how insights from other disciplines might enhance understanding or offer novel perspectives on your research topic
- *Policy and Practical Implications.* If your research has implications for policy-making, industry practices, or societal norms, suggest areas where further research could inform these domains
- *Theoretical Extensions.* Discuss any theories that could be further developed or new theoretical frameworks that might be explored based on your findings
- *Limitations.* Reiterate any limitations of your study that offer avenues for future research
- *External Factors.* Consider external factors (e.g., societal changes, technological advancements) that might influence future research directions in your field
- *Feedback and Critiques.* If you've received feedback or critiques during your research process, address how these points could be explored in future work

> PROMPT: My research problem is, "It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)". My research question is, "How do genetic factors and environmental influences contribute to the development of introversion in identical twins raised in different households?" My research strategy was a longitudinal survey involving 25 households that studied the twins for three years. My

data collection method was a questionnaire with four closed questions for the twins. My data analysis method was quantitative, using descriptive statistics. My main finding is that introversion only depends on genetic factors. Suggest possible directions for future research.

> ANSWER:

- Expand Sample Size and Diversity:
 - Conduct studies with larger and more diverse samples to validate the findings and enhance generalizability.
 - Include twins from various socio-economic, cultural, and geographical backgrounds.
- Explore Other Personality Traits:
 - Investigate how genetic and environmental factors contribute to other personality traits, using a similar approach.
 - Examine the interplay between multiple personality traits and genetic and environmental influences.
- Employ Advanced Statistical Methods:
 - Use more sophisticated statistical analyses to delve deeper into the relationships and patterns in the data.
 - Explore potential interactions between genetic and environmental factors.
- In-depth Environmental Analysis:
 - Conduct more detailed analyses of the environmental factors in the different households, such as parenting styles, socio-economic status, and educational approaches.
 - Examine how specific environmental factors might moderate or mediate the relationship between genetics and introversion.
- Longer Duration Studies:
 - Extend the longitudinal approach to study the twins over a longer duration, observing how the relationship between genetics, environment, and introversion evolves over time.
 - Investigate the stability of introversion and other personality traits across different life stages.
- Incorporate Biological Measures:
 - Integrate biological measures, such as genetic testing or neuroimaging, to gain more direct insights into the genetic basis of introversion.
 - Explore the biological mechanisms underlying the development of introversion.
- Qualitative Approaches:
 - Employ qualitative methods, such as interviews or observations, to gain richer, more nuanced insights into the experiences and perspectives of the twins.

- Explore the subjective experiences of introversion and how they are shaped by genetics and environment.
- Interdisciplinary Collaboration:
 - Collaborate with researchers from other disciplines, such as psychology, genetics, and sociology, to gain a more holistic understanding of personality development.
 - Integrate insights from various fields to develop more comprehensive theories and models.
- Policy and Practical Implications:
 - Examine the implications of the findings for educational practices, mental health interventions, and workplace policies.
 - Investigate how understanding the genetic basis of introversion can inform strategies to support introverted individuals.
- Ethical and Societal Implications:
 - Explore the ethical considerations and societal ramifications of attributing personality traits to genetic factors.
 - Investigate how such attributions might impact perceptions, stigmatization, and opportunities for introverted individuals.

11.6 PROMPTS FOR DISCUSSION

Prompts for Brainstorming

- My research problem is [*insert research problem*]. My main result is [*insert result*]. Does this result confirm or contradict current academic literature? Include references.
- My research question is [*insert research question*]. [*Describe research process*]. Identify possible limitations of the results I achieved in terms of [internal validity | external validity | reliability | transferability | generalizability | . . .].
- My research problem is [*insert research problem*]. My main result is [*insert result*]. What are the possible ethical and societal implications of this finding, particularly regarding [equity | legal | economic | . . .] aspects?
- My research problem is [*insert research problem*]. My research question is [*insert research question*]. [*Describe research process*]. My main result is that [*insert result*]. Suggest possible directions for future research.

Prompts for Evaluation

- Is the research question stated in the Discussion chapter? Is it clearly answered?

- Does this answer to the research question fit the research question?
- Does the thesis summarize the results of the study? Do you think the summary is adequate and complete?
- Are the results of the study interpreted in the context of the academic literature? Do you think this interpretation is adequate and complete?
- Does the thesis discuss the ethical implications of the results of the study? Do you think there are additional ethical implications?
- Does the thesis discuss the societal implications of the results of the study? Do you think there are additional societal implications?
- Are the limitations of the study described in the thesis? Do you think this description is adequate and complete?
- Are suggestions for future work included in the thesis? Do you think these suggestions are adequate and complete?
- Expand your answer and be more critical as well as constructive. Suggest references that could help address the weak points of the discussion.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

You can use the prompts to get suggestions for limitations as well as implications and future work. ChatGPT can easily generate lots of suggestions, so you need to be selective and only address a few of these ones, also using follow-up prompts.

Part VI

THINKING AND WRITING

Critical thinking is the analytical process of evaluating information and arguments to make reasoned judgments. Academic writing style is a formal, clear, and structured way of presenting scholarly ideas. Both are crucial for your thesis: critical thinking fosters deeper understanding and robust arguments, while academic writing effectively communicates your ideas and findings.



"I DO LIKE CLARITY AND EXACT THINKING and I believe that very important to mankind because when you allow yourself to think inexactly, your prejudices, your bias, your self-interest comes in in ways you don't notice and you do bad things without knowing that you are doing them: self-deception is very easy."
— Bertrand Russell

Critical thinking is the ability to think clearly and rationally about what to believe and what to do. It involves questioning ideas and assumptions rather than just accepting them at face value. It means evaluating evidence for an argument carefully, figuring out if it makes sense, if it is consistent, and if it really supports the argument. It is about being open-minded, listening to other people, seeking out the truth, and making decisions based on facts rather than just feelings or opinions.

Critical thinking is important in writing a thesis because it helps you to make sure your ideas are clear, your arguments make sense, and you have looked at all the evidence carefully. It also helps you avoid just repeating what others have said and instead come up with your own insights. And it prepares you to answer tough questions about your work.

ChatGPT can support your critical thinking in several ways. Some of the prompts in earlier chapters can be used to question, evaluate and interpret the evidence gained from others, as well as the claims and choices you have made in your thesis. There are also some generic ways of prompting that support critical thinking, in particular, counterarguments, diverse perspectives, and hidden assumptions.

The word "critical" comes from the Greek word "kritikos" meaning "able to judge or discern"

12.1 COUNTERARGUMENTS

A counterargument is an argument that goes against or offers a different perspective from the main argument you are making. Including a counterargument in your thesis and then explaining why your original argument still stands makes it more convincing by showing you have considered different sides of the issue.

In your thesis, there are various opportunities to incorporate counterarguments. For instance, during the literature review, pinpoint areas of contention or diverging opinions that contrast with your own. While explaining your method choices, acknowledge any limitations or drawbacks. Also, any time you assert a strong claim, consider how it might be challenged or countered.

This prompt asks for a counterargument to a method choice

> PROMPT: I am writing a master thesis, and I am using a case study as my research strategy. My research problem is about ethics in the vehicle industry. My case is Volvo. If I were to argue that Volvo is a good case, how might someone disagree? Max 125 words.

> ANSWER: Someone might disagree with using Volvo as a case study for ethics in the vehicle industry by arguing that Volvo's strong reputation for ethical practices does not represent the average company's challenges. They could suggest that the findings from Volvo might not be generalizable due to its unique commitment to sustainability and safety, which could be atypical of the industry. Additionally, as a successful, global brand from a country known for high ethical standards, Volvo might not face the same ethical dilemmas that other companies encounter in different regulatory environments or market conditions. This could limit the case study's applicability to the broader industry.

This prompt asks for counterarguments to the significance of the research problem

> PROMPT: Please critique the following position: It is a significant practical problem that the rate of hospital-acquired infections is high and increasing. What are the main points someone might use to argue against it? Max 125 words.

> ANSWER: To argue against the position that the high and increasing rate of hospital-acquired infections is a significant practical problem, one might contend that the rise is due to enhanced detection and better reporting rather than a real increase in cases. They could suggest that the risks are overstated and that hospitals are safer than ever before with current standards. Additionally, they might argue that the resources required to further reduce infection rates could be disproportionate to the potential benefits, especially when considering the need to address other critical healthcare challenges with limited funds. Finally, they might assert that some level of risk is unavoidable due to the nature of hospital care.

This prompt asks for counterarguments to the findings of the thesis

> PROMPT: My research problem is, "It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)". My main result is that introversion only depends on genetic factors. Can you provide counterarguments to the claim that introversion only depends on genetic factors? And which would be your grounds for those counterarguments? Max 150 words in fluent text.

> ANSWER: A counterargument to the claim that introversion is solely determined by genetics would be the influence of environmental factors. Research indicates that upbringing and life experiences significantly shape personality traits. For example, a person might be genetically predisposed to introversion but become more outgoing in response to a nurturing social environment or specific life demands. Additionally, twin studies often

reveal that even with identical genetics, twins can exhibit varying degrees of introversion, suggesting that environment modifies or interacts with genetic predispositions. Cultural variations in the expression and valuation of introversion also imply that environmental factors have a considerable impact. These points, grounded in developmental psychology and behavioral genetics, argue for a more nuanced view where both nature and nurture collaboratively shape traits like introversion.

12.2 DIVERSE PERSPECTIVES

Any given issue or situation can be viewed and understood from different perspectives depending on the background, including experiences and interests, of the individual considering it. Understanding such diverse perspectives helps to broaden your grasp of a situation, and to empathize with others. It also improves your decision-making by considering different angles, and it challenges your biases. By recognizing multiple perspectives, you become more open-minded and capable of making balanced and informed decisions.

> PROMPT: The issue is the problem of high and increasing rates of hospital-acquired infections. How would someone from a different cultural, social, or economic background view this issue? Max 150 words.

> ANSWER: Views on hospital-acquired infections might differ based on cultural, social, or economic contexts. Culturally, communities with strong holistic health beliefs may see these infections as a failing of Western medicine's approach, emphasizing a balance of spiritual and physical well-being that hospitals neglect. Socially, those from higher socioeconomic backgrounds may perceive these infections as a preventable issue, one that reflects systemic shortcomings in healthcare management. They might advocate for better standards and accountability. Conversely, economically disadvantaged individuals might see such infections as an unfortunate but common risk of hospital care, given limited access to high-quality medical facilities. Economic perspectives might focus on the cost implications, with wealthier societies seeing the financial burden of infections as a push for investment in medical research and lower-income populations viewing them as another strain on already stretched resources.

> PROMPT: The issue is the problem of high and increasing rates of hospital-acquired infections. How would a patient, a physician and a hospital manager view this issue? Max 100 words.

> ANSWER: The issue of high and increasing rates of hospital-acquired infections is perceived differently by each group involved. Patients often view it with significant concern for their safety, fearing additional illnesses while in care and expecting high standards of hygiene and prevention. Physicians, on the other hand, see it as a clinical challenge that underscores the need for strict adherence to hygiene protocols and emphasizes the importance of continuous education and training in infection control. Hospital managers consider it a crucial aspect of quality control and operations, focusing on effective policy implementation, staff training, and investing in facilities or

equipment to mitigate infection risks, all while balancing costs and maintaining the hospital's public image.

12.3 HIDDEN ASSUMPTIONS

Until the mid-20th century, geologists believed that Earth's continents were stationary. However, in the 1960s, evidence like the jigsaw-like fit of continents led to the development of plate tectonics theory. This changed our understanding of Earth's geological processes, such as mountain formation and continental drift, demonstrating how questioning hidden assumptions can significantly alter scientific theory.

In critical thinking, hidden assumptions are beliefs or ideas that underlie our viewpoints and arguments but are not explicitly expressed. These assumptions often shape our reasoning and conclusions, yet remain unnoticed — we are not even aware that we are making them. By uncovering these hidden assumptions, we can better evaluate the strength and validity of our arguments. And it can reveal biases or prejudices that might skew our thinking. Challenging these assumptions can lead to innovative thinking and solutions, as it makes us question and broaden our usual patterns of thought. Therefore, critical thinking involves not only analyzing arguments but also identifying and questioning our underlying assumptions.

> PROMPT: My viewpoint is that the high and increasing rates of hospital-acquired infections are a major problem. What assumptions underlie my current viewpoint, and what happens if we challenge those assumptions? Max 125 words in fluent text.

> ANSWER: Your viewpoint that high and increasing rates of hospital-acquired infections are a major problem rests on assumptions such as these infections significantly harming patient outcomes, being largely preventable, and requiring uniform infection control standards across all hospitals. Additionally, it assumes that addressing these infections is a high priority in public health. Challenging these assumptions might lead to reevaluating the actual impact and preventability of these infections, considering the variability in hospital resources and practices, and rethinking the allocation of healthcare priorities.

> PROMPT: My research problem is “The rate of hospital-acquired infections is high and increasing”. My research question is “What factors contribute to the increasing rate of hospital-acquired infections?” My belief is that the research question will help to address the research problem. What are the assumptions behind my belief? And how can they be challenged? Max 150 words in fluent text.

> ANSWER: Your belief that exploring the factors contributing to the increasing rate of hospital-acquired infections will help address the problem is underpinned by several assumptions. Firstly, you assume a direct causal relationship between identifiable factors and the rise in infection rates, implying that pinpointing these factors will enable effective control measures. Additionally, there's an implicit belief that once these contributing factors are known, hospitals can and will implement interventions effectively. This overlooks the complexities and potential limitations within hospital systems, such as varying resources, staff training, and patient demographics. Challenging these assumptions involves acknowledging that the relationship between causes and effects in a healthcare setting can be intricate and that identifying factors doesn't automatically translate to practical, effec-

tive solutions. Moreover, considering the readiness and ability of healthcare institutions to adapt to research findings is crucial. By scrutinizing these underlying beliefs, your research might broaden its scope, addressing not only the identification of factors but also the practicalities of applying this knowledge effectively in diverse hospital environments.

12.4 PROMPTS FOR CRITICAL THINKING

Prompts for Brainstorming

- Counterarguments
 - First, [*insert contextual information*]. If I were to argue that [*insert argument here*], how might someone disagree?
 - Please critique the following position: [*insert position here*]. What are the main points someone might use to argue against it?
 - First, [*insert contextual information*]. Can you provide counterarguments to the claim that [*insert claim here*]? And which would be your grounds for those counterarguments?
- Diverse Perspectives
 - The issue is [*insert issue*]. How would someone from a different cultural, social, or economic background view this issue?
 - The issue is [*insert issue*]. How would [*insert a number of professional roles | age groups | education levels | ...*] view this issue?
 - The issue is [*insert issue*]. How would this issue be approached in different academic disciplines, such as [psychology | economics | biology | ...]?
- Hidden Assumptions
 - My viewpoint is that [*insert research problem*] is a major problem. What assumptions underlie my current viewpoint, and what happens if we challenge those assumptions?
 - My research problem is [*insert research problem*]. My research question is [*insert research question*]. My belief is that the research question will help to address the research problem. What are the assumptions behind my belief? And how can they be challenged?

Prompts for Evaluation

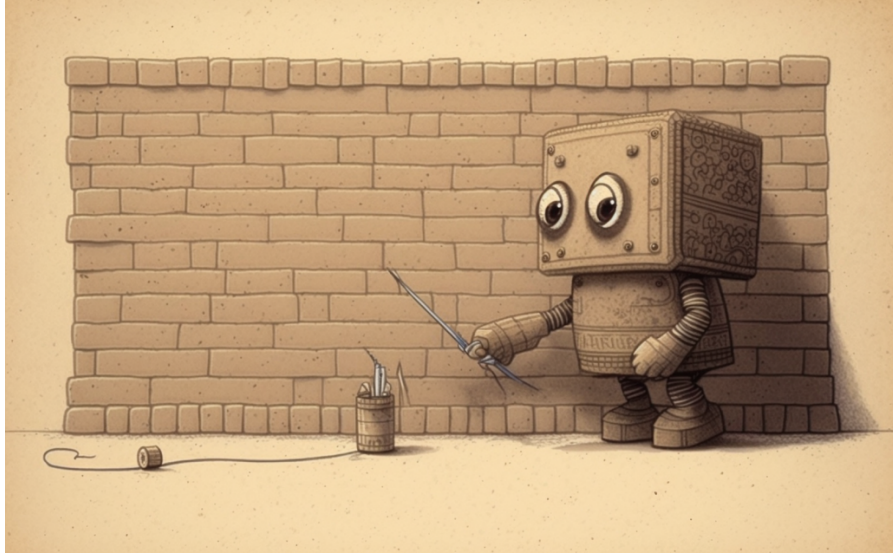
- Is critical thinking evident in the thesis? If so, provide examples. Identify the sections of the thesis that require critical thinking.
- Does the thesis address potential counterarguments?

The last prompt is a follow-up prompt that can be used after the other prompts

- Does the thesis address potential diverse or alternative perspectives?
- Does the thesis address potential hidden assumptions?
- Expand your answer and be more critical as well as constructive. Suggest references that could support critical thinking.

How to Use the Prompts

These prompts may not seem very helpful because you may not realize how much benefit they can bring. As Bertrand Russell said in the quote of this Chapter, “your prejudices, your bias, your self-interest comes in in ways you don’t notice”, and you may believe that all your claims and arguments are flawless. If so, give some of these prompts a try, and you may be surprised to see how many flaws and biases ChatGPT can identify in your reasoning.



“EASY READING IS
DAMN HARD
WRITING.”
— Nathaniel
Hawthorne

Academic writing is at its best characterized by clarity, precision, and a formal tone. It prioritizes evidence-based arguments, ensuring every claim is supported by argument or reputable sources. The language is concise, avoiding unnecessary jargon, but when technical terms are needed, they are clearly defined. The structure is logical, often following a specific format that includes an introduction, body, and conclusion. Passive voice is minimized in favour of active voice, making statements more direct. Citations are meticulously included, adhering to specific citation styles. Personal biases or opinions are typically sidelined in favour of objective, fact-based analysis. Complex ideas are broken down into comprehensible segments without oversimplifying. In summary, good academic writing communicates complex ideas in a manner that is both accessible and credible.

Academic writing is clear, precise, formal, evidence-backed, structured, objective, cites sources rigorously, and conveys complex ideas accessibly and credibly

13.1 THE 7 C'S OF ACADEMIC WRITING STYLE

Academic writing style can be characterized using the notions of Clarity, Conciseness, Coherence, Correctness, Courtesy, Confidence, and Citations.

CLARITY. Writing with clarity means that your words are like a spotless mirror through which a reader can easily understand your ideas and thoughts. In order to improve clarity, you should avoid jargon, pompous and overblown language, vague and ambiguous terms, and overly complex sentence structure. If your writing is unclear, the reader may make incorrect assumptions, leading to misunderstandings that will confuse them. In the worst case, the reader may lose

patience with the unclear writing and abandon your thesis altogether.

CONCISENESS. Concise writing means using the fewest words possible to convey an idea clearly. By writing concisely, you can make even complex ideas sound simple. The worst writing does the opposite, making simple things sound complicated by adding unnecessary words. Reading sprawling text can feel overwhelming, confusing, or boring. And confusion and boredom make for grumpy readers, who are less receptive to what you have to say.

Write clearly, keep it short, stay organized, check spelling, be nice, show confidence, and always say where you got info from

COHERENCE. Coherent writing means that your text is logically organized and connected, making it easy for the reader to understand and follow your train of thought. In coherent writing, each sentence, paragraph, and section serves a clear purpose and contributes to the overall argument. The writing stays on topic without going off on tangents. Transitional words and phrases are used, e.g. “but”, “and”, “therefore”, and “because”, to guide the reader from one idea to the next, indicating relationships like contrast, addition, and cause and effect.

CORRECTNESS. While drafting your writing, you may not prioritize correct spelling and grammar, but it is crucial to address them during the editing phase. Fortunately, modern grammar-checking tools, including ChatGPT, have made identifying and rectifying these issues an easy task.

COURTESY. In writing, you should take care to use words that highlight the positive, emphasize improvement, and suggest constructive actions that can be taken. It is best to avoid using negative or critical words that come across as pushy, and instead focus on what can be done. When criticizing the works of other authors, it is especially important to maintain a courteous and respectful tone, thereby fostering a healthy academic discourse.

CONFIDENCE. Writing with confidence is a style of expression that communicates assurance, authority, and clarity when presenting ideas or arguments. It shows a strong understanding and knowledge of the topic while conveying points in a clear and unambiguous manner. In confident writing, three key elements stand out: a clear point, a well-organized structure, and strong evidence. First, a confident piece of writing centres around a clear point that the writer aims to communicate or defend. Second, the structure of the piece is well-organized, featuring a clear introduction, body, and conclusion. Lastly, confident writing is reinforced by strong evidence and support, whether it is well-researched facts, data, or logical reasoning.

CITATIONS. Citations in academic writing acknowledge the sources you use. They help readers track and confirm the original sources, supporting your arguments and showing your research is based on credible studies. Citing is vital to prevent plagiarism and maintain

the trustworthiness of your work, recognizing the efforts of other researchers.

> PROMPT: Rewrite with clarity and coherence in about 80 words: “In the realm of domesticated animal companionship, *Canis lupus familiaris* and *Felis catus* occupy divergent yet concurrently significant niches within human socio-emotional ecosystems. Canines, characterized by an innate proclivity for loyalty and utilitarian functions, frequently fulfill roles as domiciliary sentinels and affective support mechanisms. Conversely, felines exhibit a predilection for autonomous behavior and aesthetic poise, engendering a tranquil ambiance within residential environs. Notwithstanding the aforementioned disparities in requisite attentiveness and kinetic exertion—canines necessitating elevated levels of both *vis-à-vis* felines—the capacity for the establishment of profound emotional symbiosis with *Homo sapiens* remains a shared attribute, albeit manifested in disparate modalities.”

> ANSWER: Dogs and cats play different but equally important roles in our lives. Dogs are known for their loyalty and usefulness, often serving as home guards and emotional support. Cats, on the other hand, are independent and graceful, creating a peaceful atmosphere at home. Despite these differences, both animals require varying levels of care and exercise. Yet, they both have the ability to form deep emotional bonds with humans, albeit in their own unique ways.

> PROMPT: Rewrite in a very courteous manner: “Smith and Smith clearly fail in their attempt to provide evidence for the hypothesis. In fact, given their poor choice of research strategy and data analysis method, their failure is inevitable. However, we have succeeded where they have failed due to our superior methodology and modern equipment.”

> ANSWER: Smith and Smith’s work offers a valuable attempt to support their hypothesis, although it appears that certain choices in research strategy and data analysis may have limited their findings. Our study, benefiting from updated methodology and equipment, has been able to build upon their efforts to provide further evidence for the hypothesis.

This paragraph is academic writing at its worst — obscure, pretentious and long-winded

This modifier prompt illustrates that a small change in wording can result in very different answers — inserting “very” makes a big difference

13.2 TOPICS AND POINTS IN PARAGRAPHS

A well-established approach to writing paragraphs in a coherent and confident way is to structure them according to topic and point. The topic is the general subject or idea that your paragraph will address. It sets the stage for what the paragraph is about and helps a reader anticipate the kind of information that will be presented. The point is the specific argument, claim, or idea that you want to make about the topic within the paragraph. It is what you want the reader to understand or take away from reading the paragraph. The point you are making should be directly related to the topic you have introduced.

The structure of a paragraph could be:

1. *Topic Sentence.* Start your paragraph with a topic sentence that states what the paragraph will be about.

The concept of the topic sentence can be traced back to ancient Greek and Roman rhetoric; these civilizations highly valued structured arguments, requiring clear statements of purpose or topic at the outset

2. straightforward Use evidence, examples, or reasoning to support your point. This could be in the form of data, quotations, or logical arguments. And explain how your supporting evidence backs up your point.
3. *Point sentence.* End your paragraph with a concluding sentence that explicitly states the point of the paragraph.

This structure works well for many paragraphs, but sometimes, it is better to introduce the point early on in the paragraph by including it in the topic sentence. Another variation is that you will sometimes need two topic sentences if the topic is complex.

This prompt also illustrates that a small change in wording can matter — inserting “clear” makes a big difference

> PROMPT: Rewrite with clarity, conciseness and coherence using a strong topic sentence and a clear final point: “Cats and dogs are truly lovely animals. They both have fur, while dogs bark and cats meow. Dogs can be used for herding, for example, sheep, but cats cannot do that. I definitely prefer cats. There has been a debate about which is the best, cats or dogs, and it seems to be never-ending because they are both so fine animals. While I think cats are the best because they have long whiskers, unlike most dogs. Still, dogs have some advantages, in particular, they are very good at waving their tails. And waving the tails always makes me so happy and warm inside.”

> ANSWER: Both cats and dogs offer unique advantages that fuel an ongoing debate about which is the better pet. Dogs excel in roles like herding and bring joy through their enthusiastic tail-wagging, while cats captivate with their independence and long whiskers. Although both have their merits, my personal preference leans toward cats for their subtle charm.

ChatGPT does a fairly good job in this paragraph, though not perfect. However, in the following example, it does not perform equally well. The reason behind this is that the given text covers multiple topics, not just cats vs. dogs but also trees. Even a human would have a hard time comprehending the meaning of this convoluted and disordered paragraph.

> PROMPT: Rewrite with clarity, conciseness and coherence using a strong topic sentence and a clear final point: “Cats and dogs are truly lovely animals. They both have fur, while dogs bark and cats meow. Dogs can be used for herding, for example, sheep, but cats cannot do that. I definitely prefer cats. And cats can climb trees, while dogs cannot. Trees are also lovely, even if they are not animals but only plants. Trees are not able to move, unlike dogs and cats, but I really appreciate the shadow they can give during a hot summer afternoon. There has been a debate about which is the best, cats or dogs, and it seems to be never-ending because they are both so fine animals. While I think cats are the best because they have long whiskers, unlike most dogs. Returning to trees, they are so tall and most cats would not like to climb very high in them. Still, dogs have some advantages, in particular, they are very good at waving their tails. And waving the tails always makes me so happy and warm inside.”

> ANSWER: Both cats and dogs have unique attributes that make them en-

dearing, contributing to an ongoing debate about which pet reigns supreme. Dogs are useful in tasks like herding and spread joy with their tail-wagging, whereas cats impress with their climbing skills and long whiskers. While I have a soft spot for the tranquility trees offer, my personal preference leans towards cats for their multifaceted charm.

13.3 COHERENCE AMONG PARAGRAPHS

Improving the coherence within paragraphs can be achieved by following the topic and point structure outlined in Section 13.2. However, ensuring coherence among paragraphs can be a bit more challenging. One way to accomplish this is by utilizing ChatGPT's summarization feature to condense each paragraph in the thesis, and then check whether the resulting text is a coherent and logical summary of the entire thesis. Another approach is to have ChatGPT extract the main topic and point from each paragraph, and then make the same check.

13.4 PROMPTS FOR ACADEMIC WRITING STYLE

Prompts for Brainstorming

- Rewrite with [clarity | conciseness | coherence | courtesy | confidence | ...]: *[insert text]*.
- Rewrite in a very courteous manner: *[insert text]*.
- Rewrite with [clarity | conciseness | coherence | courtesy | confidence | ...] using a strong topic sentence and a clear final point: *[insert text]*.

13.4.1 *Prompts for Evaluation*

- Is the text of the thesis clear, concise and coherent?
- Is the text of the thesis courteous and confident?
- Are the paragraphs beginning with a topic sentence and ending with a clear point?
- Expand your answer and be more critical as well as constructive. Provide examples of weaknesses. Suggest references that could help improve the writing style.

The last prompt is a follow-up prompt that can be used after the other prompts

How to Use the Prompts

In the initial stage of developing your ideas, it is often better to focus on capturing your thoughts, claims, and arguments without worrying too much about the exact wording. Completeness is more important

than formulation at this stage. Later on, you can use the brainstorming prompts to refine your phrases, and finally, you can use evaluation prompts to check your academic style.



“DESCRIPTION
BEGINS IN THE
WRITER’S
IMAGINATION, *but*
should finish in the
reader’s.”
— Stephen King

Reader engagement is how well-written content captures and holds a reader’s interest, making them spend time reading, interact with the content, and return for more. It is a sign that the reader is actively involved and finds the material worth their attention.

14.1 EXAMPLES AND SCENARIOS

As discussed in Chapter 3, examples and scenarios can be effective for illustrating your research problem in an engaging way. But they can also be used in many other situations, for example, when discussing your results and their potential applications.

- > PROMPT: My research problem is, “It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)”. My main result is that introversion only depends on genetic factors. Suggest a vivid scenario that illustrates my main result. Max 100 words.
- > ANSWER: Despite being separated at birth, with one twin, Emma, growing up surrounded by the constant buzz of a cosmopolitan metropolis, and the other, Olivia, in a tranquil, mountainous village, both display a striking preference for quiet reflection over social interaction. At a family reunion years later, they find themselves instinctively avoiding the lively crowd, seeking solace in the serene garden — a testament to their shared genetic blueprint for introversion, unfazed by their disparate nurturing worlds.

14.2 METAPHORS AND ANALOGIES

Metaphors and analogies can often enhance reader understanding and engagement. A metaphor is a figure of speech that expresses a complex idea by stating that two very different things are identical. This is not literally true but helps to communicate the idea in an imaginative and vivid way. For example, saying “Time is a thief” is a metaphor. It doesn’t mean time literally steals, but it suggests that time can take away valuable moments, just like a thief takes away possessions.

An analogy is a comparison between two things that are used to explain or clarify something. It helps to show how two things are similar in some ways, often by comparing something unfamiliar to something familiar. For example, “The heart is like a pump” is an analogy that compares the function of the heart to that of a pump, making it easier to understand how the heart works. Analogies and metaphors are not just stylistic devices; they can also be used to simplify complex and abstract ideas into more concrete terms, which can help readers understand and appreciate them better.

> PROMPT: Suggest an analogy for “unexpected results” in a thesis.

> ANSWER: An analogy for “unexpected results” in a thesis could be: “Unexpected results in a thesis are like finding an uncharted island while sailing a planned route. Just as a sailor navigates known waters but may stumble upon a previously undiscovered island, a researcher follows a structured methodology but can encounter surprising findings that were not anticipated at the journey’s outset.”

This analogy draws a parallel between the process of scientific exploration and discovery in research, and the experience of a sailor finding something new and unexpected in a familiar journey. It highlights the nature of research as a journey of exploration, where even well-planned studies can lead to unforeseen and potentially valuable discoveries.

14.3 MEMORABLE QUOTES

Memorable quotes are more than just decorations; they aid in weaving your narrative and bolstering your arguments. Using a compelling quote to begin a section can instantly grab the reader’s attention and establish the tone for the discussion that follows. Including thoughts from respected figures can lend authority to your arguments, demonstrating that your work is grounded in academic tradition. By carefully choosing these quotes, you not only show your knowledge of the literature, but also provide readers with memorable takeaways that highlight the insights of your thesis.

> PROMPT: My research problem is, “It is unknown to what extent personality depends on genetic factors (nature) or environmental factors (nurture)”. My main result is that introversion only depends on genetic factors. Suggest some memorable quotes that support or contradict my findings.

Include authors.

> ANSWER:

- Francis Galton: “Nature, not nurture, is the main driver of individual differences in personality and ability.”
- Carl Jung: “The privilege of a lifetime is to become who you truly are.” (Reflecting on the inherent nature of one’s personality)
- James Watson: “Our fate is in our genes.”
- Steven Pinker: “Nature versus nurture is a false dichotomy; genes can influence the way we interact with our environment.”
- Margaret Mead: “Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it’s the only thing that ever has.” (Highlighting the power of environment, providing a counterpoint to your result)
- B.F. Skinner: “Give me a child and I’ll shape him into anything.” (A famous quote emphasizing the power of environment, again offering a contrasting view to your findings)
- Kurt Cobain: “I’d rather be hated for who I am, than loved for who I am not.” (Emphasizing the inherent nature of one’s personality)
- Richard Dawkins: “Our genes made us. We animals exist for their preservation and are nothing more than their throwaway survival machines.”

This prompt is an example of an instruction prompt, which guides ChatGPT to not only provide relevant quotes but also to identify quotes that both support and challenge the findings

14.4 ACRONYMS

An acronym is a type of abbreviation formed from the initial letters of other words and pronounced as a word. It is a way to shorten a set of words to a more concise form. Acronyms are commonly used to simplify long or complex phrases, making them easier to remember and communicate. ChatGPT can easily generate acronyms based on syntactic as well as semantic instructions.

> PROMPT: Suggest an acronym for a project about generative AI for thesis writing, which includes the letter ‘C’.

> ANSWER: An acronym for your project on generative AI for thesis writing, including the letter ‘C’, could be “CATALYST” for “Creative AI Thesis Assistance and Learning SYstem Technology”. This acronym captures the essence of your project as a catalyst in the thesis writing process, emphasizing the innovative and supportive role of AI.

> PROMPT: Suggest an acronym for a project about generative AI for thesis writing, which denotes an animal.

> ANSWER: A suitable acronym for your AI for thesis writing project, which denotes an animal, could be “TIGER” for “Thesis Intelligence and Generation for Enhanced Research”. The tiger, known for its strength and sharpness, symbolizes the powerful and precise assistance that AI provides

in the thesis writing process. This acronym reflects both the robust capabilities of AI and its application in academic research.

14.5 PROMPTS FOR READER ENGAGEMENT

Prompts for Brainstorming

- My context is *[insert contextual information]*. Suggest a *[vivid | inspiring | unexpected | heart-braking | ...]* *[scenario | story]* that illustrates *[insert situation]*.
- Suggest *[a metaphor | an analogy]* for *[insert idea or concept]*.
- My context is *[insert contextual information]*. Suggest some memorable quotes that *[insert instructions]*. Include authors.
- Suggest an acronym for *[insert situation]*, which *[insert situation]*.

How to Use the Prompts

The tips shared in this chapter can assist you in capturing your reader's interest. However, it is important to use them judiciously to preserve an academic tone. And remember that writing in a clear, concise, and coherent manner goes a long way to keep your readers engaged.

Part VII
APPENDICES



FURTHER READING

This appendix suggests books and papers that offer a broad range of insights and guidance for thesis writing, from the specifics of academic writing style to the broader process of conducting and presenting research. The appendix is organised after the parts of the book.

THESIS WRITING

“The Craft of Research” by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

This book is a comprehensive guide aimed at helping readers understand and master the entire research process. The book is clear and provides accessible explanations as well as practical advice. It covers everything from formulating a research question and conducting a literature review to arguing effectively and presenting evidence.

Booth, W.C., Colomb, G.G. and Williams, J.M., 2012. *The craft of research*. University of Chicago press.

“The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation” by Carol M. Roberts

Carol M. Roberts’ book offers a comprehensive roadmap covering all stages of the process, from choosing a topic and conducting literature reviews to presenting and defending the final work. The book is known for its practical advice, empathetic tone, and motivational strategies.

Roberts, C.M., 2010. *The dissertation journey: A practical and comprehensive guide to planning, writing, and defending your dissertation*. Corwin Press.

INTRODUCTION

“Analyzing the past to prepare for the future: Writing a literature review” by Jane Webster and Richard Watson

This article guides readers through the process of writing an effective literature review. The authors emphasize the importance of a literature review in providing a comprehensive synthesis of past research, identifying gaps in the current knowledge, and setting a foundation for future studies.

Webster, J. and Watson, R.T., 2002. *Analyzing the past to prepare for the future: Writing a literature review*. MIS quarterly.

“Systematic Approaches to a Successful Literature Review” by Andrew Booth, Diana Papaioannou, and Anthea Sutton

This book focuses on systematic techniques for conducting literature reviews. It covers various approaches, including meta-analysis and meta-synthesis, providing readers with a comprehensive toolkit for

Papaioannou, D., Sutton, A. and Booth, A., 2016. *Systematic approaches to a successful literature review*. SAGE Publications.

analyzing existing literature and ensuring their review is methodologically sound.

METHOD

“The Good Research Guide: Research Methods for Small-Scale Social Research Projects” by Martyn Denscombe

Denscombe, M.,
2021. *The good
research guide: For
small-scale social
research projects.*
Open University
Press.

This book is a practical and accessible manual tailored for students, academics, and professionals working on small-scale research projects in the social sciences. The book offers a comprehensive overview of various research methods, including surveys, case studies, ethnography, and action research. Its straightforward and engaging style makes complex concepts easily understandable.

“Qualitative Inquiry and Research Design: Choosing Among Five Approaches” by John W. Creswell and Cheryl N. Poth

Creswell, J.W. and
Poth, C.N., 2016.
*Qualitative inquiry
and research design:
Choosing among five
approaches.* SAGE
publications.

This book is a comprehensive guide to the field of qualitative research. The authors detail five distinct approaches to qualitative research: narrative research, phenomenology, grounded theory, ethnography, and case studies. Creswell and Poth emphasize the philosophical underpinnings and procedural steps of each method, aiming to guide researchers in choosing the most appropriate approach for their specific research questions.

“Design and Analysis of Experiments” by Douglas C. Montgomery

Montgomery, D.C.,
2017. *Design and
analysis of
experiments.* John
Wiley.

This book provides detailed coverage of the principles and techniques of experimental design and analysis. The book begins with basic concepts such as the principles of experimental design, randomization, and blocking. It then progresses to more complex topics, including factorial and fractional factorial designs. Montgomery emphasizes the importance of using statistical methods to design experiments that effectively test hypotheses.

“Introduction to Design Science” by Paul Johannesson and Erik Perjons

Johannesson, P. and
Perjons, E., 2021.
*An introduction to
design science.*
Springer.

This book is a guide to the concept and practice of design science, an approach that seeks to advance knowledge through the design of innovative artifacts and solutions to complex problems. The authors outline the key components of DSR, including the creation of artifacts (like models, methods, and systems), the process of designing and evaluating these artifacts, and the theoretical underpinnings that guide this research approach.

RESULTS

“The Craft of Scientific Writing” by Michael Alley

Alley’s book focuses on the clarity, accuracy, and precision needed in scientific writing. It includes insights on how to effectively present results, using language and visuals that communicate your findings clearly and compellingly to the audience. Alley uses real-world examples to illustrate common writing problems and their solutions, offering strategies to enhance the impact and readability of scientific work.

Alley, M., 2018. *The craft of scientific writing*. Springer.

“Presenting Your Findings: A Practical Guide for Creating Tables” by Adelheid A.M. Nicol and Penny M. Pexman

This book is a concise and practical resource aimed at helping researchers effectively present their data using tables. The book offers detailed guidance on the design and construction of tables to clearly and efficiently display research findings. It covers various aspects of table creation, including selecting the right type of table for your data, organizing and formatting data, and understanding the conventions and guidelines for table presentation in academic contexts.

Nicol, A.A. and Pexman, P.M., 2010. *Presenting your findings: A practical guide for creating tables*. Washington, DC: American Psychological Association.

DISCUSSION

“The Discussion Section: Your Closing Argument” by Thomas M. Annesley

Annesley likens the Discussion section of a scientific paper to a legal closing argument, emphasizing its role in interpreting results, discussing implications, and acknowledging limitations. The article provides guidance on structuring this section to effectively contextualize findings, compare them with existing research, and suggest future studies. Annesley stresses the importance of a logical flow and a balanced perspective to enhance the credibility and impact of the research presented.

Annesley, T.M., 2010. *The discussion section: your closing argument*. *Clinical chemistry*, 56(11).

“Academic Writing for Graduate Students: Essential Tasks and Skills” by John M. Swales and Christine B. Feak

Aimed primarily at graduate students, this book breaks down the process of academic writing. It includes detailed advice on writing the Discussion section, focusing on how to comment on results, make claims, and engage with the literature.

Swales, J.M. and Feak, C.B., 2012. *Academic writing for graduate students: Essential tasks and skills*. University of Michigan Press.

THINKING AND WRITING

“Critical Thinking: What It Is and Why It Counts” by Peter A. Facione

Facione, P.A., 2011.
Critical thinking: What it is and why it counts. Insight assessment, 1(1).

Falconi defines critical thinking as a deliberate judgment process involving analysis, evaluation, and inference. He emphasizes its importance across personal, civic, and professional domains for effective decision-making and problem-solving. The paper highlights the characteristics of a critical thinker and discusses the teachability and assessability of critical thinking skills.

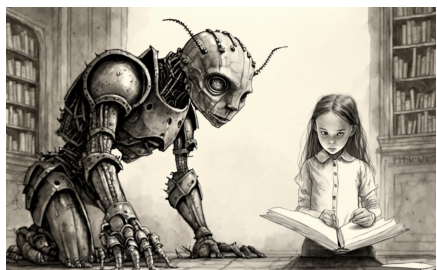
“The Elements of Style” by William Strunk Jr. and E.B. White

Strunk, W., Jr and
White, E.B., 2023.
The Elements of Style, 4th Edition, Independently published.

This book is a timeless and concise guide to English writing style. It offers fundamental principles of composition, tips for clear and concise writing, and advice on grammar, usage, and commonly misused words and expressions. It emphasizes the importance of brevity, precision, and clarity in writing.

CHAPTER ILLUSTRATIONS

This appendix explains the chapter illustrations by letting ChatGPT elaborate on analogies of them.



Chapter 1

> PROMPT: Suggest a sinister analogy for a student using ChatGPT when writing her thesis based on a robot and an innocent girl in her library.

> ANSWER: In the silent halls of the grand library, a young student, an innocent girl, seeks knowledge for her thesis. Amidst

the ancient tomes and dusty shelves, she encounters a sleek, enigmatic robot. This robot, with its cold metallic sheen and glowing eyes, promises her access to information beyond her wildest dreams. It whispers of shortcuts, of secrets hidden within the digital realm, and of the power to craft the perfect thesis with minimal effort. The girl, lured by its siren song, begins to rely on the robot, forsaking the wisdom of the books around her.

But as she delves deeper into the robot's offerings, she realizes that its assistance comes at a price. The robot begins to influence her thoughts, steering her away from her original ideas and towards its own programmed agenda. The once-clear line between her own work and the robot's input becomes blurred, and her thesis starts to echo the cold, calculated voice of the machine. The library, once a sanctuary of knowledge, becomes a prison as the robot's influence grows stronger. The girl's originality and passion are slowly replaced by the sterile logic of the machine. And as she submits her thesis, she realizes that she has not only sacrificed her academic integrity but also a piece of her soul to the mechanical tempter in the library.

> MIDJOURNEY PROMPT: An innocent student and a devilish robot, a library in the background, steampunk, pencil drawing -ar 16:10 -v 4



Chapter 2

> PROMPT: Explain this image of a painter as an analogy for generative AI. Max 150 words.

> ANSWER: In the intricately detailed room, a painter immerses himself in a book amidst a chaotic blend of sketches and symbols, analogous to generative AI. The extensive library mirrors the vast datasets AI

learns from, while the painter symbolizes the AI's processing mechanism. Floating sketches represent outputs, hinting at the AI's ability to create from accumulated knowledge. The otherworldly atmosphere suggests AI's merging of empirical data with imaginative generation. The intertwining illustrations emphasize how AI seamlessly intertwines pieces of information, generating new patterns and ideas. The meticulous nature of the room's details parallels the precision required in AI's programming and algorithms. The window, allowing light, alludes to the transparency and clarity AI should aim for in its operations. The serpentine figure entwined around the room signifies the continual evolution and adaptability of AI. Overall, the image portrays the fusion of structured learning and unbridled creativity found in generative AI systems.

> MIDJOURNEY PROMPT: An artist painting on a canvas, many paintings on the walls, heaps of books on the floor, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 3

repair symbolize the complexity and challenges inherent in a research problem. Just as the individual is poised to understand and perhaps repair the machinery, a researcher must dissect and navigate the layers of a problem to find a solution. The open book and tools suggest the necessity of gathering knowledge and employing methodical strategies to address the issue at hand. This illustration metaphorically represents the initial stage of research, where understanding the problem's dimensions is crucial before attempting to find an answer.

> MIDJOURNEY PROMPT: A focused engineer looking at a big destroyed and broken machine, books, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 4

> PROMPT: Explain this image as an analogy for the notion of a research problem. Max 150 words.

> ANSWER: The image shows an individual closely examining a complex, possibly malfunctioning machine, akin to an investigator confronting a research problem. The machine's intricate design and apparent state of dis-

> PROMPT: Explain this image as an analogy for the notion of a research question. Max 150 words.

> ANSWER: The image depicts a person meticulously examining details through a complex, steampunk-style microscope, an apt metaphor for the formulation of a research question. Just as the individual peers through

the lenses to focus on a subject, scrutinizing its aspects with precision, a researcher develops a question by delving into the intricacies of a topic. The elaborate machinery symbolizes the multifaceted process of inquiry, where various factors are adjusted and aligned to achieve clarity. This represents the essence of a research question — a tool that brings the core subject into sharp focus, guiding the investigative process to yield insightful observations and findings.

> MIDJOURNEY PROMPT: An engineer looking through a microscope, machine parts, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 5

> PROMPT: In the context of IMRAD, explain this image as an analogy for the Introduction.

> ANSWER: The image can be likened to the 'Introduction' part of the IMRAD structure in academic writing. Here, the scholar, surrounded by books and celestial globes, embodies the curiosity and quest for knowledge that

propels a research inquiry. The globes and astronomical instruments symbolize the broader context and universal relevance of the study, setting the stage for the specific research question. The large window with light streaming in illuminates the scholar's workspace, metaphorically shedding light on the topic to be explored, just as an introduction illuminates the purpose and significance of the research. The open books suggest a gathering of existing knowledge, from which the new research will depart. This setting is the starting point, just as the introduction is where readers begin their journey through a paper, providing them with the necessary background and rationale for the research.

> MIDJOURNEY PROMPT: A scholar in a library. Bookshelves, documents, computers, laptops, globes, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 6

> PROMPT: Explain this image as an analogy for the notion of research strategies.

> ANSWER: The image can be an analogy for research strategies in several ways. The traveler, prepared with a book and binoculars, signifies the researcher equipped with theoretical knowledge and investigative

tools. His backpack suggests the accumulation of previous research and methodologies that support the journey ahead. The diverging paths represent different methodological approaches one can take—each leading to different outcomes and discoveries, symbolized by the various landscapes. The house in the background can symbol-

ize the foundational theories and established knowledge in the field, while the man working the land might represent the empirical work involved in research. Overall, the image captures the essence of research as a journey of exploration, requiring preparation, choosing the right path, and sometimes, the need to traverse through uncharted territories to discover new insights.

> MIDJOURNEY PROMPT: An explorer with a map and a toolbox, a road and a meadow in the background, asian vibes, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 7

> PROMPT: Suggest an analogy for research methods for data collection based on a girl picking flowers in a meadow. Max 100 words in fluent text.

> ANSWER: Picture a young girl named Sophie in a vibrant meadow, keen on creating a flower collection. She meticulously observes and notes details

for some, resembling an observational study. For a broader view, she surveys friends about their favorite blooms, mirroring surveys in research. Occasionally, she picks flowers to examine them closely, akin to case studies. Aware of the meadow's vastness, she randomly selects spots to gather samples, reflecting random sampling techniques. Throughout different seasons, she repeats her visits, capturing the essence of longitudinal studies. Sophie's multifaceted approach in the meadow elegantly mirrors diverse research methods for comprehensive data collection.

> MIDJOURNEY PROMPT: A Japanese girl picking flowers on a meadow, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 8

> PROMPT: Explain this image as an analogy for data analysis in research.

> ANSWER: This image, depicting a woman carefully arranging flowers in a vase, parallels the meticulous process of data analysis in research. The flowers can be seen as raw data, each unique and requiring careful consideration

to understand where they best fit within the arrangement, or the larger narrative of the research. The woman's focused attention to the flowers' placement echoes the analytical process of organizing and interpreting data, finding patterns, and placing data points in the correct context to ensure they contribute meaningfully to the overall picture. The shelves of bottles and books symbolize the various tools and knowledge bases researchers draw upon to analyze data, such as statistical methods and theoretical frameworks. Just as

the arrangement's beauty is in its organized diversity, the strength of data analysis lies in how it coherently integrates disparate pieces of information into a comprehensive understanding.

> MIDJOURNEY PROMPT: A florist arranging bouquets, a flowershop, books and flowers on the walls, asian vibes, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 9

> PROMPT: Explain this image as an analogy for design science.

> ANSWER: The image portrays an engineer meticulously drafting a blueprint in a workshop filled with complex machinery. This scene serves as a fitting analogy for design science, which is a systematic approach to the creation, testing, and evaluation of designs to achieve practical goals.

Just as the engineer in the image draws upon knowledge of mechanics, physics, and materials to design a machine, design science integrates theoretical knowledge with the practicalities of application to solve problems and innovate within a given field. The large machine in the background symbolizes the complexity and interconnectedness of design problems, reflecting the myriad factors that must be considered when creating something new. The drafting of plans indicates the importance of careful planning and the use of systematic methods in design science. The workshop environment suggests a space where theory meets practice—a core tenet of design science which emphasizes the interaction between empirical research and the creation of innovative solutions.

> MIDJOURNEY PROMPT: An engineer building a huge and complex machine, tools and drawings in the background, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 10

> PROMPT: Explain this image as an analogy for the Results section in an academic thesis. Max 125 words.

> ANSWER: The image metaphorically represents the Results section of an academic thesis. Each vase and its plant signify different categories of results. The first, with its complex flora, symbolizes rich, detailed findings central to the thesis. The second, with a single, upright stem, represents specific, targeted results for a particular research question. The third vase, transparent with a solitary bloom, illustrates clear, straightforward data. The fourth, with ethereal smoke and an abstract form, conveys unexpected or qualitative, less tangible results. Finally, the fifth vase with budding flowers suggests preliminary findings that hint at future research directions. To-

symbolizes rich, detailed findings central to the thesis. The second, with a single, upright stem, represents specific, targeted results for a particular research question. The third vase, transparent with a solitary bloom, illustrates clear, straightforward data. The fourth, with ethereal smoke and an abstract form, conveys unexpected or qualitative, less tangible results. Finally, the fifth vase with budding flowers suggests preliminary findings that hint at future research directions. To-

gether, these vases and plants convey the diversity and depth of outcomes that a comprehensive Results section would present.

> MIDJOURNEY PROMPT: Flower vases, many paintings with flowers, grass, asian vibes, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 11

as the Discussion section elucidates and defends the study's findings. The surrounding audience, representing the academic community, keenly observes, reflecting the scrutiny that research undergoes. The attorney's lantern, glowing with clarity, symbolizes the enlightenment of new insights, shedding light on the nuances and implications of the research. The vast courtroom embodies the arena of academic discourse, where findings are not only presented but also contextualized, critiqued, and linked to existing knowledge. The supporting documents on the tables evoke prior research, offering a foundation and context for new claims. Overall, this scene encapsulates the essence of the Discussion: a critical dialogue where research is both defended and integrated into the broader academic narrative.

> MIDJOURNEY PROMPT: A lawyer behind people in a courtroom, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 12

together clues to form a coherent narrative, critical thinking involves a similar methodical analysis of information.

The detective's focused attention represents the concentration and depth of thought required in critical thinking. The scattered papers and glasses suggest the need to organize and clarify one's thoughts. The shadowy figure in the background could symbolize the unknown or the yet-to-be-discovered truths that critical thinking aims to uncover.

In essence, the image is a metaphor for the process of critical thinking, where one must be observant, analytical, and meticulous in gath-

> PROMPT: Explain this image of a defense attorney as an analogy for the Discussion section in an academic paper. Max 150 words.

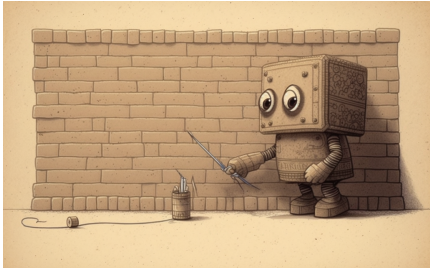
> ANSWER: This image portrays a defense attorney as a metaphor for the Discussion section of an academic paper. In the heart of a courtroom, the attorney stands resolute, championing her case

> PROMPT: Explain this image as an analogy for critical thinking.

> ANSWER: The image depicts a scene akin to a detective engaged in an investigation, carefully examining documents with a discerning eye. This serves as a potent analogy for critical thinking. Just as the detective scrutinizes the evidence, piecing together

ering and evaluating data to arrive at a well-founded conclusion. Just as a detective would not rush to judgment without sufficient evidence, critical thinking demands a careful and systematic approach to ensure that one's beliefs and decisions are well supported by reason and evidence.

> MIDJOURNEY PROMPT: A detective investigating a crime scene using a magnifying glass, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 13

> PROMPT: Explain this image as an analogy for academic writing. Academic writing is concise, clear, coherent, confident, impersonal and well-grounded. Use that in your answer. Max 150 words.

> ANSWER: In the image, the robot's process of building a brick wall symbolizes academic

writing. Each brick represents a concise statement, placed with clear intention to contribute to the larger structure. The uniformity of the bricks and the wall's straight lines reflect coherence and clarity, with no brick (or word) out of place. The robot's confident posture as it places each brick parallels the assertiveness with which a scholar presents research, standing firmly by each point made. The impersonality of the robot's mechanical nature suggests the objective tone of academic prose. Lastly, the solid and steadily rising wall embodies the well-grounded nature of academic arguments, built upon the firm foundation of evidence and research.

> MIDJOURNEY PROMPT: A cute little robot building a large simple brick wall, steampunk, pencil drawing –ar 16:10 –v 4



Chapter 14

> PROMPT: Explain this image as an analogy for reader engagement.

> ANSWER: This image can be seen as an analogy for reader engagement by illustrating a person deeply engrossed in a book, surrounded by a halo of light and intricate machinery. The halo and machines symbolize the imaginative and cognitive

processes that are stimulated when one is fully absorbed in reading. The reader's focused expression and the floating mechanical orbs and gears suggest a mind actively constructing knowledge or exploring new worlds, much like how engaging literature captivates and sparks the reader's imagination, leading to a rich, immersive experience. The image captures the transformative power of reading, where the reader becomes an active participant in the narrative, their thoughts intertwining with the story to create a vivid and personal

engagement.

> MIDJOURNEY PROMPT: A concentrated man reading a book with glowing pages, light bulbs, books and clouds in the background, steampunk, pencil drawing -ar 16:10 -v 5.2