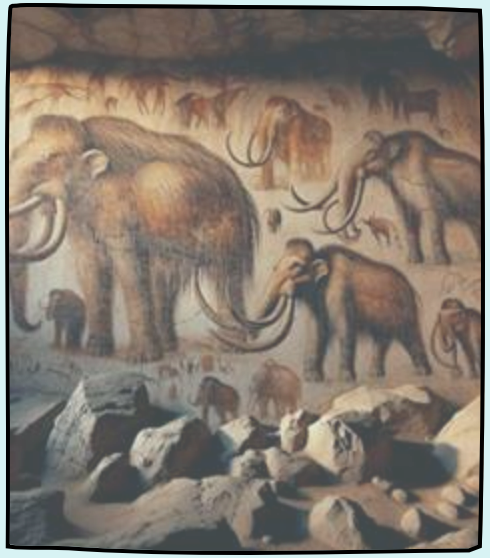

QUALITATIVE RESEARCH

...with Socio-Technical Grounded Theory

Prof Rashina Hoda

Faculty of Information Technology

www.rashina.com

MONASH University

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OVERVIEW

- Welcome and Introduction
- Qualitative Research in a Socio-Technical World
- Qualitative Data Analysis using STGT
- Examples
- Resources and Wrap up

Technical Briefing on Qual Research at ICSE (2021, 2023, 2024, 2025)

Setting Expectations:

- Safe space for learning
- Lots to cover! Need to balance between coverage and Q&A

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WHO ARE YOU?
WHY HERE?

Qual/GT experience:

- Never tried qual but want to explore it
- New to qualitative research, doing it
- Some experience in qual, not published yet
- Some experience in qual, few pubs
- Experienced in qual, several pubs

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WHO AM I?
WHY AM I HERE?

Not philosophically...though I regularly question that :)

RASHINA HODA

www.rashina.com LinkedIn: search "Rashina Hoda"

Professor of Software Engineering, Faculty of IT, Monash University, Melbourne

Research focus on human and socio-technical aspects of software engineering, AI, digital health

~20 years experience in conducting Qualitative research, last ~10 years also Mixed methods

Here to share knowledge, practical tips, resources on qualitative research and qualitative data analysis in SE and learn together!

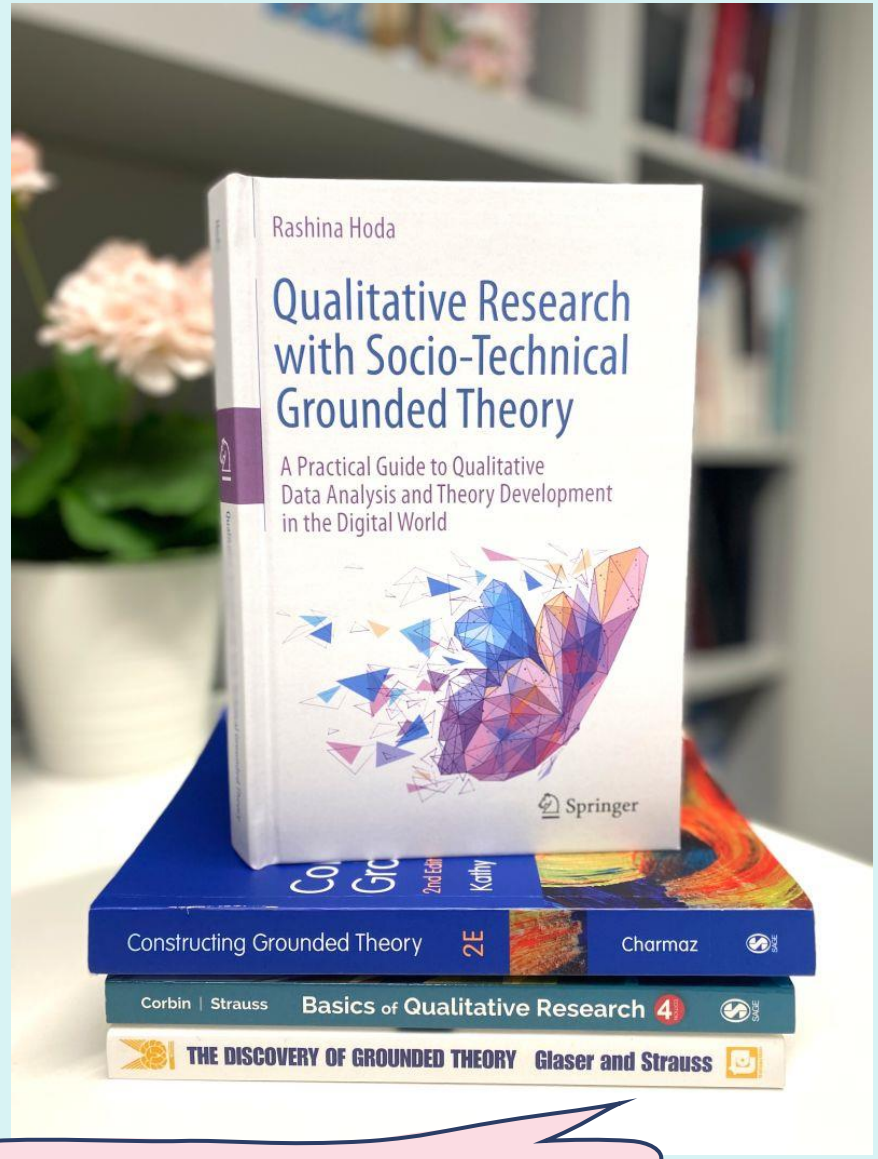
KEY REFERENCES

Book: Qualitative Research with Socio-Technical Grounded Theory, Springer, 2024

On SpringerLink (should be free download through Uni)

On Amazon or request your library to acquire a physical copy

First Article: Socio-Technical Grounded Theory for Software Engineering, IEEE Transactions on Software Engineering, 2022



Standing on the shoulders of giants

How the Book is Structured

Empirical Research

- Research Design Canvas (Chap 4)
- Research Philosophy (Chap 5)
- Literature Reviews (Chap 6)

Qualitative Research

- Basics of Qual Data Collection (Chap 7)
- Techniques of Qual Data Collection (Chap 8)
- Qualitative Data Preparation and Filtering (Chap 9)
- Future Directions in Qualitative Research (Chap 14)

STGT

- Traditional GT Methods (Chap 2)
- STGT – An Overview (Chap 3)
- STGT for Qualitative Data Analysis (Chap 10)
- What is Theory? (Chap 11)
- Theory Development (Chap 12)
- Evaluation Guidelines (Chap 13)

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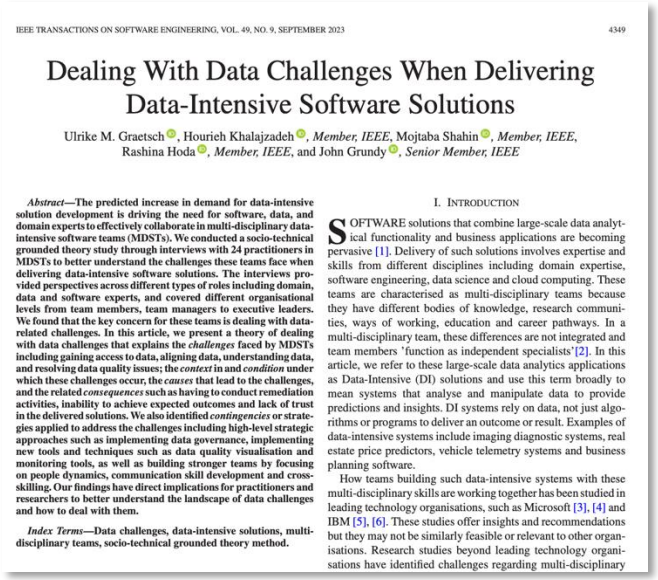
Some Examples of STGT in Use...



IEEE TRANSACTIONS ON SOFTWARE ENGINEERING, VOL. 49, NO. 9, SEPTEMBER 2023 4349

Dealing With Data Challenges When Delivering Data-Intensive Software Solutions

Ulrike M. Graetsch, Hourieh Khalajzadeh, *Member, IEEE*, Mojtaba Shahin, *Member, IEEE*, Rashina Hoda, *Member, IEEE*, and John Grundy, *Senior Member, IEEE*

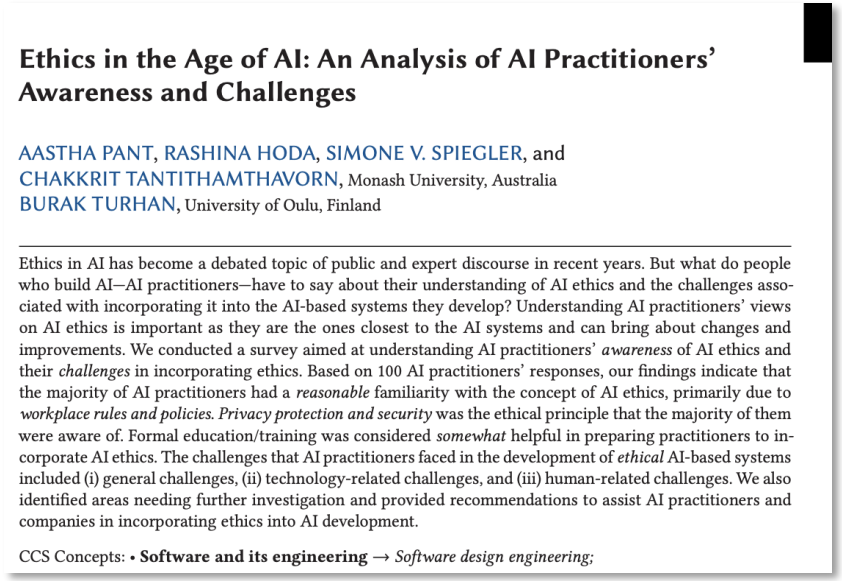
***Abstract*—The predicted increase in demand for data-intensive solution development is driving the need for software, data, and domain experts to effectively collaborate in multi-disciplinary data-intensive software teams (MDSTs). We conducted a socio-technical grounded theory study through interviews with 24 practitioners in MDSTs to better understand the challenges these teams face when delivering data-intensive software solutions. The interviews provided perspectives across different types of roles including domain, data and software experts, and covered different organisational levels from team members, team managers to executive leaders. We found that the key concern for these teams is dealing with data-related challenges. In this article, we present a theory of dealing with data challenges that explains the *challenges* faced by MDSTs including gaining access to data, aligning data, understanding data, and resolving data quality issues; the *context* in and *condition* under which these challenges occur, the *causes* that lead to the challenges, and the related *consequences* such as having to conduct remediation activities, inability to achieve expected outcomes and lack of trust in the delivered solutions. We also identified *contingencies* or strategies applied to address the challenges including high-level strategic approaches such as implementing data governance, implementing new tools and techniques such as data quality visualisation and monitoring tools, as well as building stronger teams by focusing on people dynamics, communication skill development and cross-skilling. Our findings have direct implications for practitioners and researchers to better understand the landscape of data challenges and how to deal with them.**

***Index Terms*—Data challenges, data-intensive solutions, multi-disciplinary teams, socio-technical grounded theory method.**

I. Introduction

SOFTWARE solutions that combine large-scale data analytical functionality and business applications are becoming pervasive [1]. Delivery of such solutions involves expertise and skills from different disciplines including domain expertise, software engineering, data science and cloud computing. These teams are characterised as multi-disciplinary teams because they have different bodies of knowledge, research communities, ways of working, education and career pathways. In a multi-disciplinary team, these differences are not integrated and team members 'function as independent specialists'[2]. In this article, we refer to these large-scale data analytics applications as Data-Intensive (DI) solutions and use this term broadly to mean systems that analyse and manipulate data to provide predictions and insights. DI systems rely on data, not just algorithms or programs to deliver an outcome or result. Examples of data-intensive systems include imaging diagnostic systems, real estate price predictors, vehicle telemetry systems and business planning software.

How teams building such data-intensive systems with these multi-disciplinary skills are working together has been studied in leading technology organisations, such as Microsoft [3], [4] and IBM [5], [6]. These studies offer insights and recommendations but they may not be similarly feasible or relevant to other organisations. Research studies beyond leading technology organisations have identified challenges regarding multi-disciplinary

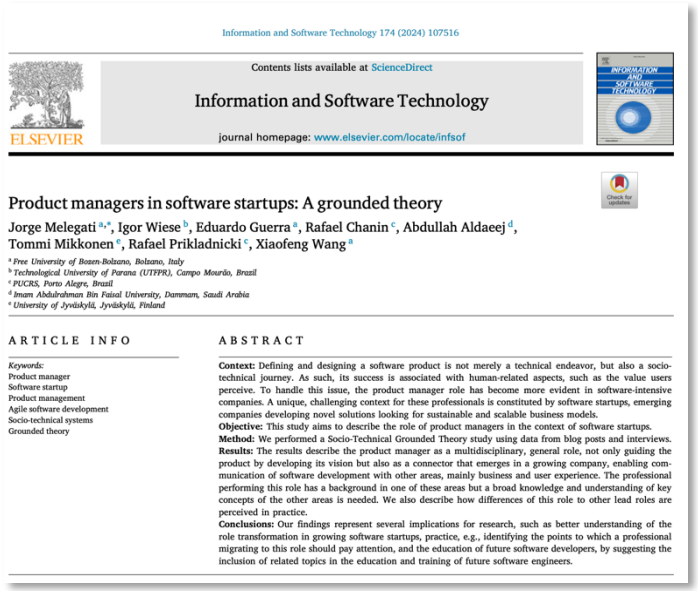


Ethics in the Age of AI: An Analysis of AI Practitioners' Awareness and Challenges

AASTHA PANT, RASHINA HODA, SIMONE V. SPIEGLER, and CHAKKRIT TANTITHAMTHAVORN, Monash University, Australia
BURAK TURHAN, University of Oulu, Finland

Ethics in AI has become a debated topic of public and expert discourse in recent years. But what do people who build AI—AI practitioners—have to say about their understanding of AI ethics and the challenges associated with incorporating it into the AI-based systems they develop? Understanding AI practitioners' views on AI ethics is important as they are the ones closest to the AI systems and can bring about changes and improvements. We conducted a survey aimed at understanding AI practitioners' *awareness* of AI ethics and their *challenges* in incorporating ethics. Based on 100 AI practitioners' responses, our findings indicate that the majority of AI practitioners had a *reasonable* familiarity with the concept of AI ethics, primarily due to *workplace rules and policies. Privacy protection and security* was the ethical principle that the majority of them were aware of. Formal education/training was considered *somewhat* helpful in preparing practitioners to incorporate AI ethics. The challenges that AI practitioners faced in the development of *ethical* AI-based systems included (i) general challenges, (ii) technology-related challenges, and (iii) human-related challenges. We also identified areas needing further investigation and provided recommendations to assist AI practitioners and companies in incorporating ethics into AI development.

CCS Concepts: • **Software and its engineering** → *Software design engineering;*



Information and Software Technology 174 (2024) 107516

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journal homepage: www.elsevier.com/locate/infsof

Product managers in software startups: A grounded theory

Jorge Melegati [a,*], Igor Wiese [b], Eduardo Guerra [a], Rafael Chanin [c], Abdullah Aldaeej [d], Tommi Mikkonen [e], Rafael Prikladnicki [c], Xiaofeng Wang [a]

[a] Free University of Bozen-Bolzano, Bolzano, Italy
[b] Technological University of Parana (UTFPR), Campo Mourão, Brazil
[c] PUCRS, Porto Alegre, Brazil
[d] Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
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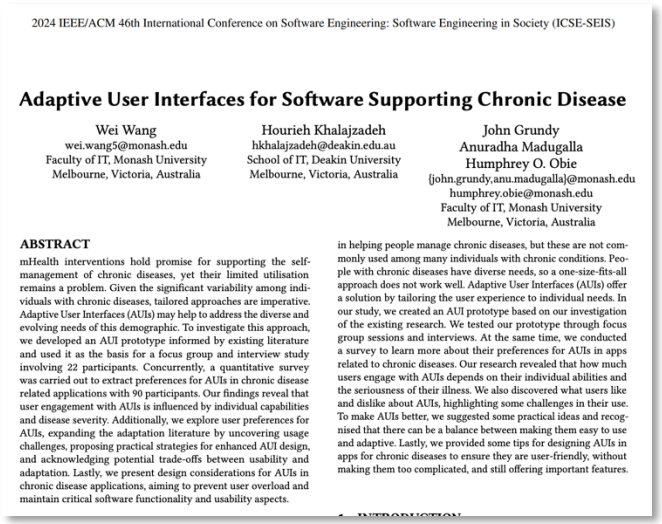
ARTICLE INFO

Keywords:
Product manager
Software startup
Product management
Agile software development
Socio-technical systems
Grounded theory

ABSTRACT

Context: Defining and designing a software product is not merely a technical endeavor, but also a socio-technical journey. As such, its success is associated with human-related aspects, such as the value users perceive. To handle this issue, the product manager role has become more evident in software-intensive companies. A unique, challenging context for these professionals is constituted by software startups, emerging companies developing novel solutions looking for sustainable and scalable business models.
Objective: This study aims to describe the role of product managers in the context of software startups.
Method: We performed a Socio-Technical Grounded Theory study using data from blog posts and interviews.
Results: The results describe the product manager as a multidisciplinary, general role, not only guiding the product by developing its vision but also as a connector that emerges in a growing company, enabling communication of software development with other areas, mainly business and user experience. The professional performing this role has a background in one of these areas but a broad knowledge and understanding of key concepts of the other areas is needed. We also describe how differences of this role to other lead roles are perceived in practice.
Conclusions: Our findings represent several implications for research, such as better understanding of the role transformation in growing software startups, practice, e.g., identifying the points to which a professional migrating to this role should pay attention, and the education of future software developers, by suggesting the inclusion of related topics in the education and training of future software engineers.



2024 IEEE/ACM 46th International Conference on Software Engineering: Software Engineering in Society (ICSE-SEIS)

Adaptive User Interfaces for Software Supporting Chronic Disease

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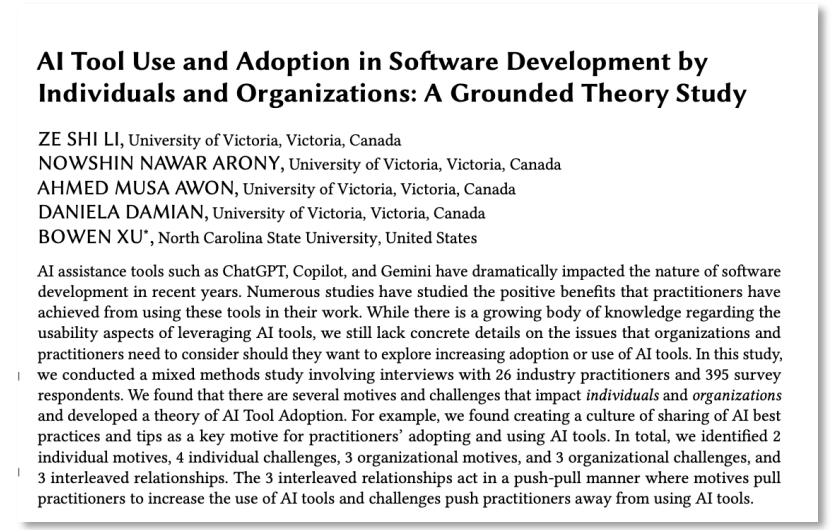
Melbourne, Victoria, Australia

ABSTRACT

mHealth interventions hold promise for supporting the self-management of chronic diseases, yet their limited utilisation remains a problem. Given the significant variability among individuals with chronic diseases, tailored approaches are imperative. Adaptive User Interfaces (AUIs) may help to address the diverse and evolving needs of this demographic. To investigate this approach, we developed an AUI prototype informed by existing literature and used it as the basis for a focus group and interview study involving 22 participants. Concurrently, a quantitative survey was carried out to extract preferences for AUIs in chronic disease related applications with 90 participants. Our findings reveal that user engagement with AUIs is influenced by individual capabilities and disease severity. Additionally, we explore user preferences for AUIs, expanding the adaptation literature by uncovering usage challenges, proposing practical strategies for enhanced AUI design, and acknowledging potential trade-offs between usability and adaptation. Lastly, we present design considerations for AUIs in chronic disease applications, aiming to prevent user overload and maintain critical software functionality and usability aspects.

in helping people manage chronic diseases, but these are not commonly used among many individuals with chronic conditions. People with chronic diseases have diverse needs, so a one-size-fits-all approach does not work well. Adaptive User Interfaces (AUIs) offer a solution by tailoring the user experience to individual needs. In our study, we created an AUI prototype based on our investigation of the existing research. We tested our prototype through focus group sessions and interviews. At the same time, we conducted a survey to learn more about their preferences for AUIs in apps related to chronic diseases. Our research revealed that how much users engage with AUIs depends on their individual abilities and the seriousness of their illness. We also discovered what users like and dislike about AUIs, highlighting some challenges in their use. To make AUIs better, we suggested some practical ideas and recognised that there can be a balance between making them easy to use and adaptive. Lastly, we provided some tips for designing AUIs in apps for chronic diseases to ensure they are user-friendly, without making them too complicated, and still offering important features.

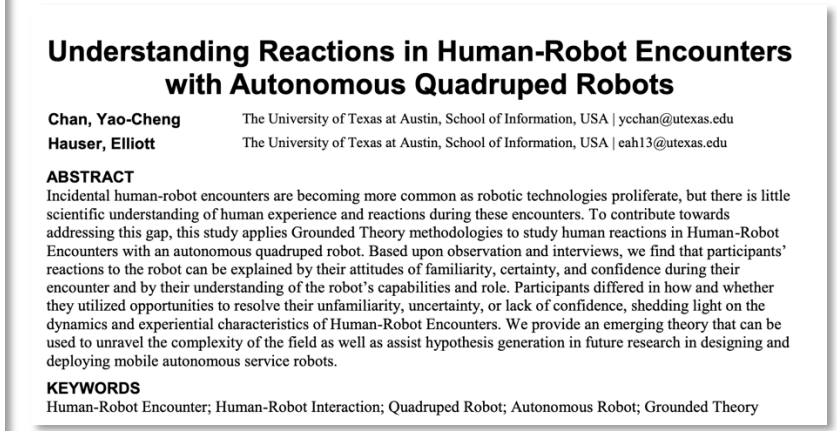
1 INTRODUCTION



AI Tool Use and Adoption in Software Development by Individuals and Organizations: A Grounded Theory Study

ZE SHI LI, University of Victoria, Victoria, Canada
NOWSHIN NAWAR ARONY, University of Victoria, Victoria, Canada
AHMED MUSA AWON, University of Victoria, Victoria, Canada
DANIELA DAMIAN, University of Victoria, Victoria, Canada
BOWEN XU*, North Carolina State University, United States

AI assistance tools such as ChatGPT, Copilot, and Gemini have dramatically impacted the nature of software development in recent years. Numerous studies have studied the positive benefits that practitioners have achieved from using these tools in their work. While there is a growing body of knowledge regarding the usability aspects of leveraging AI tools, we still lack concrete details on the issues that organizations and practitioners need to consider should they want to explore increasing adoption or use of AI tools. In this study, we conducted a mixed methods study involving interviews with 26 industry practitioners and 395 survey respondents. We found that there are several motives and challenges that impact *individuals* and *organizations* and developed a theory of AI Tool Adoption. For example, we found creating a culture of sharing of AI best practices and tips as a key motive for practitioners' adopting and using AI tools. In total, we identified 2 individual motives, 4 individual challenges, 3 organizational motives, and 3 organizational challenges, and 3 interleaved relationships. The 3 interleaved relationships act in a push-pull manner where motives pull practitioners to increase the use of AI tools and challenges push practitioners away from using AI tools.



Understanding Reactions in Human-Robot Encounters with Autonomous Quadruped Robots

Chan, Yao-Cheng The University of Texas at Austin, School of Information, USA | ycchan@utexas.edu
Hauser, Elliott The University of Texas at Austin, School of Information, USA | eah13@utexas.edu

ABSTRACT

Incidental human-robot encounters are becoming more common as robotic technologies proliferate, but there is little scientific understanding of human experience and reactions during these encounters. To contribute towards addressing this gap, this study applies Grounded Theory methodologies to study human reactions in Human-Robot Encounters with an autonomous quadruped robot. Based upon observation and interviews, we find that participants' reactions to the robot can be explained by their attitudes of familiarity, certainty, and confidence during their encounter and by their understanding of the robot's capabilities and role. Participants differed in how and whether they utilized opportunities to resolve their unfamiliarity, uncertainty, or lack of confidence, shedding light on the dynamics and experiential characteristics of Human-Robot Encounters. We provide an emerging theory that can be used to unravel the complexity of the field as well as assist hypothesis generation in future research in designing and deploying mobile autonomous service robots.

KEYWORDS

Human-Robot Encounter; Human-Robot Interaction; Quadruped Robot; Autonomous Robot; Grounded Theory

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SELECTED EXAMPLES OF STGT STUDIES

Table 3.1 Examples of studies applying socio-technical grounded theory (STGT) as a *full method* and in limited capacity *for data analysis*

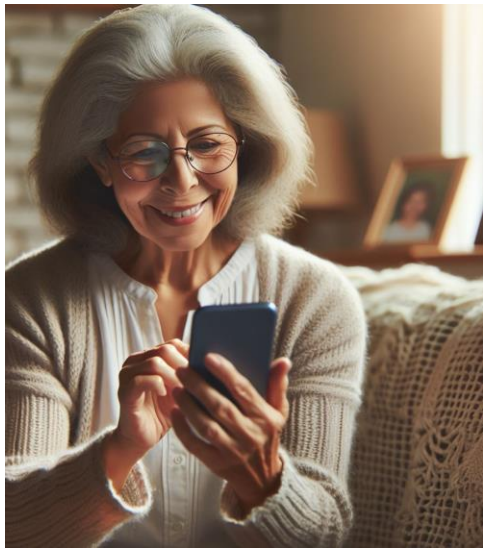
Reference	Title	Research domains	Publication venue	STGT application	Study type	Reported outcome
Graetsch et al. (2023)	*Dealing with data challenges when delivering data-intensive software solutions*	Artificial Intelligence, Software Engineering	IEEE Transactions on Software Engineering	Full STGT method *(basic & advanced stages)*	Qualitative	Theory
Pant et al. (2023)	*Ethics in the age of AI: An analysis of AI practitioners' awareness and challenges*	Artificial Intelligence, Software Engineering	ACM Transactions on Software Engineering and Methodology	STGT for data analysis	Mixed methods	Descriptive findings
Gama and Lacerda (2023)	*Understanding and supporting neurodiverse software developers in agile teams*	Psychology, Software Engineering	Proceedings of the XXXVII Brazilian Symposium on Software Engineering	Full STGT method *(basic stage)*	Qualitative	Descriptive findings
Hidellaarachchi et al. (2023)	*The influence of human aspects on requirements engineering-related activities: Software practitioners' perspective*	Requirements Engineering	ACM Transactions on Software Engineering and Methodology	STGT for data analysis	Mixed methods	Descriptive findings
Gunatilake et al. (2024)	*Enablers and barriers of empathy in software developer and user interactions: A mixed methods case study*	Human aspects, Software Engineering	ACM Transactions on Software Engineering and Methodology	STGT for data analysis	Mixed methods	Descriptive findings
Madampe et al. (2023)	*A framework for emotion-oriented requirements change handling in agile software engineering*	Requirements Engineering, Software Engineering	IEEE Transactions on Software Engineering	STGT for data analysis	Mixed methods	Descriptive findings
Madampe et al. (2022)	*The emotional roller coaster of responding to requirements changes in software engineering*	Requirements Engineering, Software Engineering	IEEE Transactions on Software Engineering	STGT for data analysis	Mixed methods	Descriptive findings
Li et al. (2023)	*Enhancing blockchain adoption through tailored software engineering: An industrial-grounded study in education credentialing*	Blockchain, Software Engineering	Distributed Ledger Technologies: Research and Practice	STGT for data analysis	Mixed methods	Descriptive findings
Wang et al. (2023)	*Adapting user interfaces for software supporting chronic diseases*	Digital Health, Human–Computer Interaction	IEEE Symposium on Visual Languages and Human-Centric Computing	STGT for data analysis	Mixed methods	Descriptive findings
Chan and Hauser (2023)	*Understanding human-robot encounters*	Human–Robot Interaction	Proceedings of the Association for Information Science and Technology	Full STGT method	Mixed methods	Emerging theory

[Table 3.1 Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

WHY QUALITATIVE?
WHY IN SE?

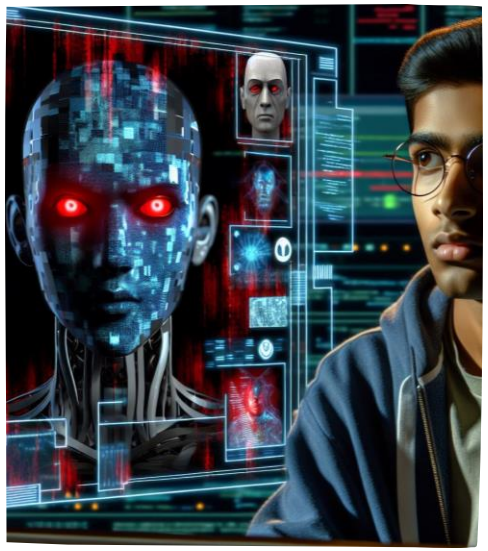
The Importance of Qualitative Research in SE...

Human Factors



Needs

Ethical Aspects

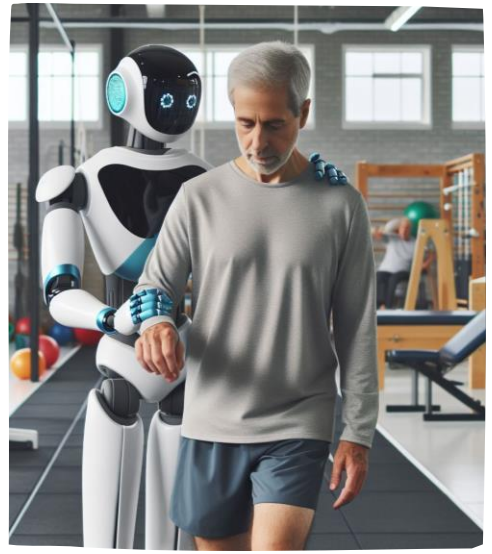


Risks

Tool Evaluations

Experiences

Human-AI Collaboration



Perceptions

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Experiences, perceptions, knowledge, values, beliefs, visions, facts, AI generated data ... in words

Qualitative Data - Where and How it Matters

Wei - PhD Student
Health & Nursing
Qual research

Topic: Understanding patient experience in digital health

Research Plan: Co-design with patients (qual) + Interviews (qual)

Hina - Postdoc
Data Science/AI
Mixed methods

Topic: Developing an LLM powered tool for bug detection

Research Plan: Tool development + functional testing + Developer experience (qual observations/survey)

Matt - Research Assistant
Business Management
Mixed methods

Topic: The impact of AI adoption on organizational culture

Research Plan: Org wide survey of level of adoption (quant) + focus groups with departments (qual)

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EXERCISE!

4 MINS

1. Share a recent/current project topic with your neighbour (not the method or plan - just the topic)
2. Let them guess the qualitative part of your project (don't correct them if you don't have one)
3. Share (briefly) your planned approach. Consider: Does it include a qual aspect? If not, should it?

Swap and repeat 1-3

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WHY SOCIO-TECHNICAL?

What do we mean by Socio-Technical?

"where the social and technical aspects are interwoven in such a way that studying one without due consideration for the other makes for incomplete investigation and understanding"

SE is Socio-Technical!

Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

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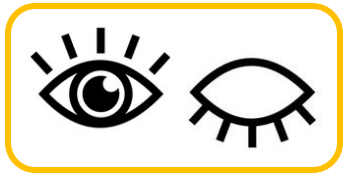
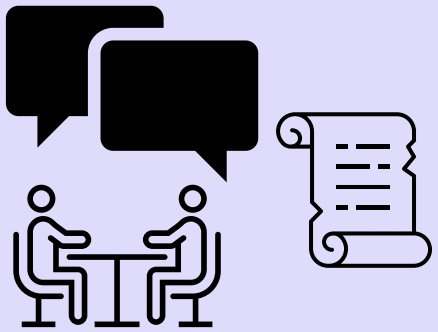
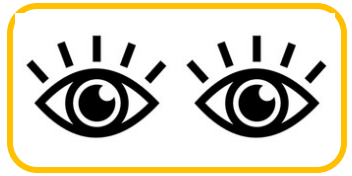
EXAMPLE: WHAT COMES TO MIND WHEN I SAY "COMMUNICATION"?



human aspects social aspects



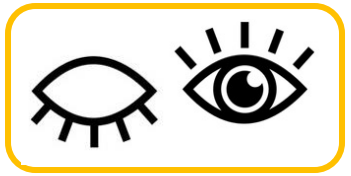
Social Aspects of Communication



humans building tech humans using tech

humans working with tech (AI) humans using tech to build tech

Communication as a Socio-Technical Phenomenon



building tech using tech

Technical Aspects of Communication

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Most disciplines are increasingly socio-technical...

Changing Landscape of Research

- Software Engineering
- Information Systems
- Artificial Intelligence/ML/DS
- Computer Science
- Human Centered Computing
- Human Computer Interaction
- Human Robot Interaction
- Digital Health
- E-Commerce
- Ethics
- Education
- Law
- Business Management
- Psychology
- Sociology
- Retail
- Supply Chain Management

Scholarly Communication Podcast on "The World is Changing...Our Research Must Change too"
https://newbooksnetwork.com/the-world-is-changing-our-research-must-change-too

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Need for a Socio-Technical Approach

Most of what we study is socio-technical

Most of what we use for qualitative research comes from social sciences, e.g., case study, ethnography, grounded theory...

Apply a socio-technical approach to studying socio-technical topics? YES!

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Social and Technical aspects are closely interwoven, studying one without the other makes for incomplete research and understanding

A Socio-Technical World

Wei - PhD Student
Health & Nursing
Qual research

Topic: Understanding patient experience in digital health

Social: patient experience
Technical: digital tools, technologies
Socio-technical: understanding patient experience with digital environments

Hina - Postdoc
Data Science/AI
Mixed methods

Topic: Developing an LLM powered tool for bug detection

Social: developer experience
Technical: tool development
Socio-technical: tool development for enhanced developer experience

Matt - Research Assistant
Business Management
Mixed methods

Topic: The impact of AI adoption on organizational culture

Social: aspects of organizational culture
Technical: AI tools and technologies
Socio-technical: impact of AI adoption on organization culture

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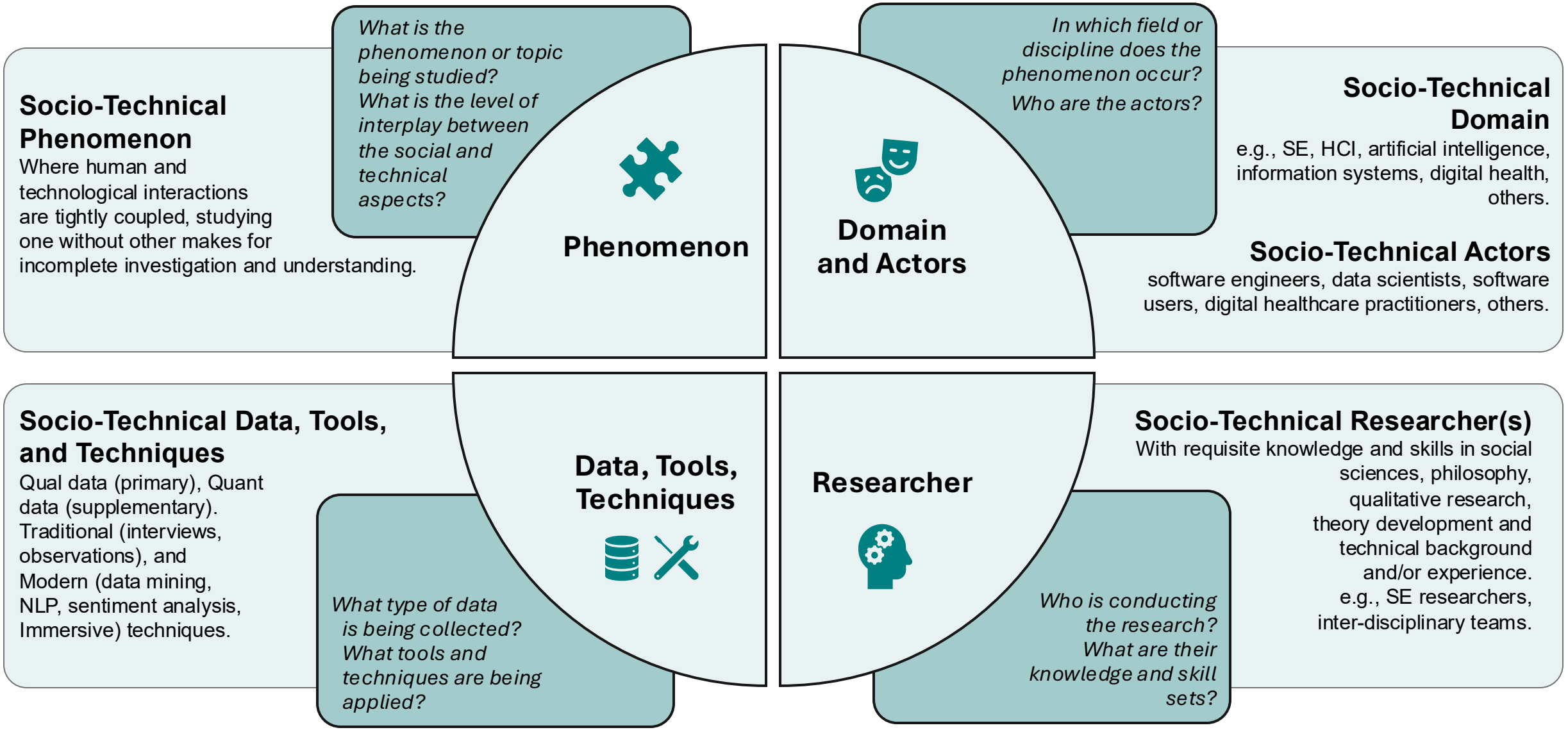
QUALITATIVE RESEARCH IN A SOCIO-TECHNICAL WORLD

Socio-Technical Research Framework

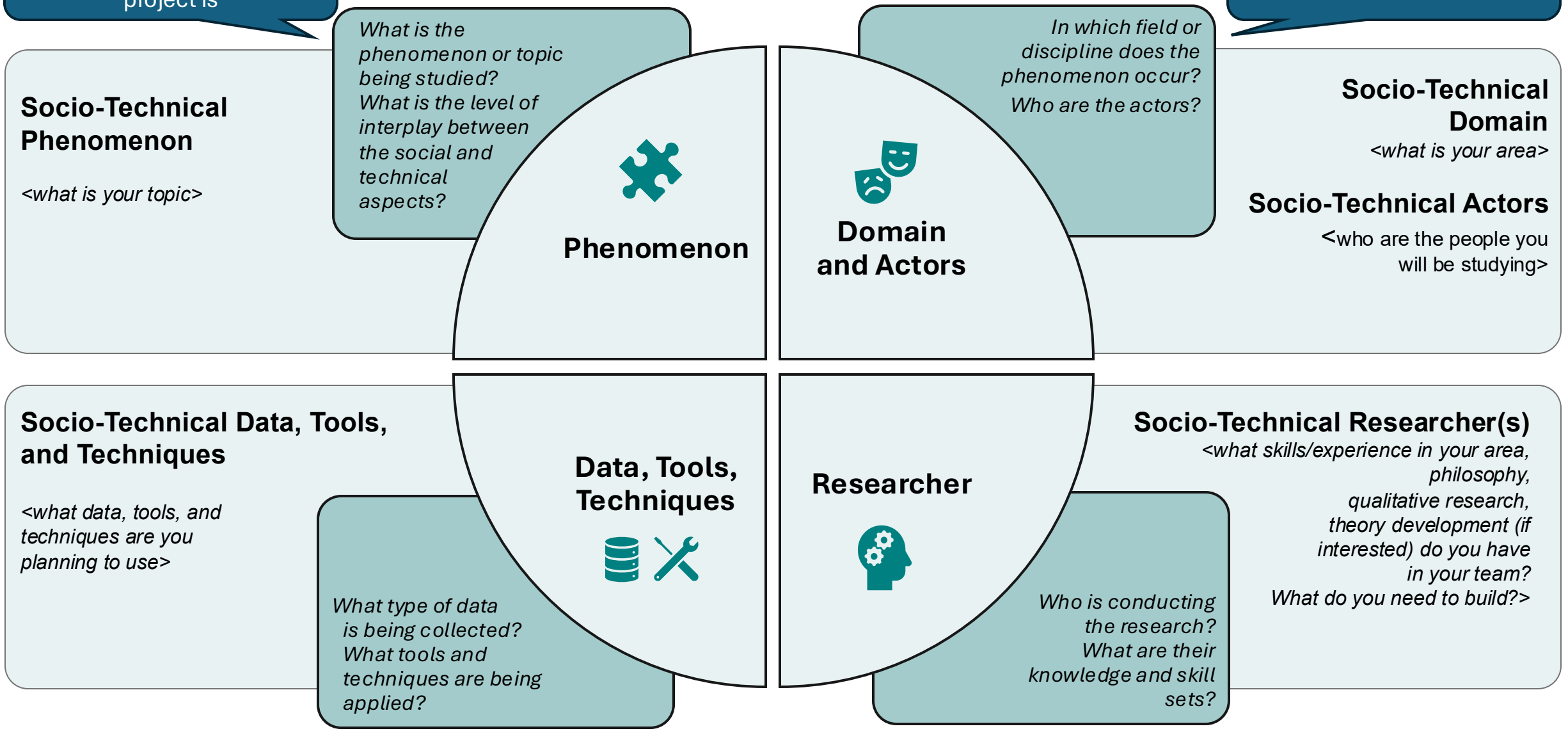


[Figure 3.3 in Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

Socio-Technical Research Framework

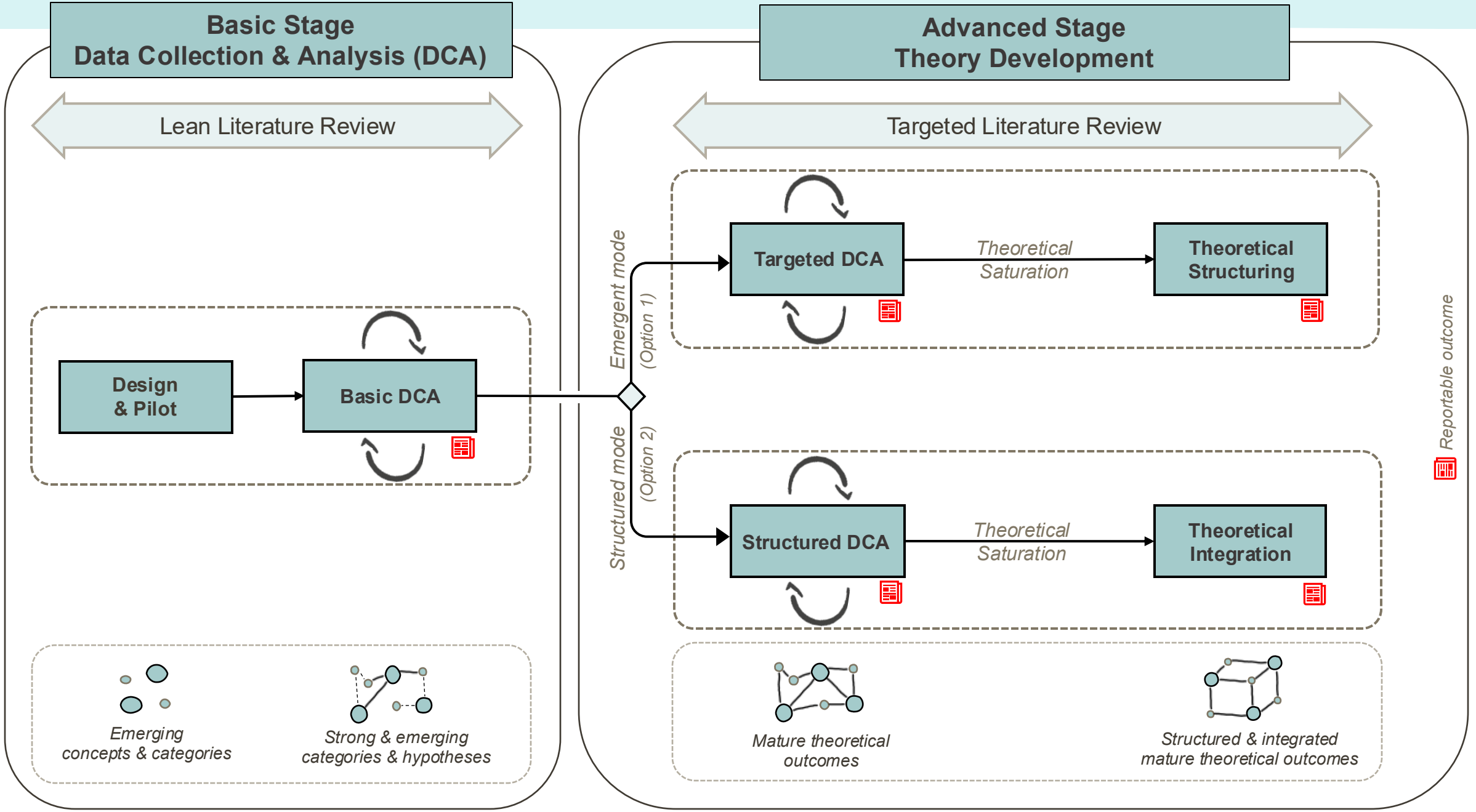
Fill in to see how socio-technical your research project is

Use to motivate use of STGT in your research



[Figure 3.3 in Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

SOCIO-TECHNICAL GROUNDED THEORY (STGT) - THE METHOD



Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

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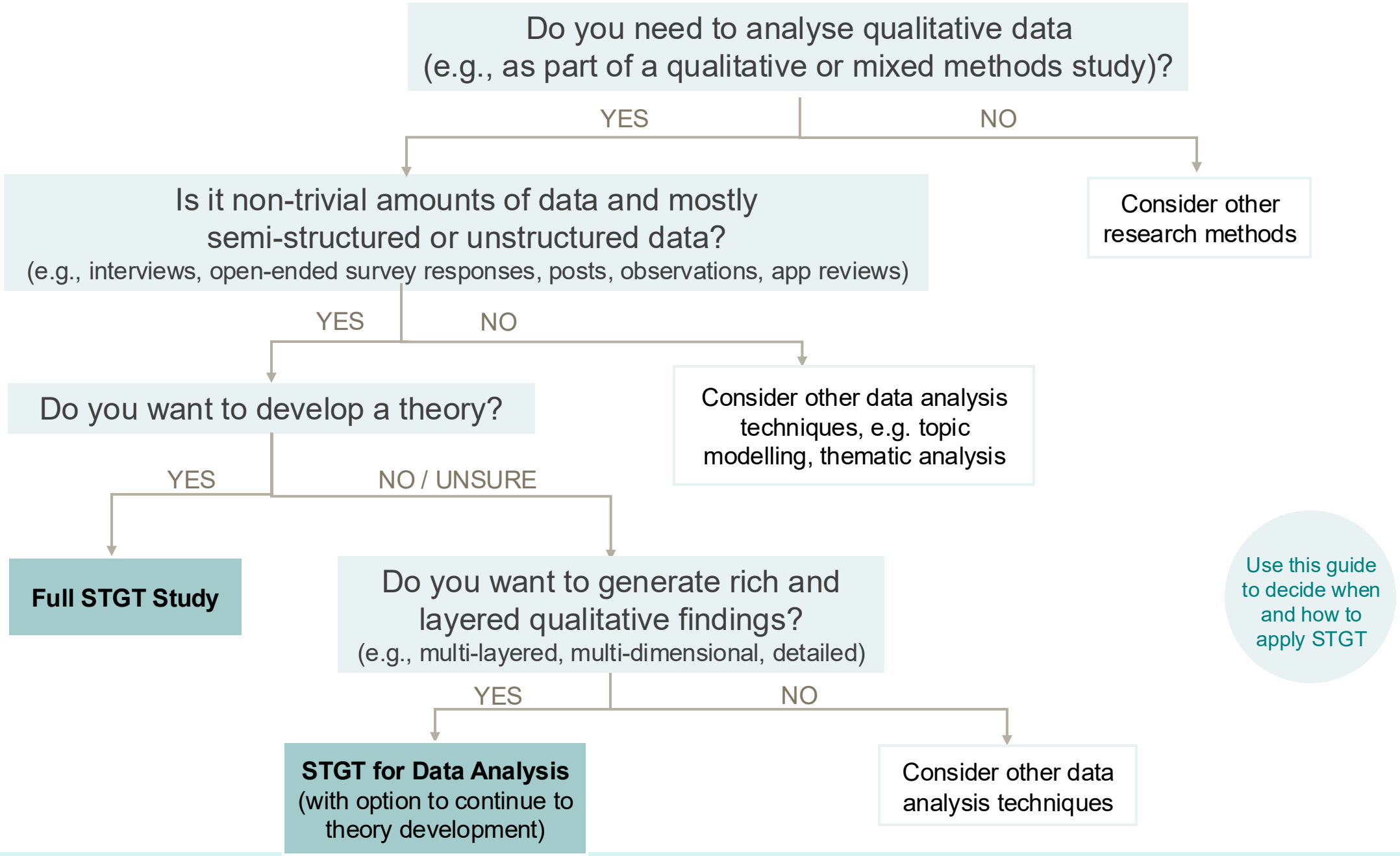
SOCIO-TECHNICAL GROUNDED THEORY (STGT) – APPLICATION SELECTION GUIDE



Use this guide to decide when and how to apply STGT

[Figure 3.5 in Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

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CHAPTER 7. BASICS OF QUALITATIVE DATA COLLECTION

CHAPTER 8. TECHNIQUES OF QUALITATIVE DATA COLLECTION

CHAPTER 9. QUALITATIVE DATA FILTERING AND PREPARATION

CHAPTER 10. STGT FOR QUALITATIVE DATA ANALYSIS

Qualitative data collection, prep, and analysis

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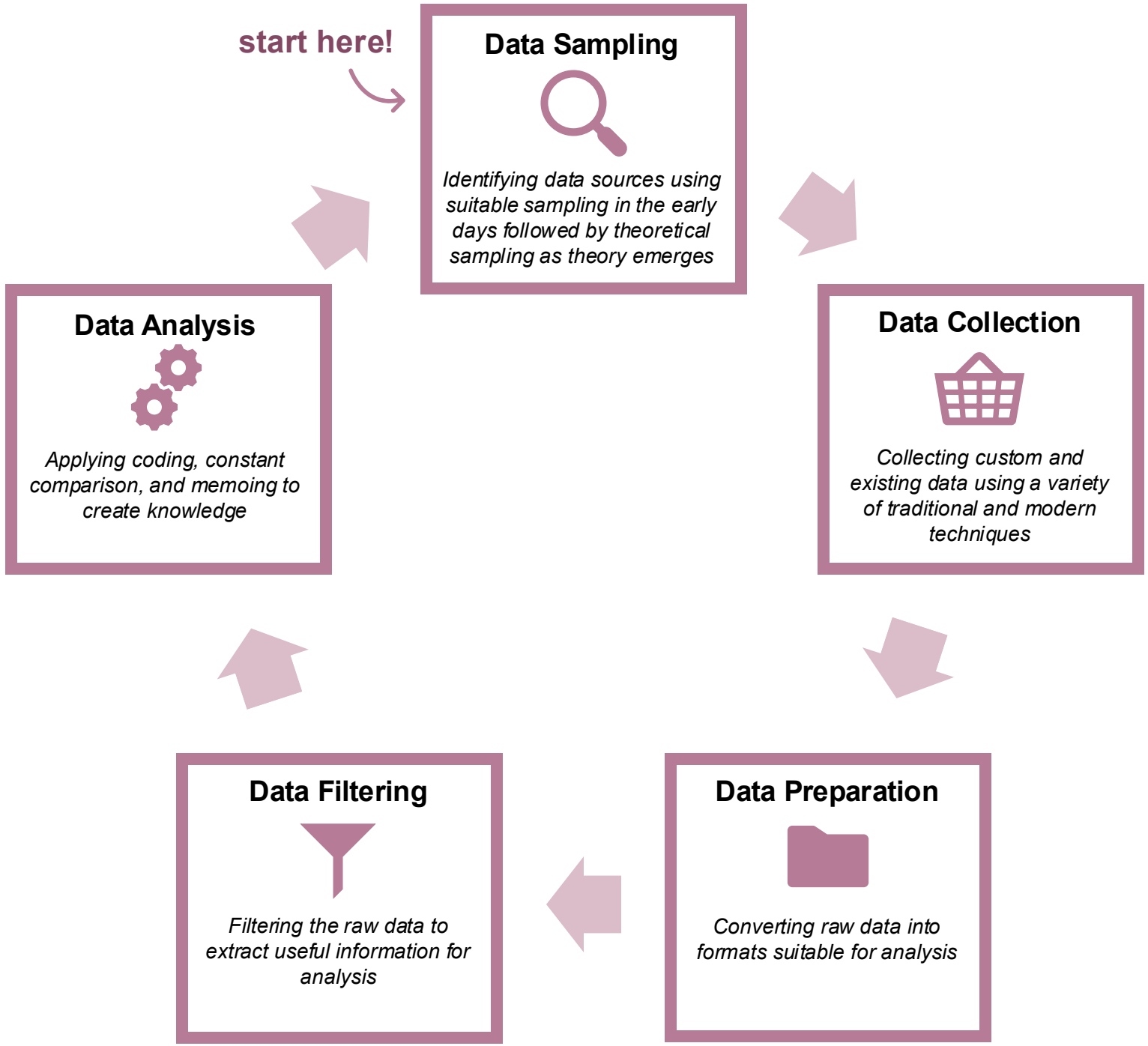
BASICS OF QUALITATIVE DATA COLLECTION

Chapter 7

Iterative Data Collection and Analysis



[Figure 7.1 from Chapter 7]
Hoda, R. (2024) Qualitative Research with Socio-Technical Grounded Theory, Springer.

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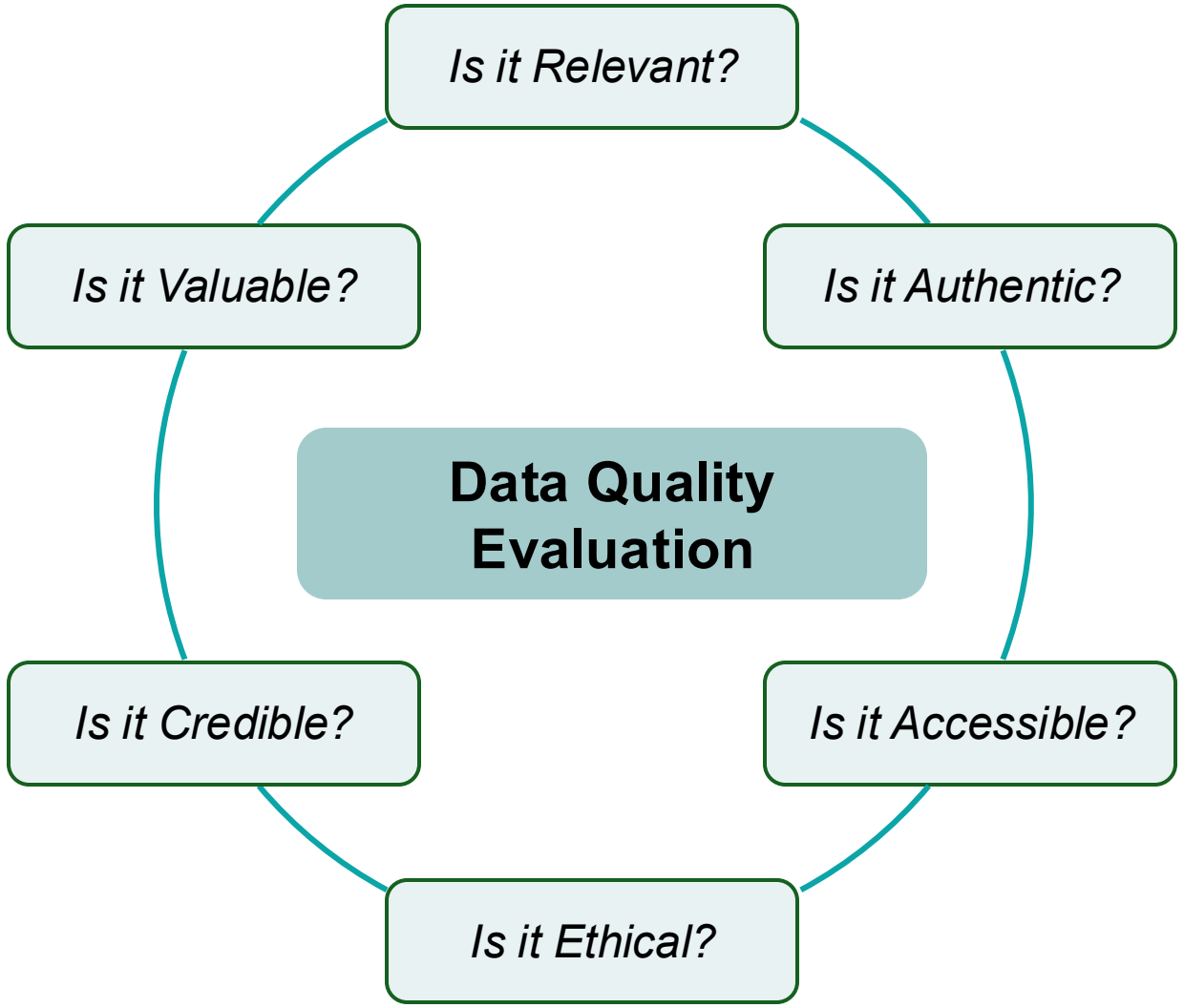

[Figure 7.5 in Chapter 7] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

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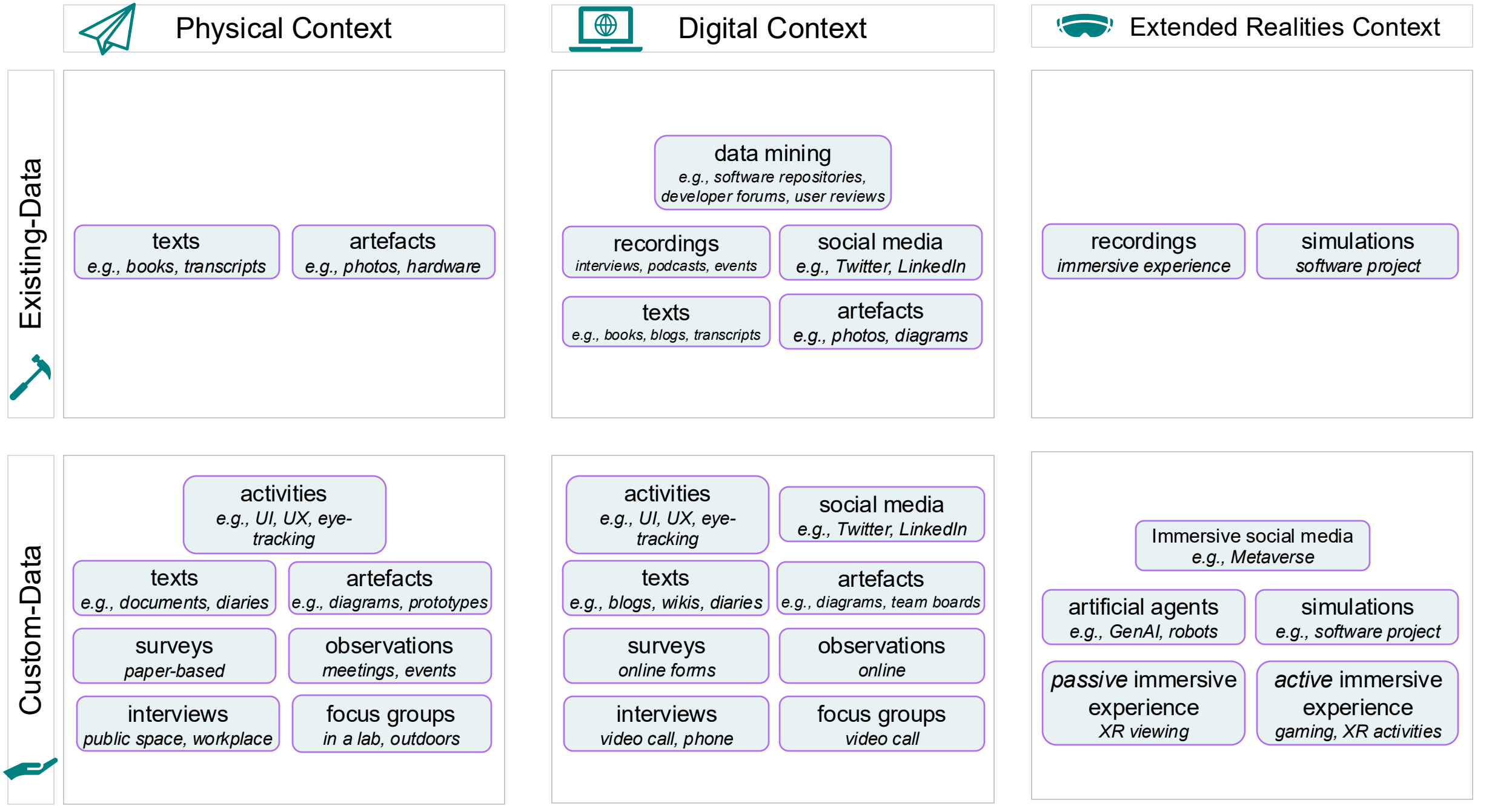
TECHNIQUES OF QUALITATIVE DATA COLLECTION

Chapter 8



[Figure 8.1 from Chapter 8] Hoda, R. (2024) Qualitative Research with Socio-Technical Grounded Theory, Springer.

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DATA COLLECTION TECHNIQUES

Pre-interview Questionnaires

Semi-structured Interviews

Observations

Using LLMs

Other techniques:

Focus groups, workshops, surveys, recordings, texts, social media, artefacts, data mining, immersive experiences in extended realities

In Chapter 8, for each technique:

- Definition
- Advantages
- Threats and Limitations
- Sample
- Tips

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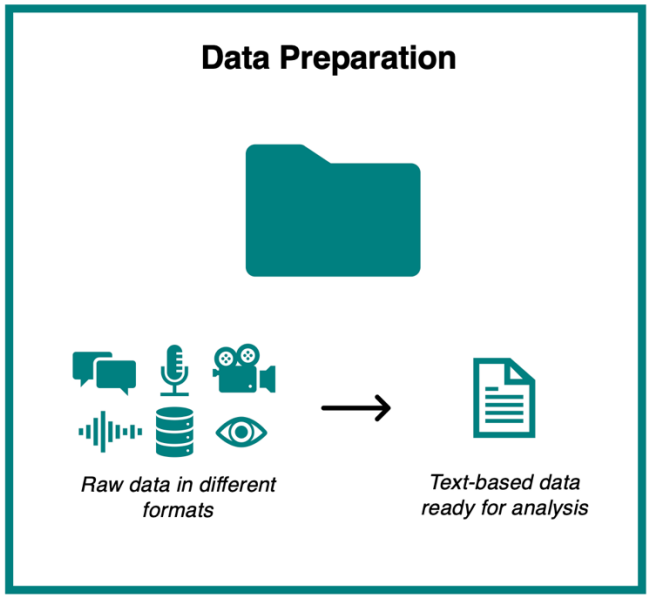
QUALITATIVE DATA PREPARATION AND FILTERING

Chapter 9

Data Preparation and Filtering

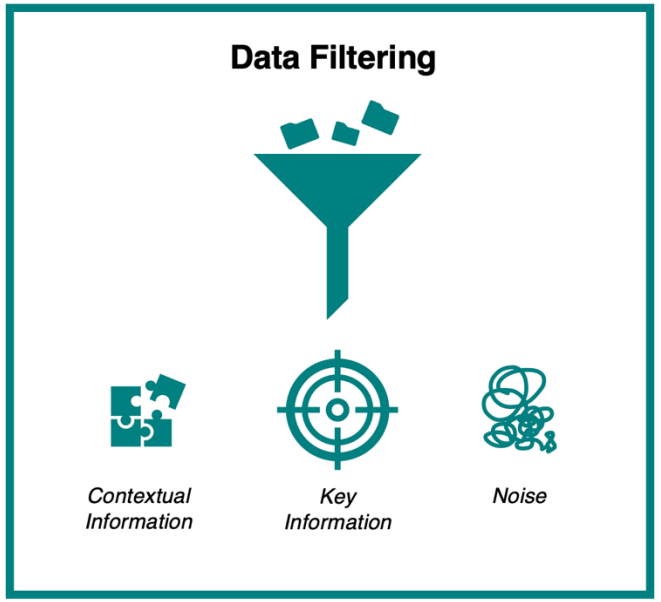
Definition

Data preparation *is the process of converting the raw data into formats (typically text-based) where qualitative analysis can be performed effectively, efficiently, and with ease and confidence.*



Definition

Data filtering *is the process of identifying the key information, contextual information, and noise in the raw data.* Data filtering can be performed alongside coding or ahead of coding in cases where the data is expected to contain considerable noise.



[Chapter 8 and Chapter 9] Hoda, R. (2024) Qualitative Research with Socio-Technical Grounded Theory, Springer.

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Tools for Qualitative Data Analysis

NVIVO

MAXQDA

atlas.ti

Google Docs

Google Sheets

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Using GenAI

ChatGPT

Microsoft Copilot

perplexity

Claude

Bano, M., Hoda, R., Zowghi, D., & Treude, C. (2024). Large language models for qualitative research in software engineering: exploring opportunities and challenges. Automated Software Engineering, 31(1), 8.

See Chap 14 for my thoughts from playing around with ChatGPT

Check your institutional guidelines on the use of AI/GenAI in research

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STGT FOR QUALITATIVE DATA ANALYSIS

Chapter 10

THE ASSUMPTIONS LIST

List ten things you believe to be true about your topic *before* you begin the data collection and analysis

These are your assumptions ☺

Keep the list handy - to check yourself when you lean into your assumptions

Share the list with team - so you can check each other

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Qualitative Data Analysis with STGT

Open Coding

- Open scope of application (code comprehensively and thoroughly)
- Analysts keeps an open mindset

Constant Comparison

- Compare newly arising codes with existing codes
- Group similar codes together into concept; similar concepts into (sub)categories

Memoing

- Capture reflections, possible links, questions, ideas
- Secret ingredient to achieving richness in findings and high-quality outcomes

Use STGT in limited capacity for qualitative data analysis only to develop categories, emerging relationships, theories, theoretical models, taxonomies...

Conduct a full STGT study to develop mature theories, theoretical models, frameworks, taxonomies, guidelines...

[Chapter 10] Hoda, R. (2024) Qualitative Research with Socio-Technical Grounded Theory, Springer.

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OPEN CODING

Definition

Coding is the process of closely inspecting, deeply making sense of, and inferring meaning from data and giving those meanings some labels or names, called codes.

Open coding is the process of coding data inductively and comprehensively, with an open mindset, to enable emergence of information and insights, without looking to find anything specific in the data.

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CODING WITH HASHTAGS

Definition

Coding with hashtags is the process of creating hashtags—a word or short phrase prefixed with a hash symbol (#)—to conceptualise and represent a key idea in a parsimonious (concise and elegant) way.

Think of creating codes as creating new #Hashtags

#AusElections2025 #AcademicTwitter #FridayVibes #PhDlife

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ZOOM OUT-ZOOM IN APPROACH

Full Study or Dataset Level
(e.g., all interviews)

Data Unit Level
(e.g., one interview)

Semantic Level
(e.g., sentence, paras)

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[Figure 10.3 in Chapter 10] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer

LET'S TRY OPEN CODING WITH HASHTAGS!

Hint: takes a few attempt ☺

PARTICIPANT QUOTE - ATTEMPT 1

Try it Yourself

Reminder: no one is judging, we are here to learn!

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

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Quote taken from an interview with a software developer done by Samuel Lucas as part of an STGT study on the developer perspectives on adopting LLM based software development tools

PARTICIPANT QUOTE - ATTEMPT 1

Let's do data filtering first

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

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PARTICIPANT QUOTE - ATTEMPT 1

What's wrong?

#usingAsAReference

#learningBetterWithLL

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

#toldNot2Use

#usingOutsideofWork

#licensingIssues

Poor Coding. First attempt!

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PARTICIPANT QUOTE - ATTEMPT 2

What's better now?

#usingGitHubCopilotAsAReferen ce

#learningBetterWithCopilotAsRef

#notUsingGitHubCopilot4Codi ng

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

#notUsingBlindly

#usingOutsideofWor k

#licensingIssues (reason4ban)

#bannedUseAtWor k

Satisfactory (Descriptive) Coding!

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PARTICIPANT QUOTE - ATTEMPT 3

#usingGitHubCopilotAsAReferen
ce
#learningBetterWithCopilotAsRef
#notUsingGitHubCopilot4Coding
#notUsingBlindly

#carefulUseOfLLMS (Copilot)
#criticalApproach2UsingLLMs
(Copilot)

What's even better?

potential concept: #strategies4UsingLLMs? (need evidence)

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

#workPoliciesBanUse

#personalInteres
t (re: side
projects)

#licensingIssues
(reason4ban)

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PARTICIPANT QUOTE - ATTEMPT 4

#usingGitHubCopilotAsAReferen
ce
#learningBetterWithCopilotAsRef
#notUsingGitHubCopilot4Coding
#notUsingBlindly

#carefulUseOfLLMS (Copilot)
#criticalApproach2UsingLLMs
(Copilot)

What's even better?

potential concept: #strategies4UsingLLMs? (need evidence)

…I always used to use this [GitHub copilot] as a reference and not as a coding tool. because I sort of felt like, you know, I'll be learning better when I'm using it as a reference rather than you know, just blindly copying things from it. So that's how I initially used it most of the time. And to be honest, I started using this … outside of work rather than at work, because we were told to not use it because of all the licensing issues and all the things that might be there.

#workPoliciesBanUse

#personalInteres
t (re: side
projects)

#licensingIssues
(reason4ban)

Good (Comprehensive + Analytical) Coding!

#initial?early?UseOfLLMs

potential concept: #evolvingUseOfLLMs? (need evidence)

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MEMOING

– the 'secret sauce'

MEMOING

Definition

Memoing is the ongoing process of documenting the researcher's thoughts, ideas, questions, and reflections on emerging codes, concepts, and categories and evidence-based conjectures on possible links between them (Hoda, 2022). Memos can be in the form of written notes, sketches, maps, diagrams, photos, annotations, and audio and video recordings. Memoing is an imperative procedure that distinguishes socio-technical grounded theory from other qualitative research methods, generates insights, and drives theory development.

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[Chapter 10] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

SAMPLE MEMO

Grounded in evidence (codes, P#s)
Synthesizing across data
Exploring possible emerging concepts and relationships

Memo "Differences in Use of LLMs arising from features they offer."

P2 said they use GitHub copilot differently to Perplexity. For Perx. they mainly use it for #convenientReferencing (#PerplexityAsAReferencingTool) while they tend to use GitHub copilot is mainly for #generatingCode (#GitHubAsACodingTool)

Note to self: this makes sense. I tried both (date: 12 Nov 2024). Copilot does not provide source/reference while Perp. does. So, it makes sense that P2 sees #PerxplexityAsAReferencingTool

In other words, different LLMs can be used differently (e.g., as #referencingTool or #codeGenerationTool) depending on the features they offer.

Potential Concepts: #LLMsAsDifferentTools or #LLMsAsTools or #PurposefulUseOfLLMs

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CONSTANT COMPARISON

CONSTANT COMPARISON

DEFINITION

Constant comparison is the process of comparing codes derived from within the same data unit and across all data units to find common patterns among them. Using constant comparison, similar *codes* are grouped to form a *concept*, and similar concepts are combined to form a *category*. Sometimes, an additional level of *subcategory* may arise between concept and category levels and *super-categories* above the category level.

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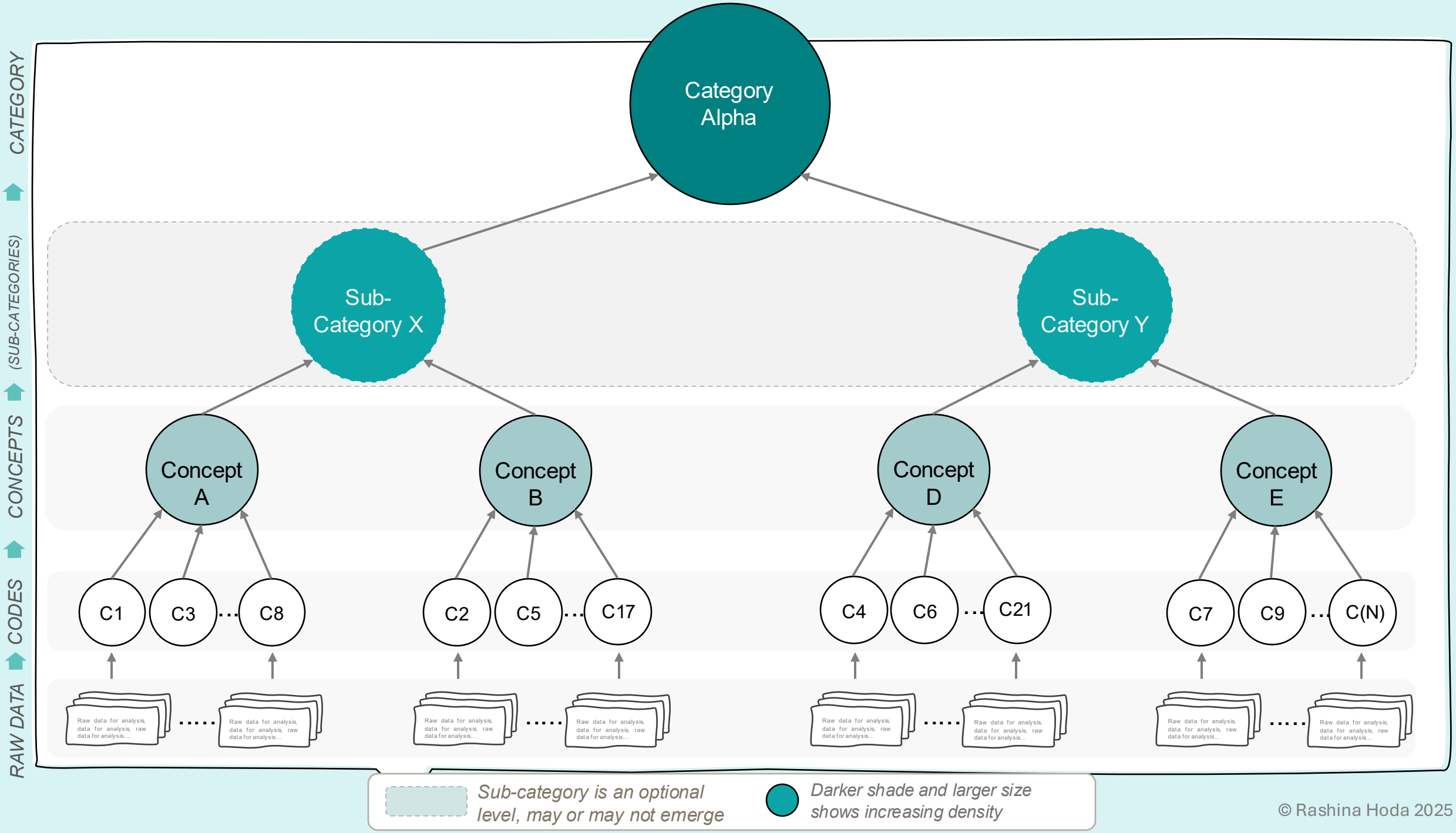
[Chapter 10] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.



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#Scam

#unintentionalUpgrade

#noCustomerService

#multipleContactChannels

"Very frustrated, pro version is scam I've had this app for about a month or so. I unintentionally upgraded to the pro version ($99.00) because I had my fingerprint set with the App Store. I called the company phone number listed on my visa statement, only to hear a recorded voice. You're then told to go to iTunes.com/bill regarding charges, then the call dies. After going to the site, you run into another dead end. [Company] has zero customer service. I've yet to talk to a person from company."

#poorReview

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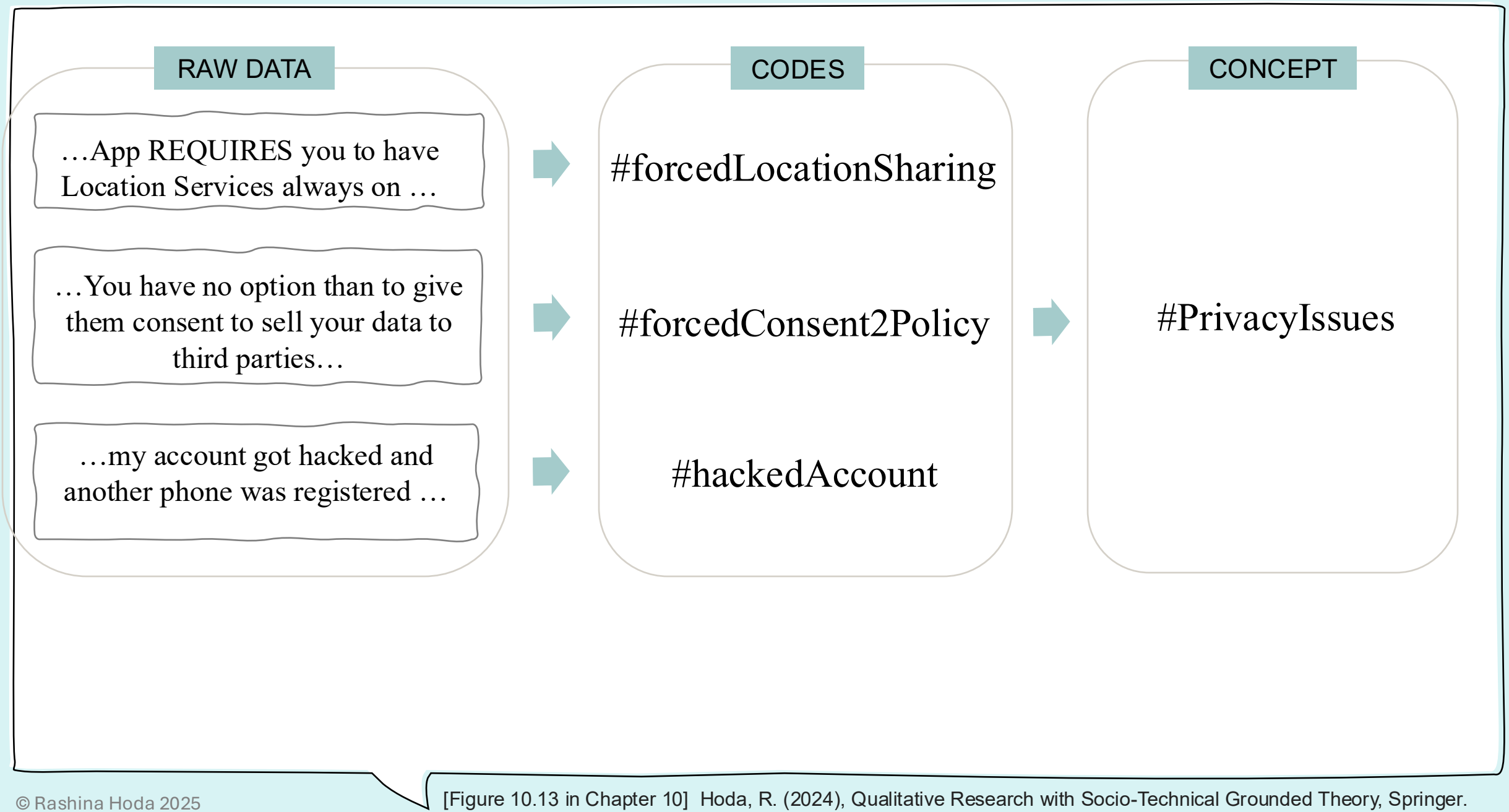
[Figure 10.12 in Chapter 10] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.



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[Figure 10.13 in Chapter 10] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

EXAMPLES OF STGT APPLICATIONS AND OUTCOMES

Application: Full STGT Method

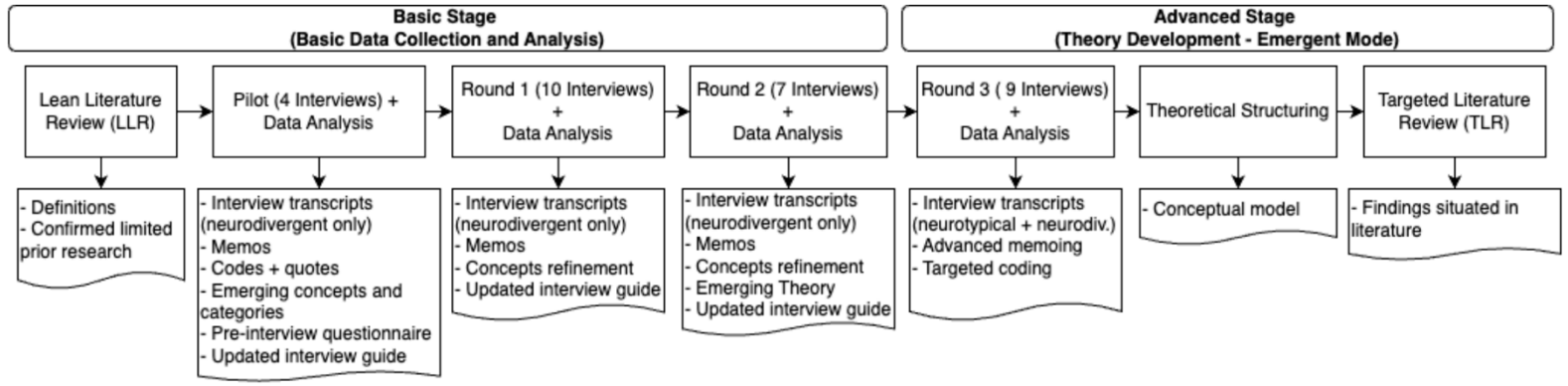


Fig. 1. Socio-technical grounded theory method applied using basic and advanced stages. The main steps are the rectangles with the respective outputs below.

Outcome: Theory

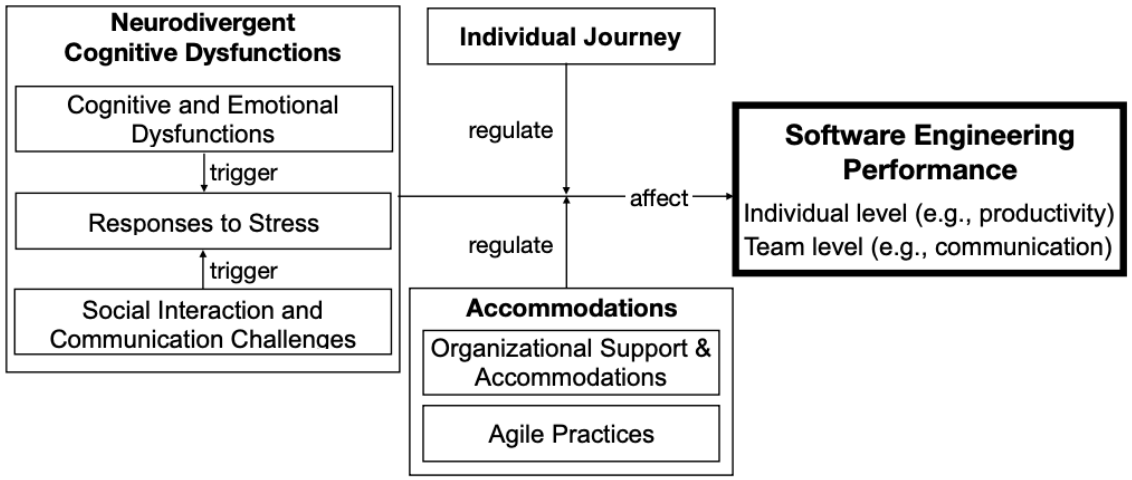
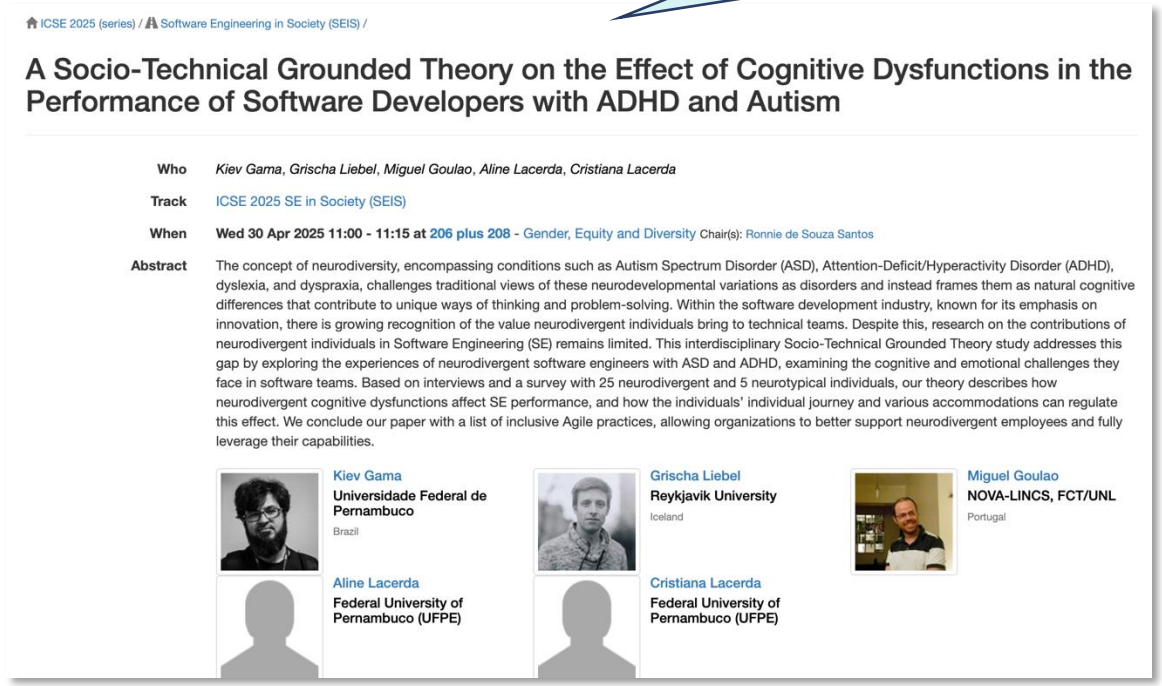


Fig. 2. Theory on the Effect of Neurodivergent Cognitive Dysfunctions in Software Engineering Performance

Publication: ICSE-SEIS 2025



ICSE 2025 (series) / Software Engineering in Society (SEIS) /

A Socio-Technical Grounded Theory on the Effect of Cognitive Dysfunctions in the Performance of Software Developers with ADHD and Autism

Who *Kiev Gama, Grischa Liebel, Miguel Goulao, Aline Lacerda, Cristiana Lacerda*

Track ICSE 2025 SE in Society (SEIS)

When **Wed 30 Apr 2025 11:00 - 11:15 at 206 plus 208** - Gender, Equity and Diversity Chair(s): Ronnie de Souza Santos

Abstract The concept of neurodiversity, encompassing conditions such as Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), dyslexia, and dyspraxia, challenges traditional views of these neurodevelopmental variations as disorders and instead frames them as natural cognitive differences that contribute to unique ways of thinking and problem-solving. Within the software development industry, known for its emphasis on innovation, there is growing recognition of the value neurodivergent individuals bring to technical teams. Despite this, research on the contributions of neurodivergent individuals in Software Engineering (SE) remains limited. This interdisciplinary Socio-Technical Grounded Theory study addresses this gap by exploring the experiences of neurodivergent software engineers with ASD and ADHD, examining the cognitive and emotional challenges they face in software teams. Based on interviews and a survey with 25 neurodivergent and 5 neurotypical individuals, our theory describes how neurodivergent cognitive dysfunctions affect SE performance, and how the individuals' individual journey and various accommodations can regulate this effect. We conclude our paper with a list of inclusive Agile practices, allowing organizations to better support neurodivergent employees and fully leverage their capabilities.

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Reykjavik University
Iceland

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NOVA-LINCS, FCT/UNL
Portugal

Aline Lacerda
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Cristiana Lacerda
Federal University of Pernambuco (UFPE)

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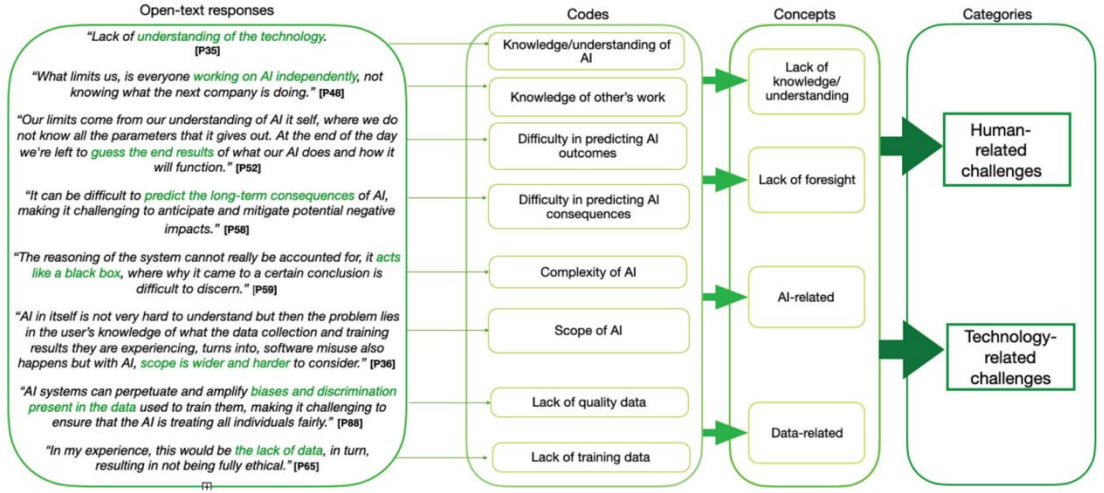

Fig. 2. Examples of STGT analysis [18] applied to qualitative data on challenges/barriers in incorporating ethics in AI.

Application: Mixed Methods with STGT for Qualitative Data Analysis and Statistical Quantitative Analysis

Table 1. Data Sources and Analysis Types used to Answer RQs (Descriptive Statistics for Quantitative Data Analysis and STGT for Qualitative Data Analysis)

RQ	Data Source	Data Analysis Type	Purpose of Analysis
RQ1	Closed-ended question	Quantitative analysis	To get an overview of participants' awareness of different aspects related to AI ethics including (i) extent of awareness of "AI ethics" concept, (ii) awareness of AI ethical principles, (iii) reasons for awareness, and (iv) role of formal education/training in preparing AI practitioners to incorporate AI ethics
RQ2	Closed-ended, Follow-up open-ended question	Quantitative analysis Qualitative analysis	To get an overview of the extent to which AI practitioners are challenged to consider and follow each AI ethical principle and the key challenges they face in incorporating AI ethics

Outcome: Descriptive Findings

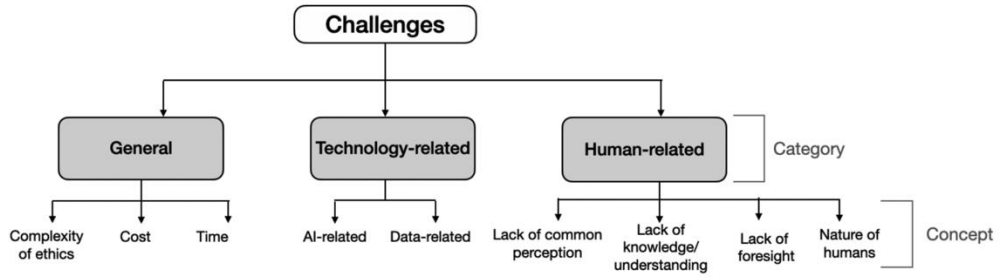

Fig. 12. Overview of the challenges/barriers in incorporating ethics in AI.

Publication: TOSEM

Ethics in the Age of AI: An Analysis of AI Practitioners' Awareness and Challenges

AASTHA PANT, RASHINA HODA, SIMONE V. SPIEGLER, and CHAKKRIT TANTITHAMTHAVORN, Monash University, Australia
BURAK TURHAN, University of Oulu, Finland

Ethics in AI has become a debated topic of public and expert discourse in recent years. But what do people who build AI—AI practitioners—have to say about their understanding of AI ethics and the challenges associated with incorporating it into the AI-based systems they develop? Understanding AI practitioners' views on AI ethics is important as they are the ones closest to the AI systems and can bring about changes and improvements. We conducted a survey aimed at understanding AI practitioners' *awareness* of AI ethics and their *challenges* in incorporating ethics. Based on 100 AI practitioners' responses, our findings indicate that the majority of AI practitioners had a *reasonable* familiarity with the concept of AI ethics, primarily due to *workplace rules and policies. Privacy protection and security* was the ethical principle that the majority of them were aware of. Formal education/training was considered *somewhat* helpful in preparing practitioners to incorporate AI ethics. The challenges that AI practitioners faced in the development of *ethical* AI-based systems included (i) general challenges, (ii) technology-related challenges, and (iii) human-related challenges. We also identified areas needing further investigation and provided recommendations to assist AI practitioners and companies in incorporating ethics into AI development.

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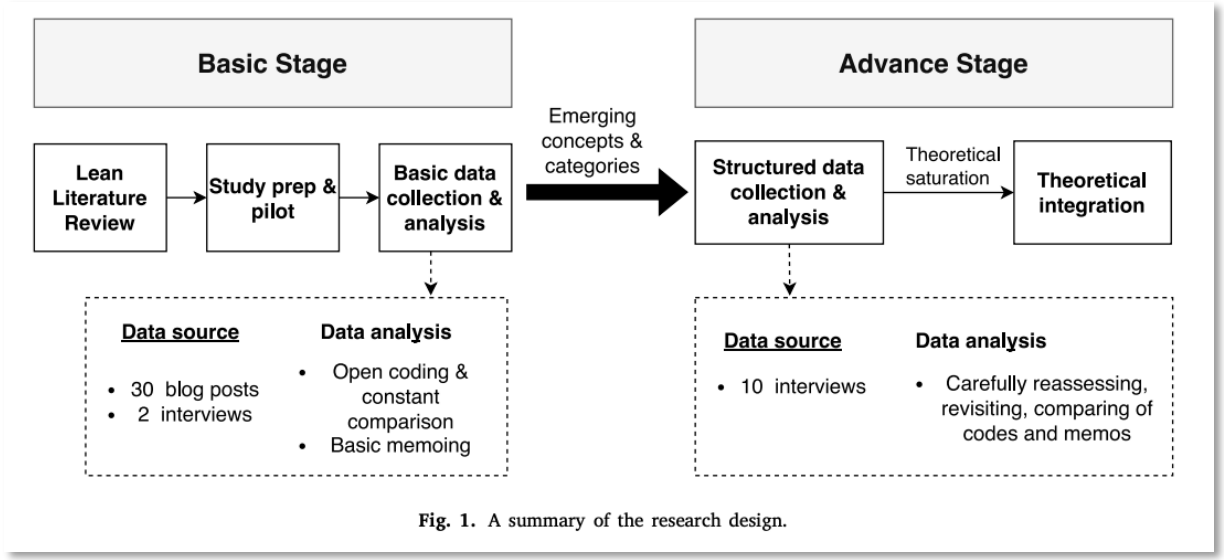

Fig. 1. A summary of the research design.

Application: Full STGT Method for Theory Development

Publication: IST

Outcome: Theory

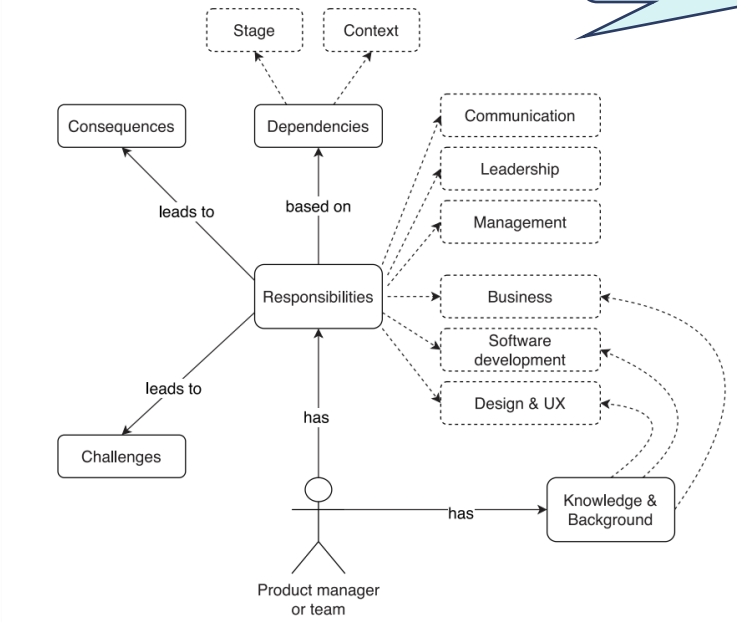

Fig. 3. A grounded theory on product management in software startups. Solid-line boxes and arrows represent core categories and their relationships. Dashed-line boxes represent subcategories linked to the core categories with dashed arrows.

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Product managers in software startups: A grounded theory

Jorge Melegati [a,*], Igor Wiese [b], Eduardo Guerra [a], Rafael Chanin [c], Abdullah Aldaeej [d], Tommi Mikkonen [e], Rafael Prikladnicki [c], Xiaofeng Wang [a]

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ARTICLE INFO

Keywords:
Product manager
Software startup
Product management
Agile software development
Socio-technical systems
Grounded theory

ABSTRACT

Context: Defining and designing a software product is not merely a technical endeavor, but also a socio-technical journey. As such, its success is associated with human-related aspects, such as the value users perceive. To handle this issue, the product manager role has become more evident in software-intensive companies. A unique, challenging context for these professionals is constituted by software startups, emerging companies developing novel solutions looking for sustainable and scalable business models.
Objective: This study aims to describe the role of product managers in the context of software startups.
Method: We performed a Socio-Technical Grounded Theory study using data from blog posts and interviews.
Results: The results describe the product manager as a multidisciplinary, general role, not only guiding the product by developing its vision but also as a connector that emerges in a growing company, enabling communication of software development with other areas, mainly business and user experience. The professional performing this role has a background in one of these areas but a broad knowledge and understanding of key concepts of the other areas is needed. We also describe how differences of this role to other lead roles are perceived in practice.
Conclusions: Our findings represent several implications for research, such as better understanding of the role transformation in growing software startups, practice, e.g., identifying the points to which a professional migrating to this role should pay attention, and the education of future software developers, by suggesting the inclusion of related topics in the education and training of future software engineers.

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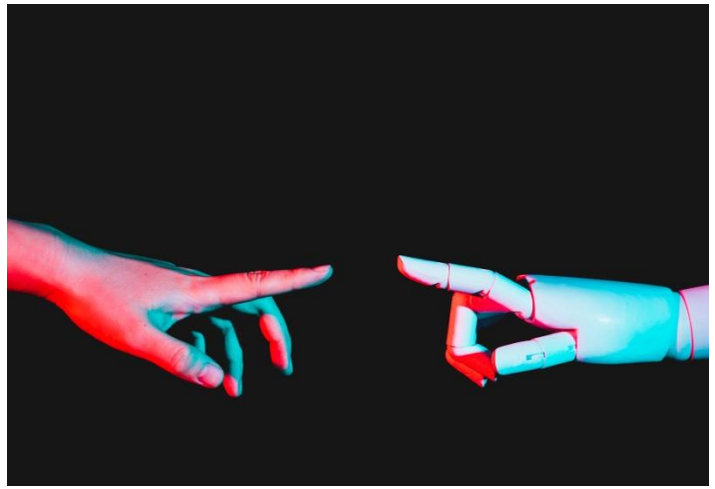
Reflections

- Consider including human experience in your research
- Embrace the socio-technical nature of your research
- Invest in learning research methods and techniques - pays off in quality outputs and in the long run
- Learn how to collect and analyse qualitative data
- Treat research method section as a first-class citizen in your manuscripts
- Tell compelling stories of human experience that complete your research and improve societal impact
- Reflect on your research practice to grow as a researcher



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Achieving Quality Outcomes
with Qualitative Research/Data...

YOU CAN DO IT!

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RESOURCES

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Book, Articles, Slides, Podcast, Videos...

Book: Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer. https://doi.org/10.1007/978-3-031-60533-8

TSE paper: Hoda, R. (2022), Socio-Technical Grounded Theory for Software Engineering, IEEE Transactions on Software Engineering.

Slides and Videos: on my website www.rashina.com/stgt

- ICSE technical briefings - ICSE 2021, ICSE 2023, ICSE 2024, ICSE 2025, HRI 2025
- Scholarly Communication Podcast on "The World is Changing...Our Research Must Change too" https://newbooksnetwork.com/the-world-is-changing-our-research-must-change-too

Studies using STGT: on Google Scholar, see citations of the book and TSE paper to find studies using STGT

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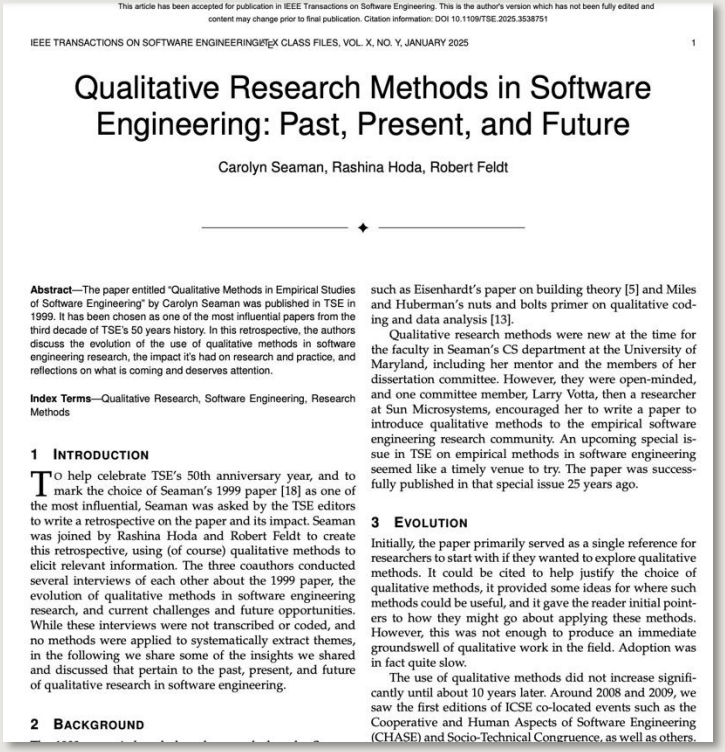
Article: Qualitative Research Methods in SE: Past, Present, And Future

by Carolyn Seaman, Rashina Hoda, Robert Feldt in IEEE Transactions on Software Engineering (50th Anniversary special issue), 2025

Marks the impact of Carolyn's original 1999 TSE paper that started the qual research ball rolling in SE 25 years ago and was selected as one of the "most influential papers" in TSE's 50 years history.



This article has been accepted for publication in IEEE Transactions on Software Engineering. This is the author's version which has not been fully edited and content may change prior to final publication. Citation information: DOI 10.1109/TSE.2025.3538751

Qualitative Research Methods in Software Engineering: Past, Present, and Future

Carolyn Seaman, Rashina Hoda, Robert Feldt

Abstract—The paper entitled "Qualitative Methods in Empirical Studies of Software Engineering" by Carolyn Seaman was published in TSE in 1999. It has been chosen as one of the most influential papers from the third decade of TSE's 50 years history. In this retrospective, the authors discuss the evolution of the use of qualitative methods in software engineering research, the impact it's had on research and practice, and reflections on what is coming and deserves attention.

Index Terms—Qualitative Research, Software Engineering, Research Methods

1 Introduction

To help celebrate TSE's 50th anniversary year, and to mark the choice of Seaman's 1999 paper [18] as one of the most influential, Seaman was asked by the TSE editors to write a retrospective on the paper and its impact. Seaman was joined by Rashina Hoda and Robert Feldt to create this retrospective, using (of course) qualitative methods to elicit relevant information. The three coauthors conducted several interviews of each other about the 1999 paper, the evolution of qualitative methods in software engineering research, and current challenges and future opportunities. While these interviews were not transcribed or coded, and no methods were applied to systematically extract themes, in the following we share some of the insights we shared and discussed that pertain to the past, present, and future of qualitative research in software engineering.

2 Background

such as Eisenhardt's paper on building theory [5] and Miles and Huberman's nuts and bolts primer on qualitative coding and data analysis [13].

Qualitative research methods were new at the time for the faculty in Seaman's CS department at the University of Maryland, including her mentor and the members of her dissertation committee. However, they were open-minded, and one committee member, Larry Votta, then a researcher at Sun Microsystems, encouraged her to write a paper to introduce qualitative methods to the empirical software engineering research community. An upcoming special issue in TSE on empirical methods in software engineering seemed like a timely venue to try. The paper was successfully published in that special issue 25 years ago.

3 Evolution

Initially, the paper primarily served as a single reference for researchers to start with if they wanted to explore qualitative methods. It could be cited to help justify the choice of qualitative methods, it provided some ideas for where such methods could be useful, and it gave the reader initial pointers to how they might go about applying these methods. However, this was not enough to produce an immediate groundswell of qualitative work in the field. Adoption was in fact quite slow.

The use of qualitative methods did not increase significantly until about 10 years later. Around 2008 and 2009, we saw the first editions of ICSE co-located events such as the Cooperative and Human Aspects of Software Engineering (CHASE) and Socio-Technical Congruence, as well as others.

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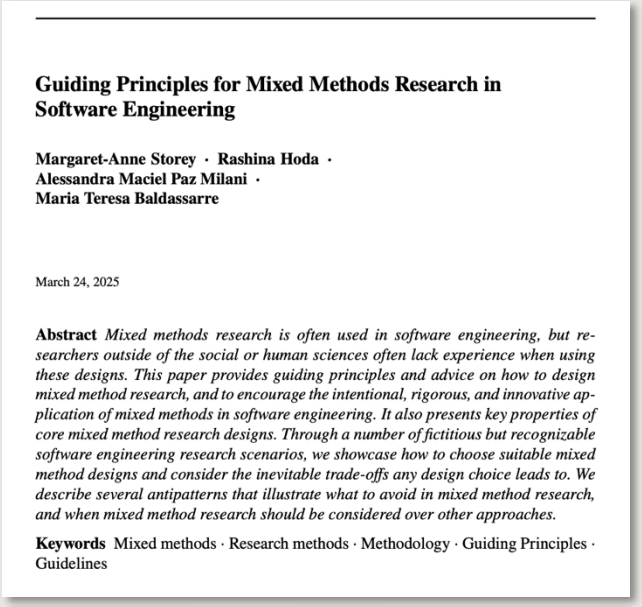
Article: Guiding Principles for Using Mixed Method Research in Software Engineering

by Margaret-Anne Storey, Rashina Hoda, Alessandra Milani, and Teresa Baldassarre, Empirical Software Engineering, 2025

https://arxiv.org/abs/2404.06011



Guiding Principles for Mixed Methods Research in Software Engineering

Margaret-Anne Storey · Rashina Hoda · Alessandra Maciel Paz Milani · Maria Teresa Baldassarre

March 24, 2025

Abstract *Mixed methods research is often used in software engineering, but researchers outside of the social or human sciences often lack experience when using these designs. This paper provides guiding principles and advice on how to design mixed method research, and to encourage the intentional, rigorous, and innovative application of mixed methods in software engineering. It also presents key properties of core mixed method research designs. Through a number of fictitious but recognizable software engineering research scenarios, we showcase how to choose suitable mixed method designs and consider the inevitable trade-offs any design choice leads to. We describe several antipatterns that illustrate what to avoid in mixed method research, and when mixed method research should be considered over other approaches.*

Keywords Mixed methods · Research methods · Methodology · Guiding Principles · Guidelines

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BONUS

Grounded Theory Literature Review

Empirical Software Engineering (2024) 29:67
https://doi.org/10.1007/s10664-024-10465-5

Ethics in AI through the practitioner's view: a grounded theory literature review

Aastha Pant[1] · Rashina Hoda[1] · Chakkrit Tantithamthavorn[1] · Burak Turhan[2]

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Abstract
The term ethics is widely used, explored, and debated in the context of developing Artificial Intelligence (AI) based software systems. In recent years, numerous incidents have raised the profile of ethical issues in AI development and led to public concerns about the proliferation of AI technology in our everyday lives. But what do we know about the views and experiences of those who develop these systems – the AI practitioners? We conducted a grounded theory literature review (GTLR) of 38 primary empirical studies that included AI practitioners' views on ethics in AI and analysed them to derive five categories: practitioner *awareness*, *perception*, *need*, *challenge*, and *approach*. These are underpinned by multiple codes and concepts that we explain with evidence from the included studies. We present a *taxonomy of ethics in AI from practitioners' viewpoints* to assist AI practitioners in identifying and understanding the different aspects of AI ethics. The taxonomy provides a landscape view of the key aspects that concern AI practitioners when it comes to ethics in AI. We also share an agenda for future research studies and recommendations for practitioners, managers, and organisations to help in their efforts to better consider and implement ethics in AI.

Keywords Artificial intelligence · Ethics · AI ethics · Grounded theory literature review · Practitioners · Software engineering

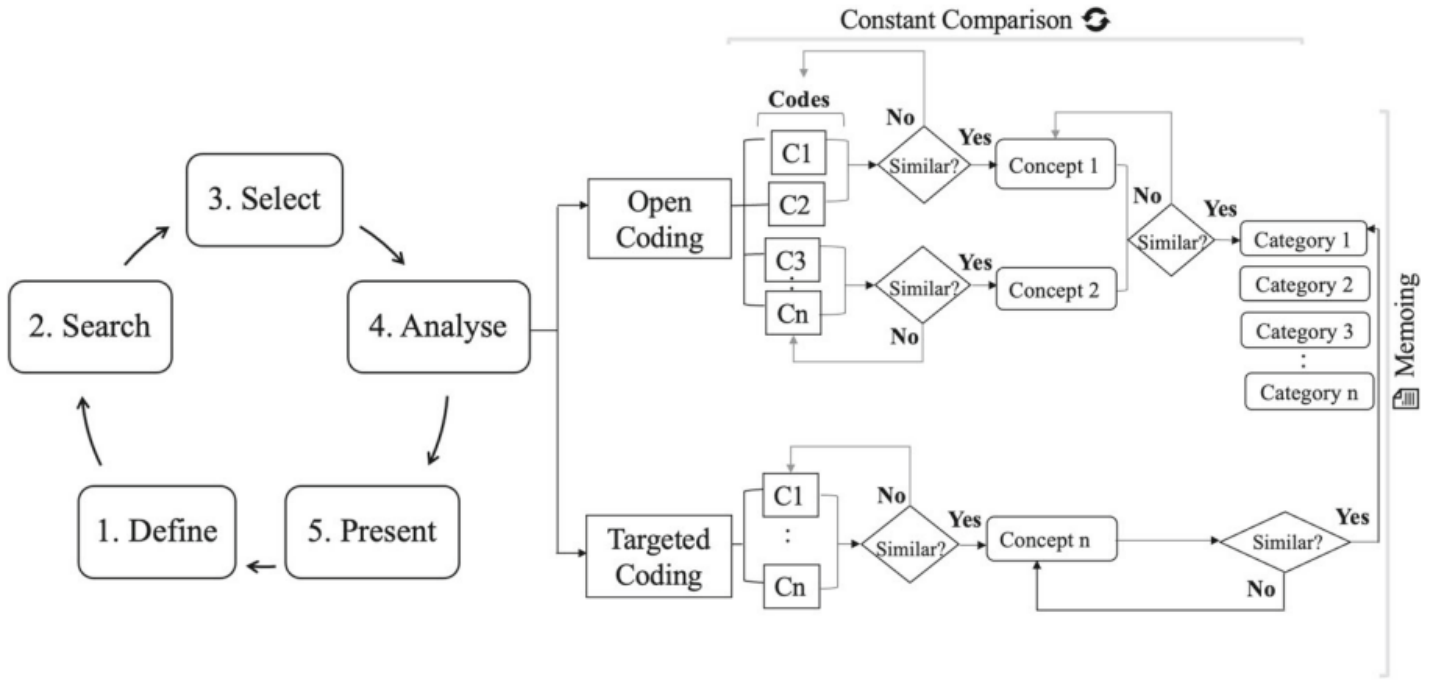

Fig. 1 Steps of the Grounded Theory Literature Review (GTLR) method with Socio-Technical Grounded Theory (STGT) for data analysis

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Pant, A., Hoda, R., Tantithamthavorn, C., & Turhan, B. (2024). Ethics in AI through the practitioner's view: a grounded theory literature review. *Empirical Software Engineering*, *29*(3), 67.

Grounded Theory Literature Review

Fig. 5 An overview of the aspects of ethics in AI from AI practitioners' viewpoints

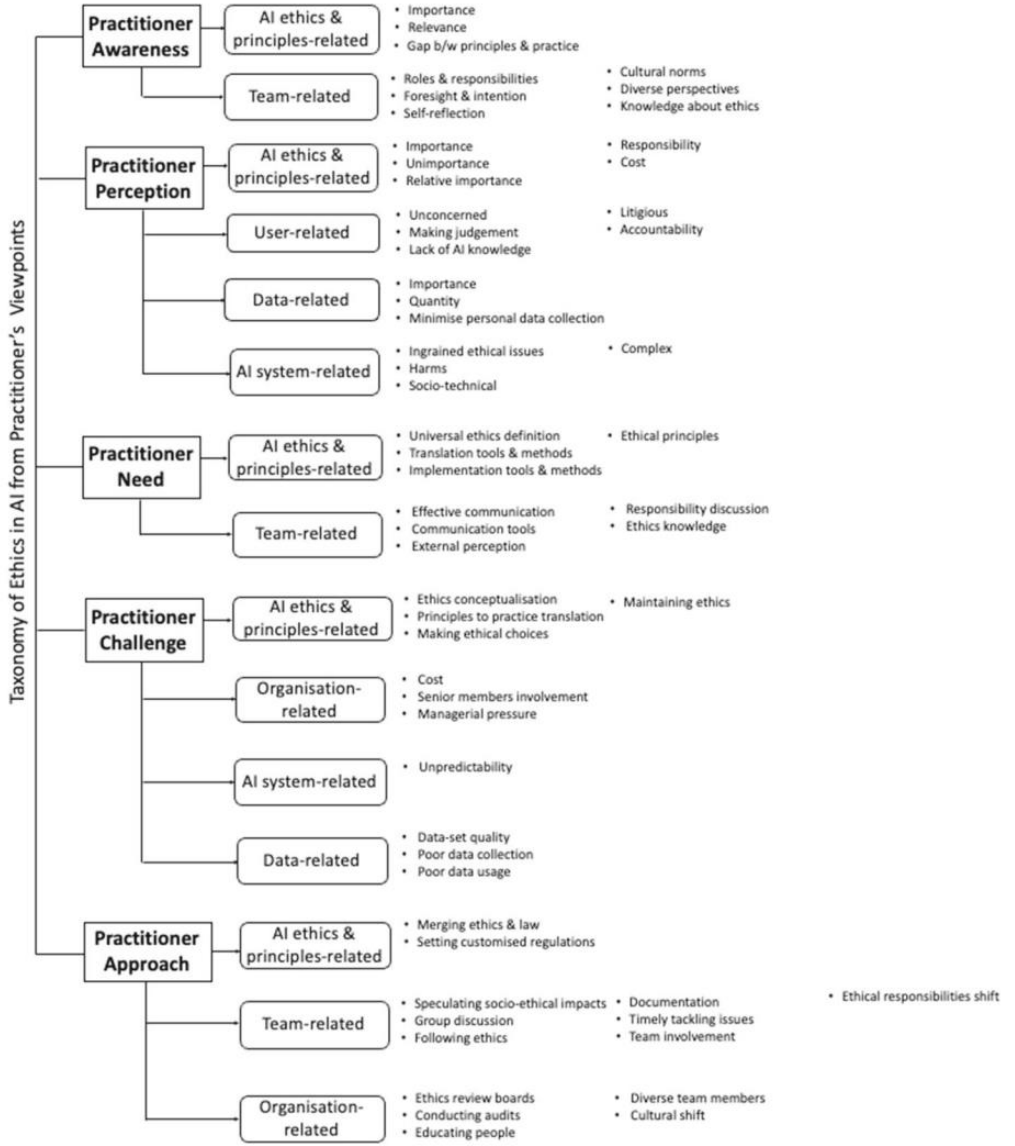

Fig. 4 Taxonomy of ethics in AI from practitioners' viewpoints

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Pant, A., Hoda, R., Tantithamthavorn, C., & Turhan, B. (2024). Ethics in AI through the practitioner's view: a grounded theory literature review. *Empirical Software Engineering*, *29*(3), 67.

RESEARCH DESIGN CANVAS (Hoda, 2024)

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Research Team

Researchers
e.g., with requisite domain knowledge, research skills, philosophical foundations, …

Advisors
e.g., domain, method experts

Stakeholders
e.g., funders, partners, …

Reviewers
e.g., peers, experts, ethics committees, examiners, …

Beneficiaries
e.g., researchers, industry, society, …

Domain and Actors

Research Domain
e.g., software engineering, HCI, AI, information systems, digital health, …

Domain Actors
e.g., software engineers, users, data scientists, …

Research Ethics

e.g., informed consent, participant and data safety, privacy, confidentiality, do no harm, beneficence to people, justice, respect, …

Research Questions

e.g., overarching question(s) and sub-questions

why, how, what questions

Research Protocols

Data
e.g., primarily qualitative, supplemented by quantitative, custom collected, publicly available, …

Techniques
e.g., traditional: interviews, observations, surveys, …
modern: data mining, NLP, sentiment analysis, immersive techniques, …

Tools
e.g., data collection: audio/video recordings, …
data analysis: pen & paper, spreadsheets, NVivo, MAXQDA, Atlas.ti, …

Research Topic

e.g., human and socio-technical aspects of software engineering, artificial intelligence, robot human interaction; interdisciplinary topics, …

Research Values

e.g., social good, fairness, transparency, open access, sustainability, enabling growth …

Research Philosophy

Reasoning
inductive, deductive, abductive

Ontology
material, virtual, simulated, combined realities, …

Epistemology
objective, subjective, relative

Research Paradigm
constructivism, positivism, …

Research Impact

Deliverables
e.g., research papers, tools, white papers, talks, guides, posters, demos, videos, patents, …

Channels
e.g., journals, conferences, events, news, blogs, social media, …

Access
e.g., open source, creative commons, pay per use, subscription, …

Pilot Study

Apply *research project design* ⟷ **Refine** *research project design*

[Chapter 4] Hoda, R. (2024) Qualitative Research with Socio-Technical Grounded Theory, Springer.

Thank You!

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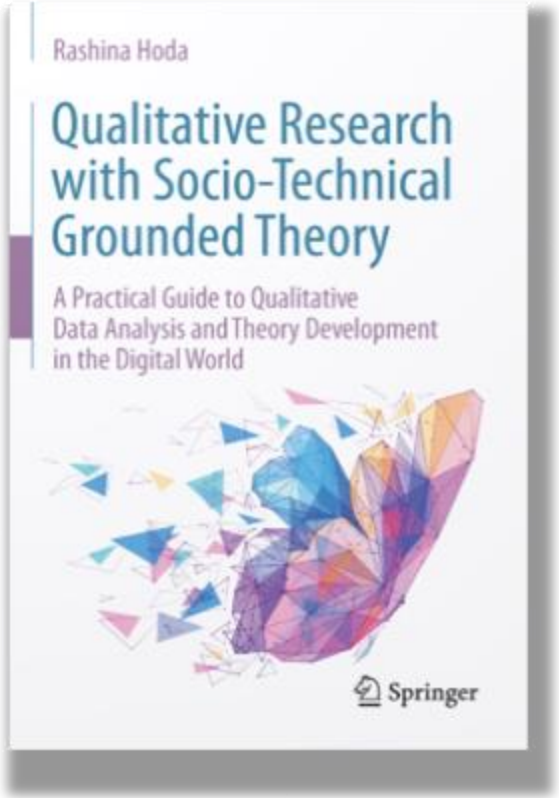

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