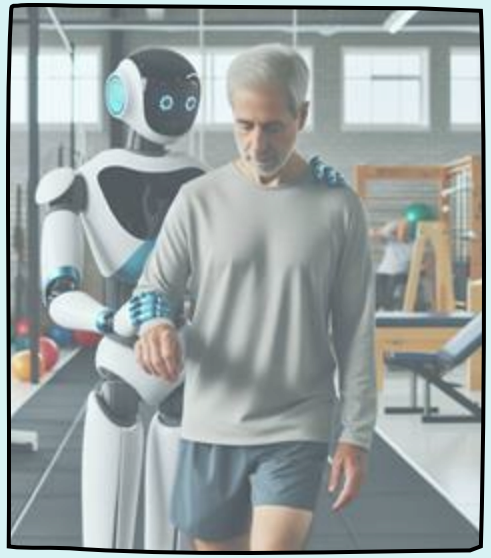


SOCIO-TECHNICAL QUALITATIVE RESEARCH...

...in Human Robot Interaction

Prof Rashina Hoda

Faculty of Information Technology

www.rashina.com

MONASH University

hri

Acknowledgement of Country

https://iview.abc.net.au/show/acknowledgement-of-country

OVERVIEW

Tutorial for Human Robot Interaction

- 09:00-09:05 Arrival
- 09:05-09:20 Welcome and Introduction (answering the Whys)
- 09:20-10:30 Qualitative Research in a Socio-Technical World + Q&A
- 10:30-11:00 Tea/Coffee break
- 11:00-12:20 Qualitative Data Analysis using STGT + Q&A
- 12:20-12:30 Resources and Wrap up

WHO ARE YOU?
WHY HERE?

Name, role/affiliation, and interested in...

- HRI
- Qualitative/mixed methods research
- Socio-technical Research
- Qualitative data analysis
- All of the above

WHO AM I?
WHY AM I HERE?

Not philosophically :)

RASHINA HODA

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

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

Human and socio-technical aspects of software engineering, AI, digital health

~20 years experience in Qualitative and Mixed methods research

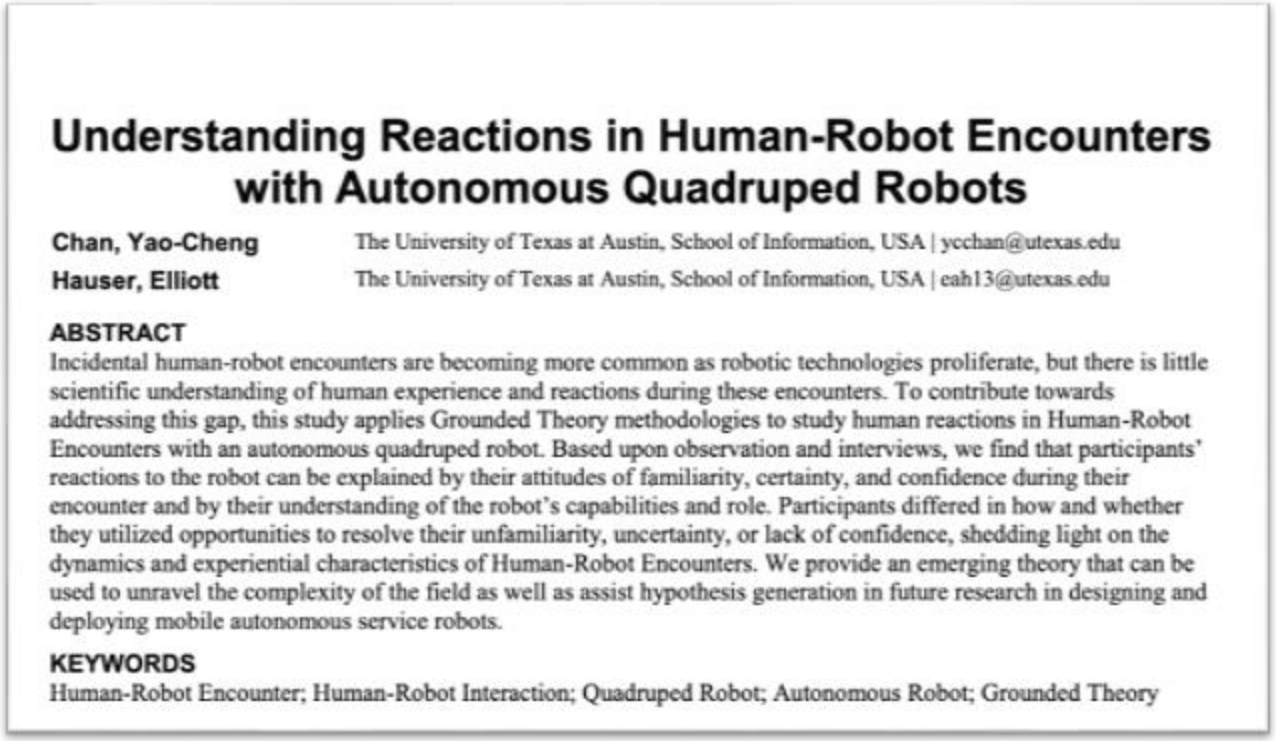
Introduced Socio-technical Grounded Theory (STGT) as a modern variation of traditional GT

Not an HRI researcher!

Discovered STGT being used in HRI :)

Here to share knowledge, tips, resources on qualitative research and qualitative data analysis in HRI

STGT IN HRI...



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

Chan, Y.-C. and Hauser, E. (2023), Understanding Reactions in Human-Robot Encounters with Autonomous Quadruped Robots. Proceedings of the Association for Information Science and Technology, 60: 86-97. https://doi.org/10.1002/pra2.771

Accomplishing Robotic Autonomy

The Complexities of Situated Practices and Agency in the Laboratory

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Yifan Xu. 2024. Accomplishing Robotic Autonomy: The Complexities of Situated Practices and Agency in The Laboratory. In Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction (HRI '24). Association for Computing Machinery, New York, NY, USA, 163–165. https://doi.org/10.1145/3610978.3638355

METHODS

Data Collection:

- Lab-based experiment - encounter with autonomous robot in hallway
- Survey - to capture perceptions about the robot
- Free-form interaction session - interact closely with robot, take photos/videos, ask questions, perform tricks
- Interview - experience in hallway, influence of presence of humans, experience of freeform interaction, speculations of reactions in non-lab settings, improvements, participant familiarity with robots, speculation of robot's purpose in study (emerged during study)

Data Analysis:

- STGT for data analysis

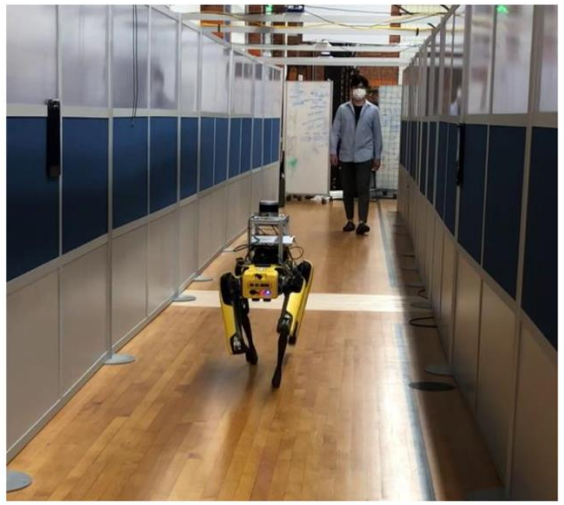


Figure 1. The simulated hallway, both the robot and participants walking in it.

Chan & Hauser, 2023

OUTCOMES

- Descriptive findings – participant reactions, relationships between reactions, familiarity, certainty, and confidence
- Emerging theory
- Implications for Future research

Chan & Hauser (2023)

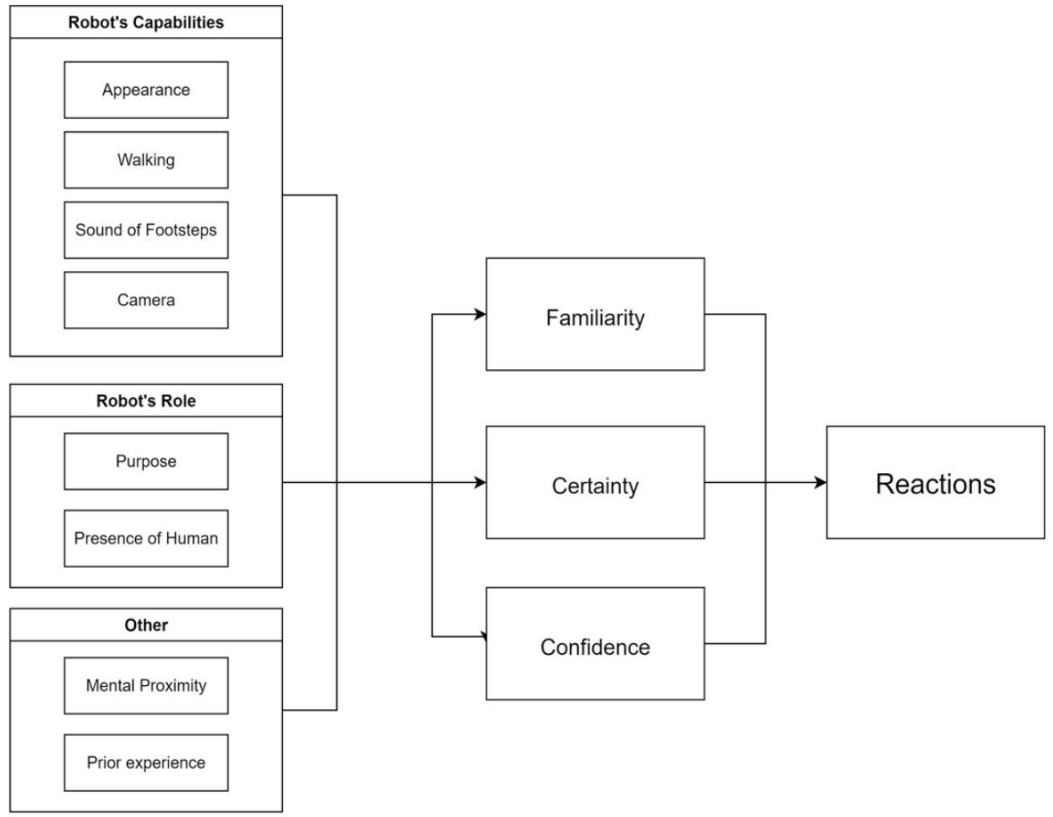


Figure 2. Our emerging theory: Human reactions in encountering an autonomous quadruped robot are influenced by their Familiarity, Certainty, and Confidence.

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

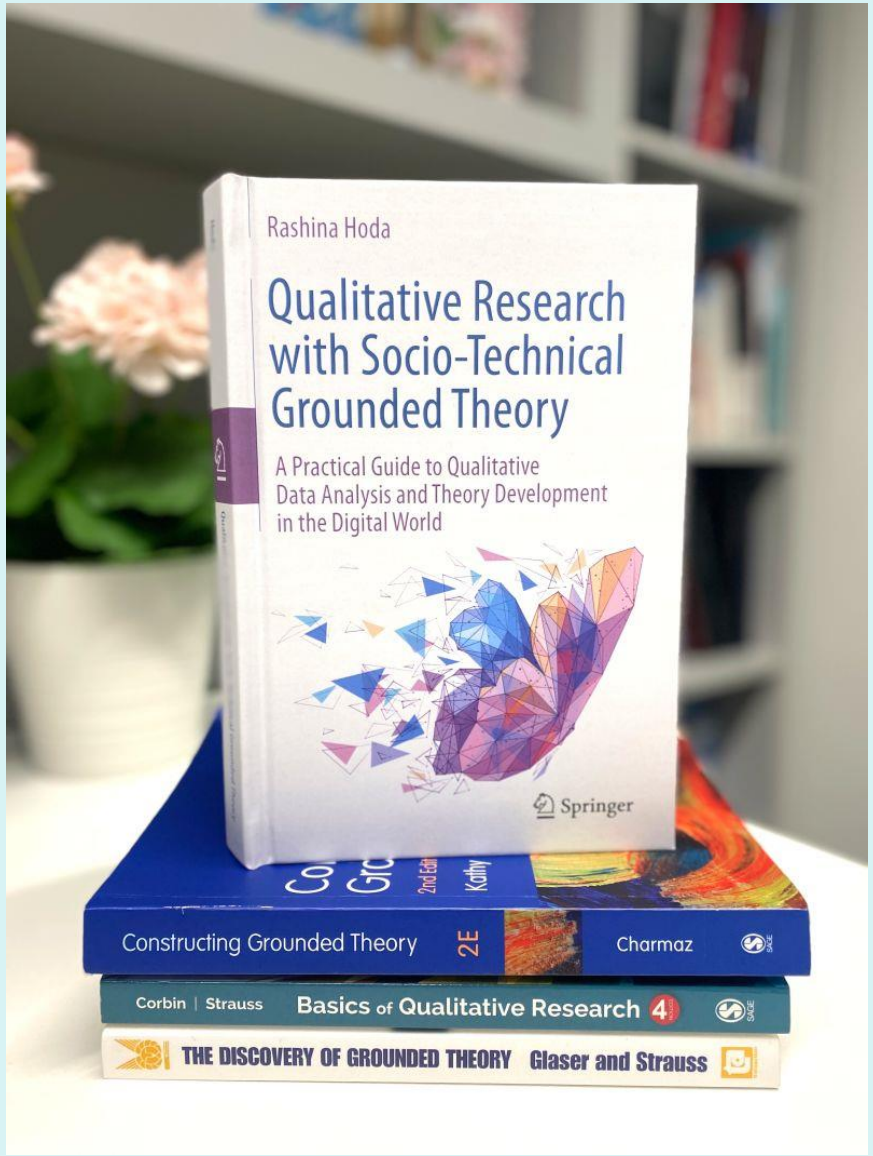
[Table 3.1 Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

KEY REFERENCES

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

Springer Discount Code: use HODA25 on https://link.springer.com to get 20% off. Valid 1st March - 1st June 2025

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



WHY QUALITATIVE?
WHY IN HRI?

The Importance of Qualitative Research in HRI...

Human Factors

Perceptions

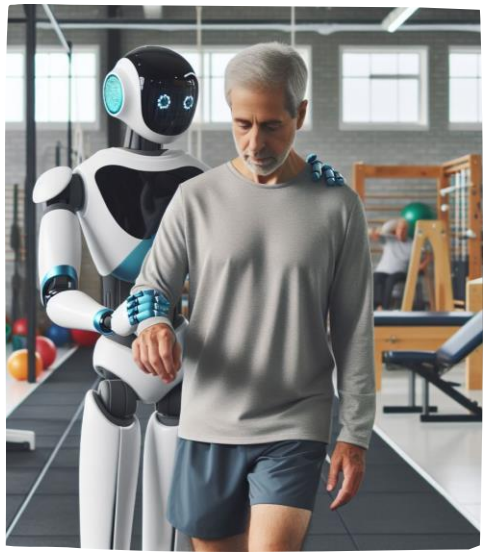
Collaboration

Reactions

User Experience

Experiences

Wellbeing



Needs

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"

HRI is Socio-Technical!

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

Most disciplines are increasingly socio-technical...

Changing Landscape of Research

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

Need for a Socio-Technical Approach

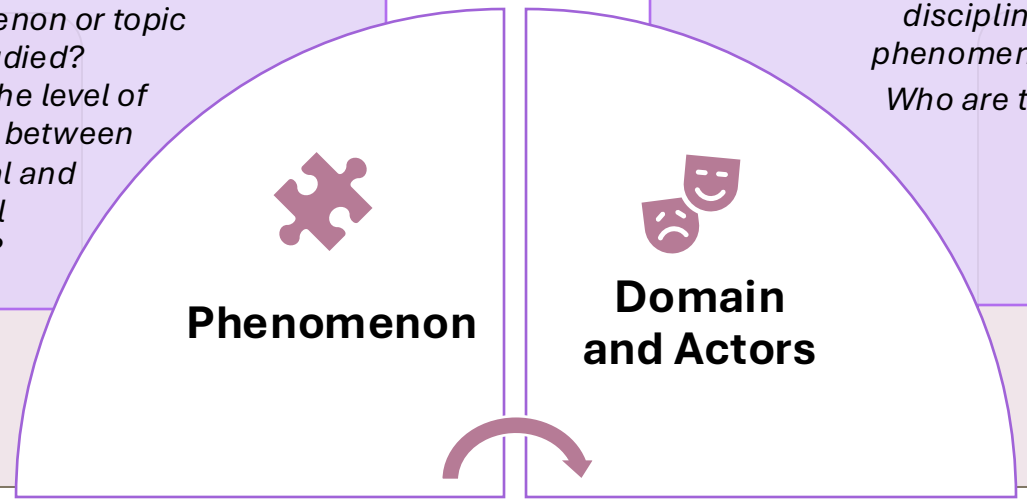
Most of what we study is socio-technical

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

Can we apply a socio-technical approach to studying socio-technical topics? YES!

QUALITATIVE RESEARCH IN A SOCIO-TECHNICAL WORLD

Socio-Technical Research Framework (adapted for HRI)



Socio-Technical Phenomenon
Where human and technological interactions are tightly coupled, studying one without other makes for incomplete investigation and understanding.

What is the phenomenon or topic being studied? What is the level of interplay between the social and technical aspects?

In which field or discipline does the phenomenon occur? Who are the actors?

Socio-Technical Domain
human robot interaction, robot design, automation...

Socio-Technical Actors
HRI designers, robots, users, HRI ethicists, AI ethicists,...

Socio-Technical Data, Tools, and Techniques
Qual data (primary), Quant data (supplementary). Traditional (experiments, interviews, observations), and Modern (data mining, NLP, sentiment analysis, Immersive) techniques.

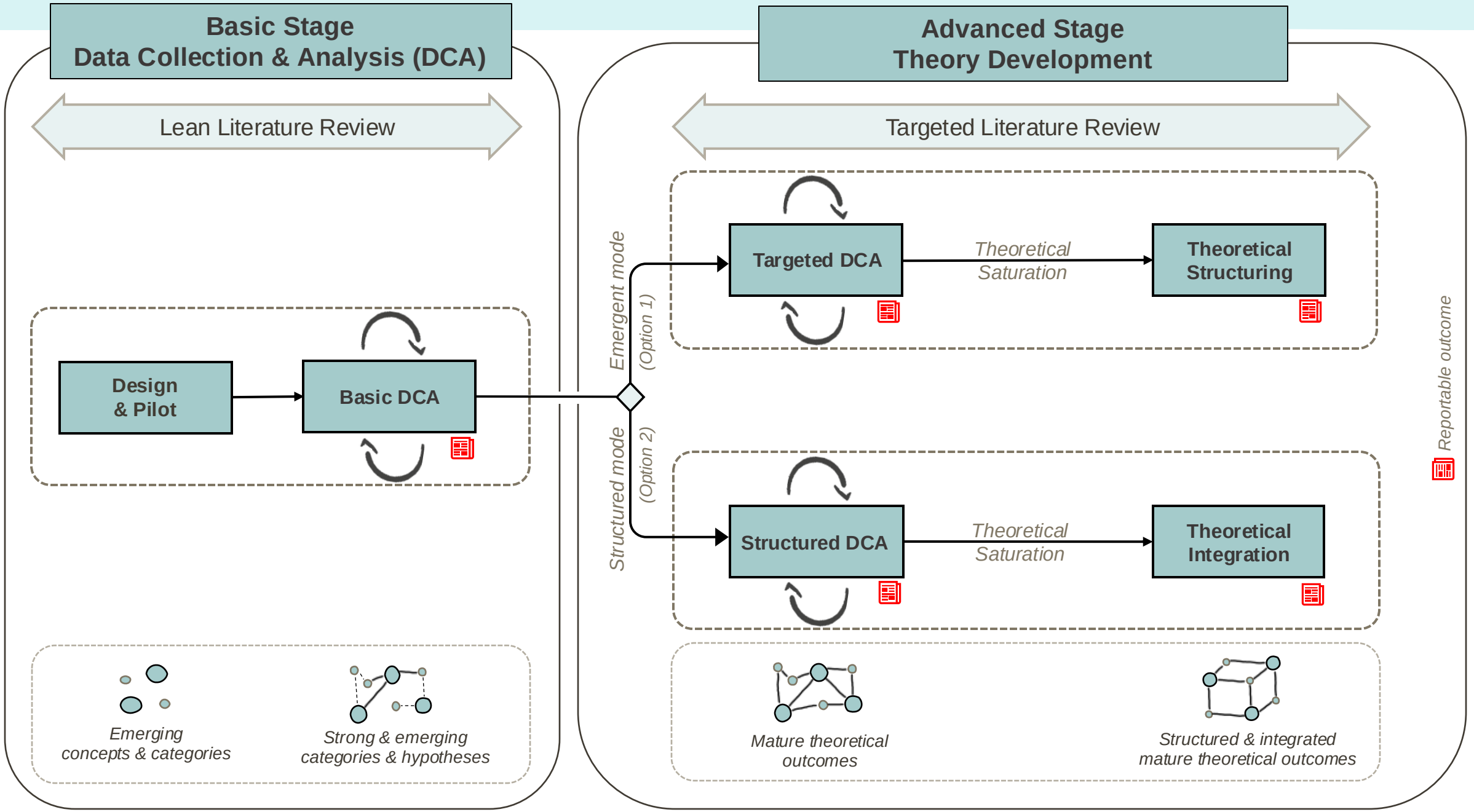
What type of data is being collected? What tools and techniques are being applied?

Socio-Technical Researcher(s)
With requisite knowledge and skills in social sciences, philosophy, qualitative research/ theory development and technical background and/or experience in HRI. e.g., inter-disciplinary teams.

Who is conducting the research? What are their knowledge and skill sets?

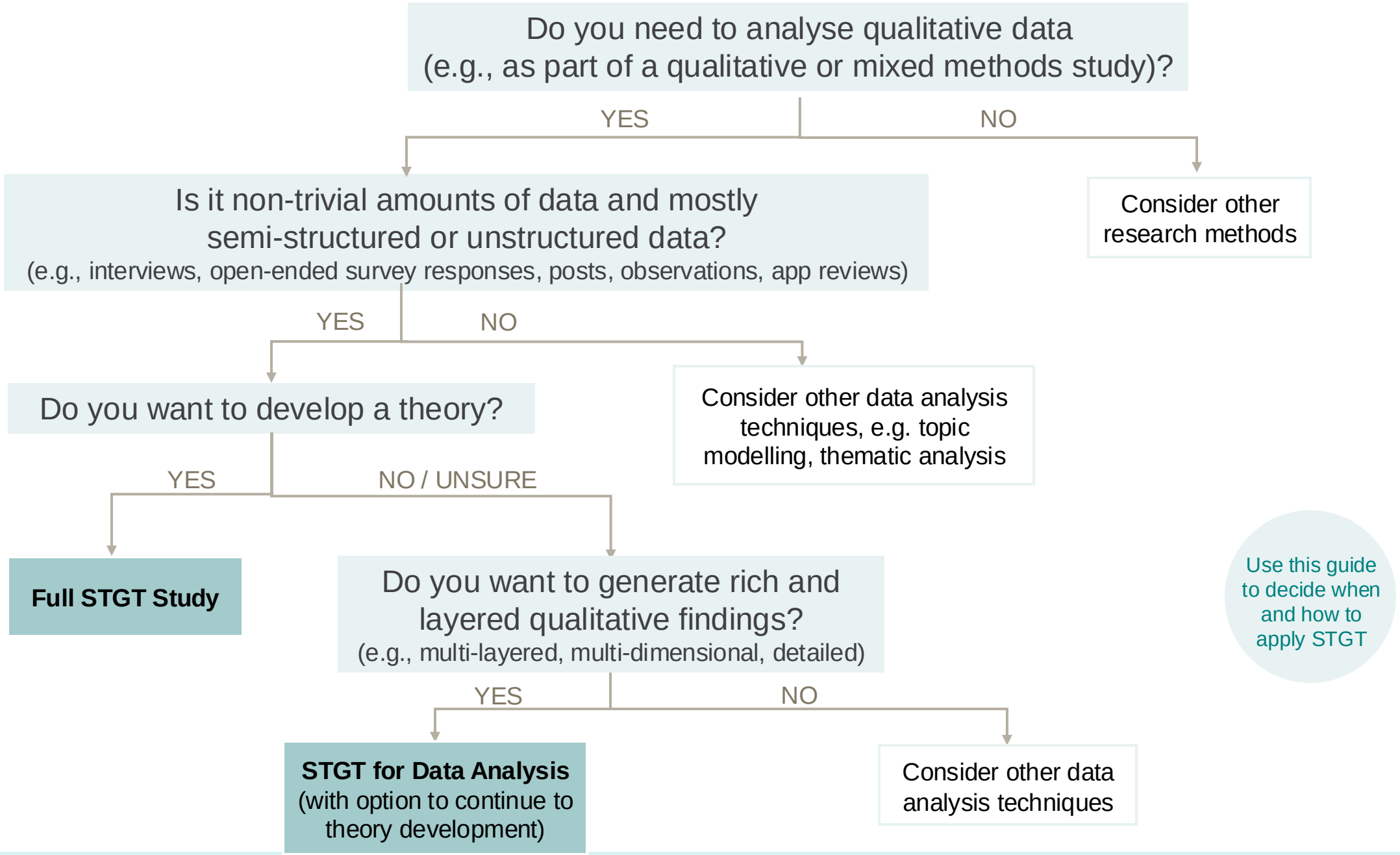
[Chapter 3] Hoda, R. (2024), Qualitative Research with Socio-Technical Grounded Theory, Springer.

SOCIO-TECHNICAL GROUNDED THEORY (STGT) - THE METHOD



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

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.

CHAPTER 7. BASICS OF QUALITATIVE DATA COLLECTION

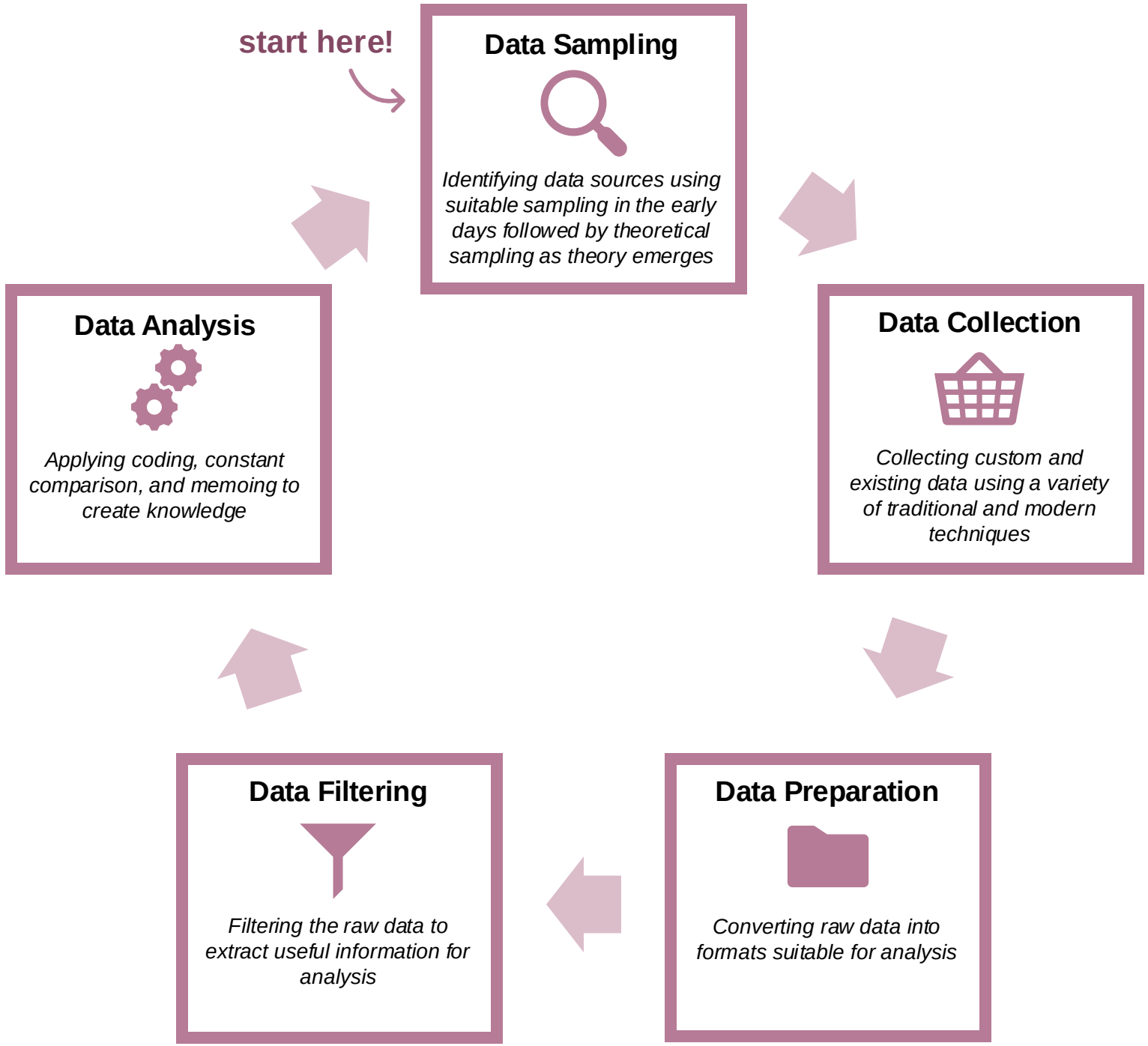
CHAPTER 8. TECHNIQUES OF QUALITATIVE DATA COLLECTION

CHAPTER 9. QUALITATIVE DATA FILTERING AND PREPARATION

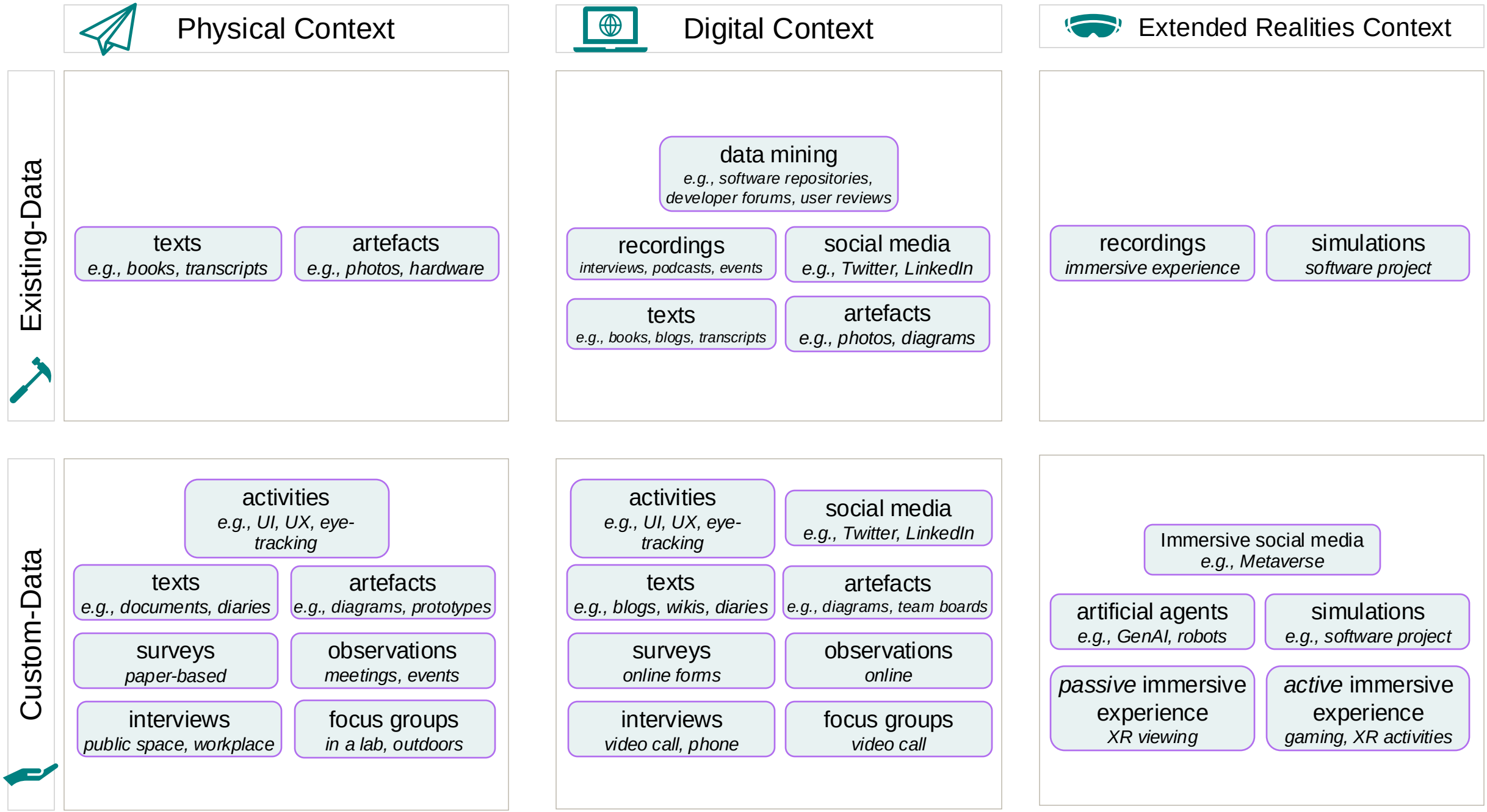
CHAPTER 10. STGT FOR QUALITATIVE DATA ANALYSIS

Qualitative data collection, prep, and analysis

Iterative Data Collection and Analysis



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



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

I love Koalatative Research

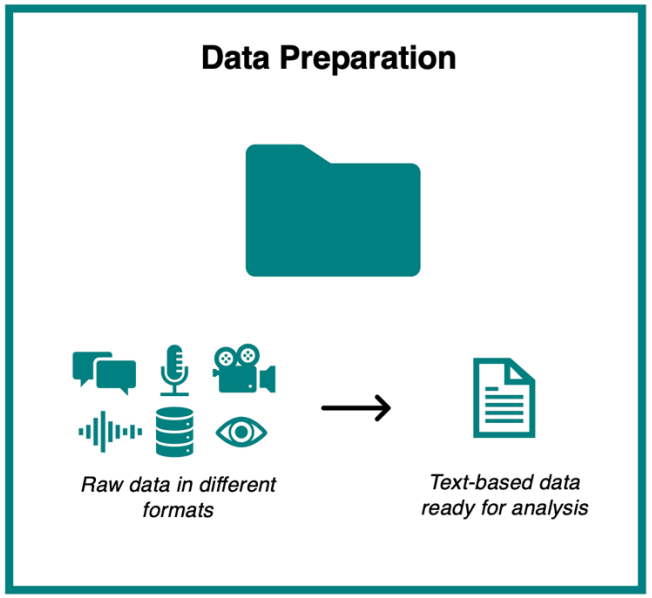
Tea/Coffee Break. When we come back…

Hands on Qualitative Data Analysis Exercises and Examples

Data Preparation and Filtering

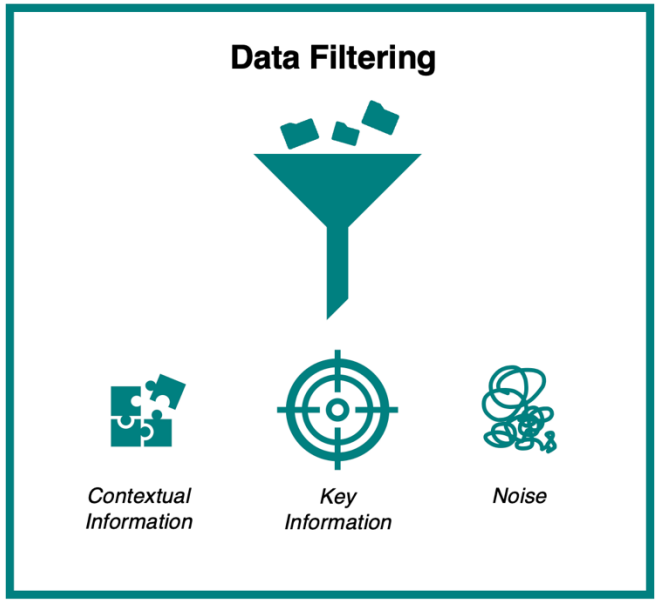
Definition

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.

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, e.g., of interview data, survey data, content generated by LLMs

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

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

More Examples of Using STGT

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;*

Additional Key Words and Phrases: AI ethics, AI practitioners, awareness, challenges, survey

ACM Reference format:
Aastha Pant, Rashina Hoda, Simone V. Spiegler, Chakkrit Tantithamthavorn, and Burak Turhan. 2024. Ethics in the Age of AI: An Analysis of AI Practitioners' Awareness and Challenges. *ACM Trans. Softw. Eng. Methodol.* 33, 3, Article 80 (March 2024), 35 pages.
https://doi.org/10.1145/3635715

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

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.

Understanding Reactions in Human-Robot Encounters with Autonomous Quadruped Robots

Chan, Yao-Cheng The University of Texas at Austin, School of Information, USA | ychan@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

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

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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.

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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]

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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.

Tools for Qualitative Data Analysis

NVIVO

MAXQDA

atlas.ti

Google Docs

Google Sheets

Using GenAI

All research in Australia is governed by the Australian Code for the Responsible Conduct of Research

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

https://www.monash.edu/ai/ai-for-staff/ai-for-research-and-graduate-research

QUALITATIVE DATA ANALYSIS USING STGT

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

BASICS OF QUALITATIVE DATA ANALYSIS IN 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

- capturing reflections, possible links, questions, ideas
- secret ingredient to achieve richness in findings and high-quality outcomes

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.

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

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

HRI: #unplannedEncounter #plannedEncounter #firstReaction #expectedBehaviour #unexpectedBehaviour

ZOOM OUT-ZOOM IN APPROACH

Full Study or Dataset Level

Data Unit Level

Semantic Level

[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!

In Black Mirror, the robot is exactly like this dog. And there's a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.

Applying STGT for data analysis to analyse participant experience quote taken from Chan & Hauser (2023)

PARTICIPANT QUOTE - - ATTEMPT 1

Let's do data filtering first

In Black Mirror, the robot is exactly like this dog. And there's a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.

Applying STGT for data analysis to analyse participant experience quote taken from Chan & Hauser (2023)

Participant quote – ATTEMPT 1

What's wrong?

#dogLikeRobot

#hiddenSwordComesOut

In Black Mirror, the robot is exactly like this dog. And there's a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.

#reallyCautious

#somethingWillPopOut

#dogAttacksHuman

Poor Coding. First attempt!

Applying STGT for data analysis to analyse participant experience quote taken from Chan & Hauser (2023)

PARTICIPANT QUOTE - ATTEMPT 2

What's better now?

#familiarDogLikeRobot

#robotArmedWithSword

In Black Mirror, the robot is exactly like this dog. And there's a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.

#humanCautiousOfRobot

#robotAttacksHuman

Satisfactory (descriptive) Coding!

Applying STGT for data analysis to analyse participant experience quote taken from Chan & Hauser (2023)

Participant quote – ATTEMPT 3

What's even better?

#popCultureInfluencesHumanExpecations

#familiarQuadrupedRobot

#weaponisedRobot

In Black Mirror, the robot is exactly like this dog. And there's a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.

#humanCautiousOfRobotBehaviour

#robotAttacksHuman

Good (analytical + comprehensive) Coding!

MEMOING

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.

[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 "#firstReactions to robot encounter"

Participant P1 was very scared by the encounter, while P2 shared being uncomfortable but curious. P3 and P4 highlighted #taskOrientation as a key first observation…Overall, most participants reported #feelingUneasy, #curiousAboutRobotCapabilities, while a few (n=3/15) felt downright scared.

Possible Concepts: #emotionalReactions #logicalReactions
Possible Relationships: #firstReactions seem to be influenced in part by #previousFirstHandExperience (P1, P3-5, P9) or #previousPerceptions (P2, P6-8, P10-15), which in turn demonstrated how #popCultureInfluencesHumanExpectations (P11, P15).

CODING AN OBSERVATION

#humanInDireNe ed

#humanSignals4Hel p

#rescueRobotResponds

A human, injured and stranded, weakly signals for help. The rescue robot approaches, scans for injuries. It transports the person to safety.

#rescueRobotScans4Injuries

#transportsHuman2Safety

With further coding and memoing, possible emerging concepts: #identifyingHumanNeeds, #responding2HumanCalls, #diagnosis&Triage, #prioritisingSafety

Applying STGT for data analysis to analyse participant experience quote taken from Chan & Hauser (2023)

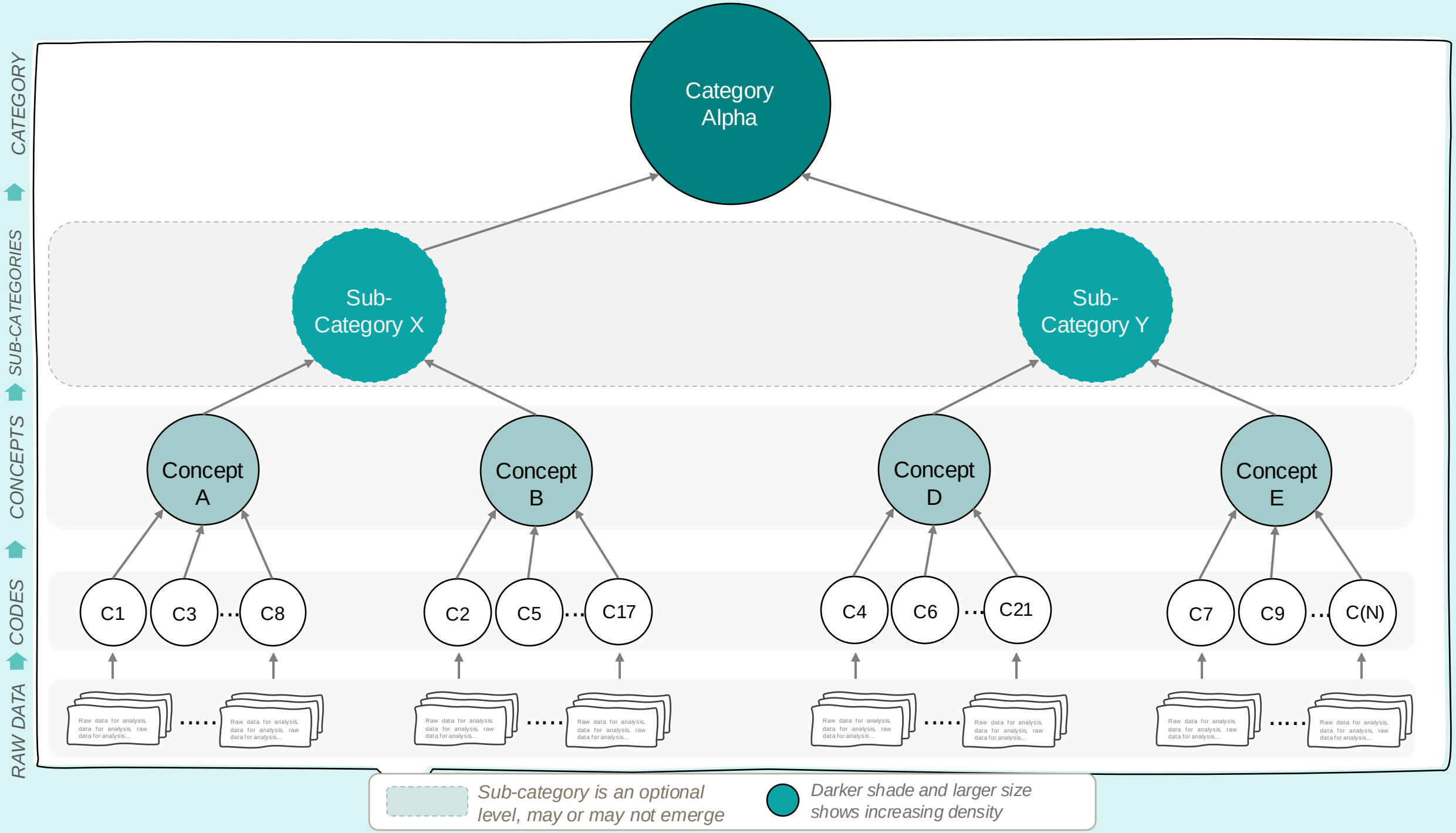
CONSTANT COMPARISON

CONSTANT COMPARISON

DEFINITION

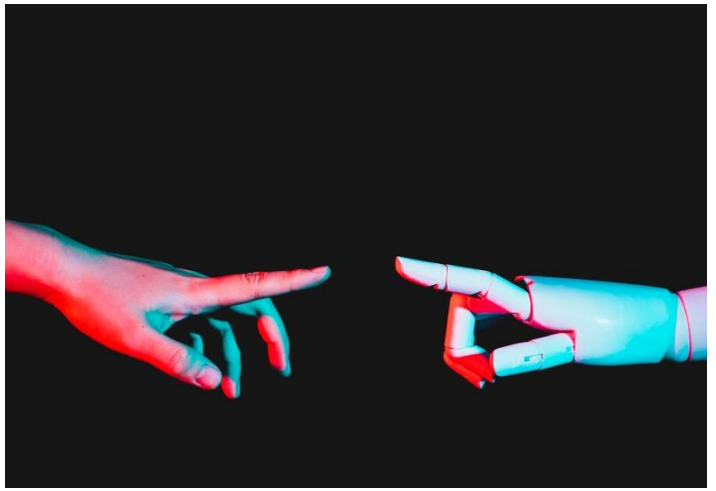
Constant comparison is the process of comparing codes derived from within the same data unit and across all data units to find common patterns among them. Using constant comparison, similar *codes* are grouped to form a *concept*, and similar concepts are combined to form a *category*. Sometimes, an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

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


CATEGORY
SUB-CATEGORIES
CONCEPTS
CODES
RAW DATA
Category Alpha
Sub-Category X
Sub-Category Y
Concept A
Concept B
Concept D
Concept E
C1
C3
C8
C2
C5
C17
C4
C6
C21
C7
C9
C(N)
Raw data for analysis, data for analysis, raw data for analysis...
Sub-category is an optional level, may or may not emerge
Darker shade and larger size shows increasing density

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



Resources

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

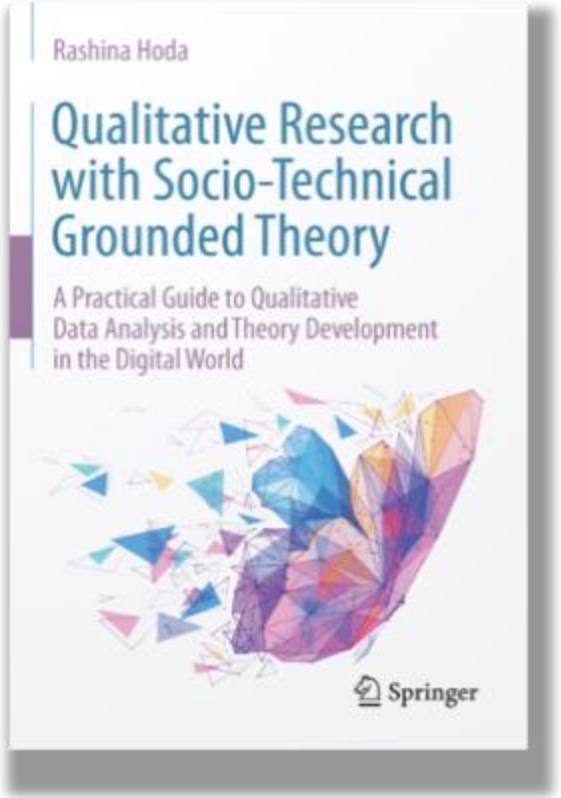
TSE paper: Hoda, R. (2022), Socio-Technical Grounded Theory for Software Engineering, IEEE Transactions on Software Engineering.

On my website www.rashina.com/stgt

- Slides and Videos: ICSE technical briefings - ICSE 2021, ICSE 2023, ICSE 2024, ICSE 2025 (tentatively 30th April), HRI 2025
- Links and Selected Examples

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

Thank You!



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