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by Rashina Hoda

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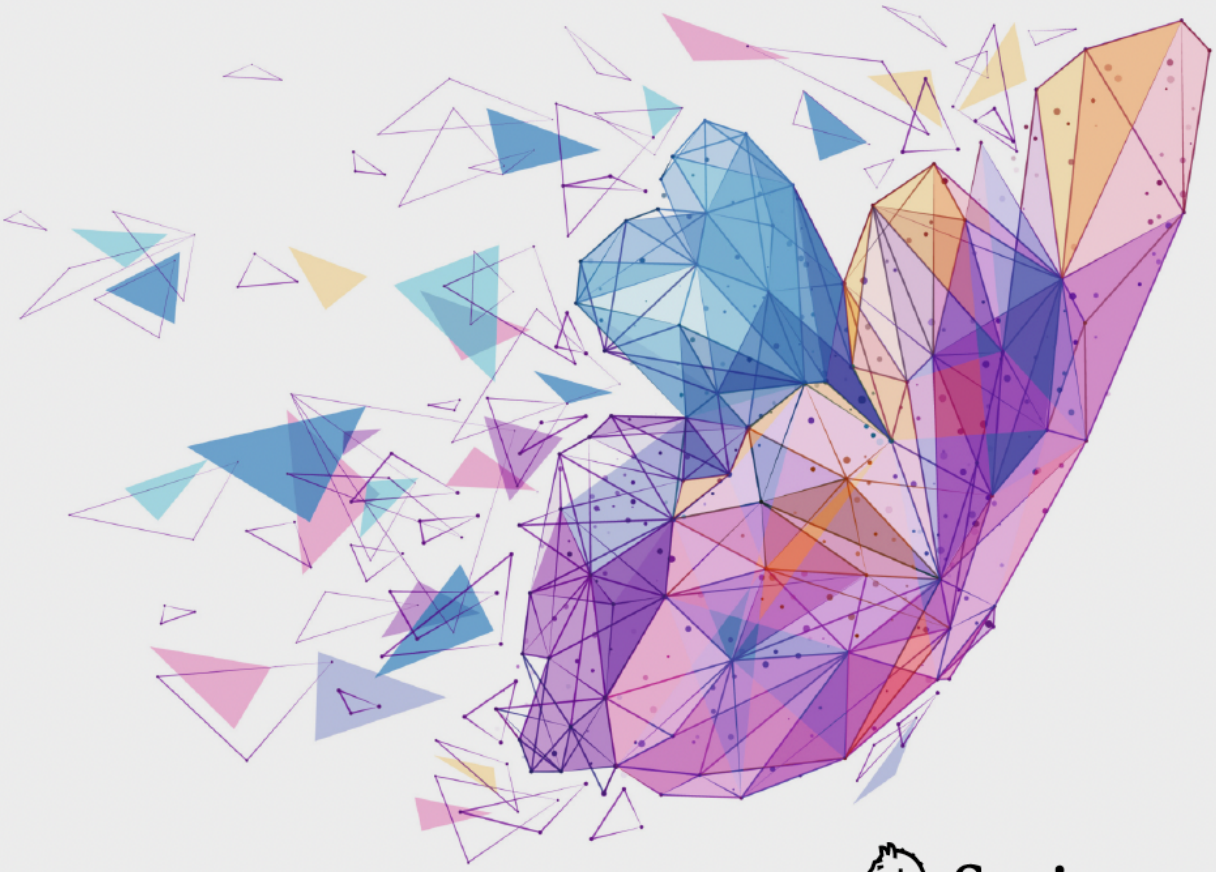
Qualitative Research with Socio-Technical Grounded Theory

A Practical Guide to Qualitative Data Analysis and Theory Development in the Digital World



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A Practical Guide to Qualitative Data Analysis and Theory Development in the Digital World

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Dedicated to my parents, Mrs Sabiha Hoda, retired Professor of English Literature, and Dr Najmul Hoda, retired Professor of Pedodontics and WHO Fellow—the original socio-technical influences in my life.

Foreword

Software engineering (SE) has, during its more than half a century of research and practice, gradually been accepted as a socio-technical endeavour. Populated by software engineers and computer scientists, research and development projects have, to a large degree, been staffed mostly by people based on their skills in numbers, algorithms, and structured logic. Consequently, they observed and interpreted the world primarily in terms of numbers, algorithms, and formal structures.

With the emerging insight that not all SE issues can be deduced from mathematical foundations, empirical approaches started to emerge under the label of experimental software engineering during the 1970s and 1980s. Still, the pioneering work was dominantly quantitative, applying hypothesis testing to experimental setups, with humans conducting limited SE tasks in highly controlled environments. While these efforts were groundbreaking in adding rigour to the knowledge creation process, they mostly treated social factors equal to technical factors, trying to control and sample their variation—which due to the huge number and variation of factors is a Sisyphean task.

Caroline Seaman's landmark paper from 1999 on qualitative methods in empirical SE—a silver jubilee this year—broke the ice to acknowledge the social side of SE and consequently to methods emerging from Social Sciences. In the related research area of Information Systems, qualitative methods, including grounded theory (GT), were more commonly received, while the engineering community remained quite sceptical. However, SE researchers gradually adapted and adopted methods from the qualitative tool-box, including my own and colleagues' work on case studies. Still, grounded theory studies were considered somewhat strange birds by many, including myself. Maybe the cult-like character of language in professing oneself to the Glaserian, Strauss-Corbinian, or Constructivist faction was a deterrent? Most probable, ignorance played a bigger role in the scepticism, at least in my own case, where embracement has come with increasing knowledge and understanding of grounded theory principles and practices.

It is therefore highly appreciated that Prof. Rashina Hoda now presents a comprehensive book on Qualitative Research with Socio-Technical Grounded Theory, where she adapts general grounded theory methods to the specific context and audience of socio-technical SE, based on her own extensive research practice. The book has a potential to reduce the ignorance among SE researchers and set a standard for research practice—not the least in the hands of supervisors and peer reviewers. The

book extends and deepens her TSE paper on the same topic, framing it in the research philosophy context, adding detailed guidance and examples of data collection and analysis, as well as of theory development. My only concern is its sheer volume. Few senior researchers allow themselves to read a book from cover to cover. However, they do not have to since the book is well structured and written, allowing the reader to find guidance when needs appear.

In these days of "nulla dies sine AI",[1] when ML and LLM models are thrown at various data sets for research purposes, what relevance do these technologies have for socio-technical grounded theory? In the concluding chapter, Hoda opens up for a balanced discussion through examples about both technical and social implications of using LLMs, like ChatGPT, in the research process. She concludes that the experienced human analyst still is at the core of grounded theory research, and my hypothesis and hope is that it will remain so even when more powerful tools assist the process.

This book is a valuable and timely contribution to the SE community. It is a gold mine for PhD students who may learn by examples and be empowered to teach their supervisors to adopt socio-technical grounded theory to further advance SE research. It is published at the right time, when the acceptance for qualitative research is growing, and before new attempts to quantify it—for example, by requesting inter-rater statistics in the coding process—have taken ground, and before ChatGPT's successors have taken over.

Lund, Sweden
March, 2024

Per Runeson

[1] Paraphrase of the Latin phrase "Nulla dies sine linea" meaning "no day without a line", often read as "no day without a line of writing". The idea was originated by Pliny the Elder in the first century AD.

Preface

I first caught the qualitative research "bug" as I embarked on my PhD journey around the mid-2000s at Victoria University of Wellington, New Zealand. Agile software development had just started proliferating across the software industry. It placed people at the heart of software engineering (SE), validating my own experiences as a software developer. I became motivated to study agile software teams. Borrowing a qualitative research method from Sociology was a natural choice for this purpose. However, piecing together an understanding of the traditional grounded theory (GT) methods from the many different books written by and for sociologists did not come easy. Subsequently, I wrote several papers elucidating GT steps and procedures and sharing my experiences with the wider SE research community.

Through my own research experience and that of supervising and reviewing others over time, I was convinced of two things. First, it did not have to be that difficult for SE researchers to excel in qualitative research and theory development. Second, there was something unique about the SE research context that meant GT had to be adapted, but that had not been systematically addressed. Motivated by these concerns, I decided to write a book that would serve as a practical guide to ease GT adoption and practice in SE research. By the time I had expanded on how SE researchers could go about charting their paths to qualitative data analysis and theory development, I realised it was no longer Glaserian, Strauss-Corbinian, or Constructivist GT that I was writing about. What I had ended up formulating was a modern socio-technical version of traditional GT. I defined the socio-technical research framework that underpinned my version and called it socio-technical grounded theory (STGT). While traditional GT methods enable the study of social phenomena, STGT enables the study of socio-technical phenomena that abound in SE and related disciplines. Traditional GT methods subscribe to specific research paradigms. In contrast, STGT can be applied with different paradigms depending on physical, virtual, and extended realities and researcher worldviews. Traditional GT methods focus exclusively on enabling theory development. STGT, on the other hand, can be applied as a full method for theory development and in a limited capacity for data analysis within qualitative and mixed-methods research studies. STGT was formally introduced in my TSE article (early access 2021, published 2022) while I continued to write this book.

The book is structured into five parts. Part I—Introduction includes three chapters that serve to provide an overview of the book in Chap. 1 About This Book; a brief history of the origins and evolution of the grounded theory methods in Chap. 2

Traditional Grounded Theory Methods; and an introduction to STGT in Chap. 3 Socio-Technical Grounded Theory: An Overview. Part II—Foundations of Research includes three chapters that serve to cover the foundational building blocks of empirical research through a simple yet powerful approach to designing research methods in Chap. 4 Research Design Canvas; the fundamental concepts of philosophy in Chap. 5 Research Philosophy; and the myriad of literature review methods including those suited to STGT in Chap. 6 Literature Reviews

Part III—Qualitative Data Collection and Analysis includes four chapters that serve to explain the key concepts related to collecting qualitative data in Chap. 7 Basics of Qualitative Data Collection; a wide range of techniques used for collecting qualitative data in Chap. 8 Techniques of Qualitative Data Collection; how to go about preparing and filtering qualitative data in Chap. 9 Qualitative Data Preparation and Filtering; and the data analysis procedures of open coding, constant comparison, and memoing in Chap. 10 STGT for Qualitative Data Analysis.

Part IV—Theory Development includes two chapters that explain what is considered theory (or theoretical outcomes) in Chap. 11 What Is Theory?; and the advanced STGT steps of theory development in Chap. 12 Theory Development. Part V—Evaluation and Future Directions includes two chapters that present the evaluation guidelines for assessing STGT applications and outcomes in Chap. 13 Evaluation Guidelines; and explore new opportunities in qualitative research using large language models in Chap. 14 Future Directions in Qualitative Research.

If you are new to qualitative research or research in general, you will benefit from reading all the chapters, preferably in sequence. If you are considering a *full STGT study*, the book will take you through a full research journey, from an interest in a topic to developing mature theoretical outcomes. If you are considering a limited application of *STGT for data analysis* as part of a qualitative or mixed-methods research study, you will find the chapters in Parts II and III especially valuable.

If you are an experienced researcher who is time-poor, you can select specific chapters to browse (or download in the digital format) based on what piques your interest or addresses your doubts and challenges (see Chap. 1 About This Book for a detailed overview). If you are a reviewer, you will find the foundational research concepts in Part II and evaluation guidelines in Part V particularly illustrative and handy. If you are curious about how the future of qualitative research may be transformed with the advent of large language models powering Generative AI, you will enjoy my interactions with ChatGPT in the last chapter.

Writing this book has been a transformational journey across time, space, and disciplines. The manuscript travelled and transformed with me as I crossed the "ditch" from the University of Auckland, New Zealand, to Monash University, Australia. Even as the global pandemic took much away from us, I found refuge in writing, pouring my passion and experiences into words. It lured me down the rabbit holes of Philosophy and Ethics and into the AI wonderland.

Like most research method guide books, this is a labour of love—my love for qualitative research and confidence in STGT to enable rich studies on socio-technical topics. Simply put, this is the book I wish I had at the start of my research journey. I hope it makes yours easier, enriching, and enjoyable.

Melbourne, VIC, Australia Rashina Hoda
March, 2024

Acknowledgements

Then which of the favours of your Lord will you deny?
– repeated 31 times, Chapter Ar-Rahmaan (The Compassionate), The Holy Qur'an

All praise be to Allah (Arabic for God), who blessed me with knowledge and patience and surrounded me with supportive and kind people who inspire me.

Narrated Abu Huraira: The Prophet (peace be upon him) said: *He who does not thank the people is not thankful to Allah* (Source: Sunan Abi Dawud 4811)

This book would not have been possible without the unwavering support of my loving family and friends. I am forever indebted to my late grandma—Mrs Qamrun Nisa Begum, a fearless champion of girls education, light-years ahead of her times—whom I will always aspire to emulate; my parents, retired Professors Najmul Hoda and Sabiha Hoda, who gifted me my wings; my husband, Mohammed Asif, who added the wind beneath those wings so I could fly; my elder son, Atif, who was my sounding board and creative guide for many design ideas; and my younger son, Imran, I love you. I am grateful to my brother and *guru*, Asif Hoda, for our numerous discussions on theories during the writing of this book and to my eldest brother, Shariq Hoda, for always expecting the very best from me. I thank my best friend, Amaara Rehmaan, for her faith in me. I lovingly thank my cat, Noorie, who made some serious attempts at contributing to the book by walking across the keyboard and whose antics provided much-needed comic relief.

There are a number of incredible people I need to thank on the professional front. I am sincerely grateful to Barney Glaser and Anselm Strauss for their invaluable contributions to the qualitative research community through the introduction of the original grounded theory research method, and to Juliet Corbin, Anselm Strauss, and Kathy Charmaz for the evolution of the method. My editor at Springer, Ralf Gerstner, for his encouragement, patience, and support through the writing of this book, including some challenging times during the global pandemic. I thank my long-term mentor, John Grundy. When I expressed concern about people being accustomed to reading research guide books authored by men with Anglo-Saxon names and questioned whether anyone would read one written by an usually named woman of colour, he simply replied "it's about time." My Dean, Ann Nicholson, the mentor I didn't know I needed, for always encouraging me to keep going. My lovely colleagues and students at the HumaniSE lab, Software Engineering group, and the wider Faculty of Information Technology.

I am especially grateful to Per Runeson for his wonderful foreword and support of the book. I am highly indebted to Christoph Treude, Philippe Kruchten, Mark Swillus, and John Grundy for their invaluable and in-depth feedback for improvements. I express my sincere gratitude to Margaret-Anne Storey, Klaas-Jan Stol, Zainab Masood, Johannes Berlind Soderqist, Steve Adolph, Burak Turhan, Dulaji Hidellaarachchi, Bran Selic, Ingo Mueller, Kla Tantithamthavorn, and Arty Starr for providing their inputs and thoughtful feedback. I thank Associate Editor Ana Monero and the anonymous reviewers of my Socio-Technical Grounded Theory (STGT) article in the *IEEE Transactions on Software Engineering*.

There are several acts of kindness I need to acknowledge that have become stepping stones in my book-writing journey. I thank Helen Sharp, Yvonne Dittrich, Alex Sloley, and all the participants of the open space session I hosted at XP2018, who enthusiastically cheered me on as I nervously announced my book writing in a public setting for the first time. I am grateful to Xavier Franch for his excellent chairing of my first STGT technical briefing at ICSE 2021 and all the participants of the technical briefings at ICSE 2021, ICSE 2023, ICSE 2024, and various talks and seminars on STGT. I am grateful to Margaret-Anne Storey, Evan Leybourn, Alessandro Garcia and Wesley K. G. Assunção, and Zerina Tomkins for inviting me to present to the empirical research methods class, the Business Agility Institute's research group, the PUC-Rio graduate course, and the Digital Health Week 2023, respectively—all of these experiences helped me address a wide range of needs and audiences. I am grateful to Rachel Slattery for allowing me to use her talk and article as an example of visual notes-taking and open coding, and to Paul McIntosh whose pro tip for proof reading proved highly effective towards the end of my book-writing journey.

I am extremely grateful to those who guided me at the beginning of my research journey, my PhD supervisors, James Noble for believing in me when I doubted myself, and Stuart Marshall, for our numerous debates on qualitative research. I thank George Allan for planting the seed of adapting traditional GT in my mind many years ago. I thank Angela Martin and Michael Waterman with whom I exchanged tips and tricks of the trade as we navigated our PhD journeys. I am blessed to have been able to guide the PhD journeys of Zainab Masood, Yogeshwar Shastri, Yanti Andriyani, and Latha Murugesan at the University of Auckland, New Zealand, and Kashumi Madapme, Aastha Pant, Dulaji Hidellaarachchi, Hashini Gunatilake, Ulrike Maria Graetsch, and Harsha Perera at Monash University, Melbourne.

I express my sincere gratitude to all the industry practitioners worldwide who have participated in my research studies and those run by my students over the years—your generously shared experiences make our research grounded. I thank all those people who have ever asked me a question or two, and expressed their curiosity, interests, concerns, confusion, or frustration with qualitative data analysis and theory development—I have tried to address them in the book. I humbly acknowledge all those new and seasoned researchers who are using STGT in their research in expected and unexpected domains, including software engineering, requirements engineering,

artificial intelligence, human robot interaction, human computer interaction, digital health, blockchain, and other emerging and interdisciplinary areas.

Finally, I thank you, the reader, who has picked up this book, for being interested in learning about qualitative research, producing robust qualitative findings, and possibly even developing theories—this is for *you*, I hope it helps!

Contents

About the Author

Rashina Hoda is a Professor of Software Engineering in the Faculty of Information Technology at Monash University, Australia, where she researches the human and socio-technical aspects of software engineering (SE) and artificial intelligence. She is passionate about helping people improve processes and outcomes—reflected in her empirical research on agile methods, mentoring of early career researchers on the use of research methods, and her educating of the next generation of software engineers. She is a passionate champion of marginalised girls and women in STEM and serves as the Associate Dean (Equity Diversity and Inclusion).

Rashina has been immersed in empirical research for two decades, practising, supervising, reviewing, and editing qualitative and mixed methods SE research. She has published over 130 peer-reviewed papers in premier SE venues, many being outcomes of Grounded Theory (GT) research. Two of her GT papers appear in the five "most comprehensive and detailed" of the nearly hundred papers reviewed in a critical review of GT in SE research by Stol et al. (2016). She received a distinguished paper award at the International Conference on Software Engineering (ICSE 2017).

Based on years of learning and reflections, she adapted the traditional GT methods to suit the unique socio-technical context of SE research projects and developed socio-technical grounded theory (STGT). She first introduced STGT in a TSE paper (early access 2021, published 2022) and has since presented it as a journal first talk at ICSE 2022 and as technical briefings at ICSE 2021, ICSE 2023, and ICSE 2024.

She is an active member of the international SE research community, serving as an Associate Editor of IEEE Transactions on Software Engineering and on the organising and programme committees for ICSE, International Conference on the Cooperative and Human Aspects of Software Engineering (CHASE), Foundations of Software Engineering (FSE), International Conference on Information Systems (ICIS), and International Conference on Agile Software Development (XP). She is a public speaker, presenting her research at TEDxAuckland, Agile conferences, industry and public events, and in news, print, and media.

Previously, she was a Senior Lecturer at the University of Auckland, New Zealand. She holds a PhD in Computer Science from Victoria University of Wellington, New Zealand, and a Bachelors (Honours) degree in Computer Science from Louisiana State University, USA. She has also had a short experience in the industry as a software developer. Rashina is often described as having a knack for presenting complex ideas in simple, clear, and engaging ways, a skill liberally applied in this book. In her free time, she enjoys sketching, reading, writing poems and short stories, walking in nature, and spending time with family and friends.