Pernille Bjørn · Maria Menendez-Blanco Valeria Borsotti

# Diversity in Computer Science

Design Artefacts for Equity and Inclusion Diversity in Computer Science

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### Introduction

Diversity in Computer Science: Design Artefacts for Equity and Inclusion presents and documents the principles, results, and learnings behind the research initiative FemTech.dk, which was created in 2016 and continues today as an important part of the Department of Computer Science at the University of Copenhagen's strategic development for years to come. However, this book is also the story of how we (the authors) as computer science researchers embarked on a journey to engage with a new research field – *equity and gender in computing* – about which we had only sporadic knowledge when we began. We refer here to equity and gender in computing as a research field – but in reality, this research field is a multiplicity of entangled paths, concepts, and directions that forms important and critical insights about society, gender, politics, and infrastructures which are published in different venues and often have very different sets of criteria, values, and assumptions. Thus, part of our journey is also to learn and engage with all these different streams of research, concepts, and theoretical approaches and, through these engagements, to identify and develop our own theoretical platform, which has a foundation in our research backgrounds in human computer interaction broadly - and interaction design and computer supported cooperative work specifically. We chose in this book to include insights about our own journey, including failures and successes we experienced along the way. In this way, we choose to become vulnerable through our writing and hope that readers will appreciate our efforts in making transparent and visible those aspects of research that sometimes remain invisible in research publications. Demonstrating vulnerability in research can be scary and present risks – however, in true equity and inclusion research, personal self-disclosure is a common practice (Hamidi et al. 2018; Keyes 2018) that allows peers to consider the perspectives through which research activities are being conducted and accomplished. Among the main theoretical assumptions within equity and inclusion research is that who you are and where you come from matter and shape the kinds of research endeavours you can accomplish (Muller 2011; Rode 2011; Spiel et al. 2020). Thus, when you study a phenomenon, you always take a position and study from 'somewhere' (Haraway 1990), and for peers to fully judge your work and contribution - and to consider how your work embraces the complexities of the contextual

considerations – they need insights into your position. We hope readers of this book can learn from our mistakes and challenges and in this way push equity and inclusion research as well as interventions forward, changing the state of diversity in computer science.

#### How to Read This Book

This book is written with five different audiences in mind. Surely, you can decide to read the whole book from cover to cover. We have intentionally made the book short with many illustrations and expect that readers can get through it in appropriate time and hopefully enjoy all the content. However, if you have specific interests, knowledge, or insights you want to start with, we will here provide suggestions for directed reading.

One audience is computer science teachers (at all levels but mostly high school and up) who are interested in thinking about diversity and equity when designing their classrooms, their assignments, and interactions. While our book is not about new teaching methods or computer science curriculum per se, the FemTech principles demonstrated through the design artefacts Cyberbear, Cryptosphere, and GRACE can inform teachers on how to think differently about their curriculum and teaching environments. We expect that such readers would benefit from focusing their reading on Chaps. 4, 5, and 6. It is in these chapters that we introduce the FemTech design principles and our design artefacts, and present the data and results from our workshops and interventions.

A second audience includes the decision-makers, managers, and policymakers who lead tech organizations or computer science departments and want to have dedicated strategies for diversity, equity, and inclusion initiatives beyond 'window dressing'. For these readers we suggest focusing their readings on Chaps. 7, 8, and 9. Of specific interest for management at universities (and computer science departments), we would include reading Chap. 1.

A third audience includes researchers who do research within equity in computing within areas such as software development, human computer interaction, computer supported cooperative work, and design research. For these readers we would suggest reading Chaps. 2, 3, 4, 5, and 6. These chapters introduce our research, methods, and findings.

A fourth audience includes tech organizations and unions, who are in the unique position of being able to make a concrete impact and push for equity within the computing industry. For this audience, we suggest reading Chaps. 7, 8, and 9 – to find a way to move organizations from only celebrating International Women's Day on March 8 each year to making real change.

The fifth audience includes journalists, the public, and other individuals who have an interest in questions such as: Why are there so few women in computing and tech organizations in Denmark? What are the historic reasons for computer science departments to have so few women? What can we do about it?

There might be even more audiences who have an interest in this book – we hope so – and therefore we have been dedicated to making the book as available as possible for a large audience in both Denmark and internationally. To help all audiences navigate the book, we next introduce each chapter briefly. Further, there are lists of all tables and figures.

The book contains nine chapters of different lengths and foci. 'Introduction' sets the stage for the book through the introduction you are currently reading. We suggest that all readers use this chapter and the table of contents to navigate the book for directed reading.

Chapter 1, 'The State of Diversity in Computer Science in 2022', focuses on the state of diversity in computer science in 2022 in Denmark. The chapter includes historic facts about three women pioneers in computing – and introduces gender statistics about PhD degrees and PhD supervision in the Department of Computer Science at the University of Copenhagen. We suggest that you read this chapter if you are interested in the history of computer science in Denmark and are puzzled about why we know so little about the women.

Chapter 2, 'Femtech.dk Research Initiative', introduces FemTech.dk, the research interest, our aim, and contextual situations, which is the foundation for the book. If you are considering being inspired by the FemTech work, it is important to understand the basic interests and assumptions behind the approach, and thus we suggest reading this chapter.

Chapter 3, 'Interventionist Research', introduces the research method used in FemTech. Chapter 3 includes reflections on how our work is situated within the Scandinavian approach to participatory design and action research. Finally, the chapter introduces our interventionist agenda and provides reflections on our role as researchers. This chapter will be most interesting for readers who want to know about the epistemological assumptions behind our work.

Chapter 4, 'Makerspace Methodologies & Design Principles', situates our work in the physical DIY (do-it-yourself) computing laboratory and explicates how moving the narrative on computer science from desktop research to the lab is a dedicated interest and concern of our work. Further, the chapter includes how we mobilized various resources in our attempt to create and build physical places for our work. The chapter also introduces the four FemTech design principles, on which all our artefacts and interventions have been based.

Chapter 5, 'Cyberbear & Cryptosphere: Sociomaterial-Design, Social Belonging, and Gender Representations', is one of the core chapters in the book. The chapter presents the research we did considering the design of FemTech artefacts and the events we organized for women who do not see themselves as belonging to computing. If you are organizing events or other activities – or considering concrete new outreach strategies for your diversity work – we suggest reading this chapter.

Chapter 6, 'GRACE: Designing Sociomaterial Assemblages Unpacking Gender Equity in Computing', is the second core chapter in this book. The chapter focuses on the FemTech artefact GRACE, an installation for discussing and reflecting on gender in computing. The chapter includes all the research results we gained using GRACE as an artefact of inquiry. If you are interested in provocative design artefacts and how they can travel and be used for engaging people in conversations, you should read this chapter.

Chapter 7, 'Equity & Inclusion', is a reflective chapter which introduces important vocabulary for organizations and individuals to consider when thinking about equity, diversity, and inclusion. The chapter is core reading if you are involved in any kind of diversity work in your organization – in particular, we suggest that all decision-makers in tech organizations as well as computer science university departments read this chapter.

Chapter 8, 'Organizational Change for Equity and Inclusion', introduces three propositions, based on all our work, which can help move 'diversity, equity, and inclusion' work in organizations. We suggest that decision-makers and managers at all levels involved in tech organizations or computer science departments read this chapter. Also, unions, union representatives, and political policymakers would benefit from reading this chapter, in their attempt to move the agenda forward in a concrete manner.

Finally, in Chap. 9, 'Final Reflections', we reflect on our own learnings, which we hope will benefit others as they move the agenda forward. This includes normative statements about what kind of activities and initiatives we found to be beneficial if tech organizations and computer science departments truly are to reach equal gender representation within computer science and technology development.

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FemTech continues today as an important research-based initiative in the Department of Computer Science, University of Copenhagen, especially with the research of the third author, Valeria Borsotti, PhD, and her role as diversity chair in the department. As a result, two new initiatives were created in 2021: Code of Conduct and Inclusive DIKU. Creating organizational transformation requires persistence, commitment, time, effort, resources, and collaborative engagement.

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